Department of Defense
Fiscal Year (FY) 2024 Budget Estimates

March 2023

Navy

Justification Book Volume 1 of 5

Research, Development, Test & Evaluation, Navy

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Department of Defense Appropriations Act, 2024

Research, Development, Test and Evaluation, Navy

For expenses necessary for basic and applied scientific research, development, test and evaluation, including maintenance, rehabilitation, lease, and operation of facilities and equipment, $26,922,225 to remain available for obligation until September 30, 2025.

Fiscal Year (FY) 2024 Overseas Operations Costs funding accounted for in the Base budget total $15.

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Department of the Navy
FY 2024 President's Budget
Exhibit R-1 FY 2024 President's Budget
Total Obligational Authority
(Dollars in Thousands)

	FY 2022 Actuals	FY 2023 Less Supplementals Enacted	FY 2023 Supplementals Enacted*	FY 2023 Total Enacted	FY 2024 Request
Summary Recap of Budget Activities					
Basic Research	681,475	688,889		688,889	637,263
Applied Research	1,243,015	1,487,017		1,487,017	1,026,339
Advanced Technology Development	960,390	1,309,342		1,309,342	1,016,552
Advanced Component Development & Prototypes	6,663,911	8,548,769		8,548,769	9,734,483
System Development & Demonstration	5,308,050	6,472,604		6,472,604	6,962,234
Management Support	1,602,667	1,251,196		1,251,196	1,163,613
Operational Systems Development	5,544,231	6,221,872	40,577	6,262,449	6,359,438
Software And Digital Technology Pilot Programs	29,128	24,008		24,008	22,303
Total Research, Development, Test, & Evaluation	**22,032,867**	**26,003,697**	**40,577**	**26,044,274**	**26,922,225**
Summary Recap of FYDP Programs					
Strategic Forces	328,259	493,924		493,924	529,130
General Purpose Forces	1,548,495	1,790,107		1,790,107	2,079,369
Intelligence and Communications	619,446	677,588		677,588	801,122
Research and Development	17,356,083	20,650,575		20,650,575	21,462,528
Central Supply and Maintenance	39,965	28,381		28,381	26,532
Administration and Associated Activities	3,203	1,811		1,811	2,168
Space	596				
Classified Programs	2,136,820	2,361,311	40,577	2,401,888	2,021,376
Total Research, Development, Test, & Evaluation	**22,032,867**	**26,003,697**	**40,577**	**26,044,274**	**26,922,225**

*Includes enacted funding in the Ukraine Supplemental Appropriation Act, 2023 (Division B of Public Law 117-180) and Additional Ukraine Supplemental Appropriation Act, 2023 (Division M of Public Law 117-328).

Department of the Navy
FY 2024 President's Budget
Exhibit R-1 FY 2024 President's Budget
Total Obligational Authority
(Dollars in Thousands)

Appropriation: 1319N Research, Development, Test and Evaluation, Navy

Line No	Program Element Number	Item	Act	Sec	FY 2022 Actuals	FY 2023 Less Supplementals Enacted	FY 2023 Supplementals Enacted*	FY 2023 Total Enacted	FY 2024 Request
1	0601103N	University Research Initiatives	01	U	169,965	147,376		147,376	96,355
2	0601153N	Defense Research Sciences	01	U	511,510	541,513		541,513	540,908
	Basic Research				**681,475**	**688,889**		**688,889**	**637,263**
3	0602114N	Power Projection Applied Research	02	U	41,760	27,953		27,953	23,982
4	0602123N	Force Protection Applied Research	02	U	215,913	345,576		345,576	142,148
5	0602131M	Marine Corps Landing Force Technology	02	U	62,130	79,467		79,467	59,208
6	0602235N	Common Picture Applied Research	02	U	50,371	51,911		51,911	52,090
7	0602236N	Warfighter Sustainment Applied Research	02	U	114,681	121,707		121,707	74,722
8	0602271N	Electromagnetic Systems Applied Research	02	U	89,120	131,288		131,288	92,473
9	0602435N	Ocean Warfighting Environment Applied Research	02	U	100,774	165,622		165,622	80,806
10	0602651M	Joint Non-Lethal Weapons Applied Research	02	U	6,213	6,659		6,659	7,419
11	0602747N	Undersea Warfare Applied Research	02	U	104,687	104,111		104,111	61,503
12	0602750N	Future Naval Capabilities Applied Research	02	U	193,392	177,141		177,141	182,662
13	0602782N	Mine and Expeditionary Warfare Applied Research	02	U	40,983	48,649		48,649	30,435
14	0602792N	Innovative Naval Prototypes (INP) Applied Research	02	U	143,842	145,637		145,637	133,828
15	0602861N	Science and Technology Management - ONR Field Acitivities	02	U	79,149	81,296		81,296	85,063
	Applied Research				**1,243,015**	**1,487,017**		**1,487,017**	**1,026,339**
16	0603123N	Force Protection Advanced Technology	03	U	35,010	59,933		59,933	29,512

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17	0603271N	Electromagnetic Systems Advanced Technology	03	U	11,762	16,253		16,253	8,418
18	0603273N	Science & Technology for Nuclear Re-entry Systems	03	U		65,735		65,735	112,329
19	0603640M	USMC Advanced Technology Demonstration (ATD)	03	U	283,332	412,747		412,747	308,217
20	0603651M	Joint Non-Lethal Weapons Technology Development	03	U	13,026	14,048		14,048	15,556
21	0603673N	Future Naval Capabilities Advanced Technology Development	03	U	275,441	268,993		268,993	264,700
22	0603680N	Manufacturing Technology Program	03	U	74,826	61,704		61,704	61,843
23	0603729N	Warfighter Protection Advanced Technology	03	U	39,057	46,999		46,999	5,100
24	0603758N	Navy Warfighting Experiments and Demonstrations	03	U	60,878	99,020		99,020	75,898
25	0603782N	Mine and Expeditionary Warfare Advanced Technology	03	U	1,922	2,007		2,007	2,048
26	0603801N	Innovative Naval Prototypes (INP) Advanced Technology Development	03	U	165,136	261,903		261,903	132,931
	Advanced Technology Development				**960,390**	**1,309,342**		**1,309,342**	**1,016,552**
27	0603128N	Unmanned Aerial System	04	U	15,545	98,883		98,883	108,225
28	0603178N	Large Unmanned Surface Vehicles (LUSV)	04	U	98,871	136,580		136,580	117,400
29	0603207N	Air/Ocean Tactical Applications	04	U	26,972	60,737		60,737	40,653
30	0603216N	Aviation Survivability	04	U	24,286	17,387		17,387	20,874
31	0603239N	Naval Construction Forces	04	U	5,271	1,706		1,706	7,821
32	0603254N	ASW Systems Development	04	U	20,079	15,977		15,977	17,090
33	0603261N	Tactical Airborne Reconnaissance	04	U	3,111	3,562		3,562	3,721

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Line No	Program Element Number	Item	Act	Sec	FY 2022 Actuals	FY 2023 Less Supplementals Enacted	FY 2023 Supplementals Enacted*	FY 2023 Total Enacted	FY 2024 Request
34	0603382N	Advanced Combat Systems Technology	04	U	40,937	73,128		73,128	6,216
35	0603502N	Surface and Shallow Water Mine Countermeasures	04	U	51,637	87,746		87,746	34,690
36	0603506N	Surface Ship Torpedo Defense	04	U	8,573	473		473	730
37	0603512N	Carrier Systems Development	04	U	7,109	11,567		11,567	6,095
38	0603525N	PILOT FISH	04	U	391,704	671,000		671,000	916,208
39	0603527N	RETRACT LARCH	04	U	60,941	7,483		7,483	7,545
40	0603536N	RETRACT JUNIPER	04	U	140,080	239,088		239,088	271,109
41	0603542N	Radiological Control	04	U	758	772		772	811
42	0603553N	Surface ASW	04	U	1,099	1,180		1,180	1,189
43	0603561N	Advanced Submarine System Development	04	U	96,405	110,146		110,146	88,415
44	0603562N	Submarine Tactical Warfare Systems	04	U	13,832	10,808		10,808	15,119
45	0603563N	Ship Concept Advanced Design	04	U	132,244	130,405		130,405	89,939
46	0603564N	Ship Preliminary Design & Feasibility Studies	04	U	39,472	75,305		75,305	121,402
47	0603570N	Advanced Nuclear Power Systems	04	U	203,572	227,400		227,400	319,656
48	0603573N	Advanced Surface Machinery Systems	04	U	74,439	207,000		207,000	133,911
49	0603576N	CHALK EAGLE	04	U	76,723	91,280		91,280	116,078
50	0603581N	Littoral Combat Ship (LCS)	04	U	80,254	76,364		76,364	32,615
51	0603582N	Combat System Integration	04	U	16,884	18,236		18,236	18,610
52	0603595N	Ohio Replacement	04	U	302,004	344,981		344,981	257,076
53	0603596N	LCS Mission Modules	04	U	75,189	31,707		31,707	31,464

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54	0603597N	Automated Test and Re-Test (ATRT)	04	U	36,461	60,073		60,073	10,809
55	0603599N	Frigate Development	04	U	98,022	108,626		108,626	112,972
56	0603609N	Conventional Munitions	04	U	7,245	9,286		9,286	9,030
57	0603635M	Marine Corps Ground Combat/Support System	04	U	69,451	111,431		111,431	128,782
58	0603654N	Joint Service Explosive Ordnance Development	04	U	33,974	36,304		36,304	44,766
59	0603713N	Ocean Engineering Technology Development	04	U	8,547	6,193		6,193	10,751
60	0603721N	Environmental Protection	04	U	28,150	21,647		21,647	24,457
61	0603724N	Navy Energy Program	04	U	64,991	75,320		75,320	72,214
62	0603725N	Facilities Improvement	04	U	6,306	5,664		5,664	10,149
63	0603734N	CHALK CORAL	04	U	558,549	753,303		753,303	687,841
64	0603739N	Navy Logistic Productivity	04	U	643	899		899	4,712
65	0603746N	RETRACT MAPLE	04	U	275,379	363,874		363,874	420,455
66	0603748N	LINK PLUMERIA	04	U	643,600	1,038,239		1,038,239	2,100,474
67	0603751N	RETRACT ELM	04	U	79,593	82,684		82,684	88,036
68	0603764M	LINK EVERGREEN	04	U	254,492	313,409		313,409	547,005
69	0603790N	NATO Research and Development	04	U	5,805	8,041		8,041	6,265
70	0603795N	Land Attack Technology	04	U	3,922	358		358	1,624
71	0603851M	Joint Non-Lethal Weapons Testing	04	U	27,556	30,533		30,533	31,058
72	0603860N	Joint Precision Approach and Landing Systems - Dem/Val	04	U	20,223	18,628		18,628	22,590
73	0603925N	Directed Energy and Electric Weapon Systems	04	U	80,055	65,080		65,080	52,129

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Department of the Navy
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74	0604014N	F/A -18 Infrared Search and Track (IRST)	04	U	47,637	55,069		55,069	32,127
75	0604027N	Digital Warfare Office	04	U	44,969	165,753		165,753	181,001
76	0604028N	Small and Medium Unmanned Undersea Vehicles	04	U	77,806	88,839		88,839	110,506
77	0604029N	Unmanned Undersea Vehicle Core Technologies	04	U	63,262	59,652		59,652	71,156
78	0604030N	Rapid Prototyping, Experimentation and Demonstration.	04	U		50,580		50,580	214,100
79	0604031N	Large Unmanned Undersea Vehicles	04	U	27,510				6,900
80	0604112N	Gerald R. Ford Class Nuclear Aircraft Carrier (CVN 78 - 80)	04	U	117,878	116,498		116,498	118,182
81	0604126N	Littoral Airborne MCM	04	U	18,067	30,240		30,240	
82	0604127N	Surface Mine Countermeasures	04	U	11,924	12,959		12,959	16,127
83	0604272N	Tactical Air Directional Infrared Countermeasures (TADIRCM)	04	U	32,530	39,028		39,028	34,684
84	0604289M	Next Generation Logistics	04	U	7,796	7,342		7,342	5,991
85	0604292N	Future Vertical Lift (Maritime Strike)	04	U	8,269	5,103		5,103	2,100
86	0604320M	Rapid Technology Capability Prototype	04	U	11,199	67,927		67,927	131,763
87	0604454N	LX (R)	04	U	3,332	18,830		18,830	21,319
88	0604536N	Advanced Undersea Prototyping	04	U	30,597	94,515		94,515	104,328
89	0604636N	Counter Unmanned Aircraft Systems (C-UAS)	04	U	5,462	7,438		7,438	11,567
90	0604659N	Precision Strike Weapons Development Program	04	U	80,661	34,824		34,824	5,976
91	0604707N	Space and Electronic Warfare (SEW) Architecture/Engineering Support	04	U	8,980	10,229		10,229	9,993

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Line No	Program Element Number	Item	Act	Sec	FY 2022 Actuals	FY 2023 Less Supplementals Enacted	FY 2023 Supplementals Enacted*	FY 2023 Total Enacted	FY 2024 Request
92	0604786N	Offensive Anti-Surface Warfare Weapon Development	04	U	75,093	223,826		223,826	237,655
93	0605512N	MEDIUM UNMANNED SURFACE VEHICLES (MUSVs))	04	U	57,872	85,966		85,966	85,800
94	0605513N	Unmanned Surface Vehicle Enabling Capabilities	04	U	115,436	181,534		181,534	176,261
95	0605514M	GROUND BASED ANTI-SHIP MISSILE	04	U	98,762	43,090		43,090	36,383
96	0605516M	LONG RANGE FIRES	04	U	85,073	36,693		36,693	36,763
97	0605518N	CONVENTIONAL PROMPT STRIKE (CPS)	04	U	1,282,595	1,230,041		1,230,041	901,064
98	0303354N	ASW Systems Development - MIP	04	U	8,536	9,769		9,769	10,167
99	0304240M	Advanced Tactical Unmanned Aircraft System	04	U	31,204	11,735		11,735	539
100	0304270N	Electronic Warfare Development - MIP	04	U	506	796		796	1,250
	Advanced Component Development & Prototypes				**6,663,911**	**8,548,769**		**8,548,769**	**9,734,483**
101	0603208N	Training System Aircraft	05	U	5,758	15,128		15,128	44,120
102	0604038N	Maritime Targeting Cell	05	U		69,600		69,600	30,922
103	0604212M	Other Helo Development	05	U					101,209
104	0604212N	Other Helo Development	05	U	47,802	66,010		66,010	2,604
105	0604214M	AV-8B Aircraft - Eng Dev	05	U	10,037	9,205		9,205	8,263
106	0604215N	Standards Development	05	U	4,066	3,766		3,766	4,039
107	0604216N	Multi-Mission Helicopter Upgrade Development	05	U	52,962	54,684		54,684	62,350
108	0604221N	P-3 Modernization Program	05	U	564	343		343	771
109	0604230N	Warfare Support System	05	U	14,945	16,337		16,337	109,485
110	0604231N	Command and Control Systems	05	U	118,895	143,573		143,573	87,457

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Department of the Navy
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Appropriation: 1319N Research, Development, Test and Evaluation, Navy

Line No	Program Element Number	Item	Act	Sec	FY 2022 Actuals	FY 2023 Less Supplementals Enacted	FY 2023 Supplementals Enacted*	FY 2023 Total Enacted	FY 2024 Request
111	0604234N	Advanced Hawkeye	05	U	339,032	487,281		487,281	399,919
112	0604245M	H-1 Upgrades	05	U	49,316	43,759		43,759	29,766
113	0604261N	Acoustic Search Sensors	05	U	47,534	50,231		50,231	51,531
114	0604262N	V-22A	05	U	89,448	125,233		125,233	137,597
115	0604264N	Air Crew Systems Development	05	U	20,271	50,282		50,282	42,155
116	0604269N	EA-18	05	U	58,692	116,589		116,589	172,507
117	0604270N	Electronic Warfare Development	05	U	126,373	144,471		144,471	171,384
118	0604273M	Executive Helo Development	05	U	40,496	45,645		45,645	35,376
119	0604274N	Next Generation Jammer (NGJ)	05	U	230,396	54,679		54,679	40,477
120	0604280N	Joint Tactical Radio System - Navy (JTRS-Navy)	05	U	225,867	334,787		334,787	451,397
121	0604282N	Next Generation Jammer (NGJ) Increment II	05	U	72,937	135,467		135,467	250,577
122	0604307N	Surface Combatant Combat System Engineering	05	U	321,118	345,489		345,489	453,311
123	0604311N	LPD-17 Class Systems Integration	05	U	869				
124	0604329N	Small Diameter Bomb (SDB)	05	U	39,366	42,881		42,881	52,211
125	0604366N	Standard Missile Improvements	05	U	341,355	309,943		309,943	418,187
126	0604373N	Airborne MCM	05	U	10,838	10,882		10,882	11,368
127	0604378N	Naval Integrated Fire Control - Counter Air Systems Engineering	05	U	49,110	45,892		45,892	66,445
128	0604419N	Advanced Sensors Application Program (ASAP)	05	U	10,000	13,000		13,000	
129	0604501N	Advanced Above Water Sensors	05	U	60,394	72,772		72,772	115,396
130	0604503N	SSN-688 and Trident Modernization	05	U	92,168	93,501		93,501	93,435

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Line No	Program Element Number	Item	Act	Sec	FY 2022 Actuals	FY 2023 Less Supplementals Enacted	FY 2023 Supplementals Enacted*	FY 2023 Total Enacted	FY 2024 Request
131	0604504N	Air Control	05	U	32,614	39,138		39,138	42,656
132	0604512N	Shipboard Aviation Systems	05	U	8,889	11,759		11,759	10,442
133	0604518N	Combat Information Center Conversion	05	U	11,389	16,160		16,160	11,359
134	0604522N	Air and Missile Defense Radar (AMDR) System	05	U	84,526	87,341		87,341	90,307
135	0604530N	Advanced Arresting Gear (AAG)	05	U	146	151		151	10,658
136	0604558N	New Design SSN	05	U	468,358	316,085		316,085	234,356
137	0604562N	Submarine Tactical Warfare System	05	U	60,806	58,741		58,741	71,516
138	0604567N	Ship Contract Design/ Live Fire T&E	05	U	52,878	60,791		60,791	22,462
139	0604574N	Navy Tactical Computer Resources	05	U	4,267	4,177		4,177	4,279
140	0604601N	Mine Development	05	U	37,054	60,793		60,793	104,731
141	0604610N	Lightweight Torpedo Development	05	U	92,274	135,500		135,500	229,668
142	0604654N	Joint Service Explosive Ordnance Development	05	U	8,315	8,618		8,618	9,064
143	0604657M	USMC Ground Combat/Supporting Arms Systems - Eng Dev	05	U	40,885	45,025		45,025	62,329
144	0604703N	Personnel, Training, Simulation, and Human Factors	05	U	7,128	7,454		7,454	9,319
145	0604727N	Joint Standoff Weapon Systems	05	U		758		758	1,964
146	0604755N	Ship Self Defense (Detect & Control)	05	U	139,580	156,426		156,426	158,426
147	0604756N	Ship Self Defense (Engage: Hard Kill)	05	U	105,984	84,518		84,518	47,492
148	0604757N	Ship Self Defense (Engage: Soft Kill/EW)	05	U	64,200	97,537		97,537	125,206
149	0604761N	Intelligence Engineering	05	U	20,684	23,742		23,742	19,969
150	0604771N	Medical Development	05	U	30,429	16,178		16,178	6,061

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151	0604777N	Navigation/ID System	05	U	48,510	60,209		60,209	45,262
152	0604800M	Joint Strike Fighter (JSF) - EMD	05	U	555	611		611	
153	0604800N	Joint Strike Fighter (JSF) - EMD	05	U	252	234		234	
154	0604850N	SSN(X)	05	U	29,174	133,772		133,772	361,582
155	0605013M	Information Technology Development	05	U	10,854	11,361		11,361	22,663
156	0605013N	Information Technology Development	05	U	261,195	318,103		318,103	282,138
157	0605024N	Anti-Tamper Technology Support	05	U	8,393	7,271		7,271	8,340
158	0605180N	TACAMO Modernization	05	U	48,644	502,493		502,493	213,743
159	0605212M	CH-53K RDTE	05	U	212,181	220,240		220,240	222,288
160	0605215N	Mission Planning	05	U	86,255	76,107		76,107	86,448
161	0605217N	Common Avionics	05	U	52,789	77,960		77,960	81,076
162	0605220N	Ship to Shore Connector (SSC)	05	U	6,295	17,886		17,886	1,343
163	0605327N	T-AO 205 Class	05	U	4,287	220		220	71
164	0605414N	Unmanned Carrier Aviation (UCA)	05	U	257,887	254,446		254,446	220,404
165	0605450M	Joint Air-to-Ground Missile (JAGM)	05	U	345	371		371	384
166	0605500N	Multi-mission Maritime Aircraft (MMA)	05	U	28,842	37,939		37,939	36,027
167	0605504N	Multi-Mission Maritime (MMA) Increment III	05	U	157,793	161,697		161,697	132,449
168	0605611M	Marine Corps Assault Vehicles System Development & Demonstration	05	U	71,237	91,501		91,501	103,236
169	0605813M	Joint Light Tactical Vehicle (JLTV) System Development & Demonstration	05	U	1,921	2,856		2,856	2,609
170	0204202N	DDG-1000	05	U	110,789	180,374		180,374	231,778

*Includes enacted funding in the Ukraine Supplemental Appropriation Act, 2023 (Division B of Public Law 117-180) and Additional Ukraine Supplemental Appropriation Act, 2023 (Division M of Public Law 117-328).

Department of the Navy
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Exhibit R-1 FY 2024 President's Budget
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(Dollars in Thousands)

Appropriation: 1319N Research, Development, Test and Evaluation, Navy

Line No	Program Element Number	Item	Act	Sec	FY 2022 Actuals	FY 2023 Less Supplementals Enacted	FY 2023 Supplementals Enacted*	FY 2023 Total Enacted	FY 2024 Request
171	0301377N	Countering Advanced Conventional Weapons (CACW)	05	U		12,341		12,341	17,531
172	0304785N	ISR & Info Operations	05	U	135,538	135,252		135,252	174,271
173	0306250M	Cyber Operations Technology Development	05	U	23,299	37,038		37,038	2,068
	System Development & Demonstration				**5,308,050**	**6,472,604**		**6,472,604**	**6,962,234**
174	0604256N	Threat Simulator Development	06	U	56,311	29,430		29,430	22,918
175	0604258N	Target Systems Development	06	U	19,553	73,708		73,708	18,623
176	0604759N	Major T&E Investment	06	U	95,451	141,371		141,371	74,221
177	0605152N	Studies and Analysis Support - Navy	06	U	3,069	3,286		3,286	3,229
178	0605154N	Center for Naval Analyses	06	U	34,686	37,685		37,685	45,672
179	0605502N	Small Business Innovative Research	06	U	531,825				
180	0605804N	Technical Information Services	06	U	1,562	987		987	1,000
181	0605853N	Management, Technical & International Support	06	U	104,950	109,565		109,565	124,328
182	0605856N	Strategic Technical Support	06	U	3,402	3,787		3,787	4,053
183	0605863N	RDT&E Ship and Aircraft Support	06	U	135,097	173,352		173,352	203,447
184	0605864N	Test and Evaluation Support	06	U	444,883	479,281		479,281	481,975
185	0605865N	Operational Test and Evaluation Capability	06	U	25,326	27,808		27,808	29,399
186	0605866N	Navy Space and Electronic Warfare (SEW) Support	06	U	17,238	27,172		27,172	27,504
187	0605867N	SEW Surveillance/Reconnaissance Support	06	U	8,065	7,186		7,186	9,183
188	0605873M	Marine Corps Program Wide Support	06	U	42,480	39,744		39,744	34,976

*Includes enacted funding in the Ukraine Supplemental Appropriation Act, 2023 (Division B of Public Law 117-180) and Additional Ukraine Supplemental Appropriation Act, 2023 (Division M of Public Law 117-328).

Department of the Navy
FY 2024 President's Budget
Exhibit R-1 FY 2024 President's Budget
Total Obligational Authority
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Appropriation: 1319N Research, Development, Test and Evaluation, Navy

Line No	Program Element Number	Item	Act	Sec	FY 2022 Actuals	FY 2023 Less Supplementals Enacted	FY 2023 Supplementals Enacted*	FY 2023 Total Enacted	FY 2024 Request
189	0605898N	Management HQ - R&D	06	U	35,018	40,648		40,648	41,331
190	0606355N	Warfare Innovation Management	06	U	38,066	52,060		52,060	37,340
191	0305327N	Insider Threat	06	U	2,482	2,315		2,315	2,246
192	0902498N	Management Headquarters (Departmental Support Activities)	06	U	1,747	1,811		1,811	2,168
193	0909980N	Judgment Fund Reimbursement	06	U	579				
194	0909999N	Financing for Cancelled Account Adjustments	06	U	877				
	Management Support				**1,602,667**	**1,251,196**		**1,251,196**	**1,163,613**
196	0604840M	F-35 C2D2	07	U	501,609	531,032		531,032	544,625
197	0604840N	F-35 C2D2	07	U	473,749	503,365		503,365	543,834
198	0605520M	MARINE CORPS AIR DEFENSE WEAPONS SYSTEMS	07	U	59,018	69,663		69,663	99,860
199	0607658N	Cooperative Engagement Capability (CEC)	07	U	148,628	156,121		156,121	153,440
200	0101221N	Strategic Sub & Weapons System Support	07	U	190,928	312,502		312,502	321,648
201	0101224N	SSBN Security Technology Program	07	U	44,212	50,761		50,761	62,694
202	0101226N	Submarine Acoustic Warfare Development	07	U	58,645	81,237		81,237	92,869
203	0101402N	Navy Strategic Communications	07	U	34,474	49,424		49,424	51,919
204	0204136N	F/A-18 Squadrons	07	U	213,010	235,204		235,204	333,783
205	0204228N	Surface Support	07	U	13,195	12,197		12,197	8,619
206	0204229N	Tomahawk and Tomahawk Mission Planning Center (TMPC)	07	U	129,919	122,719		122,719	122,834
207	0204311N	Integrated Surveillance System	07	U	83,349	98,370		98,370	76,279
208	0204313N	Ship-Towed Array Surveillance Systems	07	U	6,080	1,188		1,188	1,103

*Includes enacted funding in the Ukraine Supplemental Appropriation Act, 2023 (Division B of Public Law 117-180) and Additional Ukraine Supplemental Appropriation Act, 2023 (Division M of Public Law 117-328).

Department of the Navy
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Exhibit R-1 FY 2024 President's Budget
Total Obligational Authority
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Appropriation: 1319N Research, Development, Test and Evaluation, Navy

Line No	Program Element Number	Item	Act	Sec	FY 2022 Actuals	FY 2023 Less Supplementals Enacted	FY 2023 Supplementals Enacted*	FY 2023 Total Enacted	FY 2024 Request
209	0204413N	Amphibious Tactical Support Units (Displacement Craft)	07	U	1,650	1,789		1,789	1,991
210	0204460M	Ground/Air Task Oriented Radar (G/ATOR)	07	U	43,761	61,104		61,104	92,674
211	0204571N	Consolidated Training Systems Development	07	U	53,099	100,339		100,339	115,894
212	0204575N	Electronic Warfare (EW) Readiness Support	07	U	53,412	45,936		45,936	61,677
213	0205601N	Anti-Radiation Missile Improvement	07	U	133,315	89,479		89,479	59,555
214	0205620N	Surface ASW Combat System Integration	07	U	27,781	28,999		28,999	29,973
215	0205632N	MK-48 ADCAP	07	U	98,707	155,868		155,868	213,165
216	0205633N	Aviation Improvements	07	U	140,478	149,450		149,450	143,277
217	0205675N	Operational Nuclear Power Systems	07	U	113,760	121,439		121,439	152,546
218	0206313M	Marine Corps Communications Systems	07	U	105,494	114,264		114,264	192,625
219	0206335M	Common Aviation Command and Control System (CAC2S)	07	U	12,503	14,865		14,865	12,565
220	0206623M	Marine Corps Ground Combat/Supporting Arms Systems	07	U	84,344	106,036		106,036	83,900
221	0206624M	Marine Corps Combat Services Support	07	U	20,254	26,522		26,522	27,794
222	0206625M	USMC Intelligence/Electronic Warfare Systems (MIP)	07	U	38,089	51,976		51,976	47,762
223	0206629M	Amphibious Assault Vehicle	07	U	7,475	8,246		8,246	373
224	0207161N	Tactical AIM Missiles	07	U	23,273	29,236		29,236	36,439
225	0207163N	Advanced Medium Range Air-to-Air Missile (AMRAAM)	07	U	31,776	30,898		30,898	29,198
226	0208043N	Planning and Decision Aid System (PDAS)	07	U	2,982	3,609		3,609	3,565

*Includes enacted funding in the Ukraine Supplemental Appropriation Act, 2023 (Division B of Public Law 117-180) and Additional Ukraine Supplemental Appropriation Act, 2023 (Division M of Public Law 117-328).

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FY 2024 President's Budget
Exhibit R-1 FY 2024 President's Budget
Total Obligational Authority
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Appropriation: 1319N Research, Development, Test and Evaluation, Navy

Line No	Program Element Number	Item	Act	Sec	FY 2022 Actuals	FY 2023 Less Supplementals Enacted	FY 2023 Supplementals Enacted*	FY 2023 Total Enacted	FY 2024 Request
230	0303138N	Afloat Networks	07	U	36,259	45,683		45,683	49,995
231	0303140N	Information Systems Security Program	07	U	32,592	33,752		33,752	33,390
232	0305192N	Military Intelligence Program (MIP) Activities	07	U	7,513	8,415		8,415	7,304
233	0305204N	Tactical Unmanned Aerial Vehicles	07	U	9,837	10,576		10,576	11,235
234	0305205N	UAS Integration and Interoperability	07	U	4,842	15,396		15,396	16,409
235	0305208M	Distributed Common Ground/Surface Systems	07	U	29,749	45,705		45,705	51,192
236	0305220N	MQ-4C Triton	07	U	13,029	13,893		13,893	12,094
237	0305231N	MQ-8 UAV	07	U	33,543	27,000		27,000	29,700
238	0305232M	RQ-11 UAV	07	U	533	1,234		1,234	2,107
239	0305234N	Small (Level 0) Tactical UAS (STUASL0)	07	U	1,772	3,761		3,761	2,999
240	0305241N	Multi-Intelligence Sensor Development	07	U	59,252	56,261		56,261	49,460
241	0305242M	Unmanned Aerial Systems (UAS) Payloads (MIP)	07	U	9,274	9,780		9,780	13,005
242	0305251N	Cyberspace Operations Forces and Force Support	07	U	34,977	36,505		36,505	2,000
243	0305421N	RQ-4 Modernization	07	U	134,323	150,093		150,093	300,378
244	0307577N	Intelligence Mission Data (IMD)	07	U	907	851		851	788
245	0308601N	Modeling and Simulation Support	07	U	9,479	9,437		9,437	10,994
246	0702207N	Depot Maintenance (Non-IF)	07	U	33,870	26,248		26,248	23,248
247	0708730N	Maritime Technology (MARITECH)	07	U	6,095	2,133		2,133	3,284
248	1203109N	Satellite Communications (SPACE)	07	U	596				
999	999999999	Classified Programs	07	U	2,136,820	2,361,311	40,577	2,401,888	2,021,376

*Includes enacted funding in the Ukraine Supplemental Appropriation Act, 2023 (Division B of Public Law 117-180) and Additional Ukraine Supplemental Appropriation Act, 2023 (Division M of Public Law 117-328).

Department of the Navy
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Exhibit R-1 FY 2024 President's Budget
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Appropriation: 1319N Research, Development, Test and Evaluation, Navy

Line No	Program Element Number	Item	Act	Sec	FY 2022 Actuals	FY 2023 Less Supplementals Enacted	FY 2023 Supplementals Enacted*	FY 2023 Total Enacted	FY 2024 Request
	Operational Systems Development				**5,544,231**	**6,221,872**	**40,577**	**6,262,449**	**6,359,438**
249	0608013N	Risk management Information - Software Pilot Program	08	U	13,565	12,810		12,810	11,748
250	0608231N	Maritime Tactical Command and Control (MTC2) - Software Pilot Program	08	U	15,563	11,198		11,198	10,555
	Software And Digital Technology Pilot Programs				**29,128**	**24,008**		**24,008**	**22,303**
Total Research, Development, Test and Evaluation, Navy					**22,032,867**	**26,003,697**	**40,577**	**26,044,274**	**26,922,225**

*Includes enacted funding in the Ukraine Supplemental Appropriation Act, 2023 (Division B of Public Law 117-180) and Additional Ukraine Supplemental Appropriation Act, 2023 (Division M of Public Law 117-328).

Department of Defense
FY 2024 President's Budget
Exhibit R-1 FY 2024 President's Budget
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(Dollars in Thousands)

Appropriation	FY 2023 Overseas Operations Costs (OOC)*	FY 2024 Overseas Operations Costs (OOC)*
Research, Development, Test and Evaluation, Navy		15
Total Research, Development, Test, & Evaluation		**15**

*FY 2023 and FY 2024 Overseas Operations Costs (OOC) numbers are a subset of the baseline submission.

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	FY 2023 Overseas Operations Costs (OOC)*	FY 2024 Overseas Operations Costs (OOC)*
Summary Recap of Budget Activities		
Advanced Component Development & Prototypes		15
Total Research, Development, Test, & Evaluation		**15**
Summary Recap of FYDP Programs		
Research and Development		15
Total Research, Development, Test, & Evaluation		**15**

*FY 2023 and FY 2024 Overseas Operations Costs (OOC) numbers are a subset of the baseline submission.

Department of the Navy
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	FY 2023 Overseas Operations Costs (OOC)*	FY 2024 Overseas Operations Costs (OOC)*
Summary Recap of Budget Activities		
Advanced Component Development & Prototypes		15
Total Research, Development, Test, & Evaluation		**15**
Summary Recap of FYDP Programs		
Research and Development		15
Total Research, Development, Test, & Evaluation		**15**

*FY 2023 and FY 2024 Overseas Operations Costs (OOC) numbers are a subset of the baseline submission.

Department of the Navy
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(Dollars in Thousands)

Appropriation: 1319N Research, Development, Test and Evaluation, Navy

Line No	Program Element Number	Item	Act	Sec	FY 2023 Overseas Operations Costs (OOC)*	FY 2024 Overseas Operations Costs (OOC)*
70	0603795N	Land Attack Technology	04	U		15
		Other		U		15
	Advanced Component Development & Prototypes					**15**
Total Research, Development, Test and Evaluation, Navy						**15**

*FY 2023 and FY 2024 Overseas Operations Costs (OOC) numbers are a subset of the baseline submission.

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Program Element Table of Contents (Alphabetically by Program Element Title)

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy												Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 1: *Basic Research*					R-1 Program Element (Number/Name) PE 0601103N *I University Research Initiatives*							
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	169.965	147.376	96.355	-	96.355	100.308	104.480	108.780	112.940	Continuing	Continuing
0000: *University Research Initiatives*	0.000	114.506	90.076	96.355	-	96.355	100.308	104.480	108.780	112.940	Continuing	Continuing
9999: *Congressional Adds*	0.000	55.459	57.300	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	112.759

A. Mission Description and Budget Item Justification

The Office of Naval Research's (ONR) mission is to ensure the technological advantage of U.S. Naval forces. ONR fosters scientific research necessary for the discovery, development and delivery of new technologies. Often this research is done in partnership with academia. This program includes support for multidisciplinary basic research in a wide range of naval relevant scientific and engineering disciplines that enables the U.S. Navy to maintain technological superiority, for the university research infrastructure to acquire the research instrumentation needed to maintain and improve the quality of university research important to the Navy, and for the graduate students and postdoctoral fellows who will lead DON S&T efforts in the future. Multidisciplinary University Research Initiative (MURI) efforts involve teams of researchers investigating high priority topics and opportunities that intersect more than one traditional technical discipline. For many military problems, this multidisciplinary approach serves to stimulate innovation, accelerate research progress and lay the foundations for transition of results into Naval applications. The Defense University Research Instrumentation Program (DURIP) supports university research infrastructure essential to high quality, Navy-relevant research. The instrumentation program complements other Navy research programs by supporting the purchase of high cost research instrumentation that is necessary to carry out cutting-edge research. This program supports Presidential Early Career Awards for Scientists and Engineers (PECASE) which are single investigator research efforts performed by outstanding academic scientists and engineers early in their research careers. This program provides the knowledge base, scientific concepts, and technological advances for the maintenance of Naval power and national security. The ONR Graduate Student and Postdoctoral Fellow Support project supports the participation of graduate students and postdoctoral fellows in DON-related research. These graduate students and postdoctoral fellows will be the future leaders in areas of science, technology, engineering and mathematics (STEM) critical to DON, DOD and national security.

The missions of today's Sailors and Marines are enabled by the results of naval Science and Technology (S&T). Since 1946, the Office of Naval Research (ONR) has fostered scientific research related to the maintenance of maritime superiority and national defense. ONR manages the Department of the Navy's (DON) portfolio of naval Basic and Applied research, and Advanced Technology Development investments to ensure naval forces can effectively deter conflict, but when called upon, fight, win and come home safe. Current investments hedge against uncertainty, providing solutions to commanders today, and options for the future. The Naval S&T budget supports higher guidance defined by the National Defense Strategy, and responds to requirements identified by the Secretary of the Navy through research priorities set by the Chief of Naval Research, coordinated across the Naval Research Enterprise (NRE), and outlined in the Naval R&D Framework.

This Program Element (PE) funds Basic Research, typically defined as systematic study directed toward greater knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications towards processes or products in mind. The work in this PE can be classified between Technology Readiness Level (TRL) 1 (basic principles observed and reported) and TRL 2 (technology concept and/or application formulation).

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 1: *Basic Research*	**R-1 Program Element (Number/Name)** PE 0601103N *I University Research Initiatives*

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	174.898	90.076	122.489	-	122.489
Current President's Budget	169.965	147.376	96.355	-	96.355
Total Adjustments	-4.933	57.300	-26.134	-	-26.134
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	57.300			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.006	0.000			
• SBIR/STTR Transfer	-4.933	0.000			
• Program Adjustments	0.000	0.000	-26.134	-	-26.134
• Rate/Misc Adjustments	0.006	0.000	0.000	-	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 9999: *Congressional Adds*		
Congressional Add: *Defense University Research Instrumentation Program*	33.787	30.000
Congressional Add: *University research initiatives*	9.654	0.000
Congressional Add: *Coastal adapt. Res. for imp. coastal comm. and NWS earle military install. Resil*	0.434	0.000
Congressional Add: *Navy aircraft fleet readiness and sustainment*	7.723	0.000
Congressional Add: *Biocoherent energy transfer research*	3.861	0.000
Congressional Add: *All digitall arrays for long-distance application power maximization*	0.000	9.800
Congressional Add: *Artificial intelligence maritime maneuvering*	0.000	5.000
Congressional Add: *Enhancing installation resiliency at NWS Earle*	0.000	2.500
Congressional Add: *Defense research initiatives*	0.000	10.000
Congressional Add Subtotals for Project: 9999	55.459	57.300
Congressional Add Totals for all Projects	55.459	57.300

Change Summary Explanation

Funding: $26.134M decrease for S&T compliance to the Defense Planning Guidance

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 1: *Basic Research*	**R-1 Program Element (Number/Name)** PE 0601103N *I University Research Initiatives*

Technical: No significant change

Schedule: No significant change

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 1	R-1 Program Element (Number/Name) PE 0601103N / *University Research Initiatives*	Project (Number/Name) 0000 / *University Research Initiatives*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
0000: *University Research Initiatives*	0.000	114.506	90.076	96.355	-	96.355	100.308	104.480	108.780	112.940	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Office of Naval Research's (ONR) mission is to ensure the technological advantage of U.S. Naval forces. ONR fosters scientific research necessary for the discovery, development and delivery of new technologies. Often this research is done in partnership with academia. This program includes support for multidisciplinary basic research in a wide range of naval relevant scientific and engineering disciplines that enables the U.S. Navy to maintain technological superiority and for the university research infrastructure to acquire the research instrumentation needed to maintain and improve the quality of university research important to the Navy. Multidisciplinary University Research Initiative (MURI) efforts involve teams of researchers investigating high priority topics and opportunities that intersect more than one traditional technical discipline. For many military problems, this multidisciplinary approach serves to stimulate innovation, accelerate research progress, and lay the foundation for transition of results into Naval applications. The Defense University Research Instrumentation Program (DURIP) project supports university research infrastructure essential to high quality, Navy-relevant research. The instrumentation project complements other Navy research programs by supporting the purchase of high cost research instrumentation that is necessary to carry out cutting-edge research. The PECASE project supports single-investigator research efforts performed by outstanding academic scientists and engineers early in their research careers. This project provides the knowledge base, scientific concepts, and technological advances for the maintenance of Naval power and national security. The ONR Graduate Student and Postdoctoral Fellow Support project supports the participation of graduate students and postdoctoral fellows in DON-related research. These graduate students and postdoctoral fellows will be the future leaders in areas of science, technology, engineering and mathematics (STEM) critical to DON, DOD and national security.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Defense University Research Instrumentation Program (DURIP)	23.079	17.989	17.478	0.000	17.478
Description: DURIP funds are awarded to universities to purchase relatively high cost research instrumentation that is normally not included in single-investigator research grants. Individual grants range from $50K to $1.5M. Funding for DURIP efforts is awarded after the Office of the Secretary of Defense (OSD) selects and announces the awardees, which typically takes place towards the second half of the fiscal year. In turn, universities need to purchase the instrumentation and take delivery before any billing occurs. It frequently takes several months for delivery and billing to be completed. DURIP is a one-year program, so awards are notionally initiated and completed within the same fiscal year.					
FY 2023 Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601103N / *University Research Initiatives*	**Project (Number/Name)** 0000 / *University Research Initiatives*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Funds will be awarded to support purchase or development of instrumentation to enhance Basic Research in various technical areas such as Micro-3-dimensional Printed Ion Traps, Networked Sensors for Observing the Air-Sea Interface, Atomic and Molecular Investigation of Corrosion for Prevention and Control, Atomic and Molecular Investigation of Corrosion for Prevention and Control, Versatile Legged Robots for Open-World Human-Robot Interaction in Mixed Initiative Teams, Interactions of Supersonic Projectiles with Large Droplets and Aerosol-laden Flows ***FY 2024 Base Plans:*** Continue to fund awards to support purchase or development of instrumentation to enhance ONR basic research efforts across the S&T spectrum, to include workforce development of students and postdoctoral fellows. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding decrease from FY23 to FY24 reflects reduced demand for DURIP grants resulting from delayed university execution to prior awards. Fewer FY24 new DURIP awards are anticipated.					
Title: Multidisciplinary University Research Initiative (MURI) ***Description:*** Research efforts include high priority topics that intersect more than one traditional discipline. MURI topics are selected to address Naval Science and Technology (S&T) Framework Priorities as described in the Naval Research and Development Framework. Funding for MURI efforts is awarded after Office of the Secretary of Defense (OSD) announces the awardees, which typically takes place towards the second half of the fiscal year. Since the MURI program funds academic researchers, execution of the efforts typically ramp up during the summer months. MURI projects make significant contributions to Navy and Department of Defense (DOD) objectives by speeding up scientific programs, by cross-fertilization of ideas, by hastening the transition of basic research to practical applications, and by training students in cross-disciplinary approaches to science and engineering research of importance to DoD. MURI projects are five-year programs. ***FY 2023 Plans:*** Continue to support research grants initiated in FY22 in the areas of Topologically-Protected Quantum Information, Molecular Doping of Organic Electronic Materials, Learning from Hearing, Hydrodynamics of Fish Schooling, Self-learning for Real-world Perception, Fundamental Non-equilibrium Processes in Weakly Ionized Hypersonic Flows, Understanding of Detonation Based Combustion in Multiphase Mixtures, Bioinspired Design	80.098	63.257	75.000	0.000	75.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601103N / *University Research Initiatives*	**Project (Number/Name)** 0000 / *University Research Initiatives*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
of Energy-Self Sufficient Multi-functional Soft Material Systems, Systems-Level Foundations for Agile, Dynamic, and Ad Hoc Human Autonomy Teams, Environmental DNA-based Monitoring of the Marine Environment Continue to support multidisciplinary research in areas such as molecular qubits, computer vision, ocean dynamics off rocky coasts, thermal transport, super-hard materials, social cyber-attack in social media, control theory of safe, cognitive, and learning systems. ***FY 2024 Base Plans:*** Continue conducting research activities within forty-seven on-going multidisciplinary topic areas. Complete planned research efforts in the following thirteen multidisciplinary topic areas: - Self-assessment and Understanding of Competence and Conditions to Ensure System Success - Blueprint for design and assembly of multifunctional, adaptive materials using nanocrystals - Leveraging a New Theoretical Paradigm to Enhance Interfacial Thermal Transport In Wide Bandgap Power - Rationalization of Liquid/Solid and Solid/Solid Interphase Instabilities During Thermal-Mechanical Transients of Metal Additive Manufacturing - Livtronics Living Electronics for Biologically-Enhanced Sensing, Computing, and Signal Transmission - Photomechanical Material Systems From Molecules to Devices - Synthesis Planning and Reaction Discovery For Photochemistry and Chemistry in Novel Environments - Theoretical Foundations of Deep Learning - Classical Entanglement in Structured Optical Fields - Integrated Foundations of Sensing, Modeling, and Data Assimilation for Sea Ice Prediction - Specialization of neural processing during active acoustic sensing in marine mammals and humans - Informatics-Driven Design of Resilient and Deploymerizable Polymers - Identifying Adverse Modes via Human-Machine Cybernetic Modeling Initiate twelve new multidisciplinary research efforts. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY23 to FY24 supports initiation of twelve multidisciplinary efforts.					
Title: Presidential Early Career Awards (PECASE)	8.693	6.775	2.090	0.000	2.090

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601103N / *University Research Initiatives*	**Project (Number/Name)** 0000 / *University Research Initiatives*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Description: PECASE awards are made to academic scientists early in their research careers for extremely prestigious, single-investigator research in areas of vital importance to the Navy. Awards provide national recognition and research grants of up to $200K per year for five years. OSD, with policy and oversight responsibility for the PECASE program, awards a minimum of four new awards per year. PECASE is a five year program. ***FY 2023 Plans:*** - Continue to fund new basic research projects in Naval priority areas. - Continue to support previous year ongoing basic research projects performed by early career investigators. ***FY 2024 Base Plans:*** Continue full support of early career scientists and engineers showing exceptional potential for leadership at the frontiers of scientific knowledge. - Continue funding of new basic research projects in Naval priority areas. - Continued commitment to support twelve previous year basic research projects being conducted by early career investigators. - Initiate two new PECASE awards. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Decrease from FY23 to FY24 is a reflection of a reduced number of PECASE awardees. All PECASE awardees are approved by the Office of the Secretary of Defense and the White House Office of Science and Technology Policy (OSTP).					
Title: Minerva Research Initiative (MRI) (Social Science Networking) ***Description:*** The Minerva Research Initiative is funded in partnership with the Office of the Secretary of Defense to support basic social science and multi-disciplinary research aimed at improving national security and international stability. The goals of this program are to enhance connections between DoD and academia and	2.636	2.055	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601103N / *University Research Initiatives*	**Project (Number/Name)** 0000 / *University Research Initiatives*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
build cultural and foreign area knowledge on topics ranging from the mechanisms of radicalization to geopolitical power projection strategies in a multi-polar world. ***FY 2023 Plans:*** Complete: Create novel techniques (e.g., social network analysis, social computational models, and, artificial Intelligence) that will enable the detection and source attribution of cyber malware incursions on large networked computer systems more quickly and accurately than is possible based on current manual approaches. Continue: Research large-data analytic techniques to detect and mitigate the occurrence of disinformation in social network systems more quickly and effectively than is currently possible. Techniques are sought that scale up to very large social networks and have the robustness to quickly adapt to emerging disinformation techniques. Discover mechanisms of crowd manipulation, social hysteria, rumor and propaganda. Initiate: Efforts to address novel conflict problems such as water security, malware, ransomware, social shifts relevant to national security issues, hybrid warfare and other novel conflict problems. This will include influence operations and social media threat vectors for information operations, recruitment and training issues and identity management. ***FY 2024 Base Plans:*** All Activities funded under the Minerva Research Initiative will be moved to Defense Research Sciences PE 0601153N starting in FY 2024. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Decrease from FY23 to FY24 reflects the transfer of requirements and associated funding for the Minerva Research Initiative to the Defense Research Sciences PE 0601153N / Project 0000 in FY 2024. This transfer better represents the Basic Research focus and objectives of the Minerva Research Initiative.					
Title: Graduate Student and Postdoctoral Researcher Support ***Description:*** The Graduate Student and Postdoctoral Researcher Support Program helps to ensure the quality, vitality and diversity of the future DoN scientific and engineering workforce. The program supports graduate students and postdoctoral fellows engaged in DoN-related research activities in high priority naval science,	0.000	0.000	1.787	0.000	1.787

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601103N / *University Research Initiatives*	**Project (Number/Name)** 0000 / *University Research Initiatives*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
technology, engineering and mathematics (STEM) disciplines at U.S. institutions, its territories, or possessions, or the Commonwealth of Puerto Rico. ***FY 2023 Plans:*** N/A ***FY 2024 Base Plans:*** Initiate Graduate Student and Postdoctoral Researcher support in the following priority naval mission areas: - Command, Control, Computing, Communications, Cyber, Intelligence, Surveillance, Reconnaissance and Targeting - Ocean Battlespace Sensing - Sea Warfare and Weapons - Warfighter Performance - Air Warfare and Weapons ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The FY23 to FY24 increase reflects Naval leadership commitment and priority to the continued development, diversity, vitality and quality of the future naval research and engineering workforce.					
Accomplishments/Planned Programs Subtotals	114.506	90.076	96.355	0.000	96.355

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy												Date: March 2023
Appropriation/Budget Activity 1319 / 1					R-1 Program Element (Number/Name) PE 0601103N / *University Research Initiatives*				Project (Number/Name) 9999 / *Congressional Adds*			
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
9999: *Congressional Adds*	0.000	55.459	57.300	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	112.759

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Congressional Add: Defense University Research Instrumentation Program ***FY 2022 Accomplishments:*** Purchase instrumentation and equipment used to enhance university research in the areas of photonics; materials included high-temperature materials, soft multi-material structures, and photomechanical materials; autonomous and robotic systems; optical quantum information; oceanography; electronics; atmospheric turbulence; and distributed energy. ***FY 2023 Plans:*** Purchase instrumentation and equipment used to enhance university research in the areas of photonics; materials included high-temperature materials, soft multi-material structures, and photomechanical materials; autonomous and robotic systems; optical quantum information; oceanography; electronics; atmospheric turbulence; and distributed energy.	33.787	30.000
Congressional Add: University research initiatives ***FY 2022 Accomplishments:*** Support collaborative university research into the understanding, detection, and prevention of Traumatic Brain Injuries. Also, support grants to purchase instrumentation and equipment to enhance university basic research. ***FY 2023 Plans:*** N/A	9.654	0.000
Congressional Add: Coastal adapt. Res. for imp. coastal comm. and NWS earle military install. Resil ***FY 2022 Accomplishments:*** The funding will be used by Monmouth university, in conjunction with Naval Weapons Station Earle, to advance coastal community resilience projects identified in the Raritan/Sandy Hook Bay Coastal Resilience Planning Study - a joint study conducted by Naval Weapons Station Earle, Monmouth County Division of Planning, Monmouth University, and eight coastal communities.	0.434	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601103N / *University Research Initiatives*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Accomplishments: Conduct a joint study between Naval Weapons Station Earle, Monmouth County Division of Planning, Monmouth University, and eight coastal communities to advance coastal community resilience projects identified in the Raritan/Sandy Hook Bay Coastal Resilience Planning Study. ***FY 2023 Plans:*** N/A		
Congressional Add: Navy aircraft fleet readiness and sustainment ***FY 2022 Accomplishments:*** Navy aircraft fleet readiness and sustainment basic research ***FY 2023 Plans:*** N/A	7.723	0.000
Congressional Add: Biocoherent energy transfer research ***FY 2022 Accomplishments:*** Conduct Biocoherent energy transfer basic research ***FY 2023 Plans:*** N/A	3.861	0.000
Congressional Add: All digitall arrays for long-distance application power maximization ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct research in all digital arrays for long-distance application power maximization.	0.000	9.800
Congressional Add: Artificial intelligence maritime maneuvering ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct research in artificial intelligence maritime maneuvering.	0.000	5.000
Congressional Add: Enhancing installation resiliency at NWS Earle ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct research in enhancing installation resiliency.	0.000	2.500
Congressional Add: Defense research initiatives ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct basic research in new areas through defense research initiatives.	0.000	10.000
Congressional Adds Subtotals	55.459	57.300

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601103N / *University Research Initiatives*	**Project (Number/Name)** 9999 / *Congressional Adds*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 1: *Basic Research*	**R-1 Program Element (Number/Name)** PE 0601153N / *Defense Research Sciences*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	511.510	541.513	540.908	-	540.908	558.812	578.932	569.486	591.204	Continuing	Continuing
0000: *Defense Research Sciences*	0.000	462.869	479.480	520.984	-	520.984	538.490	558.203	548.343	569.638	Continuing	Continuing
3465: *In-House Lab Independent Res*	0.000	10.992	19.533	19.924	-	19.924	20.322	20.729	21.143	21.566	Continuing	Continuing
9999: *Congressional Adds*	0.000	37.649	42.500	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	80.149

A. Mission Description and Budget Item Justification

The Office of Naval Research (ONR) was established by Congress in 1946 to plan, foster and encourage scientific research in recognition of its paramount importance to the maintenance of American naval power and national security. ONR manages the Department of the Navy's (DON) portfolio of Basic Research, Applied Research and Advanced Technology Development investments to ensure naval forces can effectively deter conflict, but when called upon, fight, win and come home safely. This Program Element (PE) supports the Basic Research portion of the Department of the Navy (DON) science and technology (S&T) portfolio, laying the foundation for new innovative technologies and future capabilities for naval warfighters. This PE's efforts include theoretical and experimental investigations directed toward increasing knowledge and understanding of the physical, chemical, engineering, environmental and life sciences. The huge majority of the research in this PE are performed by academia and government labs, both of which play significant roles in developing the S&T workforce of tomorrow in addition to delivery new knowledge and scientific discoveries.

This PE, and the rest of Naval S&T, supports higher guidance defined by the National Defense Strategy, and responds to requirements identified by the Secretary of the Navy through research priorities set by the Chief of Naval Research, coordinated across the Naval Research Enterprise (NRE), and outlined in the Naval R&D Framework. In addition, ONR's S&T investment portfolio supports National Naval Responsibilities (NNR) critical to the naval services where the Navy has historically taken the lead (ocean acoustics, undersea weapons, naval engineering, undersea medicine and sea-based aviation) to ensure decisive naval capability in the maritime domain. Scientific breakthroughs within the current research activities:
Atmosphere & Space Sciences;
Mathematics, Computer, & Information Sciences;
Ocean Sciences;
Materials/Processes;
Human Systems;
Medical/Biology;
Science Addressing Hybrid Threats;
Sensors, Electronics & Electronic Warfare (EW);
Air, Ground & Sea Vehicles;
Weapons; and

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 1: *Basic Research*	**R-1 Program Element (Number/Name)** PE 0601153N / *Defense Research Sciences*

Science & Engineering Education, Career Development & Outreach
lead to more advanced aspects of applied research and technology development and become solutions to Navy and Marine Corps technical challenges via the Future Naval Capabilities (FNCs) pipeline, and new capability options for the future via the Innovative Naval Prototypes (INPs) portfolio. Just as today's Sailors and Marines are enabled by past naval S&T investments, current investments hedge against uncertainty, providing the scientific basis for near-term solutions to commanders today and options for an unknown future.

The work in this PE can be classified between Technology Readiness Level (TRL) 1 (basic principles observed and reported) and TRL 2 (technology concept and/or application formulation).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	523.324	499.116	510.975	-	510.975
Current President's Budget	511.510	541.513	540.908	-	540.908
Total Adjustments	-11.814	42.397	29.933	-	29.933
• Congressional General Reductions	-	-0.103			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	42.500			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-11.814	0.000			
• Program Adjustments	0.000	0.000	29.933	-	29.933
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 9999: *Congressional Adds*		
Congressional Add: *Basic Research*	24.134	25.000
Congressional Add: *Bio-inspired Engineering and Design for Naval Applications*	2.896	0.000
Congressional Add: *Generally-capable robotics for naval operations*	3.861	0.000
Congressional Add: *Multifunctional structural batteries*	1.931	3.000
Congressional Add: *Silicon-germanium-tin alloy research*	4.827	5.000
Congressional Add: *Predictive modeling for next generation undersea vehicles*	0.000	3.000

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 1: *Basic Research*	**R-1 Program Element (Number/Name)** PE 0601153N *I Defense Research Sciences*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Congressional Add: *Naval Research Laboratory S&T*	0.000	6.500
Congressional Add Subtotals for Project: 9999	37.649	42.500
Congressional Add Totals for all Projects	37.649	42.500

Change Summary Explanation

Funding: $29.933M funding increase for Basic Research Enhancements for Strategic Competition

Technical: No significant change.

Schedule: No significant change

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy										Date: March 2023		
Appropriation/Budget Activity 1319 / 1				R-1 Program Element (Number/Name) PE 0601153N / *Defense Research Sciences*				Project (Number/Name) 0000 / *Defense Research Sciences*				
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
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Mathematics, Computer, & Information Sciences;
Ocean Sciences;
Materials/Processes;
Human Systems;
Medical/Biology;
Science Addressing Hybrid Threats;
Sensors, Electronics & Electronic Warfare (EW);
Air, Ground & Sea Vehicles;
Weapons; and
Science & Engineering Education, Career Development & Outreach
lead to more advanced aspects of applied research and technology development and become solutions to Navy and Marine Corps technical challenges via the Future Naval Capabilities (FNCs) pipeline, and new capability options for the future via the Innovative Naval Prototypes (INPs) portfolio. Just as today's Sailors and Marines are enabled by past naval S&T investments, current investments hedge against uncertainty, providing the scientific basis for near-term solutions to commanders today and options for an unknown future.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601153N / *Defense Research Sciences*	**Project (Number/Name)** 0000 / *Defense Research Sciences*

The work in this PE can be classified between Technology Readiness Level (TRL) 1 (basic principles observed and reported) and TRL 2 (technology concept and/or application formulation).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Air, Ground and Sea Vehicles	55.534	56.993	57.168	0.000	57.168
Description: Sailors and Marines operate air, ground and sea vehicles in some of the most extreme environments on the planet. Basic research advances the capacity of naval platforms operating under, on and above the seas, and to project power ashore. Ongoing research in the Air, Ground and Sea Vehicles activity will increase platform performance, reliability, improve human-machine teaming, reduce the cost of at-sea operations and enhance the effectiveness of distributed maritime operations. The efforts research focus include: surface and subsurface signatures; free-surface, subsurface, and propulsor hydromechanics; hull life assurance; advanced ship concepts; distributed intelligence for automated survivability; advanced electrical power systems; air vehicles; air platforms propulsion and power; air platforms survivability and signature control; special aviation projects; environmental quality; logistics; power generation, energy conversion, and storage; and advancements in naval technology innovations. ***FY 2023 Plans:*** Aerospace Structures and Materials Research is focused on basic research for developing lightweight, reliable, survivable, sustainable, and affordable airframes for naval and marine corps aircraft and weapons. - Continue research on galvanic corrosion and mitigation strategies for metallic airframes in naval environment. - Continue efforts on multiaxial fatigue of hybrid airframes. - Continue research on high fidelity composites prediction methodologies that span multiple length scales. - Continue work on novel out of autoclave and out of oven curing technologies. - Continue research on short fiber thermoplastic composite forming and joining. - Continue work on high strain rate characterization of materials. - Continue computer assisted iterative material development for armor applications. - Continue investigating lightweight material solutions for multifunctional structures for airframes and weapons. Flight Dynamics & Control					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601153N / *Defense Research Sciences*	**Project (Number/Name)** 0000 / *Defense Research Sciences*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Research will develop theory and analysis methods to understand the phenomena and natural dynamics of air vehicles operating in the marine environment. Collaborative research will improve our knowledge of control system interactions between piloted aircraft and human performance. - Continue efforts to increase the operational envelop for air vehicles, tailor airframe dynamics with novel control effectors, improve threat engagement performance, develop fundamentals for coupled human/machine dynamics, adapt to variable airframe conditions. - Continue work on multibody control systems and the ability to demonstrate guaranteed performance relative to a desired end state. - Continue work designed to achieve robust and precise control in the presence of highly turbulent flow fields. - Continue developing algorithms to enable precise ship-relative navigation in GPS-denied environments. Aerodynamics Research will enhance understanding of Naval-unique aerodynamic challenges by developing advanced computational and experimental methods. - Continue researching the fully coupled aerodynamic interface between ships and aircraft. - Continue investigating novel state-of-the-art in-situ diagnostics and reduced-order modeling of complex flow fields. - Continue researching innovative technologies enabling increased range and/or maneuverability suitable for aircraft operating from the maritime environment and attritable systems such as unmanned aerial systems and high-speed weapons. - Continue research on the interactional and transitional aerodynamics of multi-rotor systems in complex fluid dynamic environments involving multi-body relative motion. Science of Autonomy and Control of Unmanned Systems Research related to critical multidisciplinary autonomy challenges that cut across areas/domains, including air, sea, undersea and ground. - Continue investigating the scalable and robust distributed collaboration among autonomous systems. - Continue research on human/unmanned system collaboration. - Continue work on perception-based adaptation across uncertain naval environments. - Continue investigating embodied and situated intelligence and architectures. - Continue developing theory-based tools and methods for safe, assured, robust, verifiable, and trustable autonomy. Propulsion, Power and Thermal Management					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601153N / *Defense Research Sciences*	**Project (Number/Name)** 0000 / *Defense Research Sciences*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Complete research in flow control in offset diffusers. - Continue research to advance the technical superiority of Naval Aircraft - Propulsion, Power and Thermal management with emphasis on propulsion cycles, subsystems, propulsion integration, turbo machinery and drive systems, and hot section materials and coatings. - Continue research to improve the power density, fuel efficiency, speed, range and operating reliability of future large, medium and small engines. - Continue studies with Rotating Detonation Engines and integration into platforms and weapon systems using thermodynamic models, Computational Fluid Dynamics and sub-scale experiments. - Continue research for high stage-loading and efficient turbomachinery including distortion tolerant fans, casing treatments and advanced methods in blade-disk aerodynamics; advanced cooling and thermal management for engines and auxiliary systems including new concepts of heat collection, distribution and rejection; advanced turbine engine materials and coatings; highly integrated propulsion inlets and exhausts and dust ingestion research, including modeling, separating, deposition, coatings and sensing. - Continue to improve jet engine material durability and temperature rate capabilities in both benign and corrosive environments. - Continue to develop advanced radio-frequency based sensors to provide ingestion and foreign object damage sensing, as well as overall prognostics. - Initiate research of fundamental modeling of distributed combustion in the turbine. Platform Design and Engineering Conduct basic research related to platform performance and platform autonomy and control. Efforts include, but are not limited to, the following: - Continue research related to Naval Engineering and Platform Design (NNR), Basic Surface Ship Dynamics, Propulsion Hydromechanics, Basic Subsurface Hydromechanics, Basic Surface Ship Hydrodynamics, Adaptive Control and Centers for Innovative Naval Technology - Continue and expand research associated with Digital Twin Science efforts. Conduct basic research related to platform survivability and tactical submarine evolution plan (TSEP) S&T. Efforts include, but are not limited to, the following: - Continue research related to Structural Reliability Science, Metamaterials, Structural Acoustic Science, Underwater Electromagnetic Signatures, Electromagnetic Signatures, Signature Management Science, Submarine Security S&T - Detectability and Submarine Security S&T - Susceptibility. Power, Energy & Propulsion					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Conduct basic research related to heat transfer and thermal management, power generation, energy storage and power management, distribution and control, and power electronics and electro-magnetics. - Initiate basic research efforts related to climate resiliency and clean energy. Materials - Continue research related to enabling enhanced performance and resiliency of systems and platforms through a collection of related efforts. Work includes Corrosion Control Science (for conventionally and additive manufactured materials) for enhanced resiliency and sustainability of naval platforms and systems; Nano-Engineered Materials for extended performance and sustainability of legacy systems and platforms and emerging opportunities for structural and functional (optical, electro-active, etc.) properties that will enable new system designs; Scarce Materials Mitigation Strategies to explore new compositions to reduce requirements for certain elements; Electrochemical Materials and Functional Polymeric and Organic Materials to understand phenomenology that can be applied to more efficient energy capture and power storage and distribution for a wide distribution of naval emerging requirements, and Computer-Aided Material Design to accelerate research in all areas described here.					
FY 2024 Base Plans: Aerospace Structures and Materials Research focused on the development of lightweight, reliable, survivable, sustainable, and affordable airframes for naval and marine corps aircraft and weapons. Research efforts include the following: - Continue research on galvanic corrosion and mitigation strategies for metallic airframes in naval environment. - Continue research on high fidelity composites prediction methodologies that span multiple length scales. - Continue investigations of novel out-of-autoclave and out-of-oven curing technologies. - Continue research efforts on short fiber thermoplastic composite forming and joining. - Continue research investigations of high strain rate characterizations of materials. - Continue material development efforts regarding armor applications. - Continue investigating lightweight material solutions for multifunctional structures for airframes and weapons. - Complete computer-assisted iterative material development for armor applications. - Complete research efforts regarding multiaxial fatigue of hybrid airframes. - Initiate fundamental research on manipulating material micro structure for function. Flight Dynamics & Control Research to develop the theory and analysis methods necessary to understand the phenomena and natural dynamics of air vehicles operating in the marine environment. Collaborative research efforts in this area improve					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
our knowledge of control system interactions between piloted aircraft and human performance. Research efforts include the following: - Continue research investigations to increase the operational envelop for air vehicles, tailor airframe dynamics with novel control effectors, improve threat engagement performance, develop fundamentals for coupled human/machine dynamics, adapt to variable airframe conditions. - Continue research regarding multibody control systems and the ability to demonstrate guaranteed performance relative to a desired end-state. - Continue research efforts to achieve robust and precise control in the presence of highly turbulent flow fields. - Continue research efforts to develop software algorithms that enable precise ship-relative navigation in GPS-denied environments. Aerodynamics Research efforts focused on enhancing our understanding of Naval-unique aerodynamic challenges by developing advanced computational and experimental methods. Research efforts include the following: - Continue researching the fully coupled aerodynamic interface between ships and aircraft. - Continue investigating novel state-of-the-art in-situ diagnostics and reduced-order modeling of complex flow fields. - Continue researching innovative technologies enabling increased range and/or maneuverability suitable for aircraft operating from the maritime environment and attritable systems such as unmanned aerial systems and high-speed weapons. - Continue research on the interactional and transitional aerodynamics of multi-rotor systems in complex fluid dynamic environments involving multi-body relative motion. Science of Autonomy and Control of Unmanned Systems Research investigations regarding critical multidisciplinary autonomy challenges that cut across areas/domains, including air, sea, undersea and ground. Research efforts include the following: - Continue investigating the scalable and robust distributed collaboration among autonomous systems. - Continue research on human/unmanned system collaboration. - Continue work on perception-based adaptation across uncertain naval environments. - Continue investigating embodied and situated intelligence and architectures. - Continue developing theory-based tools and methods for safe, assured, robust, verifiable, and trustable autonomy. Propulsion, Power and Thermal Management					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Research efforts with focused emphasis regarding critical areas such as propulsion cycles, subsystems, propulsion integration, turbo machinery and drive systems, and high-temperature (hot section) materials and coatings. Research efforts include the following: - Continue research to advance the technical superiority of Naval Aircraft - Propulsion, Power and Thermal management with emphasis on propulsion cycles, subsystems, propulsion integration, turbo machinery and drive systems, and hot section materials and coatings - Continue research to improve the power density, fuel efficiency, speed, range and operating reliability of future large, medium and small engines. - Continue studies with Rotating Detonation Engines and integration into platforms and weapon systems using thermodynamic models, Computational Fluid Dynamics and sub-scale experiments. - Continue research for high stage-loading and efficient turbomachinery including distortion tolerant fans, casing treatments and advanced methods in blade-disk aerodynamics; advanced cooling and thermal management for engines and auxiliary systems including new concepts of heat collection, distribution and rejection; advanced turbine engine materials and coatings; highly integrated propulsion inlets and exhausts and dust ingestion research, including modeling, separating, deposition, coatings and sensing. - Continue to improve jet engine material durability and temperature rate capabilities in both benign and corrosive environments. - Continue to develop advanced radio-frequency based sensors to provide ingestion and foreign object damage sensing, as well as overall prognostics. - Continue research of fundamental modeling of distributed combustion in the turbine. - Initiate Hierarchical nonlinear Control of Integrated Propulsion, Power, and Thermal Management Systems for Naval Aircraft - Initiate Inter-Turbine burning for enhanced performance - Initiate Enhancing Jet Breakup via High-Frequency Ultrasound Platform Design and Engineering Research efforts regarding platform performance, platform survivability in support of future platform-building programs, platform autonomy, autonomous systems, and control for naval systems. Research efforts include the following: - Continue research related to Naval Engineering and Platform Design (a National Naval Responsibility area), Basic Surface Ship Dynamics, Propulsion Hydromechanics, Basic Subsurface Hydromechanics, Basic Surface Ship Hydrodynamics, Adaptive Control and Centers for Innovative Naval Technology.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research efforts associated with Digital Data Science including Autonomous Systems (Machinery/ Platform), Digital Threads, Digital Twins, Condition Based Maintenance, and Digital Engineering. - Continue research regarding Structural Reliability and Resiliency focusing efforts on Alternative Hull/Structural Materials, Composite Structures and engineered Metamaterials. - Continue research in Platform Signature Related Sciences to include: Structural Acoustics, Underwater Electromagnetic Signatures, Electromagnetic Signatures, Submarine Detectability, and Undersea Platform Susceptibility. - Initiate research efforts related to System Complexity and Resiliency for Naval Platforms and Systems. - Initiate research in Non-Acoustic Signatures Science for Advanced Naval Platforms. - Initiate research efforts regarding Digital Decision Metrics for Naval Platform Design and Engineering. Power, Energy & Propulsion Research relevant to the power, energy & propulsion of naval systems. Research efforts include the following: - Continue climate research to improve understanding of the environmental impacts on future platforms and reduce the impact of platforms on the environment. - Initiate fundamental electrical power, energy and propulsion research. - Initiate research in heat transfer and thermal management science and materials to enable effective cooling of future directed energy systems, power electronics, personnel, etc. - Initiate power generation research to improve operational endurance, energy storage, distribution, power management and control. - Initiate power electronics research for improved energy conversion efficiency, and electromagnetic materials research to achieve compatibility with high frequency power electronics. - Initiate to advance material science for electrochemical energy storage, alternative fuels, fuel cells, dielectrics, and photovoltaics. - Initiate physics-based modeling efforts, and the development of digital twins for power and energy materials, components, and systems. Materials Research relevant to enabling enhanced performance and resiliency of naval systems and platforms. Research efforts include the following: - Continue research efforts regarding Corrosion Control Science (for conventionally and additive manufactured materials) for enhanced resiliency and sustainability of naval platforms and systems.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research investigations of Nano-Engineered Materials for extended performance and sustainability of legacy systems and platforms and emerging opportunities for structural and functional (optical, electro-active, etc.) properties that will enable new system designs. - Continue research of Electrochemical Materials and Functional Polymeric and Organic Materials to understand phenomenology that can be applied to more efficient energy capture and power storage and distribution for a wide distribution of naval emerging requirements. - Continue research investigations of Computer-Aided Material Design to accelerate research in all areas described here. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024.					
Title: Atmosphere and Space Sciences	26.855	27.597	30.462	0.000	30.462
Description: Effective Naval operations depend upon accurately understanding the maritime and littoral operating environment and predicting its characteristics at high spatial and temporal resolution in areas that may be inaccessible. Understanding atmospheric phenomena and their impact on the electromagnetic spectrum from the sea surface to space provides a significant warfighting advantage. Efforts include: Battlespace Environments, Marine Meteorology and Prediction and Space Research. These efforts support basic research on physical process studies, fundamental observations, data discovery, and modeling and forecasting of the atmosphere and space with the goal of improving the ability to predict the battlespace environment of the Navy and Marine Corps, anywhere on the globe. Emphasis is placed on the marine atmosphere, the tropics, polar regions, the upper atmosphere and ionosphere and other areas where new understanding is needed in order to overcome predictability barriers that limit the accuracy of current forecast models. Efforts are underway to understand the interactions of physics between the atmosphere, space, land, ocean and ice, represent these coupled processes in models, and extend them across scales from local to planetary, with the goal of extending the skill of predictions up to seasonal and interannual timescales. Recent efforts have also focused on the processes that control tropical cyclone formation, structure and intensity changes and phenomena that affect electromagnetic and electro-optic signal propagation in the marine atmosphere and near space domains. Research results provide the foundation for improved global and regional forecasts of the operational environment and for development of next-generation, fully coupled, high resolution prediction systems. Research areas evolve in response to priorities of the Oceanographer of the Navy.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
FY 2023 Plans: Battlespace Environments - Continue to improve the quality of the environmental analysis and prediction provided in support of warfighters, including the assessment of the impact of the atmosphere and ionosphere-thermosphere-magnetosphere on the performance of sensors, platforms and weapon systems, and the advancement of our basic understanding of atmospheric processes across spatial scales and the interactions of the atmosphere with the land, sea, wave, ice, and thermosphere. - Continue to exploit environmental observations and to characterize environmental processes more accurately, thus providing improved forecast models for the Navy and Marine Corps in regions where operations take place, including: the littoral zone, where complex topography and air-sea-land contrasts impact the environment on very short time and space scales; the tropics and sub-tropics; and the Arctic, where longer time scale atmospheric changes affect short-term weather events. - Continue research on the coupled processes in the high atmosphere, between the troposphere and stratosphere and the stratosphere/mesosphere and ionosphere and their effect on weather and space weather prediction. - Continue research on atmospheric or Earth system coupled processes that are not well understood, including cloud and aerosol interaction, marine boundary layer and coastal prediction, and diurnal and mesoscale variability to improve their representation in forecast models. Marine Meteorology and Prediction -Continue to investigate key physical processes, including clouds and moisture phenomena to improve their representation in atmospheric predictive models. -Continue exploration of new and non-conventional observational data sources and novel methodologies for their assimilation into operational predictive models. -Continue deployment of observing systems in the upper troposphere, middle and upper atmosphere and the near-space environment to allow extension of prediction systems into the middle and upper atmosphere and provide longer and higher fidelity forecasts. -Continue observing experiments to understand the processes that contribute to the poorly predicted rapid intensification of tropical cyclones. -Continue field and modeling initiatives that focus on the origin, evolution and effects of Arctic cyclones believed to have a strong influence on Arctic sea ice motion and extent. -Continue to investigate the distribution, transport and time evolution of aerosols in the atmosphere and their impact on atmospheric visibility and laser propagation.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
-Complete the Land-Air-Sea Interaction research initiative to improve understanding and prediction of coupled near- shore atmospheric and oceanographic phenomena impacting naval littoral operations. -Initiate new research in cloud processes, predictability and uncertainty and utilization of nontraditional space-based and airborne sensors towards these goals. Space Research Perform innovative sensor development and physics-based modeling and forecasting integrated across three environmental space areas: geospace, heliospace, and high-energy space. Geospace: - Continue research into affordable small-sat sensors to investigate and specify the three dimensional structure and evolution of the electromagnetic signal propagation environment in the ionosphere, including ionospheric bubbles. Employ stereo imaging and tomographic reconstruction to access the three dimensional structure and evolution of the upper atmosphere and ionosphere, relevant to Naval communications, intelligence, surveillance and reconnaissance, and geolocation. - Continue development of our understanding and computational representation of upper atmospheric, ionospheric relevant plasma processes and their coupling to the lower atmosphere and solar inputs, towards a future physics-based ionospheric prediction capability. - Continue a small-sat investigation into improved ionospheric observation and understanding through use of new signal processing approaches, based on anomalous refraction of Global Navigation System transmissions. Heliospace: - Continue efforts to advance the understanding, and advance the forecastability of, the solar radiation and particle fluxes, and magnetic fields. Investigate how they influence the near-Earth environment and the relevant Naval systems that rely on that environment. - Continue to investigate efforts to improve solar event warning times, using newly available observations. - Continue efforts to understand particle acceleration mechanisms in high energy solar flares by studying gamma-ray and neutron emissions that are measured in space. - Continue efforts to leverage millisecond pulsars as stabile timing sources for precision navigation and timing applications. - Initiate efforts to improve solar event warning times, using newly available observations. High-Energy Space: - Initiate efforts to investigate new high-energy radiation and neutron detector materials for space-based observations.					
FY 2024 Base Plans:					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Battlespace Environments - Continue research investigations to improve the quality of the environmental analysis and prediction provided in support of warfighters, including the assessment of the impact of the atmosphere and ionosphere-thermosphere-magnetosphere on the performance of sensors, platforms and weapon systems, and the advancement of our basic understanding of atmospheric processes across spatial scales and the interactions of the atmosphere with the land, sea, wave, ice, and thermosphere. - Continue research efforts to exploit environmental observations and to characterize environmental processes more accurately, thus providing improved forecast models for the Navy and Marine Corps in regions where operations take place, including: the littoral zone, where complex topography and air-sea-land contrasts impact the environment on very short time and space scales; the tropics and sub-tropics; and the Arctic, where longer time scale atmospheric changes affect short-term weather events. - Continue research on the coupled processes in the high atmosphere, between the troposphere and stratosphere and the stratosphere/mesosphere and ionosphere and their effect on weather and space weather prediction. - Continue research efforts regarding atmospheric or Earth system coupled processes that are not well understood (cloud and aerosol interactions, etc.), marine boundary layer and coastal prediction, and diurnal and mesoscale variability to improve their representation in forecast models. Marine Meteorology and Prediction - Continue research efforts regarding marine atmospheric boundary layer gradients and processes important for low and mid-cloud evolution and structure. - Continue research investigations regarding key physical processes (marine atmospheric clouds, moisture and aerosol phenomena, etc.) to improve their representation in weather prediction models. - Continue research investigations of new and non-conventional observational data sources and novel methodologies for their assimilation into operational predictive models. - Continue efforts regarding the deployment of observing systems in the upper troposphere, middle and upper atmosphere and the near-space environment to allow extension of prediction systems into the middle and upper atmosphere and provide longer and higher fidelity forecasts. - Continue research investigations regarding the distribution, transport and time evolution of aerosols in the atmosphere and their impact on atmospheric visibility and laser propagation. - Complete observing experiments to understand the processes that contribute to the poorly predicted rapid intensification of tropical cyclones. - Complete field and modeling initiatives that focus on the origin, evolution and effects of Arctic cyclones believed to have a strong influence on Arctic sea ice motion and extent.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate new research in satellite-based environmental remote sensing algorithms and techniques tailored to improved retrievals for phenomena and regions of particular Naval interest. Space Research Continue research efforts on innovative sensor development, physics-based modeling and forecasting efforts integrated across three environmental space areas: geospace, heliospace, and high-energy space. Research efforts include: Geospace: - Continue research into affordable small-sat sensors to investigate and specify the three dimensional structure and evolution of the electromagnetic signal propagation environment in the ionosphere, including ionospheric bubbles. Employ stereo imaging and tomographic reconstruction to access the three dimensional structure and evolution of the upper atmosphere and ionosphere, relevant to Naval communications, intelligence, surveillance and reconnaissance, and geolocation. - Continue development of our understanding and computational representation of upper atmospheric, ionospheric relevant plasma processes and their coupling to the lower atmosphere and solar inputs, towards a future physics-based ionospheric prediction capability. - Complete a small-sat investigation into improved ionospheric observation and understanding through use of new signal processing approaches, based on anomalous refraction of Global Navigation System transmissions. - Initiate development of new imaging techniques to examine the structure and avolution of additional airglow chemical species in the ionosphere for dayside and nightside processes. - Initiate the development of new neutral density atmospheric observations for the mesosphere. - Initiate observational research in polar ionospheric processes for improved regional prediction of the ionosphere at high latitudes. - Initiate efforts into understanding basic plasma processes in the near-earth space to protect and understanding the effects on Naval C4IRS capabilities. Heliospace: - Continue efforts to advance the understanding, and advance the forecastability of solar radiation and particle fluxes and their interaction with magnetic fields. Investigate how they influence the near-Earth environment and the relevant Naval systems that rely on that environment. - Continue to investigate efforts to improve solar event warning times, using newly available observations. - Continue efforts to understand particle acceleration mechanisms in high energy solar flares by studying gamma-ray and neutron emissions that are measured in space.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue efforts to leverage millisecond pulsars as stabile timing sources for precision navigation and timing applications. - Continue research efforts to improve solar event warning times, using newly available observations. - Initiate efforts into forecasting physically-derived solar irradiance variability and the ionosphere-thermosphere-mesosphere (ITM) response. High-Energy Space: - Continue research investigations of new high-energy radiation and neutron detector materials for space-based observations. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY 2023 to FY 2024 in Atmosphere And Space Sciences will be used to conducted increased Basic Research in areas but not limited to ocean, littoral, atmosphere, and space environment.					
Title: Science Addressing Hybrid Threats	23.937	24.248	21.129	0.000	21.129
Description: Naval expeditionary forces increasingly face hybrid adversaries using conventional weapons combined with terror, crime, cyber, information operations, etc. A hybrid adversary is flexible and adapts quickly to synchronize advanced state weapons systems, disruptive commercial technologies, cheap expedient homemade weapons, and a variety of novel tactics. The Sciences Addressing Hybrid Threats (SAHT) (formerly Counter Improvised Explosive Device (IED)) activity seeks to establish and nurture science to counter these growing challenges, while collaborating with and leveraging results from more traditional Naval research portfolios. The SAHT Sciences program provides research for Naval Forces to fight hybrid threats and adversaries in expeditionary operations. Naval Expeditionary Forces need science advances to address a range of research challenges that result from physical and operational environmental limitations so harsh that solutions push basic discovery and invention. Naval Forces able to operate amphibiously and in the littoral will have all of their capabilities exposed to degrading sea and land physical effects. Expeditionary forces must be agile and lethal but will be constrained by size, weight, and power requirements and must be sustained across large areas. Research efforts include: machine perception, reasoning and collaborative behavior; artificial intelligence enabling future intelligent systems; optics, electronics, and photonics research to enable revolutionary					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
spectral awareness in small low power sensors; computer and network science to enable expeditionary computing; fundamental chemistry and materials science research to advance technologies to support sustainment; materials research to explore and improve armor and structural materials; electrochemical energy conversion and storage research to sustain the force; chemistry and physics to provide disruptive energetics for expeditionary fires; and biology, physiology, and cognitive sciences addressing Naval Expeditionary warfighter capabilities. ***FY 2023 Plans:*** - Continue basic research in sensors and sensing technologies to enable stand-off detection and rapid neutralization of explosive hazards in multiple expeditionary mission environments while maintaining operational tempo. - Continue research into reconstructing human physiological features from audio samples based upon brain science to pair vocal tract features with identifiable facial characteristics. - Continue research into enabling secure and efficient sharing of computer hardware accelerators in systems restricted by size, weight, area and power. - Continue work in immersive sciences for automated methods for generating content and behaviors, and conduct research studies to examine questions, such as usability and training effectiveness, to increase understanding and use of Extended Reality (XR) technologies for naval applications. - Continue research into methods to identify coherent courses of action with effective outcomes using Artificial Intelligence (AI) agents. - Continue investigating learning theories to enable complex, collaborative, human-robot interactions. - Continue research for modeling autonomy, for the purpose of creating systems that operate in complex undersea/surface/land/air/space domains. - Continue research methods that model how diverse autonomous systems interact with each other in complex environments. - Continue work on means and methods for evaluating the reliability and effectiveness of collective decision making by autonomous systems and humans. - Continue researching the creation of Artificial Intelligence (AI) hybrid learning theories for the purpose of creating heterogeneous multi-agent collaborative autonomy. - Continue research to create theories for multi-agent collaborative autonomy that mimic the organizational principles found in social insects/birds/fishes. - Complete exploring concepts, techniques and methods, for the design, growth, and characterization of electronic and electro-optic sensors to counter improvised explosive devices (IEDs).					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate a follow-on and focused research effort on investigation on security aspect of non-volatile main memory usage for future computing systems. - Initiate research to provide fundamental understanding of biological olfactory sensing and processing of relevant odor representation in order to apply toward chemical sensor design and processing principles. - Initiate research of ultra-low size, weight, and power communications in a contested environment. - Initiate research to explore robotic behaviors for locating and mitigating threats from hazards in building clearing. - Initiate a follow-on and focused research effort for the machine learning investigation of multifactorial information environment parameters in order to automate the process of detecting, identifying and distinguishing intent. - Initiate a follow-on and focused research effort for discovery research on multi-class, multi-objective deep reinforced learning algorithms with automated training.					
FY 2024 Base Plans: Mathematics, Electronics, and Quantum Fundamental Research - Continue a focused research effort for discovery research on multi-class, multi-objective deep reinforced learning algorithms with automated training. - Complete research into reconstructing human physiological features from audio samples based upon brain science to pair vocal tract features with identifiable facial characteristics. Mine & Expeditionary Warfare - Continue research efforts in sensors and sensing technologies to enable stand-off detection and rapid neutralization of explosive hazards in multiple expeditionary mission environments while maintaining operational tempo. - Initiate research into rethinking data security in a speculative, hammerable, and heterogeneous world. - Initiate research into third generation network intrusion detection and prevention systems. Platform Design and Engineering - Continue research of ultra-low size, weight, and power communications in a contested environment. - Complete a focused research effort on investigation on security aspect of non-volatile main memory usage for future computing systems. - Complete research to provide fundamental understanding of biological olfactory sensing and processing of relevant odor representation in order to apply toward chemical sensor design and processing principles.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Complete research investigations into enabling secure and efficient sharing of computer hardware accelerators in systems restricted by size, weight, area and power. - Initiate efforts to study the complex energy-supply problem with deployed vehicles in contested environments en route to developing a novel decision-support framework for planning and managing adaptive transportation systems for naval logistics. - Initiate research to study, characterize, understand, and exploit anionic redox phenomena in lithium-ion and sodium-ion batteries and solve fundamental challenges en route to improving and designing new materials that could increase the cathode capacity of these battery chemistries by exploiting the anionic redox processes. Human-Level AI and Autonomy - Continue research investigations regarding learning theories to enable complex, collaborative, human-robot interactions. - Continue research for modeling autonomy, for the purpose of creating systems that operate in complex undersea/surface/land/air/space domains. - Continue research methods that model how diverse autonomous systems interact with each other in complex environments. - Continue research efforts on means and methods for evaluating the reliability and effectiveness of collective decision making by autonomous systems and humans. - Continue research investigations regarding the creation of Artificial Intelligence (AI) hybrid learning theories for the purpose of creating heterogeneous multi-agent collaborative autonomy. - Continue research to create theories for multi-agent collaborative autonomy that mimic the organizational principles found in social insects/birds/fishes. - Continue a follow-on and focused research effort for the machine learning investigation of multifactorial information environment parameters in order to automate the process of detecting, identifying and distinguishing intent. - Complete research into methods to identify coherent courses of action with effective outcomes using Artificial Intelligence (AI) agents. - Complete research to explore robotic behaviors for locating and mitigating threats from hazards in building clearing. - Initiate research to study novel collaborative methods for swarming autonomous entities to reliably determine true/relative position in GPS-denied operations. Training and Education for Naval Readiness					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue work in immersive sciences for automated methods for generating content and behaviors, and conduct research studies to examine questions, such as usability and training effectiveness, to increase understanding and use of Extended Reality (XR) technologies for naval applications. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease from FY 2023 to FY 2024 is due to a more appropriate alignment of materials, biomedical and survivability research efforts to the Material/Processes Research Activity.					
Title: Human Systems ***Description:*** Sailors and Marines operate across multiple domains: under, on and above the seas. This Activity focuses on understanding the human aspects of Naval operations with the objective of planning and execution for mission success. The long-term goal of this research is to increase total system performance by maximizing the effectiveness of human-machine systems to ensure mission effectiveness. Research areas include: attention and decision making in goal-directed behaviors, computational and neural foundations of cognitive skills and underlying processes, information exchange processes in human-human and human-machine teaming tasks, human interactions with autonomous systems, preparation and adaptation to novel challenge, new approaches to training and training assessment, personnel assessment, information conflicts, and humanitarian assistance/disaster relief. ***FY 2023 Plans:*** Command Decision Making - Continue context-based decision making research for mission planning & execution. - Complete research to explore Command and Control (C2) human-machine collaboration and management of algorithms that adapt recommendations using machine learning (ML). - Complete work to utilize machine learning algorithms for analysis and forecasting of "what if" planning scenarios. - Initiate research for creating Collaborative Artificial Intelligence and investigate methods that enable algorithms to learn task procedures and task context from human explanations. - Initiate research into methods to "close-the-loop" where decision support AI can explain recommendations and context to the user.	20.460	20.310	22.251	0.000	22.251

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Cognitive Science for Human-Machine Teaming - Continue research to understand the foundation of human intelligence that enables cognitive functions, such as communication, social interaction, and context understanding. - Continue research in computational modeling and natural language processing to support the framework and architectures necessary to develop higher-level intelligence in robotic and autonomous systems. - Complete work into modeling structured goals for monitoring the performance of autonomous agents. Schoolhouse Training - Continue efforts to create novel models for learning aimed at producing durable learning. - Continue to create skill decay models that can be used to predict when refresher training is needed for maintenance procedures. - Continue to investigate individual differences to optimize training techniques. - Continue efforts to understand how to facilitate the acquisition of generalized problem solving. - Complete research that created computationally-executable model of processes required for training dynamic maintenance tasks. Elements include attention, planning, memory, and motor action. - Complete research to measure the impact of video games on enhancing cognitive and perceptual skills. - Initiate researching neuro-psychometric tests that can reliably predict complex skill learning (e.g., second language & computer programing). - Initiate research to discover neuro-imaging analytical techniques to assess learning from written passages. - Initiate work to create new training techniques for spatial ability which facilitates learning STEM skills. Computational Neuroscience - Continue research to identify and understand neural circuits and pathways that will be used to develop models of sensorimotor control and spatial navigation. The long-term goal is to understand the neural foundation of intrinsic cognitive skills, such as attention, memory formation, perception, and problem solving in order to develop novel intelligent systems. - Complete research on neural basis of spatial navigation. - Initiate efforts to explore the neural basis of the control of reaching, grasping and manipulation to inform robotics. Human Interaction with Autonomous Systems - Continue exploring the principles of warfighter collaboration with autonomous and mission-capable robotic systems.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research to explore training of robots to perform complex manipulation skills using machine learning and human demonstration. The long-term goal is to provide better interfaces with autonomous systems, as well as provide transfer of control of autonomous platforms and payloads amongst operators. - Complete the analysis of human impressions (e.g., trust) of robotic teammates. - Initiate research exploring the combination of robot mobility with dexterous manipulation in assisting humans on Naval relevant tasks, such as shipboard maintenance and building clearing of hazards. Attention in Sensory Processing and Intelligent Sensing - Continue efforts on attention in intelligent sensing with a focus on the auditory modality, both with reflected and radiated acoustic signals on underwater targets. - Complete research in novel, brain-inspired deep-learning techniques applied to computer vision. - Initiate explorations into novel Artificial Intelligence-based approaches for Adaptive Training. Social, Cultural, and Behavioral Modeling - Continue research to improve current methods (e.g., algorithms, models) for detecting adversarial information maneuvers across social media platforms. - Complete research on detection of computer algorithms (bots) that manipulate social media traffic to influence content. - Initiate research on emerging and novel threats in cyberspace and in key military operations to include humanitarian assistance/disaster relief, civil stability, counter-terrorism and countering influence operations. - Initiate work to explore anthropological, sociological and socio-psychological research to improve blunting, mitigating and defeating influence operations against US interests abroad. Social Networks and Computational Social Science - Continue research to improve techniques in influence discernment, and the creation of effective communications strategies in the face of information conflict, modeling human behavior, the perception of information and cyber warfare. - Complete research on global models to monitor and explore social media. - Initiate research to explore social science methods and techniques to detect, mitigate, blunt, and defeat influence campaigns. - Initiate research and models on the impact of hybrid warfare and geo-political shifts on the future of conflict in the next decade. Manpower, Personnel, Training and Education for Future Warfighting					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research to understand the underlying mechanisms that optimize an individual's intellectual readiness and adaptability to military-relevant emerging technologies (e.g., Artificial Intelligence, autonomous systems) or novel operational challenges. - Continue research to improve psychometric properties of selection/assessment for high performance in military settings. - Continue research to improve analytical approaches to understand human behavior based on unstructured, interdependent, and complex data. The long-term goal is to establish a cohesive strategy for optimizing the readiness and effectiveness of the human capital enterprise. - Complete research evaluating the feasibility of virtual reality (VR) and augmented reality (AR) gaming technology to improve mental health outcomes and transition research results. - Initiate research exploring innovative technologies for real-time sensing and observation of individual behavioral responses to social and operational stressors. - Initiate research into methods to predict and detect destructive social behaviors, with a focus on novel theoretical frameworks and approaches, conducive to application in military settings. - Initiate research to create integrated modeling approaches to support management of the Naval workforce, leveraging real-time monitoring, observation, and comprehension of unit behavioral health.					
FY 2024 Base Plans: Command Decision Making - Continue research application of artificial intelligence analytic methods for enabling decision support in military team decision making. - Complete decision making research for game-based mission planning and execution tasks. - Complete research to investigate methods that enable learning algorithms for task procedures and task context derived from human explanations. - Initiate research in artificial intelligence to create bidirectional collaboration in human-machine teaming and decision making. Cognitive Science for Human-Machine Teaming - Continue research to understand the foundation of human intelligence that enables cognitive functions, such as communication, social interaction, and context understanding. - Continue research regarding natural language processing and computational modeling to support the framework and architectures necessary to develop higher-level intelligence in robotic and autonomous systems. Schoolhouse Training					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research to create novel models for learning aimed at producing durable learning. - Continue research investigations regarding the creation of skill-decay models that can be used to predict when refresher training is needed for maintenance procedures. - Continue research to understand how individual differences impact training effectiveness and how to tailor training for each individual. - Continue research efforts to understand the underlying mechanisms by which generalized problem-solving skills are acquired. - Continue research in systematically studying complex skill learning (e.g., second language, computer programming, machine troubleshooting) to understand neurological and cognitive predictors of gaining these skills. - Continue research investigations of neuro-imaging analytical techniques to assess learning from written passages. - Continue research efforts regarding training techniques for spatial ability which facilitates learning STEM skills. Computational Neuroscience - Continue research to identify and understand neural circuits and pathways that will be used to develop models of sensorimotor control. The long-term goal is to understand the neural foundation of intrinsic cognitive skills, such as attention, memory formation, perception, and problem solving in order to develop novel intelligent systems. - Continue exploring the neural basis of the control of reaching, grasping and manipulation to inform robotics. - Initiate research exploring the combination of robot mobility with dexterous manipulation in assisting humans on Naval relevant tasks, such as shipboard maintenance and building clearing of hazards. Human Interaction with Autonomous Systems - Continue research investigations regarding principles of warfighter collaboration with autonomous and mission-capable robotic systems. - Continue research efforts to explore training of robots to perform complex manipulation skills using machine learning and human demonstration. The long-term goal is to provide better interfaces with autonomous systems, as well as provide transfer of control of autonomous platforms and payloads amongst operators. - Continue research exploring the combination of robot mobility with dexterous manipulation in assisting humans on Naval relevant tasks, such as shipboard maintenance and building clearing of hazards. Attention in Sensory Processing and Intelligent Sensing					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research of attention in intelligent sensing with a focus on radiated acoustic signals in noisy environments. - Continue research regarding the understanding of Artificial Intelligence-based approaches for adaptive training, tailored to the individual learner. - Complete research efforts aimed at characterizing the fundamental aspects of how humans understand reflected acoustic signals on underwater targets. - Initiate research efforts to systematically study the neuro-cognitive processes of attention and its control. Social, Cultural, and Behavioral Modeling - Continue research of emerging and novel threats in cyberspace and in key military operations to include humanitarian assistance/disaster relief, civil stability, and countering influence operations. - Continue research of understanding the anthropological, sociological and socio-psychological factors that alter the effects of influence operations against US interests abroad. - Continue research to improve current methods (e.g., algorithms, models) for detecting adversarial information maneuvers across social media platforms. - Initiate research investigations of country-centric, descriptive and computational models of national resource and security issues to lay the foundation for forecast models relevant to military missions. Social Networks and Computational Social Science - Continue research efforts to develop models on the impact of spreading false information and geo-political shifts on the future of conflict in the next decade. - Continue research investigations to understand effective communications strategies in the face of information conflict, modeling human behavior, and the perception of information and cyber warfare. - Continue research efforts exploring social science methods and techniques to detect, mitigate, blunt, and defeat influence campaigns. - Initiate research to develop understanding of how influence campaigns in digital and social media affect decision making. Manpower, Personnel, Training and Education for Future Warfighting - Continue research efforts to increase our understanding of psychometric properties of selection/assessment for high performance in military settings. - Continue research to improve analytical approaches to understand human behavior based on real world (unstructured, interdependent, and complex) data.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research exploring innovative technologies for real-time sensing and observation of individual behavioral responses to social and operational stressors. - Continue research on the theories of destructive social behaviors (e.g., attempting suicide, compulsive activities, risky behavior, overusing alcohol, toxic leadership). - Continue research to understand fundamentals of unit behavioral health. - Complete research efforts regarding the understanding of underlying mechanisms that optimize an individual's intellectual readiness and adaptability to military-relevant emerging technologies (e.g., Artificial Intelligence, autonomous systems) or novel operational challenges. Minerva Research Initiative - Initiate research efforts to address novel conflict problems such as water security, malware, information warfare, ransomware, and basic research in social shifts relevant to national security issues, hybrid warfare and other novel conflict problems. - Initiate research investigations regarding mechanisms of crowd manipulation, social hysteria, rumor and propaganda in online and offline audiences. - Initiate multidisciplinary basic research efforts regarding national security issues, hybrid warfare, and related issues to address information advantage relevant to US military missions. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY2023 to FY2024 is due to the transfer of requirements and associated funding for the Minerva Research Initiative (MRI) activity in PE 0601103N / Project 0000 to the Human Systems activity in PE 0601153N / Project 0000. This transfer better represents the Basic Research focus and objectives of the Minerva Research Initiative.					
Title: Mathematics, Computer, and Information Sciences ***Description:*** This activity includes basic research efforts directed toward increasing scientific, mathematical, and computational foundations for integrated command, control, communications, cyber intelligence, surveillance, reconnaissance and targeting. The purpose is to sustain U.S. Naval Science and Technology (S&T) superiority, provide new technological concepts for the maintenance of naval power and national security, and help avoid scientific surprise.	58.966	61.701	63.334	0.000	63.334

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Efforts include: Scientific foundations and understanding for robust communications and networking; foundations for novel computing hardware, including nanoscale materials, emerging devices and circuits, emerging computational architecture and nanofabrication; basic research on novel techniques for controlling quantum states; algorithms for analyzing massive datasets in real time and heterogeneous information integration; science base and computational methods for building versatile intelligent agents; theory, algorithms and tools for decision support; mathematical optimization for resource allocation and usage; modeling and computation of complex physical phenomena; computation and information foundations for cyber defense; secure and reliable information infrastructure for command and control; information assurance; and research to extend state-of-the-science in artificial intelligence for the unique challenges of the Naval domain. ***FY 2023 Plans:*** Communications and Networks - Continue developing the scientific foundation and understanding of wireless communications and networking technologies that enable the naval warfighter to maintain access to mission critical information in contested environments. Research thrust areas include Tactical Communications and Tactical Networks. Tactical Communications - Continue developing new techniques for wireless distributed computing and device-to-device communication. - Continue novel coding and modulation techniques to improve the efficiency, capacity and/or resilience of wireless communications. Tactical Networks - Continue developing a feedback control model to determine the limit of fast adaptive traffic engineering. - Continue investigations in to new algorithms, protocols and middleware for dynamic and scalable multi-hop ad hoc wireless networking in contested environments. - Continue Artificial Intelligence/Machine Learning techniques for multi-dimensional Quality-of-Service optimization. - Continue development of cognitive methods and algorithms to maintain network resiliency under link disruptions without adding excess overhead. Spectrum Superiority / Networked Sensing - Continue efforts exploring advanced photonics techniques to maximize information extraction from individual photons and through tailored optical beams with the goal of being able to image at long-ranges and in degraded conditions.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue efforts on fundamental implications of classical entanglement on imaging and metrology. - Continue efforts to discover highly sensitive, multi-spectral detector materials and active sensing modalities for imaging through clouds, fog, haze and dust. - Continue efforts to explore novel optical processing architectures to significantly increase signal-processing bandwidth and to enable novel, real-time, distributed sensing applications. - Initiate efforts into direct measurement of current and phase at optical and infrared light frequencies to enable wider flexibility in signal extraction and waveforms. Nanoscale Computing Devices and Systems - Continue research on ultra-low power nanoelectronic devices, circuits and systems. - Continue research on spin based electronics, focusing on single atom and single molecule level control. - Continue research combining molecular quantum science and synthetic electronics. - Continue research on experimental routes to topologically-protected quantum computation with non-abelian any on quasiparticles in solid-state devices. - Complete research on atomic precision control of graphene nanostructures using chemical synthesis techniques. - Complete research on carbon based quantum systems that are compatible with bottom-up chemical synthesis paradigm. - Initiate research on device physics enabling probabilistic computing in stochastic networks. Quantum Information Sciences - Continue research on novel techniques for controlling quantum states to improve performance of information processors, sensors and clocks. Continue research on demonstrations of systems having a quantum advantage in the solution of optimization problems and quantum simulation of complex physical systems. - Continue research on the utilization of photonic and phononic devices for high performance quantum information processing. - Initiate research exploring the distribution of entanglement in a quantum network and applications thereof. Mathematical Data Science - Continue basic research in mathematics, probability, statistics, signal processing, machine learning, data engineering, and information theory. - Continue to develop advanced algorithms for analyzing massive datasets in real time, identify real patterns and avoid false positives.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue to develop advanced methods that can integrate and extract common features from large heterogeneous domains. - Continue research on privacy in complex networks. - Initiate development of scalable reinforcement learning. - Initiate research in approximate dynamic programming. Machine Reasoning and Intelligence - Continue developing the science base and computational methods for building versatile intelligent agents, which can function autonomously in uncertain, unstructured, uncontrolled, open-world environments, and can collaborate seamlessly with humans and other agents. - Continue basic research in developing new mathematical methods for principled design of deep learning architectures and analysis of their behavior. This program is expected to develop techniques for predicting performance learning-based systems, to improve their generalization abilities, and to reduce the need for empirical verification. - Continue basic research for developing robust computer vision systems, based on human vision, for automated understanding of surveillance imagery, perception for autonomous agents, and managing image/video libraries for after-action analysis and planning. - Initiate basic research in machine self-learning for intelligent agents, inspired by human learning, for understanding real-world environments. Optimization and Discrete Mathematics - Continue to identify exploitable mathematical structures within specific decision problems for the purpose of devising superior solution algorithms. - Continue investigation into methods for strategically formulating and solving optimization problems that arise in resource allocation, logistics, and system planning. - Continue investigations into new techniques that utilize convex optimization and duality theory to solve non-convex optimization problems. - Complete investigations on discrete and nonlinear-continuous programs for which input parameters are known with certainty, but for which the acquisition of optimal decision strategies can be computationally intensive. - Complete research on optimizing stochastic programs that, due to incomplete or partial information, have input parameters that are not known with certainty. - Initiate research on integrating machine-learning techniques with algorithms for stochastic and combinatorial optimization.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate research on developing novel first-order methods for solving general classes of problems that include saddle point problems, problems with a large number of constraints, and machine learning problems. - Initiate investigations into applying topological data analysis to combinatorial optimization problems. Applied and Computational Mathematics - Continue basic research in developing analytical and computational tools for models of physical phenomena of critical interest to the Navy waves, flows, materials, structures and information processing. - Continue to develop robust, reliable and near-real-time computational models for predicting environmental behavior in atmospheric and oceanic processes. - Continue to develop theoretical and computational tools to predict the onset of extreme events, whether in materials, such as formation of shocks, cracks and other discontinuities. - Continue to develop reduced models to enable speed up of computational models in acoustics, electromagnetics and optics, in regimes of special interest to the Navy. - Continue research to develop mathematically rigorous algorithms for employing variable-precision computations in very large-scale multi-physics problems. Complex Software Systems and Cybersecurity - Continue to investigate and develop novel computing concepts that lead toward robust, resilient, and dependable cyber systems. - Continue to explore novel application of ONR's concept of hybrid, formal-statistical machine learning in cyber security and software systems environment. - Continue to explore physics-based approaches to various security aspect of cyber-physical systems, including authentication, vulnerability testing, and exploit resilience. - Continue critical emphasis on improving scalability and capability of bottom-up formal analysis that would enable users to prove security properties about binaries directly. - Continue research on novel methods for attack surface maneuver for cyber physical systems and systems with complex apertures and sophisticated sensing apparatus, to include lightweight decoy synchronization and other resilience techniques. Complete development of tools and environment for programmability of heterogeneous multiple instruction set architecture systems. - Initiate research on autonomous cyber operations to explore what facets of cyber activities can be done fully autonomously or semi autonomously with human input. Science of Artificial Intelligence					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue to explore principled frameworks for integrating domain knowledge and machine learning for fast, robust learning of diverse complex concepts and tasks with light supervision. - Continue to explore artificial intelligence to advance the scientific understanding of collaborative, complex decision-making that is typical of naval command decision making. - Continue to explore formal verification and validation methods for artificial intelligence in the naval domain to enhance trust. - Continue to explore explainable artificial intelligence to enhance human-machine collaboration. - Continue to explore decentralized perception and planning in dynamic environments to develop a unified framework perception and planning for resources distributed across multiple platforms, autonomous systems and agents. - Continue to explore new brain-inspired artificial intelligence algorithms and architecture that provide richer computational capabilities than current deep learning networks, with an emphasis on memory systems and higher vision. - Continue to explore neuromorphic spiking neuron hardware designs based on brain models that are suitable for future edge computing and signal processing in small naval platforms. - Continue to explore autonomous problem solving and curiosity driven search for robust performance under unexpected conditions. - Initiate research to identify, characterize and model adversarial AI. - Initiate research exploring theory and algorithms for learning and decision making in multi-agent systems, particularly in adversarial situations. Information Technology - Continue development of improved methods for producing, analyzing, and securing Naval software systems. - Continue to design new concepts for future Naval tactical communication systems and networks. - Continue research in intelligent autonomy and improved interaction with autonomous systems, and improved methods for information analysis, fusion, and presentation.					
FY 2024 Base Plans: Communications and Networks - Continue research to develop the scientific foundation and understanding of wireless communications and networking technologies to enable the naval warfighter to maintain access to mission critical information in contested environments. Research thrusts in this area includes Tactical Communications and Tactical Networks. Tactical Communications					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research efforts to develop new techniques for wireless distributed computing and device-to-device communication. - Continue investigations regarding novel software coding and modulation techniques to improve the efficiency, capacity and/or resilience of wireless communication systems. Tactical Networks - Continue research efforts to develop feedback control models for determining the limit of fast adaptive traffic engineering. - Continue research investigations of algorithms, protocols and middleware regarding dynamic and scalable multi-hop ad hoc wireless networking in contested environments. - Continue research efforts regarding Artificial Intelligence/Machine Learning techniques relevant to multi-dimensional Quality-of-Service optimization issues. - Continue research efforts on the development of cognitive methods and algorithms to maintain network resiliency when experiencing communications link disruptions without adding excess overhead resources. Spectrum Superiority / Networked Sensing - Continue research investigations regarding fundamental implications of classical entanglement on imaging and metrology. - Continue research efforts regarding the exploration of highly sensitive, multi-spectral detector materials and active sensing modalities for imaging through clouds, fog, haze and dust. - Continue research efforts to explore novel optical processing architectures to significantly increase signal-processing bandwidth and to enable novel, real-time, distributed sensing applications. - Continue research investigations into the direct measurement of current and phase at optical and infrared light frequencies to enable wider flexibility in signal extraction and waveforms. - Complete research efforts exploring advanced photonics techniques to maximize information extraction from individual photons and through tailored optical beams with the goal of being able to image at long-ranges and in degraded conditions. Nanoscale Computing Devices and Systems - Continue research efforts on ultra-low power nanoelectronic devices, circuits and systems. - Continue research investigations of experimental routes to topologically-protected quantum computation with non-abelian quasiparticles in solid-state devices. - Continue research efforts regarding device physics enabling probabilistic computing in stochastic networks. - Complete research combining molecular quantum science and synthetic electronics.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Complete research investigations of spin-based electronics, focusing on single atom and single molecule level control. Quantum Information Sciences Research of quantum states, devices, phenomena relative to the simulation, information processing and computing performance needs of naval systems. Research efforts include the following: - Continue research on novel techniques for controlling quantum states to improve performance of information processors, sensors and clocks. - Continue research on demonstrations of systems having a quantum advantage in the solution of optimization problems and quantum simulation of complex physical systems. - Continue research on the utilization of photonic and phononic devices for high performance quantum information processing. - Continue research exploring the distribution of entanglement in a quantum network and applications thereof. Mathematical Data Science - Continue basic research in mathematics, probability, statistics, signal processing, machine learning, data engineering, and information theory. - Continue efforts to develop advanced algorithms for analyzing massive datasets in real time, identify real patterns and avoid false positives. - Continue investigations regarding the development of advanced methods to integrate and extract common features from large heterogeneous domains. - Continue research investigations of privacy in complex networks. - Continue research efforts regarding the development of scalable reinforcement learning. - Complete research efforts in approximate dynamic programming. - Initiate research investigations of causal dependences in complex networks. Machine Reasoning and Intelligence - Continue developing the science base and computational methods for building versatile intelligent agents, which can function autonomously in uncertain, unstructured, uncontrolled, open-world environments, and can collaborate seamlessly with humans and other agents. - Continue basic research in developing new mathematical methods for principled design of deep learning architectures and analysis of their behavior. This program is expected to develop techniques for predicting performance of learning-based systems, to improve their generalization abilities, and to reduce the need for empirical verification.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue basic research for developing robust computer vision systems, based on human vision, for automated understanding of surveillance imagery, perception for autonomous agents, and managing image/video libraries for after-action analysis and planning. - Continue basic research in machine self-learning for intelligent agents, inspired by human learning, for understanding real-world environments. - Initiate basic research in learning and decision-making in multi-agent systems in dynamic, uncertain settings where there are many competitive and cooperative agents and information about intentions and rewards are not fully known. This research area has a wide range of applications in tactical and strategic planning, economic planning, etc. Optimization and Discrete Mathematics - Continue to identify exploitable mathematical structures within specific decision problems for the purpose of devising superior solution algorithms. - Continue investigation into methods for strategically formulating and solving optimization problems that arise in resource allocation, logistics, and system planning. - Continue investigations into new techniques that utilize convex optimization and duality theory to solve non-convex optimization problems. - Continue research on integrating machine-learning techniques with algorithms for stochastic and combinatorial optimization. - Continue research on developing novel first-order methods for solving general classes of problems that include saddle point problems, problems with a large number of constraints, and machine learning problems. - Continue investigations into applying topological data analysis to combinatorial optimization problems. - Initiate investigations into finding solutions to various forms of multiagent, multiround games. Applied and Computational Mathematics - Continue basic research in developing analytical and computational tools for models of physical phenomena of critical interest to the Navy in waves, flows, materials, structures and information processing. - Continue to develop robust, reliable and near-real-time computational models for predicting environmental behavior in atmospheric and oceanic processes. - Continue to develop theoretical and computational tools to predict the onset of extreme events, whether in materials, such as formation of shocks, cracks and other discontinuities. - Continue to develop reduced models to enable speed up of computational models in acoustics, electromagnetics and optics, in regimes of special interest to the Navy.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research to develop mathematically rigorous algorithms for employing variable-precision computations in very large-scale multi-physics problems. Complex Software Systems and Cybersecurity - Continue to investigate and explore novel computing concepts that lead toward robust, resilient, and dependable cyber systems. - Continue to explore novel application of ONR's concept of hybrid, formal-statistical machine learning in cyber security and software systems environment. - Continue to explore physics-based approaches to various security aspect of cyber-physical systems, including authentication, vulnerability testing, and exploit resilience. - Continue critical emphasis on improving scalability and capability of bottom-up formal analysis that would enable users to prove security properties about binaries directly. - Continue research on novel methods for attack surface maneuver for cyber physical systems and systems with complex apertures and sophisticated sensing apparatus, to include lightweight decoy synchronization and other resilience techniques. - Continue research on autonomous cyber operations to explore what facets of cyber activities can be done fully autonomously or semi autonomously with human input. - Initiate Exploration of new alternatives for computing devices and architectures. Science of Artificial Intelligence - Continue research exploring principled frameworks for integrating domain knowledge and machine learning for fast, robust learning of diverse complex concepts and tasks with light supervision. - Continue research efforts regarding the use of artificial intelligence to advance the scientific understanding of collaborative, complex decision-making that is typical of naval command decision making. - Continue research of formal verification and validation methods for artificial intelligence in the naval domain to enhance trust. - Continue research investigations exploring explainable artificial intelligence to enhance human-machine collaboration. - Continue research regarding decentralized perception and planning in dynamic environments to develop a unified framework perception and planning for resources distributed across multiple platforms, autonomous systems and agents. - Continue research exploring new brain-inspired artificial intelligence algorithms and architecture that provide richer computational capabilities than current deep learning networks, with an emphasis on memory systems and higher vision.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research investigations of neuromorphic spiking neuron hardware designs based on brain models that are suitable for future edge computing and signal processing in small naval platforms. - Continue research efforts regarding autonomous problem solving and curiosity driven search for robust performance under unexpected conditions. - Continue research efforts to identify, characterize and model adversarial AI. - Continue research exploring theory and algorithms for learning and decision making in multi-agent systems, particularly in adversarial situations. - Initiate research efforts exploring computational models of vision-language interactions for intelligent agents that can learn and reason bout the real world with high levels of complexity. Information Technology - Continue development of improved methods for producing, analyzing, and securing Naval software systems. - Continue to design new concepts for future Naval tactical communication systems and networks. - Continue research in intelligent autonomy and improved interaction with autonomous systems, and improved methods for information analysis, fusion, and presentation. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY 2023 to FY 2024 includes increased emphasis and investments in areas such as Human-Level AI and Autonomy, Information Superiority, and fundamental Mathematics, Electronics, and Quantum Fundamental Research.					
Title: Materials/Processes ***Description:*** Lighter, faster, stronger is a winning combination. Naval materials research produces quieter submarines, fuel-efficient ships/vehicles and systems capable of operating under extreme temperature and chemical environments. New materials will result in warfighting advantages, as well as, systems that ensure environmental compliance, improved system reliability/resilience, stealthier materials, reduced manufacturing/ maintenance and lower total ownership costs. The Materials/Processes activity generates fundamental scientific understanding for new, advanced and improved materials, and to accelerate materials-driven concepts essential to Naval superiority. The research is conducted in a cross-cutting and interdisciplinary manner covering Structural Materials, Functional Materials, Manufacturing, Chemistry and Undersea Materials to ensure future Naval power and maritime superiority.	56.288	59.945	68.964	0.000	68.964

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Fundamental challenges include understanding atomic-scale to meso-scale phenomena; developing robust, accurate and validated computational modeling and simulation capabilities; and translating this understanding into materials composition, synthesis, processing, properties and performance design principals for engineered devices, components and systems. This activity also includes peer-review basic research to develop innovative solutions and enhance the science and engineering base. Research directions in the Focus Area are selected to generate new, advanced and improved materials that enable innovative new technologies or can close critical technology gaps. Successes provide breakthroughs for higher performing, cost effective and/or timely technologies supporting Navy and Marine Corps acquisitions, operations and sustainment. Accomplishments and plans described below are examples for each effort category. ***FY 2023 Plans:*** Structural Materials - Continue foundational research that provides the underpinnings for robust systems and platforms, exploring and understanding phenomenology of structural properties as functions of with the aim to improve performance and predict and mitigate component degradation, captured in quantitative data and physics-driven models that utilize an Integrated Computational Materials Engineering (ICME) approach and support machine learning. Research domains include Basic Materials Research, Structural Metals, Polymer Composite Materials, Propulsion Materials, Materials for Additive Manufacturing, Sensors & NDE Prognostics, and Alternative Hull Materials & Structures. - Complete efforts in Structural Cellular Materials and Solid Mechanics, as technology areas have matured and attention turns to other emerging research areas. Functional Materials - Continue research to explore opportunities for controlling material composition and atomic structure through characterization and modeling enabling and utilizing an ICME approach to enhance electro-mechanical coupling for next generation Acoustic Transduction Materials; better understand the chemical and mechanical properties of Material Science for Environment Quality; and accelerate research efforts through Computer Aided-Material Design - Functional Materials. Manufacturing					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Complete basic manufacturing science research efforts, migrating fundamental work to portfolios of the relative disciplines including Structural Metals and Materials for Additive Manufacturing. Materials and Chemistry Continue the development of the scientific foundations for molecular-level understanding of materials synthesis, processing, and physical properties aimed at propelling, equipping and sustaining the US Navy and Marine Corps with tactical and strategic advantage. These efforts include: -Continue efforts into nanoparticle surface chemistry for plasmonic mediated reactions, photocatalysis, hydrogen storage, energetic materials, and fuel additives which will enable new high power and energy density generation, storage, release and harvesting materials and technologies. These fuel generation, energetic, fuel cell and battery material will enable next generation Navy autonomous undersea and air vehicles. -Continued research efforts on combustion and reacting transport, coupled with advanced mutiphysics computational simulation, will advance fire suppression for damage control as well as liquid and solid-fueled power and energy for hypersonics. Combinatorial and multivariate chemical approaches inform sensor system designs for aviation fuel surety and complex shipboard atmosphere environment monitoring. -Continue advancements into quantum computing simulations of quantum systems which1 model aqueous chemistries to allow design of anti-corrosion additives. Understanding fundamental electrochemistry, (tribo)corrosion, and biofouling will guide materials solutions for fleet sustainment through manpower and life-cycle cost reductions. Undersea Materials - Continue laboratory and theoretical/numerical work focusing on creation of new techniques for understanding, predicting, and controlling the interactions between acoustic and elastic waves and the processing routes for associated new materials; high performance source transducer materials that achieve high powered performance with reduced cost and complexity; and high efficiency silicon-based thin film thermoelectric modules for undersea warfare applications. - Continue research into high performance source transducer materials, such as textured ferroelectric ceramics, that should achieve high power receiver performance at reduced cost and complexity. This would enable high throughput production of high performace tranducer ceramics, providing alternatives to current costly and difficult to produce single crystal technology. - Continue the creation of high efficiency silicon-based thin film thermoelectric modules for undersea warfare applications by exploiting nanocrystallization and multilayering to control thermal conductivity.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Complete research on advanced underwater material coupling architectures that achieve a broad range of passive and active acoustic impedances and control.					
FY 2024 Base Plans: Structural Materials - Continue foundational research that provides the underpinnings for robust systems and platforms, exploring and understanding phenomenology of structural properties as functions of with the aim to improve performance and predict and mitigate component degradation, captured in quantitative data and physics-driven models. Research domains include Basic Materials Research, Structural Metals, Polymer Composite Materials, Propulsion Materials, Materials for Additive Manufacturing, Sensors & NDE Prognostics, and Alternative Hull Materials & Structures. Functional Materials - Continue research to explore opportunities for controlling material composition and atomic structure through characterization and modeling to enhance electro-mechanical coupling for next generation Acoustic Transduction and Sensor Materials; better understand the chemical and mechanical properties of Material Science for Environment Quality; and accelerate research efforts through Computer Aided-Material Design. Materials and Chemistry Continued research in Materials and Chemistry is essential to develop the scientific foundations required for a molecular-level understanding of materials synthesis, processing, and physical properties aimed at propelling, equipping and sustaining the US Navy and Marine Corps with tactical and strategic advantage. Research efforts include the following: - Continue efforts into nanoparticle surface chemistry for plasmonic mediated reactions, photocatalysis, hydrogen storage, energetic materials, and fuel additives which will enable new high power and energy density generation, storage, release and harvesting materials and technologies. These fuel generation, energetic, fuel cell and battery material will enable next generation Navy autonomous undersea and air vehicles. - Continued research efforts on combustion and reacting transport, coupled with advanced mutiphysics computational simulation, will advance fire suppression for damage control as well as liquid and solid-fueled power and energy for hypersonics. Combinatorial and multivariate chemical approaches inform sensor system designs for aviation fuel surety and complex shipboard atmosphere environment monitoring. - Continue advancements into quantum computing simulations of quantum systems which1 model aqueous chemistries to allow design of anti-corrosion additives. Understanding fundamental electrochemistry,					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
(tribo)corrosion, and biofouling will guide materials solutions for fleet sustainment through manpower and life-cycle cost reductions. - Initiate efforts into how to understand and predict oleophobic and synergistic mechanisms thru machine learning to design/develop more effective surfactant molecules for fire suppression. Undersea Materials - Continue laboratory and theoretical/numerical research efforts focusing on creation of new techniques for understanding, predicting, and controlling the interactions between acoustic and elastic waves and the processing routes for associated new materials; high performance source transducer materials that achieve high powered performance with reduced cost and complexity; and high efficiency silicon-based thin film thermoelectric modules for undersea warfare applications. - Continue research into high performance source transducer materials, such as textured ferroelectric ceramics, that should achieve high power receiver performance at reduced cost and complexity. This would enable high throughput production of high performace tranducer ceramics, providing alternatives to current costly and difficult to produce single crystal technology. - Continue the creation of high efficiency silicon-based thin film thermoelectric modules for undersea warfare applications by exploiting nanocrystallization and multilayering to control thermal conductivity. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY 2023 to FY 2024 is due to a more appropriate alignment of materials and biomedical efforts from the Science Addressing Hybrid Threat (SAHT) research activity and increased focus on quantum computing research and increases in Materials/Processes research. Increased emphasis will be placed on Basic Research in Materials/Processes in areas such as but not limited to materials, mathematics, electronics, and quantum fundamental research.					
Title: Medical and Biological Sciences ***Description:*** The health and performance of Sailors and Marines is a top priority. Extensive research in the medical and biological sciences discover and leverage breakthroughs to improve Naval warfighter performance, so they can fight, win and come home safe. Sailors and Marines operate in the harshest working environments at sea and around the world. Conducting research to gain a better understanding of the biologic challenges of warfighters in their operating environments will ensure optimal performance, prevent injury, and equip the DON to provide the best care for its warfighters.	15.655	15.675	15.306	0.000	15.306

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Research areas include: bio-inspired autonomous systems; bioengineering; biophysics; microbial synthetic biology; microelectronics; microbial electrophysiology; microbiome research; bio-inspired multi-spectral camouflage and sensing; sensory neuroscience and physiology; Naval force health protection; undersea medicine; stress responses, health monitoring and modeling research; and health and welfare of the Navy's marine mammals. ***FY 2023 Plans:*** Bio-Inspired Autonomous Systems and Soft Robotics - Continue research to explore novel bio-inspired sensing, control, and fluid dynamics of underwater propulsion and control systems to expand capabilities of underwater autonomous and unmanned systems. This research will include: (i) Exploration of experimental sensing capabilities and modeling for bio-sensing to enable sensorimotor control including fish schooling for passive swarm coordination in underwater vehicles; (ii) Exploration of bio-inspired locomotion from amphibious animals to enable technologies for amphibious and cross-domain vehicles; (iii) Investigation of bio-inspired design principles of distributed sensing, actuation, and control in soft biological structures for underwater propulsion and manipulation; and (iv) Design bio-inspired soft robots (e.g., worm-like robots) to characterize and measure geotechnical properties of the ocean floor. The long-term result will be bio-inspired propulsion and control systems to enable high-lift, stealthy propulsion without propellers and achieve high maneuverability for underwater vehicles. - Complete investigation of fish lateral line pressure sensing for navigation and obstacle avoidance of underwater vehicles. - Initiate research to explore multi-fin control, propulsion and maneuver with robotic fish prototypes. Bioengineering and Life Sciences - Continue the exploration of computational tools and fabrication methods for producing materials with targeted properties from the molecular level (nanometers) to the macroscopic level (meters) for Naval applications. - Continue investigation of bioinspired and biomimetic adhesives and reversible adhesives that cure in seawater for underwater applications. - Continue the exploration of computational design tools and characterization methods for nanostructures made from DNA, and their application to optical computing, data storage, and cell-free bioconversion systems for bioproduct manufacturing. - Continue experimentation with synthetic biology to establish new biomanufacturing strategies for complex and living materials. - Continue the exploration					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
of water absorption-evaporation cycling in biomaterials to develop hydro- and thermo-responsive textiles and as a power source for maritime sensing surveillance systems. Naval Biosciences and Synthetic Biology for Naval Applications (This thrust includes the efforts previously listed under Warfighter Augmentation in the FY22 plan.) - Continue research to investigate: (i.) bio-inspired mechanisms for multi-spectral camouflage (adaptive texture/ shape, color, and near- to mid- infrared concealment), and (ii.) bioengineering bacteria for sensing, materials, and functionalized microbial communities. - Continue researching the construction of bacterially synthesized biomaterials for capturing and enriching rare earth elements to establish a secure source of these critical materials for defense-related applications. - Continue the investigation of novel materials and electroactive bacteria to improve energy generation from bacteria powered fuel cells and for use of components in synthetic biology applications. Auditory Science for the Naval Domain (This thrust was previously part of the Sensory Neuroscience and Physiology FY22 plan. The name was changed to more accurately describe the research.) - Complete studies that led to the discovery of small molecule therapeutics for the potential treatment of auditory system injuries associated with noisy Naval environments. - Initiate studies investigating how biological systems use acoustic camouflage and design bio-inspired acoustic dampening metamaterials. Physiological Monitoring and Modeling - Continue to research the use of nucleic acid cleavage in creation of detection systems for the Warfighter. This will enable easily adapted nucleic acid detection with orders of magnitude lower sensitivity and specificity. - Complete research on innovative communications capabilities for discreet transmission of individual and team health and geolocation data. - Initiate research to characterize new physiologic signal monitoring capabilities. - Initiate research into innovative technologies for real-time sensing and observation of individual responses to environmental and operational stressors. Naval Force Health Protection - Continue research into methods for modeling and simulation approaches to improve Warfighter protection and injury treatment.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue to investigate nanotechnologies, microelectronics, artificial intelligence, and autonomy for use in medical care of combat casualties to repair damage at the scale of cells, tissues, and whole body. - Continue research to understand use of composite materials, additive manufacturing, and microelectronics to enhance warfighter protective equipment by providing increased biomedical sensing of warfighter status and greater operator situational awareness. The long-term goal of this research is to explore to optimize medical treatment, logistics, and casualty evacuation in the tactical environment. - Continue use of fundamental principles of physics to determine material properties of biological tissues. Undersea Medicine - Continue studies to enhance our understanding of human physiology (and leverage insights from comparative physiology studies of marine mammals) in the undersea environment. - Continue work to create synthetic biology approaches for thermal protection during dive operations. - Continue research to identify novel technologies to support underwater breathing apparatus to include utilizing resources naturally present in the ocean for gas management (e.g., oxygen supply and carbon dioxide disposal). - Complete research that identified the role of specific gas channels (AQP1 and 4) now being explored as potential targets for limiting oxidative stress caused by elevated oxygen exposures encountered in dive operations. - Initiate research on respiratory plasticity in relation to metabolic efficiency, immunologic resilience and thermal tolerance with a particular focus on respiratory loads in altered breathing gas states (e.g., hyperoxia, hypercapnia, hypoxia). Stress Response - Continue to investigate the clinical, neurobiological, and genetic factors that predict differences in stress reactivity for constructing a multi-modal predictor of stress responsiveness, and for identifying targets for intervention. - Continue to examine the interaction of a chronically stressful environment and changes in light/dark periods on the function of the stress response system. - Continue to explore the feasibility of continuous and unobtrusive stress detection, tracking, and mitigation for a wearable closed-loop system capable of monitoring stress and providing bioelectronic therapy.					
FY 2024 Base Plans: Bio-Inspired Autonomous Systems and Soft Robotics - Continue research to explore novel bio-inspired sensing, control, and fluid dynamics of underwater propulsion and control systems to expand capabilities of underwater autonomous and unmanned systems. This research					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
will include: (i) Exploration of experimental sensing capabilities and modeling for bio-sensing to enable sensorimotor control including fish schooling for passive swarm coordination in underwater vehicles; (ii) Exploration of bio-inspired locomotion from amphibious animals to enable technologies for amphibious and cross-domain vehicles; (iii) Investigation of bio-inspired design principles of distributed sensing, actuation, and control in soft biological structures for underwater propulsion and manipulation; and (iv) Design bio-inspired soft robots (e.g., worm-like robots) to characterize and measure geotechnical properties of the ocean floor. The long-term result will be bio-inspired propulsion and control systems to enable high-lift, stealthy propulsion without propellers and achieve high maneuverability for underwater vehicles. - Continue research investigations exploring multi-fin control, propulsion and maneuver with robotic fish prototypes. Bioengineering and Life Sciences - Continue research investigations using synthetic biology to establish new biomanufacturing pathways/ strategies for complex and living materials. - Continue exploration of building and characterizing DNA nanostructures for use in optical computing, data storage, materials, and cell synthesis. - Complete basic research on computational tools for producing materials with targeted properties from the molecular level (nanometers) to the macroscopic level (meters) for Naval applications. - Complete research investigation of bioinspired and biomimetic adhesives and reversible adhesives that cure in seawater for underwater applications. Naval Biosciences and Synthetic Biology for Naval Applications - Continue research investigations into bio-inspired mechanisms for multi-spectral camouflage. - Continue basic research efforts regarding the use of bioengineering bacteria for sensing and materials synthesis. - Continue investigations of the use of novel materials and electroactive bacteria to improve energy generation from microbial powered devices. - Continue research efforts to understand electroactive bacteria and their components for use in synthetic biology/bioelectronics applications. - Complete research investigations of bacterially synthesized biomaterials for capturing and enriching rare earth elements to establish a secure source of these critical materials. Auditory Science for the Naval Domain					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research investigations regarding biological systems' use of acoustic camouflage and design of bio-inspired acoustic dampening metamaterials. Physiological Sciences and Monitoring - Continue research investigations to characterize novel physiologic signal monitoring capabilities. - Continue research efforts into innovative technologies for real-time sensing and observation of individual responses to environmental and operational stressors. - Continue Physiological Monitoring and Modeling research efforts regarding the use of nucleic acid cleavage in creation of detection systems for the Warfighter. This will enable easily adapted nucleic acid detection with orders of magnitude lower sensitivity and specificity. - Complete research efforts regarding the use of nucleic acid cleavage in the creation of detection systems for the Warfighter. - Initiate research efforts regarding concepts for passive or semi-passive location and identification of people lost at sea. - Initiate research into the development of functional bio/nanohybrid materials that will enable the ability to reprogram cellular behavior without the manipulation of the cell's genetic material. Naval Force Health Protection - Continue research into methods for modeling and simulation approaches to improve Warfighter protection, injury treatment, and safer platforms. - Continue investigations into nanotechnologies, microelectronics, artificial intelligence and autonomy that will inform future applications for estimation of combat casualty injury severity, improve care and facilitate casualty evacuation. - Continue research regarding the understanding of fundamental principles of composite materials, additive manufacturing, and microelectronics to enhance warfighter protection, health and situational awareness. - Continue research regarding the understanding of fundamental principles of physics to determine material properties of biological tissues to allow for physics based prediction and modeling of tissue damage resulting from insult or injury. - Complete research efforts regarding computational cellular biology investigations of blast effects to allow physics-based prediction and modeling of cavitation damage of tissues. - Initiate research regarding microelectronic detection of warfighter brain health to guide transcranial stimulation research into attentiveness, sleep, and mission focus. Undersea Medicine					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue studies to enhance our understanding of human physiology (and leverage insights from comparative physiology studies of marine mammals) in the undersea environment. - Continue work to create synthetic biology approaches for thermal protection during dive operations. - Continue research to identify novel technologies to support underwater breathing apparatus to include utilizing resources naturally present in the ocean for gas management (e.g., oxygen supply and carbon dioxide disposal). - Continue fundamental research to understand the pulmonary physiology of exposure to altered levels of oxygen and carbon dioxide. -Initiate studies to explore use of porous liquids as novel gas management for biomedical applications to include Nitrogen capture for DCS mitigation. Stress Response - Continue research investigations regarding neurobiological and genetic factors that predict differences in stress reactivity for constructing a multi-modal predictor of stress responsiveness, and for identifying targets for intervention. - Continue research efforts to examine the impact of an acutely stressful environment on the function of the stress response system. - Continue research efforts to explore the feasibility of continuous and unobtrusive stress detection, tracking, and mitigation for a wearable closed-loop system capable of monitoring stress and providing bioelectronic therapy. - Complete research efforts regarding clinical factors that predict differences in stress reactivity for constructing a multi-modal predictor of stress responsiveness, and for identifying targets for intervention. - Complete research investigations regarding impact of changes in light/dark periods on the function of the stress response system. - Initiate comprehensive investigation of physiological and cognitive stress response following acute exposure to high stress operational or emergency scenarios/environments (i.e. extreme heat/cold, smoke/fire, unexpected water immersion), which will inform future development of countermeasures against these exposures. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024.					
Title: Ocean Sciences	81.741	84.169	89.591	0.000	89.591
Description: Understanding and predicting oceanographic and acoustical phenomena provides significant warfighting advantages to naval forces. Ocean Sciences research addresses the full spectrum of acoustics and					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
oceanography to enable observation, modeling, and prediction of the maritime environment. Efforts include: studying common operating areas for naval forces in the open oceans, the Arctic, the littorals, and nearshore and river mouths and inlet environments; elucidating the coupling between oceanographic, geophysical and acoustical phenomena relevant to such mission areas such as Anti-Submarine Warfare and Mine Warfare; development of global, regional and local predictive models that fully couple the ocean-atmosphere-wave-ice domains; development and use of autonomous systems and sampling technologies for the collection of environmental observations and continuing support to research vessels of the U.S. Academic Research Fleet to enable at-sea oceanographic science. Research within the Ocean Sciences subactivity responds to mission needs of the Navy and Marine Corps as guided by the Oceanographer of the Navy. At-sea research involves ancillary studies to ensure full compliance with environmental requirements. ***FY 2023 Plans:*** Littoral Geosciences and Optics Areas of research include the highly nonlinear coupling between atmospheric phenomena and surface gravity and internal waves; the transport of sediment by waves and currents; and the bathymetric evolution of the nearshore and coastal environment using integrated field observations, modeling, experimental and remote sensing studies. - Continue studies of surface gravity waves, currents, tides and internal wave processes along rocky coastlines. - Continue autonomous, scalable, hydrographic charting and coastal parameter sampling studies with concomitant remote sensing for data-assimilative coastal models. - Continue research using airborne and satellite active and passive microwave sensors, overhead optical sensors, and ship or shore-based radars to observe coastal and nearshore phenomena. - Continue field studies of coastal oceanographic phenomena using sonar-equipped autonomous underwater vehicles in conjunction with ground-based, airborne and satellite remote sensing. - Continue research to predict physical, geological, geochemical, geoacoustic and geotechnical properties of the seafloor in shallow-water coastal environments. - Initiate studies of the dynamics of shallow coastal inlets; specific areas include their formation and maintenance processes by tides, waves, currents, discharge and sediment type and supply. Physical Oceanography and Prediction Areas of research include ocean circulation, thermodynamics and mixing, and the dynamics of surface gravity waves, nonlinear internal waves and the interaction of waves with sea ice in order to understand the sub-					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
mesoscale physical oceanography parameters from the tropics to the poles. Sub-mesoscale understanding of the ocean is necessary to support the required fidelity and accuracy of ocean feature inputs to Naval warfighting applications. - Continue study of three-dimensional Lagrangian ocean circulation and the prediction of vertical pathways in field experiments in the Mediterranean Sea. - Continue exploration of novel expeditionary ocean instrumentation to support targeted observing. - Continue study of ocean fronts, eddies and turbulence; ocean thermodynamics including mixing and acoustic impacts; and ocean boundary layer processes and surface gravity waves. - Continue study of the rapid evolution of the upper ocean in the high North Atlantic between Iceland and the European continent to understand the physical processes that control vertical and horizontal density structures in the upper ocean. - Continue study of the seasonal variability of processes that control sea surface temperature in the Arabian Sea to understand the relevant space and time scales that enable improved ocean and weather forecasts through the reduction of ocean temperature biases in coupled models. - Complete study of sources and sinks of near-inertial shear and energy in the ocean in the Greenland, Iceland, United Kingdom (GIUK) region. - Initiate studies to explore the cascade of energy in the sub-mesoscale ocean, including the physics and dynamics of ocean features such as current meanders, vortices, and filiaments, with a field program in the Western Pacific, to expand the knowledge of the lifecycle of these features and enable improved predictions. Arctic Sciences Areas of research include the complex processes governing the interaction of the arctic atmosphere, ocean, and sea ice, including formation, deformation, and melting. Physical processes in the arctic are inherently different from those in non- polar regions. - Continue studies to characterize the behavior of sea ice, including melt and reformation, ice rheology and motion, and interactions with ocean stratification, surface waves and the atmosphere. - Continue development of Arctic System models and data assimilation techniques for improved prediction of the Arctic region and development of new sensors and unmanned platforms to collect observations of the Arctic environment. - Continue development of algorithms enabling the space-based remote sensing of bulk properties of Arctic sea-ice that previously could be sampled only by localized in-situ methods. - Initiate studies of the circulation of the Arctic Ocean to explore the fate of heat flowing in through the Bering Strait and the impact on the upper ocean density structure of the Beaufort Sea.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Ocean Acoustics Ocean Acoustics continues as one of five National Naval Responsibilities (NNR). Research and education supported under this PE contributes to a vigorous science and technology base to ensure continuing U.S. leadership in the critically important discipline of Ocean Acoustics. Areas of research contribute to improved basic understanding of the physical, seafloor and biological parameters that impact acoustic propagation in the ocean. Accurate acoustic predictions are required to keep our undersea assets undetected as well as to enable the detection and tracking of adversary assets. - Continue research to understand propagation and scattering of acoustic energy in shallow-water ocean environments. Specific efforts include shallow-water scattering mechanisms related to reverberation and clutter; seabed acoustic measurements supporting geoacoustic inversion; acoustic propagation through internal waves and coastal ocean processes and the development of unified ocean/seabed/acoustic models, including scattering from rough surfaces, biologics and bubbles; and penetration/propagation within the porous seafloor. - Continue the investigation in optimal representations information contained in acoustic data. Specific efforts will include the investigation summary statistics and sparse encoding of underwater acoustic data. The objective is to enable efficient analysis and compact representations of acoustic scenes. - Continue efforts in naturalization applicable to the ocean battlespace. Specific efforts will include investigations into source separation, characterization, and recombination along with physical, biological, and anthropogenic sound generating mechanisms. The objective is to model and simulate acoustic phenomena in undersea environments to be rendered as virtual soundfields. - Continue research into the effects of environmental variability induced by ocean internal waves, internal tides and mesoscale processes, and by bathymetric features including seamounts and ridges, on the stability, statistics, spatial distribution, and predictability of broadband acoustic signals, as well as the coherence and depth dependence of deep-water ambient noise. - Continue investigations into the effects of Arctic conditions on acoustic propagation and ambient noise, particularly in under-ice environments. - Continue the joint physical oceanography and acoustic field studies to investigate propagation and scattering in regions characterized by complex bathymetry and/or meteorological and oceanographic forcing. Specific efforts will include processes studies with the objective of linking observed ocean and acoustic phenomena. An objective is to characterize oceanographic phenomena and the effects on acoustic propagation and scattering at different frequencies. - Continue efforts in characterizing and forecasting sediment acoustic properties. Specific efforts will include investigations aimed at linking local physical and biological processes to acoustic observables. Continue analysis efforts related to acoustic seabed characterization experiment. Specific efforts will include development					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
and verification of geoacoustic models and inference techniques for soft sediments based on experimental evidence. - Initiate analysis of data from a previous trans-arctic basin collection effort to extend studies of under-ice environments. Marine Mammals and Biology The Marine Mammals and Biology Program conducts basic research to understand and characterize the effects of sound exposure on marine mammals to enable Navy to meet operational training and testing objectives in an environmentally responsible and legal manner. Areas of research include monitoring and detection of marine mammals, integrated ecosystem research, hearing in large whales, and effects of sound on marine mammals. - Continue development and testing of new and existing technologies to detect, classify, localize and potentially track marine mammals. - Continue multidisciplinary ecosystem research including tagging, visual surveys, and passive acoustics to collect baseline measures of marine mammal behaviors and distributions relative to environmental features and marine mammal prey fields. - Continue research on sound reception mechanisms in large whales. - Continue research on the effects of sound include behavioral, physiological and population-level consequences of sound exposure on marine life. - Continue studies to characterize and quantify the cumulative effects of multiple stressors on marine mammal populations. - Continue research to develop framework for understanding the ecology of eDNA, including the origin, state, transport, and fate of extraorganismal genetic material. - Initiate studies to design appropriate primers and bioinformatics workflows to effectively and efficiently detect and identify target biological communities and ecosystems, and advance our understanding of the relationships between eDNA and the abundance of marine megafauna. Battlespace Environments - Continue research is to improve basic understanding of physical, seafloor and biological oceanographic processes on space and time scales of naval interest. Emphasis is on improved measurements, laboratory and model based experiments to quantify and understand important oceanographic processes that lead to the development of ocean dynamic/thermodynamic models from global to sub-mesoscale scales, and to couple these oceanographic models with atmospheric, ice, biological, sediment response, and optical models. While today's numerical analysis and prediction systems are more capable of resolving and predicting highly variable phenomena than were the systems of 10-20 years ago, there are still oceanographic processes that are not					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
well understood and must be studied including aspects of ocean circulation (fronts, eddies and turbulence), thermodynamics (mixing and acoustic impacts), waves (including their impact on sea ice and rogue waves), sea ice (including landfast ice) as well as ocean boundary layer processes. Navy and Marine Corps requirements also include: a) an improved use of overhead (airborne and satellite) active and passive microwave sensors, overhead optical sensors, surface-based (ships and ground-based) grazing angle microwave sensor, b) use of remote sensing of bulk properties of Arctic sea-ice over broad two-dimensional areas that previously could be sampled only at spot locations by in-situ sampling, and c) use of newly available higher resolution (sub-mesoscale) oceanographic data.					
FY 2024 Base Plans: Littoral Geosciences and Optics Research efforts regarding nonlinear coupling between atmospheric phenomena and surface/waves, sediment transport dynamics, and the study of bathymetric environments using field observations, modeling, and remote sensing data. Research efforts include the following: - Continue studies of surface gravity waves, currents, tides and internal wave processes along rocky coastlines. - Continue autonomous, scalable, hydrographic charting and coastal parameter sampling studies with concomitant remote sensing for data-assimilative coastal models. - Continue research using airborne and satellite active and passive microwave sensors, overhead optical sensors, and ship or shore-based radars to observe coastal and nearshore phenomena. - Continue studies of the dynamics of shallow coastal inlets; specific areas include their formation and maintenance processes by tides, waves, currents, discharge and sediment type and supply. - Continue research to predict physical, geological, geochemical, geo-acoustic and geotechnical properties of the seafloor in shallow-water coastal environments. - Complete field studies of coastal oceanographic phenomena using sonar-equipped autonomous underwater vehicles in conjunction with ground-based, airborne and satellite remote sensing. - Initiate research to investigate sub-seabed geophysical properties. Physical Oceanography and Prediction Research of ocean circulation, thermodynamics and mixing, and the dynamics of surface gravity waves, nonlinear internal waves and the interaction of waves with sea ice in order to understand the sub-mesoscale physical oceanography parameters from the tropics to the poles. Sub-mesoscale understanding of the ocean is necessary to support the required fidelity and accuracy of ocean feature inputs to Naval warfighting applications. Research efforts include the following:					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research efforts exploring novel expeditionary ocean instrumentation to support targeted observing. - Continue research regarding the study of ocean fronts, eddies and turbulence; ocean thermodynamics including mixing and acoustic impacts; and ocean boundary layer processes and surface gravity waves. - Continue research investigations of the rapid evolution of the upper ocean in the high North Atlantic between Iceland and the European continent to understand the physical processes that control vertical and horizontal density structures in the upper ocean. - Continue research efforts to explore the cascade of energy in the sub-mesoscale ocean, including the physics and dynamics of ocean features such as current meanders, vortices, and filaments, with a field program in the Western Pacific, to expand the knowledge of the lifecycle of these features and enable improved predictions. - Complete research investigations of three-dimensional Lagrangian ocean circulation and the prediction of vertical pathways in field experiments in the Mediterranean Sea. - Complete research regarding the seasonal variability of processes that control sea surface temperature in the Arabian Sea to understand the relevant space and time scales that enable improved ocean and weather forecasts through the reduction of ocean temperature biases in coupled models. - Initiate research investigations of air-sea interaction in the Arabian Sea to understand the origin of monsoon moisture and precipitation biases that exist in all coupled climate models (including the Navy's forecasting system) at subseasonal and shorter timescales. Program will leverage new observations of the ocean and atmosphere collected with regional partners. Arctic Sciences Research of complex processes governing the interaction of the arctic atmosphere, ocean, and sea ice, including formation, deformation, and melting. The physical processes in the arctic are inherently different from those in non-polar regions. Research efforts include: - Continue research efforts to characterize the behavior of sea ice, including melt and reformation, ice rheology and motion, and interactions with ocean stratification, surface waves and the atmosphere. - Continue research investigations regarding the development of Arctic System models and data assimilation techniques for improved prediction of the Arctic region and development of new sensors and unmanned platforms to collect observations of the Arctic environment. - Continue research development of algorithms enabling the space-based remote sensing of bulk properties of Arctic sea-ice that previously could be sampled only by localized in-situ methods. - Continue research efforts into studies of the circulation of the Arctic Ocean to explore the fate of heat flowing in through the Bering Strait and the impact on the upper ocean density structure of the Beaufort Sea. Ocean Acoustics					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Ocean Acoustics research continues as one of five National Naval Responsibilities (NNR) S&T investment areas. Research and education supported under this PE contributes to a vigorous science and technology base to ensure continuing U.S. leadership in the critically important discipline of Ocean Acoustics. Research in these areas contribute to improved basic understanding of the physical, seafloor and biological parameters that impact acoustic propagation in the ocean. Accurate acoustic predictions are required to keep our undersea assets undetected as well as to enable the detection and tracking of adversary assets. Research efforts include the following: - Continue research efforts to understand propagation and scattering of acoustic energy in shallow-water ocean environments. Specific efforts include shallow-water scattering mechanisms related to reverberation and clutter; seabed acoustic measurements supporting geoacoustic inversion; acoustic propagation through internal waves and coastal ocean processes and the development of unified ocean/seabed/acoustic models, including scattering from rough surfaces, biologics and bubbles; and penetration/propagation within the porous seafloor. - Continue research investigations regarding optimal representations information contained in acoustic data. Specific efforts will include the investigation summary statistics and sparse encoding of underwater acoustic data. The objective is to enable efficient analysis and compact representations of acoustic scenes. - Continue research investigations regarding naturalization applicable to the ocean battlespace. Specific efforts will include investigations into source separation, characterization, and recombination along with physical, biological, and anthropogenic sound generating mechanisms. The objective is to model and simulate acoustic phenomena in undersea environments to be rendered as virtual sound-fields. - Continue research into the effects of environmental variability induced by ocean internal waves, internal tides and mesoscale processes, and by bathymetric features including seamounts and ridges, on the stability, statistics, spatial distribution, and predictability of broadband acoustic signals, as well as the coherence and depth dependence of deep-water ambient noise. - Continue research investigations into the effects of Arctic conditions on acoustic propagation and ambient noise, particularly in under-ice environments. - Continue research efforts regarding joint physical oceanography and acoustic field studies to investigate propagation and scattering in regions characterized by complex bathymetry and/or meteorological and oceanographic forcing. Specific efforts will include processes studies with the objective of linking observed ocean and acoustic phenomena. An objective is to characterize oceanographic phenomena and the effects on acoustic propagation and scattering at different frequencies. - Continue research efforts regarding characterizing and forecasting sediment acoustic properties. Specific efforts will include investigations aimed at linking local physical and biological processes to acoustic observables. Continue analysis efforts related to acoustic seabed characterization experiment. Specific efforts					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
will include development and verification of geoacoustic models and inference techniques for soft sediments based on experimental evidence. - Continue research efforts regarding the analysis of data from a previous trans-arctic basin collection effort to extend studies of under-ice environments. Marine Mammals and Biology - Continue research efforts regarding the development and testing of new and existing technologies to detect, classify, localize and potentially track marine mammals. - Continue multidisciplinary ecosystem research including tagging, visual surveys, and passive acoustics to collect baseline measures of marine mammal behaviors and distributions relative to environmental features and marine mammal prey fields. - Continue research investigations of sound reception mechanisms in large whales. - Continue research efforts regarding the effects of sound include behavioral, physiological and population-level consequences of sound exposure on marine life. - Continue research investigations to characterize and quantify the cumulative effects of multiple stressors on marine mammal populations. - Continue research to develop framework for understanding the ecology of eDNA, including the origin, state, transport, and fate of extra-organismal genetic material. - Continue studies to design appropriate primers and bioinformatics workflows to effectively and efficiently detect and identify target biological communities and ecosystems, and advance our understanding of the relationships between eDNA and the abundance of marine megafauna. Battlespace Environments - Continue research efforts to improve basic understanding of physical, seafloor and biological oceanographic processes on space and time scales of naval interest. Research emphasis is on improved measurements, laboratory and model based experiments to quantify and understand important oceanographic processes that lead to the development of ocean dynamic/thermodynamic models from global to sub-mesoscale scales, and to couple these oceanographic models with atmospheric, ice, biological, sediment response, and optical models. While today's numerical analysis and prediction systems are more capable of resolving and predicting highly variable phenomena than were the systems of 10-20 years ago, there are still oceanographic processes that are not well understood and must be studied including aspects of ocean circulation (fronts, eddies and turbulence), thermodynamics (mixing and acoustic impacts), waves (including their impact on sea ice and rogue waves), sea ice (including landfast ice) as well as ocean boundary layer processes. Navy and Marine Corps requirements also include: a) an improved use of overhead (airborne and satellite) active and passive microwave sensors,					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
overhead optical sensors, surface-based (ships and ground-based) grazing angle microwave sensor, b) use of remote sensing of bulk properties of Arctic sea-ice over broad two-dimensional areas that previously could be sampled only at spot locations by in-situ sampling, and c) use of newly available higher resolution (sub-mesoscale) oceanographic data. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY 2023 to FY 2024 includes increased emphasis and efforts in Physical Oceanography, Littoral Geosciences and Optics, Atmosphere, and Space Environment related research areas.					
Title: Science and Engineering Education, Career Development and Outreach	43.986	47.405	65.196	0.000	65.196
Description: The Science and Engineering Education, Career Development and Outreach activity addresses the critical need to grow and maintain a highly skilled technical naval workforce. These efforts inspire, engage, educate and attract participants to pursue naval careers and build the extramural performer base. DON Science, Technology, Engineering and Math (STEM) education and outreach is designed to increase the number of students and naval civilians with naval-relevant skills and degrees, expand capabilities of the current and future workforce by developing curricula and augmenting education, and augment awareness of Naval opportunities through localized education and outreach initiatives that foster the talent pipeline. This activity supports both the Naval Research Enterprise Intern Program (NREIP) for college students and the Science and Engineering Apprenticeship Program (SEAP) for high school students to encourage participants to pursue science and engineering careers. The objective is to further education via mentoring by laboratory personnel and their participation in research, and to make them aware of Department of the Navy (DON) research and technology efforts. This program serves as a recruitment tool for employment within the DON. Participating students at 45 DON laboratories will spend eight to ten weeks during the summer conducting research. The separately-managed Department of the Navy's (DON) Historically Black Colleges and Universities/Minority Institutions (HBCU/MI) program oversees the Navy's efforts to engage and support research in our nation's HBCU/MIs and is responsible for developing and managing efforts that strengthen and support the capabilities of HBCU/MIs to participate in basic, applied, and advanced development research programs within the Naval Research Enterprise.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
The ONR Young Investigator Program (YIP) attracts outstanding faculty members to the Department of Navy's basic research program by identifying individuals that show exceptional promise for doing creative research and encourage their teaching and research careers through long term support. Young Investigator awards are for a period of three years. Proposals are solicited annually via a funding opportunity announcement open to tenure-track faculty in science, engineering, and mathematics. YIP awardees are competitively selected based on faculty achievements, technical proposal, benefit to the Navy and Marine Corps, and university endorsement. The Naval Research Institution was established through a Memorandum of Understanding between the United States Naval Academy (USNA) and the Office of Naval Research. This effort contributes to the technical education of midshipmen by providing a research experience in STEM and its impact on fleet and forces capabilities. This activity also supports the Office of Naval Research Global mission to serve as the enduring Navy and Marine Corps global presence in technical and operational communities, investing in trusted partnerships to discover and connect science and technology leaders for sustained maritime security. This is accomplished by establishing quality, relevant connections between the international research and development community, Naval fleet/forces, Department of Defense, other US Government agencies and international partners. The direct impact of this investment is to leverage international basic research during increasingly dynamic global interdependence and improve the ability to solve DON Science & Technology challenges through shared knowledge with partners. ***FY 2023 Plans:*** Science, Technology, Education and Mathematics (STEM) - Continue existing successful efforts, while examining approaches to further scale up these efforts to achieve greater impact across the DON. - Continue the development of highly scalable pilot efforts to expand STEM education and outreach, with a focus on reaching underrepresented students, through the development of new virtual and in-person curricula as well as virtual and in-person experiential learning activities. - Continue activities targeting regional efforts to augment awareness of naval opportunities and increase diverse workforce opportunity for the naval science and technology community. - Continue to support the Naval Research Institution efforts that provide hands-on and virtual research experiences in STEM fields for United States Naval Academy (USNA) midshipmen and faculty members to enhance the midshipmen's educational environment at the USNA.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue NREIP and SEAP opportunities for students to participate in Navy and Marine Corps-relevant research at Naval Warfare Centers and Laboratories by expanding the number of participating sites, mentors, and interns. Historically Black Colleges and Universities / Minority Institutions (HBCU/MI): - Continue to provide innovative research opportunities, such as faculty fellowships and student internships that address critical Naval S&T challenges through collaborations between academic researchers and Naval scientists and engineers. - Continue to advance Naval-relevant research, by cultivating long-term partnerships that leverage knowledge sharing and empower scientific global discovery. - Continue new outreach initiatives to increase the number of HBCU/MI white paper and grant proposal submissions. - Initiate new efforts to increase applications and participants in the HBCU/MI Post-doctoral program that impacts the number of HBCU/MI PhD candidates working within the Navy STEM related fields. - Initiate new efforts to increase the number of science fairs at HBCU/MI that have partnerships with local junior and high schools. Young Investigator Program (YIP): - Continue YIP awards to 25 to 35 assistant professors that have demonstrated exceptional promise for performing creative research. Recent YIP topics include innovative technical approaches to: autonomy, deep learning, optimization, artificial intelligence, wireless communications, energetics, power and energy, propulsion, turbulence, hypersonics, remote sensing, bio-sensors, bionic composites, nanocomposites, ocean sciences, marine mammal health, multi-function materials and additive manufacturing. These and other research topics will benefit today's and the next generation warfighter by improving lethality, survivability, and communications. Additionally, many of these investigators will provide long-term support and knowledge in solving Naval related S&T challenges. - Complete Young Investigator Program topics initiated in previous fiscal years. - Initiate Young Investigator Program topics selected in fiscal year 2023. ONR Global - Continue international outreach efforts to foster collaboration through doctoral-level scientists located in Europe, South America, Canada, Asia and Australia, providing coverage in these regions by awarding grants					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
in innovative basic research to discover, access and assess revolutionary, high-payoff technologies for future Naval missions and capabilities.					
FY 2024 Base Plans: Science, Technology, Education and Mathematics (STEM) - Continue existing successful efforts, like the Navy and Marine Corps Junior Reserve Officers' Training Corps (JROTC) Flight Academy, while examining approaches to further scale up these efforts to achieve greater impact across the DON. - Continue the development of highly scalable pilot efforts, like Naval Horizons, to expand STEM education and outreach, with a focus on reaching underrepresented students, through the development of new virtual and in-person curricula as well as virtual and in-person experiential learning activities. - Continue activities targeting regional efforts to augment awareness of naval opportunities, like SeaPerch, and increase diverse workforce opportunity for the naval science and technology community. - Continue to support the Naval Research Institution efforts that provide hands-on and virtual research experiences in STEM fields for United States Naval Academy (USNA) midshipmen and faculty members to enhance the midshipmen's educational environment at the USNA. - Continue Naval Research Enterprise Internship Program (NREIP) and Science and Engineering Apprenticeship Program (SEAP) opportunities for students to participate in Navy and Marine Corps-relevant research at Naval Warfare Centers and Laboratories by expanding the number of participating sites, mentors, and interns. - Continue NREIP and SEAP internship opportunities for students to participate in Navy and Marine Corps-relevant research at Naval Warfare Centers and Laboratories. Continue to increase the number of participating sites resulting in additional mentors and interns. - Initiate new STEM efforts to address Naval skilled technical workforce needs. Historically Black Colleges and Universities/Minority Institutions (HBCU/MI) - Continue with increasing the number of internships at SYSCOMs: NRL, NAVSUP, NAVAIR, NAVFAC, BUMED and NAVWAR for students at HBCU/MIs. - Continue to provide faculty fellowships for HBCU/MI faculty to conduct naval relevant research at all Naval Warfare Centers and Labs working naval scientist and engineers. - Continue new outreach initiatives to increase the number of HBCU/MI white paper and grant proposal submissions - to include making more grant awards. - Continue to increase the number of science fairs at HBCU/MI that have partnerships with local junior and high schools to include providing more CNR scholarships.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Expand the DoN HBCU/MI Post-doctoral program that impacts the number of HBCU/MI PhD candidates working within the Navy STEM related fields. Young Investigator Program (YIP) - Continue FY2022 & FY2023 YIP awards to assistant professors that have demonstrated exceptional promise for performing creative research. Recent YIP topics include innovative technical approaches to a broad range of naval-relevant research topics, including improved ocean wave forecasting; bio-inspired wings for unmanned systems; hypersonic aerodynamics; bio-degradable polymers; and advanced metal alloys for improved thermal management. These and other research topics will benefit today's and the next generation warfighter by improving lethality, survivability, and communications. Additionally, many of these investigators will provide long-term support and knowledge in solving Naval related S&T challenges. - Complete Young Investigator Program topics initiated in previous fiscal years. - Initiate Young Investigator Program topics selected in fiscal year 2024. ONR Global - Continue international outreach efforts to foster collaboration through doctoral-level scientists located in Europe, South America, Asia and Australia, providing coverage in these regions by awarding grants in innovative basic research to discover, access and assess revolutionary, high-payoff technologies for future Naval missions and capabilities. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY 2023 to FY2024 is due to increased focus on STEM education, career awareness and outreach activities and expanding Global collaboration activities.					
Title: Sensors, Electronics and Electronic Warfare (EW) ***Description:*** Basic research efforts directed toward increasing knowledge, components and algorithmic advances for electronics, sensing and EW ensuring the Navy can counter current and future threats. These efforts are applicable to sensing and EW on individual Naval platforms, as well as, efforts that aggregate capabilities in a Distributed Maritime Operation. The efforts research focus include: sensing, diagnostics, and detectors; navigation and timekeeping; nanoelectronics; wide band gap power devices; real-time targeting; Electro-Optical/Infra-Red (EO/IR)	52.502	55.113	61.328	0.000	61.328

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electronics; EO/IR electronic warfare; EO/IR sensors for surface/aerospace surveillance; Radio Frequency (RF) sensors for surface/aerospace surveillance; solid state electronics; vacuum electronics; and RF electronic warfare. ***FY 2023 Plans:*** Electronics Technology - Continue to create new knowledge and understanding and explore new concepts, components, techniques and methods, for the design, growth, and characterization of electronic, electromagnetic, quantum phenomenology, and electro-optical materials, fabrication processes, electronic and electro-optic components, including novel electromagnetic concepts and techniques, and plasma phenomena and theory. - Continue efforts in nitrogen-polar GaN materials and device development. - Continue efforts in superconducting GaN materials and device development. - Continue efforts in plasmonic photomixer devices and circuits. - Continue effort to use generative neural networks to design topology-optimized metasurfaces and apply results to generate dual-level short-wave infrared antireflective coatings. - Continue efforts to develop novel materials for linear, low-power, broadband switches, including phase-change materials such as GeTe, as well as two-dimensional hexagonal boron nitride. - Continue work on squeezed lasers, optical cooling, and new superconducting sensors of magnetic field sources, even if cloaked. - Continue work on quantum entanglement and measurement as applied to RF signal analysis. - Continue device reliability studies of nitrogen-polar GaN devices. - Continue studies on superconducting GaN functional circuits. - Continue efforts to create new knowledge and understanding for quantum computing algorithms and their use to create new understanding of materials by design, process optimization, and quantum simulation. - Continue to improve full spectrum, real time, fully adaptive reception of many simultaneous signals-of-interest by exploiting the unique quantum properties of superconductor microelectronics and photonics. - Continue to investigate how to realize increased receiver dynamic range over entire DC to 200 GHz spectrum and enhance functional density to produce lighter and smaller receivers. - Initiate research in epitaxial synthesis of p-type crystalline metal nitrides. - Initiate transport studies of p-type and crystalline metal nitrides. - Initiate investigations into p- and n-type crystalline metal nitrides heterostructures. - Initiate architectural studies for implementing priority based processing utilizing the combination of wideband reception and machine learning algorithms. Such systems will be applicable to all RF applications while being most important to Surveillance, Electronic Warfare (EW), signal intelligence (SIGINT).					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Quantum Measurement Architectural Devices (formerly Quantum Information Sciences) - Continue the development of protocols for sensing and timekeeping devices based on quantum systems, including clocks with improved short and long-term performance and electromagnetic field sensors. - Continue the development of inertial and gravity sensors based on light-atom interferometry. - Initiate research on the capabilities of non-equilibrium many-body systems for novel metrology. Electromagnetic Warfare - Continue research efforts with the overarching objective of establishing the mathematical constructs, techniques, computational procedures, and scientific foundations for analysis/design of signal, image, control, and data generating systems. - Continue the development of ultrafast, efficient, and accurate time domain (TD) algorithms to predict the ultra-wideband radar cross-section (RCS) of complex naval platforms by solving the long-standing late-time instability problem. - Continue research efforts to enable the imaging of self-illuminating thermal objects occluded by walls by sensing non-specular reflections from rough surfaces such as open doors and around corners, to allow for asymmetric warfare through image recovery in previously denied conditions. - Complete the research to develop advanced multi-dimensional Convolutional Neural Network approaches and algorithms to investigate and demonstrate improved means of analyzing high-dimensional data resulting in improved results for classification, segmentation, anomaly/ target detection. Complete the investigation of mathematical, statistical and algorithmic issues associated with performing robust and adaptive detection and discrimination of targets when sensed by multiple, resource-constrained, unmanned vehicle sensors operating in a decentralized fashion and in highly cluttered environments. - Complete research efforts to establish basic feasibility of novel emerging non-linearized imaging and feature extraction techniques with respect to existing and/or realistic multi-static sensing geometries, research to utilize and enhance the understanding and applicability of topological techniques to enable improved capabilities for target detection, object identification, and data fusion. - Initiate the investigation into novel approaches to deep-generative machine learning-based algorithms and architectures for multistatic radar imaging to enable better noise robustness and resolution performance. Materials and Chemistry - Continue the design and fabrication of single-monolayer or low-dimensional materials with unique and useful fundamental properties, e.g. ferromagnets and semiconductors, distinct from bulk materials and capable of being functionalized for high performing sensors, computer memory elements and electronic components.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue the use of precision molecular placement and orientation to design and create bio-inspired materials exploiting quantum phenomena to perform functions such as ultrasensitive photon detectors and energy generation - Continue highly sensitive measurement and modeling techniques to design, detect, diagnose and/or quantify physical, chemical and biological processes and properties affected by trace impurities, subtle composition changes and chemical species with high spatial resolution, sensitivity, and precision. Undersea Warfare - Continue to conduct laboratory, field, and theoretical/numerical studies to investigate physical phenomena related to acoustic propagation and scattering in oceanic environments such as: prediction of the scattering signature of a structure using noise sources of opportunity; fundamental physical phenomena of wave propagation in ocean environments; approaches to separate an acoustical field from turbulent flow on an acoustic array; new structural acoustics theory for scattering from large, complex undersea objects; and creation of new approaches to monitoring the acoustic signature and structural state of undersea vessels.					
FY 2024 Base Plans: Electronics Technology - Continue research efforts in nitrogen-polar GaN materials and device development. - Continue research investigations in superconducting GaN materials and device development. - Continue research efforts in plasmonic photomixer devices and circuits. - Continue research efforts regarding device reliability studies of nitrogen-polar GaN devices. - Continue studies on superconducting GaN functional circuits. - Continue research investigations into p-type and n-type crystalline metal nitride materials, transport properties and heterostructures. - Continue research to improve full spectrum, real time, fully adaptive reception of many simultaneous signals-of-interest by exploiting the unique quantum properties of superconductor microelectronics and photonics. - Continue research investigations regarding methods to realize increased receiver dynamic range over entire DC to 200 GHz spectrum and enhance functional density to produce lighter and smaller receivers. - Continue architectural studies correlating the type of superconducting logic used to the expected performance and circuit SWaP when performing in the cryogenic environment specific digital signal processing tasks highly relevant to the naval environment. Such systems will be applicable to all RF applications while being most important to Surveillance, Electronic Warfare (EW), signal intelligence (SIGINT). - Complete research efforts regarding squeezed lasers and optical cooling of solids.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601153N / *Defense Research Sciences*	**Project (Number/Name)** 0000 / *Defense Research Sciences*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Complete research investigations regarding the use of generative neural networks to design topology-optimized metasurfaces and apply results to generate dual-level short-wave infrared antireflective coatings. - Complete research efforts developing novel materials for linear, low-power, broadband switches, including phase-change materials such as GeTe, as well as two-dimensional hexagonal boron nitride. - Complete research efforts on quantum entanglement and measurement as applied to RF signal analysis. - Complete research efforts to create new knowledge and understanding for quantum computing algorithms and their use to create new understanding of materials by design, process optimization, and quantum simulation. - Continue research efforts to create new knowledge and understanding and explore new concepts, components, techniques and methods, for the design, growth, and characterization of electronic, electromagnetic, quantum phenomenology, and electro-optical materials, fabrication processes, electronic and electro-optic components, including novel electromagnetic concepts and techniques, and plasma phenomena and theory. - Initiate research exploring new classes of analog superconducting devices including dynamically tunable resonators for analog processing and 3D stacks of predeposited YBCO as low loss interconnects. - Initiate research efforts to create new knowledge and understanding for quantum computing algorithms and their use to create new understanding of materials by design, process optimization, and quantum simulation. - Initiate research investigations into the use of molecular excitonics as a platform for quantum technologies such as quantum computing and quantum communications - Initiate research investigations into integrated mm-wave plasmonic photomixer receivers. - Initiate research efforts to evaluate RF properties of low Vpi electro-optical modulators made of thin film LiNbO3 deposits for airborne analog data links, including when hybridized with III-V, Si and SiN photonic devices. Quantum Measurement Architectural Devices - Continue research efforts regarding the development of protocols for sensing and timekeeping devices based on quantum systems, including clocks with improved short and long-term performance and electromagnetic field sensors. - Continue research into the development of inertial and gravity sensors based on light-atom interferometry. - Continue research efforts on the capabilities of non-equilibrium many-body systems for novel metrology. Electromagnetic Warfare - Continue research efforts with the overarching objective of establishing the mathematical constructs, techniques, computational procedures, and scientific foundations for analysis/design of signal, image, control, and data generating systems for use in Navy, other DoD, dual-use, or commercial development programs. Each					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601153N / *Defense Research Sciences*	**Project (Number/Name)** 0000 / *Defense Research Sciences*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
project has defined objectives within the contexts of the Naval Research Enterprise Research and Development Strategic Framework and Marine Corps S&T Strategic Plan. - Continue research investigation into novel approaches to deep-generative machine learning-based algorithms and architectures for multi-static radar imaging to enable better noise robustness and resolution performance. - Complete research efforts regarding the development of ultrafast, efficient, and accurate time domain (TD) algorithms to predict the ultra-wideband radar cross-section (RCS) of complex naval platforms by solving the long-standing late-time instability problem. - Complete research efforts to enable the imaging of self-illuminating thermal objects occluded by walls by sensing non-specular reflections from rough surfaces such as open doors and around corners, to allow for asymmetric warfare through image recovery in previously denied conditions. Materials and Chemistry - Continue the design and fabrication of single-monolayer or low-dimensional materials with unique and useful fundamental properties, e.g. ferromagnets and semiconductors, distinct from bulk materials and capable of being functionalized for high performing sensors, computer memory elements and electronic components. - Continue the use of precision molecular placement and orientation to design and create bio-inspired materials exploiting quantum phenomena to perform functions such as ultrasensitive photon detectors and energy generation. - Continue highly sensitive measurement and modeling techniques to design, detect, diagnose and/or quantify physical, chemical and biological processes and properties affected by trace impurities, subtle composition changes and chemical species with high spatial resolution, sensitivity, and precision. Undersea Warfare - Continue to conduct laboratory, field, and theoretical/numerical studies to investigate physical phenomena related to acoustic propagation and scattering in oceanic environments such as: prediction of the scattering signature of a structure using noise sources of opportunity; fundamental physical phenomena of wave propagation in ocean environments; approaches to separate an acoustical field from turbulent flow on an acoustic array; new structural acoustics theory for scattering from large, complex undersea objects; and creation of new approaches to monitoring the acoustic signature and structural state of undersea vessels. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601153N / *Defense Research Sciences*	**Project (Number/Name)** 0000 / *Defense Research Sciences*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
The increase from FY 2023 to FY 2024 in Sensors, Electronics And Electronic Warfare (EW) is due to increased Basic Research in such as areas but not limited to undersea warfare, mathematics, electronics, and quantum fundamental research.					
Title: Weapons	26.945	26.324	26.255	0.000	26.255
Description: The Weapons activity focuses on a number of fundamental scientific areas aimed at expanding the underlying understanding of disciplines that are broadly useful for a wide range of naval weapon applications, including undersea weaponry; air weaponry; energetic materials and solid rocket propulsion; both laser and high power microwave directed energy systems; counter directed energy phenomena; and hypersonic aerodynamics and materials to address the unique challenges of extreme temperatures and air flow. ***FY 2023 Plans:*** Undersea Weaponry - Continue research on Undersea Warheads (characterization and modeling of explosive formulations), Advanced Concepts for Sea Warfare and Weapons (unconventional power and energy technology), Cooperative Autonomous Swarm Technology and the Naval Undersea Research graduate-level STEM program, which supports the development of the Navy lab workforce. Air Weaponry - Continue efforts in the areas of solid and hybrid rocket propulsion, advanced structural and aperture materials, navigation, aerodynamics, single and multi-missile control, and power management. - Continue research on multifunctional material structures include making missile skins with embedded (woven-in) antennas, sensors, power sources, computational resources, and energetic materials. These efforts will enable missiles with greatly increased speed, range and lethality to meet future naval warfare needs. -Initiate research to develop models and tool to provide robust bearings without oil. Directed Energy and Counter Directed Energy Directed energy weapons are defined as electromagnetic systems capable of converting chemical and/or electrical energy to radiated energy and focusing it on a target, resulting in damage that degrades, neutralizes, defeats, or destroys an adversarial capability. Directed Energy Weapons efforts include High Energy Lasers that emit photons and High Power Microwaves that release radiofrequency waves. The ability to focus the radiated energy reliably and repeatedly at range, with precision and controllable effects, while producing measured physical damage, is the measure of effectiveness - requiring understanding of the basic sciences in high					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601153N / *Defense Research Sciences*	**Project (Number/Name)** 0000 / *Defense Research Sciences*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
energy physics, optics, quantum mechanics and material sciences. The U.S. Navy applies the basic research knowledge through follow on applied technology programs for power projection and integrated defense missions. Energetic Materials and Rocket Propulsion - Continue research investigating advanced energetic materials, which provide reactive, explosive, and propulsive phenomena including high-energy ingredient synthesis, modeling, characterization, and the fundamentals of initiation, decomposition, combustion and shock. - Continue and expand research in energetic material ingredients and material concepts with superior specific energy / energy density, brisance, and insensitivity for useful warhead fills and tactical propulsion. - Continue and expand research in novel diagnostic method development for improved understanding of energetic material combustion, shock response, and related dynamic phenomena. - Continue and expand efforts in advanced modeling and simulations on energetic materials to further understand and predict energetic material properties, response to stimuli, and performance. - Complete efforts in ingredient development, experimental diagnostics, and modeling that have not shown promise. - Initiate research focused on novel synthetic methodology development for carbon/hydrogen/nitrogen/oxygen-based energetic ingredients in addition to new metal based fuel particle design and other inorganic and hybrid energetic material concepts; - Initiate research into fundamental understanding of material interfacial physics/chemistry relevant to energetic formulation development and advanced manufacturing. Hypersonics - Continue research that will address technologies needed for long-range weapon components that are able to survive high temperature exposure for several minutes and thwart anti-access/ area denial countermeasures; - Continue investigating the hypersonic boundary-layers and shock-wave / boundary-layer interactions, prediction of hypersonic weapon flight performance and control, environment-material interactions, exploration of ultrahigh temperature materials, and technologies needed for high-speed propulsion. High Energy Lasers - Continue the exploration of the physics of photonic creation, materials interaction, energy release and interactions with optical materials via computational and mathematical modeling methods, including machine learning.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601153N / *Defense Research Sciences*	**Project (Number/Name)** 0000 / *Defense Research Sciences*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research on next-generation photon waveform and mode shaping interactions with materials, including metamaterials, examining high efficiency energy conversion designs within unique nanostructured materials with goal of increasing efficiency from source to release. - Continue examination of high energy laser-launched collimated photon interactions with the atmosphere, which are unique in propagation within the maritime domain, examining unique physical and optical interactions related to absorption, reflectance, scatter and turbulence often seen in expeditionary and at-sea conditions; - Continue research that will contribute to identifying new nanostructured materials, metamaterials and optical coatings processing for naval applications and investigate unique interactions of high energy photons with materials and coatings; High Power Microwaves - Continue research into solid-state and vacuum electronic based sources and amplifiers, antennas, high voltage storage/switching components and power supplies, novel high power capable materials, radio-frequency coupling and electronic device interaction physics, predictive effects and modeling tools along with novel sensors and instrumentation. Ultra Short Pulse Laser - Initiate research on interaction of intense laser pulses with nanostructured surfaces, the role of disorder in promoting synchronization in technological systems of relevance to the Navy, hybrid quantum devices with the greatest technological impact to photonics and solid-state laser components, and extension of mode-locked laser and optical frequency comb technologies from the traditional near-infrared regime to new spectral regions. - Initiate research on generation of high-average power ultra-broadband radio frequency and mid-infrared radiation in dielectrics and plasmas, effects of atmospheric turbulence on the propagation of laser beams having orbital angular momentum, demonstration of a compact solid-state laser source, demonstration of highly efficient frequency conversion of ultrashort pulse laser sources, and demonstration of ultrahigh peak power compact ultrashort sources in specific spectral ranges via advanced mode locking and chirped pulse amplification techniques.					
FY 2024 Base Plans: Undersea Weaponry - Continue research investigations of Undersea Warheads with respect to the characterization and modeling of explosive formulations. - Continue research efforts regarding Advanced Concepts for Sea Warfare and Weapons regarding unconventional power and energy technologies.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601153N / *Defense Research Sciences*	**Project (Number/Name)** 0000 / *Defense Research Sciences*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research investigations of Cooperative Autonomous Swarm Technology. - Continue research efforts relevant to the Naval Undersea Research graduate-level STEM program to support the development of the Navy laboratory workforce. Air Weaponry - Continue efforts in the areas of solid and hybrid rocket propulsion, advanced structural and aperture materials, navigation, aerodynamics, single and multi-missile control, and power management. - Continue research on multifunctional material structures include making missile skins with embedded (woven-in) antennas, sensors, power sources, computational resources, and energetic materials. These efforts will enable missiles with greatly increased speed, range and lethality to meet future naval warfare needs. - Continue research to develop models and tools to provide robust bearings without oil. Energetic Materials and Rocket Propulsion - Continue research investigating advanced energetic materials, which provide reactive, explosive, and propulsive phenomena including high-energy ingredient synthesis, modeling, characterization, and the fundamentals of initiation, decomposition, combustion and shock. - Continue and expand research in advanced synthetic methodologies and motifs for energetic material ingredients and material concepts with superior specific energy / energy density, brisance, and insensitivity for useful warhead fills and tactical propulsion, including new metal-based fuel particle designs and other inorganic and hybrid energetic material concepts. - Continue and expand research in novel diagnostic method development for improved understanding of energetic material decomposition, pyrolysis, combustion, shock response, and related dynamic phenomena. - Continue and expand efforts in advanced modeling and simulations on energetic materials to further understand and predict energetic material properties, response to shock, thermal and other stimuli, and performance. - Continue and expand research into fundamental understanding of material interfacial physics/chemistry relevant to energetic formulation development and advanced manufacturing. - Continue research focused on novel synthetic methodology development for carbon/hydrogen/nitrogen/oxygen-based energetic ingredients in addition to new metal based fuel particle design and other inorganic and hybrid energetic material concept Hypersonics - Continue research to address technologies needed for long-range weapon components that are able to survive high temperature exposure for several minutes and defeat anti-access / area denial countermeasures.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601153N / *Defense Research Sciences*	**Project (Number/Name)** 0000 / *Defense Research Sciences*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue investigating the hypersonic boundary-layers and shock-wave / boundary-layer interactions, prediction of hypersonic weapon flight performance and control, environment-material interactions, exploration of ultrahigh temperature materials, and technologies needed for high-speed propulsion. Directed Energy and Counter Directed Energy Directed energy weapons are defined as electromagnetic systems capable of converting chemical and/or electrical energy to radiated energy and focusing it on a target, resulting in damage that degrades, neutralizes, defeats, or destroys an adversarial capability. Directed Energy Weapons efforts include High Energy Lasers that emit photons and High Power Microwaves that release radiofrequency waves. The ability to focus the radiated energy reliably and repeatedly at range, with precision and controllable effects, while producing measured physical damage, is the measure of effectiveness - requiring understanding of the basic sciences in high energy physics, optics, quantum mechanics and material sciences. The U.S. Navy applies the basic research knowledge through follow-on applied technology programs for power projection and integrated defense missions. High Energy Lasers - Continue the exploration of the physics of photonic creation, materials interaction, energy release and interactions with optical materials via computational and mathematical modeling methods, including machine learning. - Continue research on next-generation photon waveform and mode shaping interactions with materials, including metamaterials, examining high efficiency energy conversion designs within unique nanostructured materials with goal of increasing efficiency from source to release. - Continue examination of high energy laser-launched collimated photon interactions with the atmosphere, which are unique in propagation within the maritime domain, examining unique physical and optical interactions related to absorption, reflectance, scatter and turbulence often seen in expeditionary and at-sea conditions. - Continue research that will contribute to identifying new nanostructured materials, metamaterials and optical coatings processing for naval applications and investigate unique interactions of high energy photons with materials and coatings. High Power Microwaves (HPM) - Continue research into solid-state and vacuum electronic based sources and amplifiers, antennas, high voltage storage/switching components and power supplies, novel high power capable materials, radio-frequency coupling and electronic device interaction physics, predictive effects and modeling tools along with novel sensors and instrumentation. Planned research efforts include the following:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601153N / *Defense Research Sciences*	**Project (Number/Name)** 0000 / *Defense Research Sciences*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- research investigations in HPM technologies including not only consideration of sources, but also the supporting pulsed power, antennas, and other subsystems. - research efforts in Solid-state and vacuum electronic based HPM sources capable of flexible waveforms. - research in Distributed array sources for agile beamforming. - research in Wide-bandwidth high-power frequency agile amplifiers. - research investigations of Low profile steerable antennas; high energy density capacitors, solid-state high voltage switches; high voltage power supplies, power electronics switches, hardened controls. - research in Novel materials - dielectric insulators, 3D printed materials, improved radome materials. - research efforts in RF coupling, device interaction physics and component level effects. - research in Prediction of effects on electronics with improved techniques for HPM lethality testing and analysis from L band to X band and above. - research in Novel HPM sensors including electronic battle damage indication (eBDI) instrumentation. Ultra Short Pulse Laser - Continue research on interaction of intense laser pulses with nanostructured surfaces, the role of disorder in promoting synchronization in technological systems of relevance to the Navy, hybrid quantum devices with the greatest technological impact to photonics and solid-state laser components, and extension of mode-locked laser and optical frequency comb technologies from the traditional near-infrared regime to new spectral regions. - Continue research on generation of high-average power ultra-broadband radio frequency and mid-infrared radiation in dielectrics and plasmas, effects of atmospheric turbulence on the propagation of laser beams having orbital angular momentum, demonstration of a compact solid-state laser source, demonstration of highly efficient frequency conversion of ultrashort pulse laser sources, and demonstration of ultrahigh peak power compact ultrashort sources in specific spectral ranges via advanced mode locking and chirped pulse amplification techniques. - Initiate research investigation of improved AI deep learning approaches for beaconless atmospheric turbulence prediction and compensation for deep turbulence. - Initiate research into the evaluation of wavefront sensing, reconstruction, and control methods for deep turbulence in the laboratory.					
FY 2024 OCO Plans: N/A					
FY 2023 to FY 2024 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601153N / *Defense Research Sciences*	**Project (Number/Name)** 0000 / *Defense Research Sciences*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
There is no significant funding change from FY 2023 to FY 2024.					
Accomplishments/Planned Programs Subtotals	462.869	479.480	520.984	0.000	520.984

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 1	R-1 Program Element (Number/Name) PE 0601153N / *Defense Research Sciences*	Project (Number/Name) 3465 / *In-House Lab Independent Res*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3465: *In-House Lab Independent Res*	0.000	10.992	19.533	19.924	-	19.924	20.322	20.729	21.143	21.566	Continuing	Continuing

Note

Effective in FY 2022, In-house Laboratory Independent Research (ILIR) funding and associated requirements are realigned from Program Element (PE) 0601152N, Project 0000 to PE 0601153N, Project 3465.

A. Mission Description and Budget Item Justification

The In-house Laboratory Independent Research (ILIR) initiative seeks to improve the quality of defense research conducted predominantly through the Naval Warfare Centers/Laboratories. It also supports the development of technical intellect and education of engineers and scientists in disciplines critical to national defense needs through the development of new knowledge in a military laboratory environment. Initial research focus is often conducted in an unfettered environment since it is basic research, but many projects focus on applying recently developed theoretical knowledge to real world military problems with the intention of developing new capabilities and improving the performance of existing systems.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: In-House Laboratory Independent Research (ILIR)	10.992	19.533	19.924	0.000	19.924
Description: The In-house Laboratory Independent Research program provides opportunities to strengthen the Naval Science and Engineering workforce through basic research conducted at the Naval Warfare Centers and Laboratories. These research efforts address high risk/high payoff warfighter science and technological needs, as well as attract the next generation of researchers to consider employment within the Department of the Navy. ILIR also provides opportunities for advanced degrees, technical publications, presentations, and patents. ***FY 2023 Plans:*** Continue: Further develop and maintain the Science and Engineering workforce by providing funding to Naval Warfare Centers and Laboratories to foster high risk/ high reward basic research initiatives of Naval interest. Each naval site conducts peer reviews for existing research projects, assess the quality of the research, and determine if projects should continue. Complete: Conclude research topics that initiated in FY 2021. Assess opportunities for technology transition through coordination with various resource sponsors. Transfer successful efforts to research, development, test, and evaluation-sponsored programs.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601153N / *Defense Research Sciences*	**Project (Number/Name)** 3465 / *In-House Lab Independent Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Initiate: The participating warfare centers or laboratories generate new three-year research topics where priority is given to warfighter needs, technology alignment, high quality research, and the recruitment and retention of outstanding scientists and engineers. Topics cover a broad range of naval relevant research areas critical to the support of warfare center and laboratory missions. ***FY 2024 Base Plans:*** Continue: - Further develop and maintain the Science and Engineering workforce by providing funding to Naval Warfare Centers and Laboratories to foster high risk/ high reward basic research initiatives of Naval interest. Each Naval site conducts peer reviews for existing research projects, assess the quality of the research, and determine if projects should continue. Complete: - Research topics that initiated in FY 2022. Assess opportunities for technology transition through coordination with various resource sponsors. Transfer successful efforts to research, development, test, and evaluation-sponsored programs. Initiate: - The participating warfare centers or laboratories generate new three-year research topics where priority is given to warfighter needs, technology alignment, high quality research, and the recruitment and retention of outstanding scientists and engineers. Topics cover a broad range of naval relevant research areas critical to the support of warfare center and laboratory missions. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change between FY 2023 and FY 2024.					
Accomplishments/Planned Programs Subtotals	10.992	19.533	19.924	0.000	19.924

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601153N / *Defense Research Sciences*	**Project (Number/Name)** 3465 / *In-House Lab Independent Res*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy										Date: March 2023		
Appropriation/Budget Activity 1319 / 1					R-1 Program Element (Number/Name) PE 0601153N / *Defense Research Sciences*				Project (Number/Name) 9999 / *Congressional Adds*			
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
9999: *Congressional Adds*	0.000	37.649	42.500	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	80.149

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Congressional Add: Basic Research ***FY 2022 Accomplishments:*** Conduct basic research efforts including scientific study and experimentation directed toward increasing knowledge and understanding in national security related aspects of physical, engineering, environmental and life sciences. Basic research effort subject areas include: Autonomous Systems; Artificial Intelligence/Machine Learning; Command, Control, Communications and Computers (C4); Marine as a System; Information Analysis and Decision Support; Intelligence, Surveillance and Reconnaissance; Logistics; Materials; Operational Environments; Platforms; Power and Energy Technology; Sensors and Electronics; Warrior Performance and Protection; Weapons and Support (Education and Outreach). ***FY 2023 Plans:*** Provide significant new opportunities for basic research across the spectrum of activities in the 0601153N Program Element performed in the five departments of the Office of Naval Research.	24.134	25.000
Congressional Add: Bio-inspired Engineering and Design for Naval Applications ***FY 2022 Accomplishments:*** Conduct basic research on mobility, maneuverability and agility, with focus on locomotion and mechanics (e.g., fin-based swimming, flapping flight and legged locomotion), modalities of distributed sensing and processing (visual, echolocation, lateral-line and vibrissae "imaging" and cognitive-neural processing, neuroscience and machine learning), and distributed actuation (neural activation and muscle mechanics, hard and soft robotics). ***FY 2023 Plans:*** N/A	2.896	0.000
Congressional Add: Generally-capable robotics for naval operations ***FY 2022 Accomplishments:*** Conduct basic research focused on generally-capable robotics for naval operations ***FY 2023 Plans:*** N/A	3.861	0.000
Congressional Add: Multifunctional structural batteries	1.931	3.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601153N / *Defense Research Sciences*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
FY 2022 Accomplishments: Conduct basic research in multifunctional structural batteries ***FY 2023 Plans:*** Objective to investigate the important basic engineering science challenges that can substantially advance the naval undersea systems technologies.		
Congressional Add: Silicon-germanium-tin alloy research ***FY 2022 Accomplishments:*** Conduct basic research on silicon-germanium-tin alloys ***FY 2023 Plans:*** This project is to deliver breakthroughs in semiconductor science and technology for the fabrication of new and novel focal-plane array digital imaging systems.	4.827	5.000
Congressional Add: Predictive modeling for next generation undersea vehicles ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct research in predictive modeling for next generation undersea vehicles.	0.000	3.000
Congressional Add: Naval Research Laboratory S&T ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct Congressional Interest Science and Technology at the Naval Research Laboratory	0.000	6.500
Congressional Adds Subtotals	37.649	42.500

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy												Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602114N *I Power Proj Applied Research*							
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	41.760	27.953	23.982	-	23.982	23.880	24.358	24.845	25.341	Continuing	Continuing
0000: *Power Proj Applied Research*	0.000	22.453	22.953	23.982	-	23.982	23.880	24.358	24.845	25.341	Continuing	Continuing
9999: *Congressional Adds*	0.000	19.307	5.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	24.307

A. Mission Description and Budget Item Justification

In an Artificial Intelligence (AI) enabled maritime battlespace, the ability to fight at the speed of light will determine the outcome. The effective defense against threats increasingly beyond human speed, will enable U.S. naval forces to outthink, outmaneuver and outfight adversaries. This Program Element (PE) supports both advanced technology research and near to mid-term transition opportunities. The advanced research focus is primarily on directed energy, high speed weapon propulsion, Electro-Optic/Infrared (EO/IR) sensor technologies, and Naval Precision Strike Operations. The goal of this research is to develop technologies and capabilities that enable Directed Energy (DE) weapons as well as defense against adversary DE systems; the development of vehicle and propulsion technology for high-speed weapons operating from Mach 3 to Mach 8 and beyond; investment in the areas of Electro Optic/Infrared devices and advanced sensors; and technologies that provide the navy of the future the ability to quickly locate, target, and strike critical targets ashore.

Today's Sailors and Marines are enabled by naval Science and Technology (S&T). Since 1946, the Office of Naval Research (ONR) has fostered scientific research related to the maintenance of maritime superiority and national defense. ONR manages the Department of the Navy's (DON) portfolio of naval Basic and Applied research, and Advanced Technology Development investments to ensure naval forces can effectively deter conflict, but when called upon, fight, win and come home safe. Current investments hedge against uncertainty, providing solutions to commanders today, and options for the future. The Naval S&T budget supports higher guidance defined by the National Defense Strategy, and responds to requirements identified by the Secretary of the Navy through research priorities set by the Chief of Naval Research, coordinated across the Naval Research Enterprise (NRE), and outlined in the Naval R&D Framework.

This Program Element (PE) funds Applied Research, which is the systematic study to understand the means to meet a recognized and specific need. Most of the work in this PE can be classified between Technology Readiness Level (TRL) 2 (technology concept and/or application formulation) and TRL 4 (component and/or breadboard validation in laboratory environments).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602114N *I Power Proj Applied Research*

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	43.013	22.953	27.166	-	27.166
Current President's Budget	41.760	27.953	23.982	-	23.982
Total Adjustments	-1.253	5.000	-3.184	-	-3.184
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	5.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.253	0.000			
• Program Adjustments	0.000	0.000	-3.184	-	-3.184
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 9999: *Congressional Adds*		
Congressional Add: *Miniaturization of Lasers*	3.861	0.000
Congressional Add: *Manufacturing of high temperature hypersonic materials*	7.723	0.000
Congressional Add: *Multi-mission UAV-borne electronic attack*	7.723	0.000
Congressional Add: *Meta material broadband coatings*	0.000	5.000
Congressional Add Subtotals for Project: 9999	19.307	5.000
Congressional Add Totals for all Projects	19.307	5.000

Change Summary Explanation

Funding: $3.184M S&T reduction to comply with Defense Planning Guidance

Technical: No significant change.

Schedule: No significant change

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602114N / *Power Proj Applied Research*	Project (Number/Name) 0000 / *Power Proj Applied Research*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
0000: *Power Proj Applied Research*	0.000	22.453	22.953	23.982	-	23.982	23.880	24.358	24.845	25.341	Continuing	Continuing

A. Mission Description and Budget Item Justification

In an Artificial Intelligence (AI)enabled maritime battlespace, the ability to fight at the speed of light will determine the outcome. The effective defense against threats increasingly beyond human speed, will enable U.S. naval forces to outthink, outmaneuver and outfight adversaries. This Project supports both advanced technology research and near to mid-term transition opportunities. The advanced research focus is primarily on directed energy, high speed weapon propulsion, electro-optic/ infrared (EO/IR) sensor technologies, and Naval Precision Strike Operations. The goal of this research is to develop technologies and capabilities that enable Directed Energy (DE) weapons as well as defense against adversary DE systems; the development of vehicle and propulsion technology for high-speed weapons operating from Mach 3 to Mach 8 and beyond; investment in the areas of Electro Optic/Infrared devises and advanced sensors; and technologies that provide the navy of the future the ability to quickly locate, target, and strike critical targets ashore.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Directed Energy	7.484	7.139	6.191	0.000	6.191
Description: The goal of this activity is to develop technologies and capabilities that enable Directed Energy (DE) weapons for naval applications as well as defense against adversary DE systems. The advanced research focus is in Naval Ship Defense, Naval Air Defense, and Naval Precision Strike Operations. The scope of this activity includes systems, sub-systems and their associated technologies. These technologies provide naval forces the ability to quickly engage critical and emerging targets, in cost effective means, while minimizing potential collateral damage, as well as the ability to defend against and counter adversarial modes of attack. ***FY 2023 Plans:*** Conduct exploratory research and develop component technologies that enables higher power, more lethal High Energy Laser (HEL), High Power Microwave (HPM) and Ultra Short Pulse Laser (USPL) weapons. Continuing Efforts - Development of novel laser and beam-director architectures - Improved sensor and illuminator technologies - Improved HEL electrical-to-optical efficiency - Improved laser sources with enhanced spectrum control - Reduced system jitter and improved precision aim-point maintenance - Improved characterization of atmosphere and associated modeling tools - Improved understanding of blooming and laser/material/target interactions					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602114N / *Power Proj Applied Research*	**Project (Number/Name)** 0000 / *Power Proj Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Development of novel laser sources in Mid Wave Infrared (MWIR) and Long Wave Infrared (LWIR) - Development of Counter-capabilities, including the understanding of HEL Weapons risks to US naval forces - Improved understanding of USPL propagation mechanisms and effects - Development of understanding of HPM use in Electromagnetic (EM) Maneuver Warfare and Integrated Defense of US naval forces - Improved understanding of HPM effects and lethality - Effort to develop and apply innovative S&T in plasmas, pulsed power, electromagnetic acceleration, particle beams, high-energy & ultra-short-pulse lasers (USPL), and non-linear optics to support current and future Navy and DoD needs. Continue to focus on areas of high power fiber laser efforts. Initiating Efforts - Engineering USPL sub-component maturation for prototype sub systems - USPL component integration for prototype system of systems (SOS) experimentation - New effort for novel Counter-HEL capability -Preparation for range testing of HPM engagement systems -Performing system level performance analysis and mission level modeling relative to threats. -Applied research to further the State-of-the-Art Advancement for HPM source, antenna, pulsed power, and high voltage power supplies to support prototype development. -Explore HPM source and related component development around open architecture principles, to explore hardware options for achieving effective system CONEMPS -Developing self-contained HPM prototype development with integrated sensor and C2 capabilities that will provide a response to UAS swarm attack. ***FY 2024 Base Plans:*** Conduct exploratory research and develop component technologies that enables more capable and more lethal High Energy Laser (HEL), High Power Microwave (HPM) and Ultra Short Pulse Laser (USPL) weapons technologies aligned to warfighter requirements and capabilities to counter adversary DE weapons through Counter Directed Energy Weapons (CDEW). Continuing Efforts - Development of novel laser and beam-director architectures - Improved sensor and illuminator technologies - Reduced system jitter and improved precision aim-point maintenance					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602114N / *Power Proj Applied Research*	**Project (Number/Name)** 0000 / *Power Proj Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Improved characterization of atmosphere and associated modeling tools - Improved understanding of blooming and laser/material/target interactions - Development of novel laser sources in Mid Wave Infrared (MWIR) and Long Wave Infrared (LWIR) - Improved understanding of USPL propagation mechanisms and effects - Development of understanding of HPM use in Electromagnetic (EM) Maneuver Warfare and Integrated Defense of US naval forces - Improved understanding of HPM effects and lethality through RF coupling, device interaction physics and component level effects - Engineering USPL sub-component maturation for prototype sub systems - USPL component integration for prototype system of systems (SOS) experimentation - The effort for novel Counter-HEL capability - Range testing of HPM engagement systems - Performing system level performance analysis and mission level modeling relative to threats. - Applied research to further the State-of-the-Art Advancement for HPM capable low profile steerable antennas; high energy density capacitors, solid-state high voltage switches; high voltage power supplies, power electronics switches, and hardened controls to support prototype development. - Explore HPM source and related component development around open architecture principles, to explore hardware options for achieving effective system CONEMPS - Developing self-contained HPM prototype development with integrated sensor and C2 capabilities that will provide a response to UAS swarm attack in both ground and air platform applications -Applied research in Solid-state and vacuum electronic based HPM sources capable of flexible waveforms for cross EM spectrum applications - Effort to develop and apply innovative S&T in plasmas, pulsed power, electromagnetic acceleration, particle beams, high-energy & ultra-short-pulse lasers (USPL), and non-linear optics to support current and future Navy and DoD needs. Completing Efforts - Improved laser sources with enhanced spectrum control - Improved HEL electrical-to-optical efficiency - Development of Counter-capabilities, including the understanding of HEL Weapons risks to US naval forces Initiating Efforts - Enhancement of HEL efficiency based on improved diode & fiber laser technologies					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602114N / *Power Proj Applied Research*	**Project (Number/Name)** 0000 / *Power Proj Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Improvements in fiber laser doped illuminating lasers at unique "eye-safer" wavelengths - Improvements in laser light detection and testing sensors - Requirement's analysis to relate USPL functional requirements to operational needs - Functional analysis and design in order to identify USPL performance issues - Building and test of prototypes of USPL critical components - Validation of the maturity of USPL critical components - Conduct USPL precision dynamic engagements, against multiple maneuvering targets, with various effects (hard kill, sensing, non-lethal) - Explore the use of Artificial Intelligence for HEL & HPM systems to increase lethality in complex maritime operational environments - Applied research in HPM capable wide-bandwidth high-power frequency agile amplifiers - Initiate efforts into hollow core multiband fibers for laser power transmission. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease in funding from FY23 to FY24 is due to efforts completing and reduced investment in Counter Directed Energy Weapons and Ultra Short Pulse Laser research.					
Title: High Speed Propulsion and Advanced Weapon Technologies	12.235	13.773	15.000	0.000	15.000
Description: This activity is focused on applied research to support the development of vehicle and propulsion technology for high-speed weapons operating from Mach 3 to Mach 8 and beyond. The goal is to develop computational, experimental and flight testing capabilities along with the workforce needed to support the development of hypersonic weapons. Research includes: Objectives: - Prediction and control of hypersonic boundary-layers and shock-wave boundary-layer interactions - Development of hypersonic ground test facilities, instrumentation and nonintrusive diagnostics - Prediction of interactions between materials and the high-speed flight environment such as flight through weather and oxidation of thermal protection systems - Development of improved modeling tools to predict the aerothermal and aerodynamic performance of hypersonic weapons over a wide range of velocities and altitudes					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602114N / *Power Proj Applied Research*	**Project (Number/Name)** 0000 / *Power Proj Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Development of ultra-high temperature materials, cooling strategies and thermal protection systems that can survive the launch and flight environment - Development high-speed propulsion technologies such as solid fuel ramjets ***FY 2023 Plans:*** Conduct applied research for high-speed propulsion technologies such as solid-fuel ramjets/scramjets and dual mode ramjet/scramjet (DMRJ) to extend the range of hypersonic missiles; external aerodynamic technologies such as laminar flow control to enable high-performance hypersonic missiles; and improved modeling tools to predict the aerothermal, aerodynamic and propulsion performance of hypersonic weapons over a wide range of velocities and altitudes. Continuing Efforts - Experimental and numerical investigation on the combustion characteristics of solid fuels in supersonic combustors - Development of physics based computational structural analysis tools for prediction of impact damage in weapon structures due to atmospheric encounters under high-speed flow conditions. Completing Efforts - Assessment of advanced high-fidelity modeling and simulation tools for the prediction of boundary layer transition on relevant weapon geometries Initiating Efforts - Development and testing of new aeroshell material technology to extend laminar flow - High-fidelity computations, ground test techniques and flow diagnostics to characterize neutral and ionized gas species - Experimental and computational studies to extend the flight envelope of solid fuel ramjets to higher speeds and altitudes and to improve throttle-ability - Applied research for Nuclear Aircraft Carrier (CVN) compliant hypersonic air-breathing weapons to increase performance & operability - Development of reduced orders models for rapid prediction of aerothermal and aerodynamic performance using data driven approaches such as machine learning, high-fidelity simulations and experiments as training data ***FY 2024 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602114N / *Power Proj Applied Research*	**Project (Number/Name)** 0000 / *Power Proj Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Conduct applied research for high-speed propulsion technologies such as solid-fuel ramjets/scramjets and dual mode ramjet/scramjet (DMRJ) to extend the range of hypersonic missiles; external aerodynamic technologies such as laminar flow control to enable high-performance hypersonic missiles; improved modeling tools to predict the aerothermal, aerodynamic and propulsion performance of hypersonic weapons over a wide range of velocities and altitudes; ultra-high temperature metamaterials and structures to enable sensing, flow control, power generation, and improved aero-thermo-mechanical performance of aeroshells and high-speed propulsion systems. Continuing Efforts - Experimental and numerical investigation on the combustion characteristics of solid fuels in supersonic combustors - Development of physics based computational structural analysis tools for prediction of impact damage in weapon structures due to atmospheric encounters under high-speed flow conditions - Development and testing of new aeroshell material technology to extend laminar flow - High-fidelity computations, ground test techniques and flow diagnostics to characterize neutral and ionized gas species - Experimental and computational studies to extend the flight envelope of solid fuel ramjets to higher speeds and altitudes and to improve throttle-ability - Applied research for Nuclear Aircraft Carrier (CVN) compliant hypersonic air-breathing weapons to increase performance & operability - Development of reduced orders models for rapid prediction of aerothermal and aerodynamic performance using data driven approaches such as machine learning, high-fidelity simulations and experiments as training data Initiating Efforts - Development and characterization of ultra-high temperature metamaterials and structures to enable, sensing, flow control, power generation, and improved aero-thermo-mechanical performance of aeroshells and high-speed propulsion systems - Development of efficient, predictive computational tools for high-speed, air-breathing propulsion systems to enable robust digital-engineering methodologies					
FY 2024 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602114N / *Power Proj Applied Research*	**Project (Number/Name)** 0000 / *Power Proj Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY23 to FY24 is due to expanded investment in technology supporting hypersonic weapons in addition to initiating propulsion research.					
Title: Navigation, Electro Optic/Infrared (EO/IR), and Sensor Technologies ***Description:*** This activity describes Navy Science and Technology investments in the areas of Electro Optic/ Infrared (EO/IR) devices and advanced sensors and includes investment/performance in the technology areas of EO/IR, Electronic Warfare (EW), Electromagnetic Warfare, and Communications. ***FY 2023 Plans:*** - Initiate research and develop technologies that will protect surface platforms against imaging infrared seekers. Further efforts into development of inexpensive photodetectors operating at room temperature with higher detectivity than state-of-the-art cooled detectors. ***FY 2024 Base Plans:*** Continuing Efforts - Continue to research and develop technologies that will protect surface platforms against imaging infrared seekers. - Continue efforts into development of inexpensive photodetectors operating at room temperature with higher detectivity than state-of-the-art cooled detectors. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY23 to FY24 is due to increased investment in the ability to counter the capability of an adversary to target and detect U.S. forces.	0.810	0.605	2.107	0.000	2.107
Title: Strike and Littoral Combat Technologies ***Description:*** The focus of this activity is on those technologies that will support Naval Precision Strike Operations and provide the Navy of the future the ability to quickly locate, target, and strike critical targets ashore. ***FY 2023 Plans:***	1.924	1.436	0.684	0.000	0.684

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602114N / *Power Proj Applied Research*	**Project (Number/Name)** 0000 / *Power Proj Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
-Continue efforts for machine-learning-based resource management for distributed radar system operation. This will support search and track requirements while minimizing emissions to degrade, defeat, and delay counter targeting. -Initiate projects which aim to develop technology and techniques to provide the Navy of the future the ability to quickly locate, target, and strike critical targets ashore. ***FY 2024 Base Plans:*** Continuing Efforts - Continue projects that aim to develop technology and techniques to provide the Navy of the future the ability to quickly locate, target, and strike critical targets ashore. Completing Efforts - Complete efforts for machine-learning-based resource management for distributed radar system operation. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease from FY23 to FY24 is due to completing efforts for machine-learning-based resource management for distributed radar system operation.					
Accomplishments/Planned Programs Subtotals	22.453	22.953	23.982	0.000	23.982

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602114N / *Power Proj Applied Researc h*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	19.307	5.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	24.307

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Congressional Add: Miniaturization of Lasers ***FY 2022 Accomplishments:*** Conduct applied research in miniaturization of lasers. ***FY 2023 Plans:*** N/A	3.861	0.000
Congressional Add: Manufacturing of high temperature hypersonic materials ***FY 2022 Accomplishments:*** Conduct applied research in manufacturing of high temperature hypersonic materials ***FY 2023 Plans:*** N/A	7.723	0.000
Congressional Add: Multi-mission UAV-borne electronic attack ***FY 2022 Accomplishments:*** Conduct applied research supporting multi-mission UAV-borne electronic attack ***FY 2023 Plans:*** N/A	7.723	0.000
Congressional Add: Meta material broadband coatings ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct research in Meta material broadband coatings	0.000	5.000
Congressional Adds Subtotals	19.307	5.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602123N *I Force Protection Applied Res*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	215.913	345.576	142.148	-	142.148	137.376	139.999	142.674	145.291	Continuing	Continuing
0000: *Force Protection Applied Res*	0.000	119.861	133.426	142.148	-	142.148	137.376	139.999	142.674	145.291	Continuing	Continuing
9999: *Congressional Adds*	0.000	96.052	212.150	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	308.202

A. Mission Description and Budget Item Justification

America is a maritime nation with global responsibilities that require U.S. naval forces be respected around the world and decisive when it matters. The Office of Naval Research (ONR) was established to guide ongoing research to ensure the technical superiority of the U.S. Navy and Marine Corps. This Program Element (PE) addresses applied research associated with providing the capability of Platform and Force Protection for the U.S. Navy. This program supports the development of technologies associated with all naval platforms (surface, subsurface, terrestrial, and air) and the protection of those platforms. The goal is to provide the ability to deter, or avoid engagements, and if necessary, fight and win against adversary naval platforms or weapons. In the event of conflict, naval platforms must be able to resist and control damage while preserving operational capability. Research is focused on providing technologically superior defense of naval assets and delivering warfighting capabilities at reduced total ownership costs for surface and subsurface platforms through investments in applied research in: a) Power, Energy & Propulsion b) Platform Design and Engineering and c) new technology innovation from identification to prototype to scaling. . This program identifies and develops technologies for reduced observables technology and enhanced capability of naval aviation aircraft platforms in terms of mission effectiveness, platform range, responsiveness, survivability, observability, readiness, safety and life cycle cost. The program addresses innovation in technology development to provide substantial improvements in energetic material systems and subsystems, primarily in terms of performance, but also addressing safety, reliability, and affordability concerns. The program supports mission-driven design think problem solving within the Naval Research and Development Establishment (NR&DE) and academia in support of culture changes to agile and rapid prototyping development driven by well defined and effective innovation process and operations.

Today's Sailors and Marines are enabled by naval Science and Technology (S&T) and the business of innovation. Since 1946, the Office of Naval Research (ONR) has fostered scientific research related to the maintenance of maritime superiority and national defense. ONR manages the Department of the Navy's (DON) portfolio of naval Basic and Applied research, and Advanced Technology Development investments, as well as the NavalX office, to ensure naval forces can effectively deter conflict, but when called upon, fight, win and come home safe. Current investments, combined with innovation operations, hedge against uncertainty, providing solutions to commanders today, and options for the future. The Naval S&T budget supports higher guidance defined by the National Defense Strategy, and responds to requirements identified by the Secretary of the Navy through research priorities set by the Chief of Naval Research, coordinated across the Naval Research Enterprise (NRE), and outlined in the Naval R&D Framework.

This Program Element (PE) funds Applied Research, which is the systematic study to understand the means to meet a recognized and specific need. Most of the work in this PE can be classified between Technology Readiness Level (TRL) 2 (technology concept and/or application formulation) and TRL 4 (component and/or breadboard validation in laboratory environments).

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602123N *I Force Protection Applied Res*

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	222.388	133.426	135.956	-	135.956
Current President's Budget	215.913	345.576	142.148	-	142.148
Total Adjustments	-6.475	212.150	6.192	-	6.192
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	212.150			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-6.475	0.000			
• Program Adjustments	0.000	0.000	6.192	-	6.192
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 9999: *Congressional Adds*		
Congressional Add: *Alternative Energy Research*	0.000	30.000
Congressional Add: *Advanced Energetics Research*	2.896	6.000
Congressional Add: *Talent and technology for Navy power and energy systems*	10.136	10.500
Congressional Add: *Energy resilience efforts*	6.757	8.000
Congressional Add: *Coastal environmental research*	4.827	5.000
Congressional Add: *Direct Air Capture and Blue Carbon Removal Technology*	9.654	10.000
Congressional Add: *Additive Manufacturing of Unmanned Maritime Systems*	5.792	10.000
Congressional Add: *Navy Alternative Energy Research*	26.547	0.000
Congressional Add: *relative position of autonomous platforms*	2.896	5.000
Congressional Add: *Bonded metal matric composit repair*	4.827	5.000
Congressional Add: *Resilient innovative sustainable economies via university partnerships*	7.240	9.000
Congressional Add: *Titanium metal and wire domestic production demonstration*	14.480	0.000
Congressional Add: *high speed/hypersonic test capability development*	0.000	4.000

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602123N *I Force Protection Applied Res*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Congressional Add: *Resilient autonomous systems research and diversity programs*	0.000	8.500
Congressional Add: *Seawater to jet fuel demo*	0.000	20.000
Congressional Add: *Arctic energy resiliency*	0.000	10.000
Congressional Add: *Cavitation erosion*	0.000	5.000
Congressional Add: *Corrosion control coating and material*	0.000	5.000
Congressional Add: *Cyberphysical security resilency*	0.000	7.000
Congressional Add: *Intelligent data managment for distributed Naval platforms*	0.000	10.500
Congressional Add: *Materials by design for Navy aircraft sustainment*	0.000	5.000
Congressional Add: *sUAS degraded enviorment facility*	0.000	12.650
Congressional Add: *Universal achemetal titanium process*	0.000	12.000
Congressional Add: *Unmanned surface vehicle*	0.000	5.000
Congressional Add: *High-entropy materials for hypersonics*	0.000	9.000
Congressional Add Subtotals for Project: 9999	96.052	212.150
Congressional Add Totals for all Projects	96.052	212.150

Change Summary Explanation

Funding: $6.192M increase for Support Equipment Electrification.

Technical: not applicable

Schedule: not applicable

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602123N / *Force Protection Applied Res*	Project (Number/Name) 0000 / *Force Protection Applied Res*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
0000: *Force Protection Applied Res*	0.000	119.861	133.426	142.148	-	142.148	137.376	139.999	142.674	145.291	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project addresses applied research associated with providing the capability of Platform and Force Protection for the U.S. Navy. It supports the development of technologies associated with all naval platforms (surface, subsurface, terrestrial, and air) and the protection of those platforms. Research is focused on providing technologically superior defense of naval assets and delivering warfighting capabilities at reduced total ownership costs for surface and subsurface platforms through investments in applied research in: a) Power, Energy, Propulsion, Engineering and Design. This project develops technologies for reducing detectable signatures, while enhancing the mission effectiveness of naval platforms (surface, subsurface, terrestrial, and air) through improvements in platform range, responsiveness, survivability, observability, readiness, safety and life cycle cost. The project addresses technology development that provides substantial performance improvements in energetic material systems and subsystems, while addressing safety, reliability, and affordability concerns.

This project is broken out into five primary areas of study: Aircraft Technology, Fleet Force Protection and Defense Against Undersea Threats, Advanced Energetics, Surface Ship and Submarine Hull Mechanical & Electrical (HM&E), and Naval Research Enterprise/Innovation Operations.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Aircraft Technology	35.606	35.485	36.317	0.000	36.317
Description: The Aircraft Technology activity develops technologies for reduced observables technology and enhanced capability of naval aviation aircraft platforms in terms of mission effectiveness, platform range, operational energy, expeditionary capability, responsiveness, survivability, observability, readiness, safety and life cycle cost. It also develops new Naval air vehicle concepts and high impact, saleable naval air vehicle technologies, such as - autonomous air vehicle command and control, helicopter and tilt rotor systems, aerodynamics, propulsion systems, materials, structures and flight controls for future and legacy air vehicles. The Sea-Based Aviation National Naval Responsibility (SBA NNR) Structures and Materials program will develop the next generation structural capability and material response science for aircraft technology in fixed and rotary wing, manned and unmanned airframe technology to achieve reduced weight, increased durability, strength, streamlined manufacturability, reduced life-cycle cost and maintenance/readiness gaps improvements. Program payoffs include increased availability/readiness, reduced sustainment requirements, fatigue/loads life enhancement, reduced weight and improved range, and advanced prognostics design tools.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
These efforts address unique attributes to propulsion, power and thermal management technologies for Naval Aviation, as well as those having higher importance to Naval Aviation and some that are more pervasive to all of military aviation. Related basic research efforts are addressed under 0601153N Defense Research Sciences. ***FY 2023 Plans:*** Research related to Sea Based Aviation National Naval Responsibility (SBA NNR) priorities in Aviation, Aerodynamics, Flight Dynamics & Control, Propulsion, and Structures & Materials. Research in Aircraft Science & Technology includes: Continuing Efforts - Advanced analytical methods for achieving guaranteed performance in multibody control systems. - Control law synthesis methods to expand the recovery envelope and reduce touchdown loads. - Advanced modeling and analysis methods for ship/aircraft aerodynamic interface. - Air vehicle flying qualities and control. - High lift aerodynamics and control. - Vertical/Short Take-off and Landing (V/STOL) science & technology. - Automated launch and recovery technology. - Mechanical/environmental failure prediction research. - Advanced dynamics and topology of coupled human/machine systems. - Precise relative navigation science & technology. - Integrated development environment for cyber secure avionics. - Infrastructure for rapid development, analysis, and experimentation with advanced flight science and technology across academia, government and industry. - Manned/unmanned teaming technology. Applied research in Flight Dynamics & Control will develop theory, analysis and experimental data to better understand and exploit the natural dynamics of both conventional and unconventional air vehicles operating in the marine environment. Efforts include: Continuing Efforts - Multibody control systems and the ability to demonstrate guaranteed performance relative to a desired end state.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Robust and precise control in the presence of highly turbulent flow fields to increase operational capability and reduce structural requirements for ship-based operations; - Algorithms and sensors to enable precise ship-relative navigation in GPS-denied environments; - Control effectors and vehicle configurations to enable platforms with VTOL utility and fixed-wing efficiency. - Collaborative research to improve our knowledge of control system interactions between piloted aircraft and human performance. Applied Aerodynamics research for aircraft and weapons platforms will include: Continuing Efforts - Advanced computational methods addressing the Navy-unique challenge of a fully coupled aerodynamic interface between ships and aircraft; - Advanced methods for reduced-order modeling of complex flow fields to enable real-time, high-fidelity simulations of ship-based aircraft operations. - Advanced methods for manipulating and more precisely controlling the flow fields around air vehicles operating in the maritime environment. - Novel diagnostics and techniques for in situ measurement ship airwake dynamics and its coupling to ship motions (sea states) and environmental flow field. - Advanced technologies for improved weapons aerodynamics enabling increased range and maneuverability. - Innovative concepts for compact, highly-integrated inlets for air-breathing weapons. Initiating Efforts - Innovative concepts for launch and recovery of unmanned aerial systems. - Understanding aerodynamics of novel air vehicle configurations, including the effects of multi-rotor systems and operational environments. Applied research in aircraft Propulsion, Power and thermal management concepts for high speed, long endurance and responsiveness include: Continuing Efforts - Cooling and thermal management for engines and auxiliary systems. - Diagnostics, prognostics and control for Integrated Power, Propulsion and Thermal Management. - Highly integrated Propulsion inlets, exhausts.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Sand, Salt and Dust Ingestion research: including modeling, separating, deposition, coatings and sensing.; - Next Generation Propulsion Enablers includes applied research in propulsion, power and thermal management, advanced casing treatments, advanced compression system technologies and engine robustness in austere sand and salt environments. - Enabling the use of 'hot' fuels as a heat sink and provide additional energy. - Highly loaded efficient Turbomachinery with improved operability. - Advanced materials and coatings for austere environments. - Hybrid propulsion system component technologies for small to mid-size VTOL capable UAS. Research related to Autonomy includes the following efforts: Continuing Efforts - High confidence/Safe Autonomous single and multi-vehicle control in naval environments and human interaction with advanced autonomy such decentralized heterogeneous naval systems and interactive machine learning. - New theory-based methods and processes for rapid and safe adoption of new autonomy capabilities including Verification and Validation, safety, risk management, human systems integration, and robustness within complex naval, adversarial environments. - Safe perception based autonomous control in complex naval environments with limited communications and on autonomy to support combined unmanned and manned air systems/units. Structures and Materials Research includes: Continuing Efforts - Structural remediation: development of materials and processes for extending and restoring operational life. - Hybrid nano-Composites - extend basic research investments in aligned carbon nano-tubes to develop damage tolerant composite structures for composites airframes. - Lightweight flight and transparent armor - Transparent armor with improved performance than those currently fielded. - Lightweight multifunctional structures Completing Efforts					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Composites Characterization: development of composites characterization and validation methods for current and next generation composites for rapid certification and sustainment. - Galvanic compatibility tool development for assessing galvanic capability of metals in operational environment. Initiating Efforts - Structural Power Research - Thermoplastic composites - Out of Autoclave and Out of Oven Composites Manufacturing. - Automated Composites Manufacturing - AI/ML applications for reducing composites defects -High Fidelity/ Unitized/ Optimized Structures for Aircraft and Weapons.					
FY 2024 Base Plans: Research related to Sea Based Aviation National Naval Responsibility (SBA NNR) priorities in Aviation, Aerodynamics, Flight Dynamics & Control, Propulsion, Autonomy, and Structures & Materials. Research in Aircraft Science & Technology includes: Continuing Efforts - Advanced analytical methods for achieving guaranteed performance in multibody control systems. - Control law synthesis methods to expand the recovery envelope and reduce touchdown loads. - Advanced modeling and analysis methods for ship/aircraft aerodynamic interface. - Air vehicle flying qualities and control. - High lift aerodynamics and control. - Vertical/Short Take-off and Landing (V/STOL) science & technology. - Automated launch and recovery technology. - Mechanical/environmental failure prediction research. - Advanced dynamics and topology of coupled human/machine systems. - Precise relative navigation science & technology. - Integrated development environment for cyber secure avionics. - Infrastructure for rapid development, analysis, and experimentation with advanced flight science and technology across academia, government and industry.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Manned/unmanned teaming technology. Applied research in Flight Dynamics & Control will develop theory, analysis and experimental data to better understand and exploit the natural dynamics of both conventional and unconventional air vehicles operating in the marine environment. Continuing Efforts - Multibody control systems and the ability to demonstrate guaranteed performance relative to a desired end state. - Robust and precise control in the presence of highly turbulent flow fields to increase operational capability and reduce structural requirements for ship-based operations; - Algorithms and sensors to enable precise ship-relative navigation in GPS-denied environments; - Control effectors and vehicle configurations to enable platforms with VTOL utility and fixed-wing efficiency. - Collaborative research to improve our knowledge of control system interactions between piloted aircraft and human performance. Applied Aerodynamics research for aircraft and weapons platforms will include: Continuing Efforts - Advanced computational methods addressing the Navy-unique challenge of a fully coupled aerodynamic interface between ships and aircraft. - Advanced methods for reduced-order modeling of complex flow fields to enable real-time, high-fidelity simulations of ship-based aircraft operations. - Advanced methods for manipulating and more precisely controlling the flow fields around air vehicles operating in the maritime environment. - Novel diagnostics and techniques for in situ measurement ship airwake dynamics and its coupling to ship motions (sea states) and environmental flow field. - Advanced technologies for improved weapons aerodynamics enabling increased range and maneuverability. - Innovative concepts for compact, highly-integrated inlets for air-breathing weapons. - Innovative concepts for launch and recovery of unmanned aerial systems. - Understanding aerodynamics of novel air vehicle configurations, including the effects of multi-rotor systems and operational environments.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Applied research in aircraft Propulsion, Power and thermal management concepts for high speed, long endurance and responsiveness include: Continuing Efforts - Cooling and thermal management for engines and auxiliary systems. - Diagnostics, prognostics and control for Integrated Power, Propulsion and Thermal Management. - Highly integrated Propulsion inlets, exhausts. - Sand, Salt and Dust Ingestion research: including modeling, separating, deposition, coatings and sensing. - Next Generation Propulsion Enablers includes applied research in propulsion, power and thermal management, advanced casing treatments, advanced compression system technologies and engine robustness in austere sand and salt environments. - Enabling the use of 'hot' fuels as a heat sink and provide additional energy. - Highly loaded efficient Turbomachinery with improved operability. - Advanced materials and coatings for austere environments. - Hybrid propulsion system component technologies for small to mid-size VTOL capable UAS. Initiating Efforts - Resin Transfer Molding for High Temperature Polyimide Composites - EMI mitigation for future electric generators - New Suite of Insulations for High Power Density Electrical Generators Research related to Autonomy includes the following efforts: Continuing Efforts - High confidence/Safe Autonomous single and multi-vehicle control in naval environments and human interaction with advanced autonomy such decentralized heterogeneous naval systems and interactive machine learning. - New theory-based methods and processes for rapid and safe adoption of new autonomy capabilities including Verification and Validation, safety, risk management, human systems integration, and robustness within complex naval, adversarial environments. - Safe perception based autonomous control in complex naval environments with limited communications and on autonomy to support combined unmanned and manned air systems/units.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Aerospace Structures and Materials Research includes: Continuing Efforts - Structural remediation: development of materials and processes for extending and restoring operational life. - Lightweight flight and transparent armor - Transparent armor with improved performance than those currently fielded. - Lightweight multifunctional structures - Structural Power Research - Thermoplastic composites - Out of Autoclave and Out of Oven Composites Manufacturing. - Automated Composites Manufacturing - AI/ML applications for reducing composites defects - High Fidelity/ Unitized/ Optimized Structures for Aircraft and Weapons. Completing Efforts - Hybrid nano-Composites - extend basic research investments in aligned carbon nano-tubes to develop damage tolerant composite structures for composites airframes Initiating Efforts - Repair development for bismaleimide (BMI) composite airframes - Improved design of skin/stringer joints for airframes - Post buckled aircraft subcomponent demo - Self-sealing technologies for fuel bladders ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase from FY 2023 to FY 2024 is due to increased investment in energy focused Sea-Based Aviation related research.					
Title: Fleet Force Protection and Defense Against Undersea Threats ***Description:*** Fleet Force Protection and Defense against Undersea Threats efforts include applied research for complementary sensor and processing technologies for platform protection. Current small platforms	7.576	9.280	1.833	0.000	1.833

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
(surface, subsurface and airborne) have little to no situational awareness (SA) or self-protection against air, surface, and asymmetric threats. A goal of this activity is to provide these platforms with effective self-protection. The technology areas specific to platform protection will develop individual, multispectral electro-optical (EO), infrared (IR), radio frequency (RF), electro-magnetic (EM), visual and acoustic or chemical sensors/ biosensors and associated processing. To defend platforms from current and advanced threats in at-sea littoral environments and in port, these technologies must improve multispectral detection and distribution of specific threat information. ***FY 2023 Plans:*** Materials and Chemistry: - Continue designing and developing inexpensive, miniaturized, low power electrochemical sensors for use in autonomous and distributed sensor networks in order to provide real-time, stand-off detection of explosive hazards in expeditionary missions; developing real time, standoff, moving target, laser based detection for explosives and hazardous chemicals in littoral environment; and developing chemical vapor sensing strategy for application in littoral environment. - Continue the development of high bandwidth modularized airborne ground penetrating radar array and related components as well as integrated near-real-time ground tracking and detection algorithm. - Continue research and development of modular compact sensors and automated algorithms to rapidly assess, analyze, and report damage to infrastructure for repair following an attack or natural disaster particularly damage to runways, roads, piers, utilities, and buildings. - Initiate work on a low-cost, high performance, broadband infrared optics solution utilizing new materials. Undersea Warfare: - Continue developing acoustics technology and associated signal processing to detect and track small-unmanned aerial vehicles for force and infrastructure protection; developing a pressure tolerant, inexpensive hydrogen storage based on hydrogenated graphene to increase undersea storage capacity; and developing technologies for active control of acoustic scattering to increase stealth and survivability of unmanned undersea vehicles. - Continue efforts on safe-perception based autonomous control in complex naval environments and on autonomy to support combined unmanned and manned systems/units. ***FY 2024 Base Plans:*** Materials and Chemistry:					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue developing real time, standoff, moving target, laser based detection for explosives and hazardous chemicals in littoral environment. - Continue developing chemical vapor sensing strategy for application in littoral environment. - Complete efforts into designing and developing inexpensive, miniaturized, low power electrochemical sensors for use in autonomous and distributed sensor networks in order to provide real-time, stand-off detection of explosive hazards in expeditionary missions. - Initiate efforts into organically modified chalcogenide (ORMOCHALC) Polymers for Next-Generation IR Optics. Undersea Warfare: - Continue developing acoustics technology and associated signal processing to detect and track small-unmanned aerial vehicles for force and infrastructure protection. - Continue the development of a pressure tolerant, inexpensive hydrogen storage based on hydrogenated graphene to increase undersea storage capacity. - Complete the development technologies for active control of acoustic scattering to increase stealth and survivability of unmanned undersea vehicles. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The funding decrease from FY 2023 to FY 2024 is due to higher demands for development of materials to provide hull mechanical & electrical support for Surface Ship and Submarines in terms of power, energy, and propulsion research as well as mission capable, persistent, and survivable Naval Platforms. Funds moved within PE 0602123N to Surface Ship Hull Mechanical and Electrical (HM&E) Activity.					
Title: Advanced Energetics ***Description:*** Advanced Energetics efforts address technology development to provide substantial improvements in energetic material systems and subsystems, primarily in terms of performance, but also addressing safety, reliability, and affordability concerns. Goals include: advanced energetic materials for warheads, propellants, and reactive material based subsystems for both defensive and offensive applications. Efforts include: development of new fuels, oxidizers, explosive ingredients and formulations; and reliable simulation tools and diagnostics to develop and design superior-performance, and/or reduced-vulnerability systems tailored to specific warfighter missions.	5.340	5.321	5.446	0.000	5.446

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
FY 2023 Plans: Overall, continue applied advanced energetic materials research efforts focused on longer range, reduced time-to-target, enhanced lethality/target effects, and cost savings pertaining to kinetic weapons without sacrificing insensitive munitions requirements. Continuing Efforts: -Applied research focused on development, scale up, and evaluation of novel explosive, propellant, and reactive composite ingredients and energetic formulations, in addition to dynamic diagnostic experimental and multi-scale theoretical efforts for development of next generation higher performing weapon systems. - Expanding research focused on ingredient chemistry and chemical processing technologies. This work includes: synthesis, scale up, and evaluation of new energetic (i.e. explosives, oxidizers, fuels) and other formulation-enabling ingredients (i.e. polymer binders, plasticizers), and exploration and adaptation of innovative mixing, formulation, and other novel manufacturing processes for agile progression of enhanced energetic formulations. - Expanding research in development and application of experimental diagnostics of novel energy conversion concepts to enhance performance, more efficiently exploit available energy, and more effectively couple energy to target for air, surface, and underwater warhead and propulsion applications. This work includes: explosive blast, reactive materials, and propulsion relevant combustion science, shock-wave/energetic formulation studies, advanced tactical propulsion concepts, and ingredient specific structure/property studies. - Expanding research in development and application of modeling, simulation, and computation to predict dynamic response and effects of energetic processes such as ignition, combustion/deflagration, shock, fragmentation, and detonation in order to predict weapon performance, lethality, and lifecycle for air, surface, and underwater weapon applications. Completing Efforts: - Discontinuing minor efforts in ingredient development, experimental diagnostics, and modeling that do not show promise. Initiating Efforts: - Research focused on new ingredients and processing technologies including incorporation of molecular design and particle morphology technology into synthetic scale-up and process development. New compliant					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
commodity ingredients, and new scale-up and formulation processes will be transitioned to the industrial base as appropriate. - Novel dynamic experimentation in support of design, evaluation and progression of enhanced lethality warhead concepts with focus on smaller form-factor without sacrificing effect on target; and advanced solid rocket motor, air-breathing, gun and other novel tactical propulsion concepts for extended range and reduced time-to-target. - Applied theory and model development for understanding complex lethality mechanisms and properly assessing target damage for emerging warhead concepts and materials (i.e. high-density reactive materials) in addition to modeling efforts that support progression and transition of advanced tactical propulsion (i.e. ram-jets, high performance solid rocket motor, detonation engines).					
FY 2024 Base Plans: Overall, continue applied advanced energetic materials research efforts focused on longer range, reduced time-to-target, enhanced lethality/target effects, and cost savings pertaining to kinetic weapons without sacrificing insensitive munitions requirements. Continuing Efforts: - Applied research focused on development, scale up, and evaluation of novel explosive, propellant, and reactive composite ingredients and energetic formulations, in addition to dynamic diagnostic experimental and multi-scale theoretical efforts for development of next generation higher performing weapon systems. - Expanding research focused on ingredient chemistry and chemical processing technologies. This work includes: synthesis, scale up, and evaluation of new energetic (i.e. explosives, oxidizers, fuels) and other formulation-enabling ingredients (i.e. polymer binders, plasticizers), and exploration and adaptation of innovative mixing, formulation, and other novel manufacturing processes for agile progression of enhanced energetic formulations. - Expanding research in development and application of experimental diagnostics of novel energy conversion concepts to enhance performance, more efficiently exploit available energy, and more effectively couple energy to target for air, surface, and underwater warhead and propulsion applications. This work includes: explosive blast, reactive materials, and propulsion relevant combustion science, shock-wave/energetic formulation studies, advanced tactical propulsion concepts, and ingredient specific structure/property studies. - Expanding research in development and application of modeling, simulation, and computation to predict dynamic response and effects of energetic processes such as ignition, combustion/deflagration, shock, fragmentation, and detonation in order to predict weapon performance, lethality, and lifecycle for air, surface, and underwater weapon applications.					

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Completing Efforts: - Discontinuing minor efforts in ingredient development, experimental diagnostics, and modeling that do not show promise. Initiating Efforts: - Research focused on new reactive material formulations and configurations for warhead use. New consolidated effort towards high performing explosive oxidizer materials, polymer binders, and new energetic material molecular configurations for simplistic, cost effective synthesis of potentially high temperature explosives. New compliant commodity ingredients, and new scale-up and formulation processes will be transitioned to the industrial base as appropriate. - Novel dynamic experimentation in support of design, evaluation and progression of enhanced lethality warhead concepts with focus on smaller form-factor without sacrificing effect on target; and advanced solid rocket motor, air-breathing, and other novel tactical propulsion concepts for extended range and reduced time-to-target with additional focus on throttling capability for extended range. - New methods toward applied theory and model development for shock interactions. New experimental and physics based sub-model development for incorporating novel damage effects into lethality codes. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant change from FY 2023 to FY 2024.					
Title: Surface Ship and Submarine Hull Mechanical and Electrical (HM&E) ***Description:*** Technology programs focused on providing technologically superior warfighting capabilities at reduced total ownership costs for surface and subsurface platforms through investments in applied research and advanced technology development of programs in: a) Power, Energy, Propulsion, Engineering and Design. This element also includes the National Naval Responsibility in Naval Engineering (NNR-NE). Specific research themes are: Power and Energy Technology: Efforts address electrical and auxiliary system and component technology to dramatically improve naval capabilities by providing energy and power resiliency through applied research into energy and power density, control, operating efficiency, operational endurance, recoverability from casualties,	66.813	74.149	89.161	0.000	89.161

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
and design tools. A major investment focus is providing the power, energy, and thermal management required for directed energy weapons and advanced sensor systems on current and future surface combatants. Significant investments are also focused on improving the energy performance of unmanned systems for the next generation surface fleet, subsea and seabed warfare, and expeditionary forces wherein the limited availability of power and energy are critical. Platform Design and Engineering Technology: This research area seeks to further the applied physics and mathematics necessary to increase force effectiveness by improving platform hydrodynamics, platform structures, platform resiliency/survivability, autonomy, and enabling digital technologies needed to improve naval warfighting capabilities as they relate to platforms/capabilities for use in expeditionary, surface and subsurface warfare. - Hydrodynamics: Critical design for naval platform hydrodynamics that is focused on the applied sciences, computation, laboratory experiments, and at-sea experimentation to develop the understanding and prediction capabilities for all hydrodynamic phenomena associated with naval sea-going platforms including, surface ships, submarines, unmanned vessels and manned small craft. Key research goals are to fully understand the physics of hydrodynamics of wakes, ship dynamics/control, propulsors and their effects on vessel performance and associated energy dissipation into the environment to provide science-based metrics for the evaluation of new design concepts to improve efficiency, signatures, and overall capabilities. - Platform Structures: Focused on all timescales of varying reliability of naval structures. Key applied research is focused on the analysis and prediction for a ship structural system with uncertainty quantification and propagation based on real world usage. - Unmanned Vehicles (UxV): Autonomy for UxVs and related mission functions aligned with Naval S&T strategic focus on autonomy and unmanned vehicles in support of surface, submarine, subsea/seabed naval warfare. - Sea Platform Resiliency: Aligned with survivability S&T strategic focus area, research investigates susceptibility, survivability, and recoverability of all naval platforms. Work in susceptibility of naval platforms concentrates on signature reduction across the acoustic and non-acoustic spectrums. Applied research on survivability seeks to improve the ability of naval platforms to survive under stressing combat conditions, before, during, and after being affected by adversarial actions from kinetic and/or non-kinetic effectors. Research in recoverability of naval platforms seeks to better understand the complex nature of modern damage control measures necessary to enable platforms to recover to capability states necessary to avoid mission kill. - Digital Engineering: Naval engineering and platform design efforts to increase the speed to field and capability resiliency in the engineering process across platform lifecycles through the enablement of virtual design/monitor/usage models to be better informed through improved modeling and data science. Concentration of effort is					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
placed on digitally linking all aspects of a platform lifecycle from ideation to destruction with identifiable metrics of military utility enabling fuller solution trade-space exploration. ***FY 2023 Plans:*** Power, Energy and Propulsion Technology: - Continue research efforts associated with High Temperature Superconducting Cables for flexible ship degaussing system design and sustainable deployment for new and existing surface ship and submarine programs. - Complete advanced energy systems research, which is focused on the analysis and optimization of resilient electrical grids and microgrids in the Pacific and across DON critical mission areas. Results from previous research will be used to evaluate and increase the energy resiliency of critically infrastructures on DON installations. Efforts include enhancing collaborations across academia, industry and DON beneficiaries. - Complete research associated with Advanced Power Systems, Combat Power Systems and Energy Resiliency to expand surface ship and submarine program efforts aimed at supporting electrical system reliability, as well as advanced power distribution and control to support both new and existing surface ship and submarine programs. This will be utilizing the Electric Ship Research and Development Consortium (ESRDC) to develop modeling and simulation tools, system analysis tools and models to provide critical design and operational capabilities for the all-electric ship program, accelerate development and demonstration of technologies, and to reduce risk of technology insertion. These efforts also address the national shortage of naval electrical power engineers. - Complete HM&E initiatives associated with Next Generation Integrated Power System (NGIPS) and Distribution/Control of Power Advanced Power Systems efforts focused on power and energy requirements for directed energy weapons and advance sensor systems on current and future surface combatants, as well as for unmanned naval platforms, including thermal modeling. - Initiate and focus prior research efforts on the Naval Enterprise Partnership Teaming with Universities for National Entrepreneurship (NEPTUNE) program. The effort is derived from previous efforts in the areas of advanced energy systems research, which was focused on enhancing collaborations across academia, industry and DON beneficiaries. The NEPTUNE program is focused on conducting research that provides Navy Energy Education & Training for students. - Initiate applied superconductivity research in support of future Naval HM&E and mission systems. - Initiate applied research in Thermal Management. - Initiate applied research in Medium Voltage Direct Current (MVDC) electrical architectures. - Initiate research efforts in support of climate resiliency and clean energy to include applied research on low Global Warming Potential (GWP) refrigerants & environmentally friendly refrigeration cycles, electromechanical					

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Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602123N / *Force Protection Applied Res*	**Project (Number/Name)** 0000 / *Force Protection Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
machinery applied research to reduce energy demand and improve component and power system energy conversion efficiencies, local generation of sustainable and zero-carbon fuels, DDG(X) advanced propulsion and to expand existing fuel efficiencies in the DDG-51 fleet, and design tools for uncrewed platform power architecture design, performance, and performance prediction Platform Design and Engineering Technology: - Complete research to develop and test autonomy for Unmanned Undersea Vehicle (UUV) missions including understanding of counter-UUV autonomy options; implementations and testing; autonomy development involving a shared world model and sensor feedback; and extensive in-water testing. - Complete applied research related to critical S&T that supports platform design and advanced capability efforts related to propulsor, surface, and subsurface hydrodynamics; platform performance, and platform structural reliability. - Complete applied research related to critical S&T to investigate efforts related to signature reduction; structural and machinery acoustics; machinery autonomy; and platform survivability (detectability and susceptibility); and acoustic and non-acoustic signatures. - Complete research efforts focused on the science and physics based signal detection technologies that, individually or as a system, can impact the security of the SSBN and submarines in general. - Complete research related to critical multidisciplinary autonomy challenges that cut across areas/domains, including air, sea, undersea and ground. This includes multi-disciplinary research into the science of autonomy focuses on four interrelated areas: scalable and robust distributed collaboration among autonomous systems; human/unmanned system collaboration; autonomous perception and intelligent decision-making; and intelligent architectures for autonomous systems. - Initiate and focus research efforts in the following areas: USV and UUV Applied Research, Vessel Dynamics with Propulsors, Submarine Wakes, Structural Reliability, EM Signature Reduction, Topside Signature Reduction, Machinery Autonomy, Platform Survivability, Structural Acoustic Signature Control, Top-Side Signature Development, Machine Learning, Digital Twins, Data Analytics Rapid Experimentation, and Submarine Security S&T-Susceptibility. These efforts are derived from previous efforts in the area of Platform Design and Engineering. - Initiate and focus research efforts focused on digital engineering, the digital framework, and the digital thread, particularly regarding design tools, in order to increase the reliability and resiliency across the lifecycle for surface and undersea platforms, both manned and unmanned. These efforts are derived from previous efforts in the area of Platform Design and Engineering.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602123N / *Force Protection Applied Res*	**Project (Number/Name)** 0000 / *Force Protection Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate and focus research efforts on the Tactical Submarine Evolution Plan, Integrated Permanent Magnet Motors, Submarine Future Technologies and Future Surface Ship and Unmanned Technologies that support their capability evolution plans. These efforts are derived from previous efforts in the area of Platform Design and Engineering. Spectrum Superiority: - Continue research efforts for passive and active long-range high-resolution detection and imaging for increased survivability and situational awareness even in degraded/contested environments. - Continue research efforts to demonstrate portable sensor technology and machine learning based algorithms capable of identifying and recognizing emitters based off of unique RF characteristics in a complex EM environment. - Continue research efforts exploring simultaneous full-spectrum (RF and optical) effects to enable full operations and signature control across the entire electromagnetic spectrum and conduct laboratory-based sub-system demonstrations of component technologies. - Initiate research efforts into coherent combination of optical, infrared, and mm-wave imagers for increased resolution and longer-range detection. - Initiate development of microelectronics system on a transient glass substrate for controlled destruction, which will allow sensitive software application use in hostile operations. - Initiate development of machine learning techniques for automated signal identification in order for own-forces to understand and adjust electromagnetic spectrum signature. Electronics: - Continue research to develop and explore new high voltage, high efficiency wide bandgap and ultra-wide bandgap power switches for electric propulsion and electric weapons. Current plans are to focus efforts on: Pioneering Vertical GaN High Power Switches; Ultra-Wide Bandgap Gallium Oxide Power Device Transformative Integrated GaN Power Technology Platform; and High-Voltage Ultra-Fast SiC Semiconductor Closing Switches. Materials and Chemistry: - Initiate research into the use of prototype ammonium borosulfate electrolyte fuel cells to increase power output in current commercial solid acid fuel cells. Undersea Warfare:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602123N / *Force Protection Applied Res*	**Project (Number/Name)** 0000 / *Force Protection Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Complete research to reduce the time and cost for Submarine hull inspections by creating technologies for non-destructive evaluation (NDE) of submerged elastic surfaces coated with highly absorptive layers.					
FY 2024 Base Plans: Power, Energy and Propulsion Technology: - Continue research efforts associated with superconducting cables for flexible ship degaussing system design and sustainable deployment for new and existing surface ship and submarine programs. Continue applied superconductivity research in support of future Naval HM&E and mission systems. - Continue research efforts on the Naval Enterprise Partnership Teaming with Universities for National Entrepreneurship (NEPTUNE) program. The effort is derived from previous efforts in the areas of advanced energy systems research, which was focused on enhancing collaborations across academia, industry and DON beneficiaries. The NEPTUNE program is focused on conducting research that provides Navy Energy Education & Training for students. - Continue applied research in Thermal Management to address directed energy, environmental control needs, and update Navy design tools to include advanced thermal modeling capability. - Continue applied research in Medium Voltage Direct Current (MVDC) electrical architectures to reduce risk on future platforms. - Continue research efforts in support of climate resiliency and clean energy to include applied research on low Global Warming Potential (GWP) refrigerants & environmentally friendly refrigeration cycles. Conduct research to study impact of climate on system performance. Address the areas of climate-informed decision-making, training and equipping for climate resilience, resilient built and natural infrastructure, supply chain resilience and innovation, and enhanced mitigation and adaptation through collaboration. - Continue electromechanical machinery applied research to reduce energy demand and improve component and power system energy conversion efficiencies. - Continue research on local generation of sustainable, net-zero, and zero-carbon fuels to include design tool development to understand the impact of alternative fuels on platforms and operational missions. - Complete DDG(X) advanced propulsion research, and improvement of fuel efficiencies in the DDG-51 fleet - Initiate research in support of safely integrating large-scale embedded energy storage onto Naval platforms. This includes containment and non-propagation research, and development of the knowledge needed to certify technologies. Electronics:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602123N / *Force Protection Applied Res*	**Project (Number/Name)** 0000 / *Force Protection Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research to develop and explore new high voltage, high efficiency wide bandgap and ultra-wide bandgap power switches for electric propulsion and electric weapons. Current plans are to focus efforts on High-Voltage Ultra-Fast SiC Semiconductor Closing Switches. - Complete research on Pioneering Vertical GaN High Power Switches and Ultra-Wide Bandgap Gallium Oxide Power. - Initiate research on High-Voltage Planar Low Damage GaN Power Switch. Platform Design and Engineering Technology: - Continue applied research in hydrodynamics of surface and subsurface platforms and propulsion focusing on the prediction of innovative propulsion concepts and platform designs that improve control of dynamic behaviors to improve efficiency, speed, maintainability, and maneuverability, while reducing overall associated platform signatures, weight, and lifecycle cost - Continue applied research into resilient platform materials and structures focusing efforts on innovative that improve performance and lifecycle reliability in harsh marine environments that improve platform survivability in hostile environments - Continue applied research into general acoustic and electromagnetic signature prediction tools for ground, sea-surface, and subsurface platforms - Continue applied research in technologies to reduce exploitable acoustic signatures from manned and unmanned platforms ground, sea-surface, and subsurface platforms - Continue research efforts in Hull, Mechanical, and Electrical (HM&E) Technologies focusing on digital and data sciences as applied to naval platforms in support of naval objectives in its Digital Transformation, to include work in Digital Engineering, Digital Twins, Digital Threads, Machine Learning and Artificial Intelligence to increase the availability, reliability, and resiliency of all naval platforms across all domains and manning configurations. - Continue research efforts in support of on the Tactical Submarine Evolution Plan (TSEP) S&T, Submarine Detectability, Integrated Permanent Magnet Motors, and Submarine Future Technologies -Complete efforts in Top-Side signature control for undersea platforms -Initiate research on broad based countermeasures and signature improvement technologies associated with Non-Acoustic Undersea Warfare (NAUSW) -Initiate applied research program on Total Platform Resiliency that seeks to improve the resiliency and extensibility of complex platforms and systems of systems throughout their lifecycle					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602123N / *Force Protection Applied Res*	**Project (Number/Name)** 0000 / *Force Protection Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
-Initiate efforts in applied research of manned platform autonomous systems, as well as autonomous surface (USV) and undersea platforms (UUV) focusing on the Resiliency of systems and system of systems for extended time between needed human intervention to extend range, time on station, signature reduction, warfighter efficiency, damage control, and adaptability in uncertain adversarial environments Spectrum Superiority: - Continue research efforts for passive and active long-range high-resolution detection and imaging for increased survivability and situational awareness even in degraded/contested environments. - Continue research efforts into coherent combination of optical, infrared, and mm-wave imagers for increased resolution and longer-range detection. - Continue research efforts to demonstrate portable sensor technology and machine learning based algorithms capable of identifying and recognizing emitters based off of unique RF characteristics in a complex EM environment. - Continue research efforts exploring simultaneous full-spectrum (RF and optical) effects to enable full operations and signature control across the entire electromagnetic spectrum and conduct laboratory-based sub-system demonstrations of component technologies. - Continue development of microelectronics system on a transient glass substrate for controlled destruction, which will allow sensitive software application use in hostile operations. - Continue development of machine learning techniques for automated signal identification in order for own-forces to understand and adjust electromagnetic spectrum signature. Explosive Hazard Defeat in Expeditionary Warfare: - Continue designing and developing inexpensive, miniaturized, low power electrochemical sensors for use in autonomous and distributed sensor networks in order to provide real-time, stand-off detection of explosive hazards in expeditionary missions; developing real time, standoff, moving target, laser based detection for explosives and hazardous chemicals in littoral environment; and developing chemical vapor sensing strategy for application in littoral environment. - Continue the development of high bandwidth modularized airborne ground penetrating radar array and related components as well as integrated near-real-time ground tracking and detection algorithm. - Continue research and development of modular compact sensors and automated algorithms to rapidly assess, analyze, and report damage to infrastructure for repair following an attack or natural disaster particularly damage to runways, roads, piers, utilities, and buildings. - Continue work on a low-cost, high performance, broadband infrared optics solution utilizing new materials.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602123N / *Force Protection Applied Res*	**Project (Number/Name)** 0000 / *Force Protection Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate research and development on the scalable precision neutralization of threat explosive hazards, mines, and kill chain components with lethal or non-lethal force from standoff distances to enable in-stride littoral movement and maneuver, designated ground corridors, at forward aviation points, littoral transition points, and in designated areas of interest. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The funding increase from FY 2023 to FY 2024 is due to an increase in efforts associated with energy storage and naval platforms. This includes increased emphasis on development of materials to provide hull mechanical & electrical support for Surface Ship and Submarines in terms of power, energy, and propulsion research, as well as mission capable, persistent, and survivable Naval Platforms objectives. Funds realigned within 0602123N from Fleet Force Protection and Defense Against Undersea Threats Activity.					
Title: Naval Research Enterprise	4.526	9.191	9.391	0.000	9.391
Description: The Naval Research Enterprise (NRE), through NavalX, supports mission-driven design think problem solving within the Naval Research and Development Establishment (NR&DE) and academia in support of culture changes to agile and rapid prototyping development driven by well defined and effective innovation process and operations. This will promote common innovation processes to stimulate effective NR&DEv and industry wide collaborations and facilitation to accelerate the delivery of innovative capabilities to the warfighter. Activities are based on three foundational principles: (1) utilize innovative technical and business pathways that accelerate technology acquisition and deployment to the warfighter and pilot potential efforts as a result of this investigation; (2) leverage the commercial market and attract private investments to accelerate and reduce the cost for defense acquisition and deployment of technologies that provide capabilities to the warfighter; and (3) employ innovative best-practices in contracting that accelerate awards and provide flexibility and speed in technology and acquisition. The Independent Applied Research (IAR) Program focuses on solving a wide range of Naval Science and Technology (S&T) fleet issues utilizing unique Naval Warfare Center (WC) laboratory capabilities. Efforts under this activity address the full spectrum of the Naval Research and Development Framework using focus areas which engage Naval aviation, sea surface, undersea, space, weapons, communication, information, and human systems. The IAR Program provides participating WCs with in-house funding for applied research to support the execution of their assigned missions by: (1) developing and maintaining a cadre of active researchers who can					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602123N / *Force Protection Applied Res*	**Project (Number/Name)** 0000 / *Force Protection Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
distill and extend results from worldwide research and apply them to solve Naval problems; (2) promoting the hiring and development of talented new scientists and engineers (S&E) with the assurance of proper mentoring with senior personnel; and (3) encouraging collaboration with universities, private industry, and other Navy and Department of Defense laboratories. Funded projects are chosen through rigorous internal competition by each WC's selection committee and typically last two to three years. IAR projects are generally designed to promote investment in high-risk/high- payoff research and also allow young S&Es to manage Navy relevant research projects. ***FY 2023 Plans:*** Naval Innovation Process Adoption (NIPA): - Continue/expand development of innovative prototypes at Warfare Centers, Naval Laboratories, NavalX Tech Bridges and related DON organizations solving key warfighter problems that are identified through the H4D innovation process pipeline. - Continue/expand efforts that will be carried out under the NIPA program to emphasize the implementation of a common process and language to promote collaborations and facilitate the use of best practices to accelerate the delivery of capabilities to the warfighter. - Continue NIPA Challenges that solicit and expand the DON industrial base, especially small businesses, to solve warfighter problems. The Challenges will employ the NavalX Tech Bridge network to reach the widest possible industrial base and to promote collaborations across the Naval R&D community. - Expand Naval sustainment efforts across Warfare Centers through cross-community NIPA/H4D Challenges and Small Business Innovative Research (SBIR) topics. - Support the Gordian Knot Center for National Security Innovation at Stanford University. Independent Applied Research (IAR): Initiate the following efforts: - Naval warfare centers and laboratories generate new two- to three-year research topics where priority is given to warfighter needs, technology alignment, high quality research, and the recruitment and retention of outstanding scientists and engineers. Topics cover a broad range of naval relevant research areas critical to supporting the missions of the warfare centers and laboratories.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602123N / *Force Protection Applied Res*	**Project (Number/Name)** 0000 / *Force Protection Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Utilize peer review process to select and evaluate IAR topics and develop a diverse S&T research portfolio. - Establish mid-year and annual progress review meetings to ensure topic objectives are being accomplished and projected outcomes are being achieved. ***FY 2024 Base Plans:*** Independent Applied Research (IAR): Continue: - Further develop and maintain the Science and Engineering workforce by providing funding to Naval Warfare Centers and Laboratories to foster high risk/ high reward applied research initiatives of Naval interest. Each Naval site conducts peer reviews for existing research projects, assess the quality of the research, and determine if projects should continue. - Continue NIPA Challenges that solicit and expand the DON industrial base, especially small businesses, to solve warfighter problems. The Challenges will employ the NavalX Tech Bridge network to reach the widest possible industrial base and to promote collaborations across the Naval R&D community. - Expand Naval sustainment efforts across Warfare Centers through cross-community NIPA/H4D Challenges and Small Business Innovative Research (SBIR) topics. Complete: - Conclude two-year research topics that initiated in FY 2023. Assess opportunities for technology transition to larger programs through coordination with various resource sponsors. Transfer successful efforts to research, development, test, and evaluation-sponsored programs. Initiate: - The participating warfare centers or laboratories generate new two-year and three-year research topics where priority is given to warfighter needs, technology alignment, high quality research, and the recruitment and					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602123N / *Force Protection Applied Res*	**Project (Number/Name)** 0000 / *Force Protection Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
retention of outstanding scientists and engineers. Topics cover a broad range of Naval relevant research areas critical to the support of warfare center and laboratory missions. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant change from FY 2023 to FY 2024.					
Accomplishments/Planned Programs Subtotals	119.861	133.426	142.148	0.000	142.148

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602123N / *Force Protection Applied Res*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	96.052	212.150	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	308.202

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Congressional Add: Alternative Energy Research ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct Alternative Energy Research	0.000	30.000
Congressional Add: Advanced Energetics Research ***FY 2022 Accomplishments:*** Continue research towards the advanced demonstration of energetic materials in a variety of weapon system applications to include: high performance solid rocket and air breathing propulsion, reactive materials demonstrations and effects in advanced lethality and effectiveness models, advanced warhead concepts to include novel reactive shaped charge configurations, hybrid reactive material warhead demonstrations, and the development and demonstration of any necessary modeling and simulation capabilities for quantification of damage effects on adversary weapon systems, and other potential energetic technologies. ***FY 2023 Plans:*** Continue research towards the advanced demonstration of energetic materials in a variety of weapon system applications to include: high performance solid rocket and air breathing propulsion, reactive materials demonstrations and effects in advanced lethality and effectiveness models, advanced warhead concepts to include novel reactive shaped charge configurations, hybrid reactive material warhead demonstrations, and the development and demonstration of any necessary modeling and simulation capabilities for quantification of damage effects on adversary weapon systems, and other potential energetic technologies.	2.896	6.000
Congressional Add: Talent and technology for Navy power and energy systems ***FY 2022 Accomplishments:*** Continue efforts to develop autonomous command and control of ship power and energy systems, leveraging digital twin technology that protects the ship's power and energy grid. In	10.136	10.500

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602123N / *Force Protection Applied Res*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
addition, designed and built a digital twin testbed for physical experimentation with power and energy controls technologies. ***FY 2023 Plans:*** Continue efforts to develop autonomous command and control of ship power and energy systems, leveraging digital twin technology that protects the ship's power and energy grid. In addition, designed and built a digital twin testbed for physical experimentation with power and energy controls technologies.		
Congressional Add: Energy resilience efforts ***FY 2022 Accomplishments:*** Conduct applied research supporting energy resilience efforts. ***FY 2023 Plans:*** Conduct applied research supporting energy resilience efforts.	6.757	8.000
Congressional Add: Coastal environmental research ***FY 2022 Accomplishments:*** Continue efforts to provided a complete, portable, and field-tested ocean electro-magnetic observatory capable of global deployment to observe the fluid dynamics and magnetic signature of the ocean in coastal environments. Installed, calibrated, and collected data for the Navy's Electro-Magnetic Observatory prototype. ***FY 2023 Plans:*** Continue efforts to provided a complete, portable, and field-tested ocean electro-magnetic observatory capable of global deployment to observe the fluid dynamics and magnetic signature of the ocean in coastal environments. Installed, calibrated, and collected data for the Navy's Electro-Magnetic Observatory prototype.	4.827	5.000
Congressional Add: Direct Air Capture and Blue Carbon Removal Technology ***FY 2022 Accomplishments:*** This funding will support direct air capture and blue carbon technology development. Advancements in these technologies and their integration with next generation fuel producing and material producing technologies will enhance DoN & DoD fuel energy security. ***FY 2023 Plans:*** This funding will support direct air capture and blue carbon technology development. Advancements in these technologies and their integration with next generation fuel producing and material producing technologies will enhance DoN & DoD fuel energy security.	9.654	10.000
Congressional Add: Additive Manufacturing of Unmanned Maritime Systems ***FY 2022 Accomplishments:*** This work will develop advanced composite structures for an unmanned surface vessel (USV) using additive manufacturing techniques. The final USV enabled is expected to provide higher performance, lower weight, lower cost and faster manufacturing times than achievable with conventional	5.792	10.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602123N / *Force Protection Applied Res*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
technologies. This contract will deliver the USV design, hull manufacturing process demonstrations, full scale hull sections and a sub-scale complete hull. ***FY 2023 Plans:*** This work will develop advanced composite structures for an unmanned surface vessel (USV) using additive manufacturing techniques. The final USV enabled is expected to provide higher performance, lower weight, lower cost and faster manufacturing times than achievable with conventional technologies. This contract will deliver the USV design, hull manufacturing process demonstrations, full scale hull sections and a sub-scale complete hull.		
Congressional Add: Navy Alternative Energy Research ***FY 2022 Accomplishments:*** Conduct applied research supporting Navy Alternative Energy technologies. ***FY 2023 Plans:*** N/A	26.547	0.000
Congressional Add: relative position of autonomous platforms ***FY 2022 Accomplishments:*** Conduct applied research in relative position of autonomous platforms. ***FY 2023 Plans:*** Conduct applied research in relative position of autonomous platforms.	2.896	5.000
Congressional Add: Bonded metal matric composit repair ***FY 2022 Accomplishments:*** Conduct applied research in bonded metal matric composite repair. ***FY 2023 Plans:*** Conduct applied research in bonded metal matric composite repair.	4.827	5.000
Congressional Add: Resilient innovative sustainable economies via university partnerships ***FY 2022 Accomplishments:*** Conduct applied research for resilient innovative sustainable economies via university partnerships. ***FY 2023 Plans:*** Conduct applied research for resilient innovative sustainable economies via university partnerships.	7.240	9.000
Congressional Add: Titanium metal and wire domestic production demonstration ***FY 2022 Accomplishments:*** Conduct applied research supporting titanium metal and wire domestic production demonstration. ***FY 2023 Plans:*** N/A	14.480	0.000
Congressional Add: high speed/hypersonic test capability development	0.000	4.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602123N / *Force Protection Applied Res*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
FY 2022 Accomplishments: N/A ***FY 2023 Plans:*** Conduct high speed/hypersonic test capability development.		
Congressional Add: Resilient autonomous systems research and diversity programs ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct resilient autonomous systems and diversity programs research.	0.000	8.500
Congressional Add: Seawater to jet fuel demo ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct seawater to jet fuel demo.	0.000	20.000
Congressional Add: Arctic energy resiliency ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct arctic energy resiliency research.	0.000	10.000
Congressional Add: Cavitation erosion ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct cavitation erosion research.	0.000	5.000
Congressional Add: Corrosion control coating and material ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct corrosion control coating and material research.	0.000	5.000
Congressional Add: Cyberphysical security resiliency ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct cyberphysical security resiliency research.	0.000	7.000
Congressional Add: Intelligent data managment for distributed Naval platforms ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct intelligent data management for distributed Naval platforms research.	0.000	10.500
Congressional Add: Materials by design for Navy aircraft sustainment	0.000	5.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602123N / *Force Protection Applied Res*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
FY 2022 Accomplishments: N/A ***FY 2023 Plans:*** Conduct Materials by design for Navy aircraft sustainment research.		
Congressional Add: sUAS degraded enviorment facility ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** A new facility (Unmanned Systems Degraded Environment Facility (UxSDEF)) supporting research, development, and test of unmanned systems in challenging environments will be built at Naval Surface Warfare Center, Carderock Division's Memphis Detachment. This facility will enable large and full-scale testing of unmanned systems and autonomy technologies in a controlled environment.	0.000	12.650
Congressional Add: Universal achemetal titanium process ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct universal achemetal titanium process research.	0.000	12.000
Congressional Add: Unmanned surface vehicle ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct unmanned surface vehicle research.	0.000	5.000
Congressional Add: High-entropy materials for hypersonics ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct research in high-entropy materials for hypersonics.	0.000	9.000
Congressional Adds Subtotals	96.052	212.150

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602131M *I Marine Corps Lndg Force Tech*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	62.130	79.467	59.208	-	59.208	64.575	66.618	67.950	69.309	Continuing	Continuing
2958: *Cyberspace Activities*	0.000	4.898	5.100	5.100	-	5.100	5.202	5.306	5.412	5.520	Continuing	Continuing
3001: *Marine Corps Landing Force Tech*	0.000	44.683	48.367	54.108	-	54.108	59.373	61.312	62.538	63.789	Continuing	Continuing
9999: *Congressional Adds*	0.000	12.549	26.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	38.549

A. Mission Description and Budget Item Justification

The U.S. Navy/Marine Corps team is the most potent naval fighting force in the world. Fundamental to their success are the technologies necessary for effective distributed maritime operations. The Office of Naval Research (ONR) combines knowledge of the naval mission with researchers to select and explore solutions critical to expeditionary warfighting needs.

This Program Element (PE) addresses requirements outlined in the Marine Corps Operating Concept, which calls for Expeditionary Forces to conduct maneuver warfare in challenging, contested maritime environments characterized by complex terrain, technology proliferation, information and electronic warfare. Additionally, an emergent operation stressor is the contested urban environment which exemplifies the characterizations listed above. The urban environment is one of the most complex terrains with physical compartmentalization and canalization, additional physical dimensions (subterranean and multi-story structures), crowded conditions and associated threat obscuration, communications challenges, informational and human aspects, and proliferation of observation and fires technologies. This environment requires capabilities addressing all the activities within this PE and while it provides many challenges, unique opportunities are also presented and can further shape technology approaches.

These future challenges and portents demand robust technologies for the Marine Corps, but the technology options are constrained. They must have a lightweight deployable character, and the ability to operate in austere conditions with little fixed infrastructure or support while retaining the agility and lethality of an integrated maneuver force. Technology must provide full spectrum capability against robust and complex peer and near-peer adversaries while meeting Size, Weight, Power, Post limitations, and information availability within Distributed, Intermittent and Limited environments.

The approach within this PE encompasses ideas that support both revolutionary and evolutionary capabilities, and in this way considers and balances both "push" and "pull" aspects of technology projects.

This Program Element (PE) funds Applied Research, which is the systematic study to understand the means to meet a recognized and specific need. Most of the work in this PE can be classified between Technology Readiness Level (TRL) 2 (technology concept and/or application formulation) and TRL 4 (component and/or breadboard validation in laboratory environments).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602131M *I Marine Corps Lndg Force Tech*

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	64.112	53.467	59.208	-	59.208
Current President's Budget	62.130	79.467	59.208	-	59.208
Total Adjustments	-1.982	26.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	26.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.982	0.000			
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 9999: *Congressional Adds*		
Congressional Add: *Marine Corps Asset Life-Cycle Management*	1.448	0.000
Congressional Add: *Unmanned Logistical Solutions*	7.240	7.500
Congressional Add: *5G biometric installation access control demonstration*	3.861	4.000
Congressional Add: *Microtube heat exchangers*	0.000	4.500
Congressional Add: *Modular multi-mode autonomous seeker*	0.000	10.000
Congressional Add Subtotals for Project: 9999	12.549	26.000
Congressional Add Totals for all Projects	12.549	26.000

Change Summary Explanation

Funding: No significant change.

Technical: No significant change.

Schedule: No significant change.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602131M / *Marine Corps Lndg Force Tech*	Project (Number/Name) 2958 / *Cyberspace Activities*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
2958: *Cyberspace Activities*	0.000	4.898	5.100	5.100	-	5.100	5.202	5.306	5.412	5.520	Continuing	Continuing

A. Mission Description and Budget Item Justification

This Project activity provides freedom of maneuver and influence in the cyber-electronic warfare domain while simultaneously denying the same to the adversary and protecting critical command systems. Technologies are being developed using a multi-disciplinary approach that combines Radio Frequency electronics, digital signal processing, computer engineering, software engineering, machine learning and data science to support Naval Expeditionary warfighters operating with size, weight and power constrained equipment in Disrupted, Intermittent, Limited environments. Areas of applied research include distributed precision time, predictive software defined radio architectures, coordinated Cyber and Spectrum maneuver to mitigate detection and exploitation, tactical Cyber visualization, discovering and mapping networks in dense urban environments, contextual awareness and blind channel characterization.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Expeditionary Cyber	4.898	5.100	5.100	0.000	5.100
Description: This activity provides freedom of maneuver and influence in the cyber-electronic warfare domain while simultaneously denying the same to the adversary and protecting critical command systems. Technologies are being developed using a multi-disciplinary approach that combines Radio Frequency electronics, digital signal processing, computer engineering, software engineering, machine learning and data science to support Naval Expeditionary warfighters operating with size, weight and power constrained equipment in Disrupted, Intermittent, Limited environments. Areas of applied research include distributed precision time, predictive software defined radio architectures, coordinated Cyber and Spectrum maneuver to mitigate detection and exploitation, tactical Cyber visualization, discovering and mapping networks in dense urban environments, contextual awareness and blind channel characterization.					
FY 2023 Plans: - Continue algorithm and tool development for Cyber-EW (Electronic Warfare) capabilities for tactical engagement. - Continue development of sense-making algorithms through machine learning for the cyber physical layer and algorithms to assist in supply chain validation that are designed for small form-factor tools. - Continue cyber threat identification (cyber health assessments) including vulnerability research of ubiquitous embedded systems focusing on devices commonly carried by Marines. - Continue development of new portable tools to capture software configuration management to include malware on forward deployed systems.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 2958 / *Cyberspace Activities*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research into the development of low space, weight and power (SWAP) cyber secure technologies that when integrated into a single platform will enable dismounted Marines to conduct EW/Cyber missions in a highly responsive, dynamically reprogrammable and modular standards based configuration. ***FY 2024 Base Plans:*** - Complete development of sense-making algorithms through machine learning for the cyber physical layer and algorithms to assist in supply chain validation that are designed for small form-factor tools. - Complete development of new portable tools to capture software configuration management to include malware on forward deployed systems. - Continue algorithm and tool development for Cyber-EW (Electronic Warfare) capabilities for tactical engagement. - Continue cyber threat identification (cyber health assessments) including vulnerability research of ubiquitous embedded systems focusing on devices commonly carried by Marines. - Continue research into the development of low space, weight and power (SWAP) cyber secure technologies that when integrated into a single platform will enable dismounted Marines to conduct EW/Cyber missions in a highly responsive, dynamically reprogrammable and modular standards based configuration. - Initiate development on distributed mission planning with multi-security enclaves on tactical Cyber-EW systems. - Initiate development of a generic microprocessor fuzzer for firmware on embedded devices that can be extended to legacy Naval systems. - Initiate the development of automated binary analysis tool that can attribute features from malware campaigns. - Initiate the development of fuzzing techniques designed for components located within the RF chain. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024.					
Accomplishments/Planned Programs Subtotals	4.898	5.100	5.100	0.000	5.100

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 2958 / *Cyberspace Activities*

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy											Date: March 2023	
Appropriation/Budget Activity 1319 / 2					R-1 Program Element (Number/Name) PE 0602131M / *Marine Corps Lndg Force Tech*				Project (Number/Name) 3001 / *Marine Corps Landing Force Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
3001: *Marine Corps Landing Force Tech*	0.000	44.683	48.367	54.108	-	54.108	59.373	61.312	62.538	63.789	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project funds applied research; technology assessment, road mapping, and concept development; and less technologically mature projects within the Future Naval Capability (FNC) process as means to inform, enhance, enable, and invent future concepts and capabilities with new Science and Technology (S&T). This project is organized into ten activities, the core of which is represented by the eight Expeditionary Warfighting Capability Areas.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Command, Control, Communications, and Computers (C4)	5.955	7.200	8.100	0.000	8.100
Description: This activity investigates robust, resilient, and secure networked communications pathways and capability that support an expeditionary force's distributed and disaggregated operations. Research supports both networked and local computation for communications that exploits the expeditionary forces close physical proximity to threats while mitigating shortfalls commiserate within Distributed, Intermittent and Limited environments. Expeditionary forces must operate in the cyber domain and in addition to defending communications networks, vehicles, and weapons systems, are reliant on electronic controllers for basic operations and as such are susceptible to cyber attacks. Technologies addressed within this activity include secure, robust, self-forming, mobile communications networks; distributed computing to support information dissemination to all echelons; improved capabilities in over-the-horizon, beyond line-of-sight, and restricted environment communications and sensors; and software and data processing to support formation of an appropriate common picture. Other efforts include power management, low detectability, conforming to Size, Weight, Power, Cost constraints, and interoperability within the joint environment. ***FY 2023 Plans:*** - Continue developing portable technologies using advanced algorithms and machine learning to manage, control and exploit the electromagnetic spectrum. - Continue investigations to increase bandwidth and dynamic range of portable systems to increase real-time situational awareness and enable assured spectrum operations in a congested and contested Electromagnetic environment.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 3001 / *Marine Corps Landing Force Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue development of electromagnetic signature management, countermeasures, and interoperability technologies utilizing machine learning in order to manage the control and exploitation of the electromagnetic spectrum. - Initiate efforts to explore combined Electromagnetic Warfare (EW)/Cyber resilient communications and effects. ***FY 2024 Base Plans:*** - Continue developing portable technologies, precision pointing/tracking algorithms, software/hardware subsystem to extend surface connectivity over the horizon using low-signature optical communications. - Continue investigations to increase bandwidth and dynamic range of portable systems to increase real-time situational awareness and enable assured spectrum operations in a congested and contested Electromagnetic environment. - Continue development of electromagnetic signature management, countermeasures, and interoperability technologies utilizing machine learning in order to manage the control and exploitation of the electromagnetic spectrum. - Continue efforts to explore combined Electromagnetic Warfare (EW)/Cyber resilient communications and effects. - Initiate laboratory and outdoor test planning, information assurance and laser safety approval process for capability and flight integration. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 reflects an alignment to Naval priorities and a targeted investment in signature management, multi-domain sensors and robust communications networks necessary to close high priority capability gaps. These efforts meet the demands of the National Defense Strategy and directly support Navy and Marine Corps operating concepts Distributed Maritime Operations (DMO), Expeditionary Advanced Base Operations (EABO), Littoral Operations in a Contested Environment (LOCE) and Force Design 2030.					
Title: Firepower ***Description:*** The activity investigates a large variety of weapons technologies to enhance fires capabilities of Fleet Marine Forces as part of joint maritime campaigns to counter emerging threats and create new opportunities for the joint force to secure operational advantage. Research efforts increase range, lethality, and capacity, while maintaining mobility and tempo to operate inside actively contested maritime domains, to	3.073	3.400	4.400	0.000	4.400

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 3001 / *Marine Corps Landing Force Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
achieve overmatch fires capabilities when operating within the landward portions of the littorals, and to provide weapons system capabilities able to persist when operating within the adversary's intelligence, surveillance, collection, and weapons ranges. Focus on low size, weight, power, and cost of weapons components and weapon systems, having low manpower and cognitive burdens to operate, with low logistics burdens, stresses technical solutions. Weapons system technologies being developed include fire control, launch and propulsion, precision guidance, navigation, and control, seekers, fuzing, and lethality. ***FY 2023 Plans:*** -Continue end-to-end navigation technology developments suitable for shaping trajectories of extended range, precision guided munitions in satellite- and network-denied environments. -Continue research into real-time, multi-spectral target detection and identification technologies for expanded applications to weapons optics, aviation targeting and navigation sensors, unmanned aircraft systems, missile seekers, and naval platforms, to improve anomaly and object detection during degraded visibility and long-range day and night situations, and to improve decision-aid algorithms. ***FY 2024 Base Plans:*** - Continue end-to-end navigation technology developments for Global Positioning System (GPS) absent conditions, suitable for shaping trajectories of extended range, precision guided munitions in satellite and network-denied environments. - Continue research into real-time, multi-spectral target detection and identification technologies for expanded applications to weapons optics, aviation targeting and navigation sensors, unmanned aircraft systems, missile seekers, and naval platforms, to improve anomaly and object detection during degraded visibility and long-range day and night situations, and to improve fire-and-forget logic algorithms. - Initiate experimental test series investigating the minimum explosive quantity needed to provide a prompt reaction in a cylindrical equivalent of small munition form factor, including formulation mix/cast/cure and hardware build. - Initiate research and development to shock hydrocode modeling for specific formulation enhanced blast reaction regime. - Initiate research and development to validated simulations for effect of casing on formulation reaction regime and performance. - Initiate experimental test series for case effects on performance including formulation mix/cast/cure and hardware build. ***FY 2024 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 is due to the initiation of efforts to 1) extend ranges and velocities of high-speed tactical missiles and projectiles to increase survivability, 2) provide high performance missile fuel to increase range and lethality of all DoD air-breathing powered systems currently using JP-10 fuel and 3) provide a modular combination warhead enhancement of cases/liners of low density reactive material (LDRM) for enhanced blast and high density reactive material (HDRM).					
Title: Force Protection ***Description:*** This activity investigates new ways and means to protect forces and materiel across all operational settings, from contested sea-land surface interfaces to complex urban environments. The portfolio protects against adversaries' challenges such as guided-rockets and missiles, mobile coastal artillery, threat Electronic Warfare, and counter Intelligence, Surveillance and Reconnaissance. Mines and obstacles both in the water and ashore also complicate amphibious landings. The activity invests in vehicle survivability aspects that are exacerbated due to Size, Weight, Power, Cost constraints inherent to Marine Corps operation and the harsh nature of the amphibious environment. Technologies addressed include lightweight armor for ballistic and underbody blast protection, advanced sensors for counter tactical surveillance, active protection, and signature management. This activity also considers technology for payloads, packages and sensors that are needed by amphibious vehicles (both manned and unmanned) including mine counter measures; explosive hazard defeat systems; and obstacle and threat detection systems as well as technologies for improved protection for individuals against blast, ballistic and blunt impact threats. ***FY 2023 Plans:*** - Continue computer vision/machine learning (CV/ML) approaches for detection and classification of obscured and camouflaged threats. - Create multi-agent hardware and software components capable of autonomous operation in complex, contested, and congested environments, leading to autonomous systems that can operate without reliance on radio communications or Global Navigation Satellite System (GNSS). -Continue Research in enabling technologies for countering unmanned aerial vehicles. This addresses both an increase in number and sophistication of threat systems to include kinetic and/or controlled interceptors with a specific focus on countering UAV swarms and scalable/low-cost approaches.	6.462	6.750	7.750	0.000	7.750

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 3001 / *Marine Corps Landing Force Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue effort to create multi-agent hardware and software components capable of autonomous operation in complex, contested, and congested environments. The objective is to create autonomous systems that can operate without relying on of radio communications and Global Navigation Satellite System (GNSS). - Initiate a follow-on and focused research effort into high-power directed energy weapon systems for increased efficiency and scalable power, when used by ground platforms/assets against adversarial ground and air threats. ***FY 2024 Base Plans:*** - Continue computer vision/machine learning (CV/ML) approaches for detection and classification of obscured and camouflaged threats. - Continue to create multi-agent hardware and software components capable of autonomous operation in complex, contested, and congested environments, leading to autonomous systems that can operate without reliance on radio communications or Global Navigation Satellite System (GNSS). -Continue research in enabling technologies for countering unmanned aerial vehicles. This addresses both an increase in number and sophistication of threat systems to include kinetic and/or controlled interceptors with a specific focus on countering UAV swarms and scalable/low-cost approaches. - Continue effort to create multi-agent hardware and software components capable of autonomous operation in complex, contested, and congested environments. The objective is to create autonomous systems that can operate without relying on of radio communications and Global Navigation Satellite System (GNSS). - Continue focused research effort into high-power directed energy weapon systems for increased efficiency and scalable power, when used by ground platforms/assets against adversarial ground and air threats. -Initiate research to provide a solid-state High-Power Microwave prototype in a form factor that upon transition will enable the USMC to conduct advanced expeditionary base operations (EABO) while being capable of defeating Unmanned Aircraft System sUAS swarms and other unmanned systems in littoral regions. - Initiate experimentation on full scale dynamic assembly followed by open air source integration testing and lab based prototype antenna feed network & dynamic mount testing. -Initiate effort to provide an energy efficient, high rep-rate burst duration prototype driver that is the most compact modulator solution high power NLTLsv (Non Linear Transmission Lines) and relativistic beam sources with short pulse durations. Initiate research associated with enhanced waveform implementation. ***FY 2024 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 3001 / *Marine Corps Landing Force Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 is due to the initiation of efforts to 1) provide a solid-state High-Power Microwave prototype in a form factor that upon transition will enable the USMC to conduct advanced expeditionary base operations (EABO) while being capable of defeating sUAS swarms and other unmanned systems in littoral regions and 2) provide an energy efficient, high rep-rate burst duration prototype driver that is the most compact modulator solution high power NLTLsv (Non Linear Transmission Lines) and relativistic beam sources with short pulse durations.					
Title: Human Performance, Training and Education ***Description:*** This activity investigates two technology investment areas: warrior resilience, and decision-making and expertise development. Warrior resilience is focused on advanced training technologies and methodologies that enhance neural, cognitive, and physical readiness. Decision making and expertise development accelerates and improves the advancement in retention of skills in decision making, situation awareness, including individual and team adaptability and coordination on decentralized, dynamic and dispersed battlefields. ***FY 2023 Plans:*** - Continue research on algorithm development using advanced analytics techniques to generate predictions and recommend actions to improve physical readiness and performance. - Continue research on generalized approaches for adaptive training and assessment that minimizes the need for content and curriculum development, and improves learning outcomes and engagement. - Continue research in training and decision tools to provide information to the warfighter at the point of friction to enhance individual performance, mitigate negative aspects of combat, and reduce negative consequences of stressors (e.g., sleep) to improve readiness and resilience. - Continue research into implementation of state-of-the-art and science-of-learning based training techniques to improve the development of small unit decision-making expertise. - Expand and extend small unit leader training and education continuum to increase learning outcomes for the warfighter. - Complete applied research into the ability of the warfighter to process information and speed good decision-making by implementing novel data collection and visualization techniques into Marine Corps specific applications. ***FY 2024 Base Plans:***	3.265	3.400	4.400	0.000	4.400

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 3001 / *Marine Corps Landing Force Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research on algorithm development using advanced analytics techniques to generate predictions and recommend actions to improve physical readiness and performance. - Continue research on generalized approaches for adaptive training and assessment that minimizes the need for content and curriculum development, and improves learning outcomes and engagement. - Continue research in training and decision tools to provide information to the warfighter at the point of friction to enhance individual performance, mitigate negative aspects of combat, and reduce negative consequences of stressors (e.g., sleep) to improve readiness and resilience. - Continue research to expand and extend small unit leader training and education continuum to increase learning outcomes for the warfighter. - Complete research into implementation of state-of-the-art and science-of-learning based training techniques to improve the development of small unit decision-making expertise. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 is due to increased investments in decision-making and expertise development to improve the advancement in retention of skills in decision-making, situation awareness, including individual and team adaptability and coordination on decentralized, dynamic and dispersed battlefields.					
Title: Intelligence, Surveillance, And Reconnaissance (ISR)	5.379	5.700	6.360	0.000	6.360
Description: This activity investigates enhanced situational awareness, persistent surveillance, and tactical decision making through automated analysis of data and rapid integration of information and acquired knowledge. Specific technologies in this activity effectively present actionable information to decision-makers, especially those at the lower command levels. This includes biometric monitoring for expeditionary operations, operational Course Of Action (COA) development, and autonomous surveillance in support of distributed operations. ***FY 2023 Plans:*** - Continue effort to create new artificial intelligence (AI) algorithms to inform and support command decision making by inferring adversarial intent, plans, and tactics from sensor data. - Continue effort to create new artificial intelligence (AI) algorithms to automate the parsing of naval communications to create a common operating picture for naval tactical operators.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 3001 / *Marine Corps Landing Force Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research to generate a new family of neural network algorithms to identify and counter adversarial deception. - Continue effort to create learning-enabled artificial intelligence (AI) algorithms to provide reactive and adaptive tactical and strategic planning for supporting logistic and mission level operations. - Continue development of new artificial intelligence (AI) algorithms capable of developing tactical plans, utilizing existing games and military simulations to derive winning strategies. - Continue applied research for dynamic metadata that enable question and answering techniques. - Continue development of algorithms to understand and recognize patterns in common intelligence and tactical pictures, useful for decision support tools. - Continue effort for use of Artificial Intelligence (AI) and machine learning to automate mission planning and mission re-planning. - Continue to develop end-to-end deep reinforced learning and demonstrate warfare at machine speed that can be applied to a very large force of manned and unmanned platforms. - Continue applied research on strong artificial intelligence decision support systems that avoid bad decisions even when presented with very noisy data. - Continue research in analytic algorithms and visualizations (e.g., smart graphs, network shaping metrics, actionable visualizations, and network fractures). - Initiate research to help warfighters best employ deception systems, detect when adversaries engage their own systems, and design systems architecture to enable experimentation within virtual or live environments.					
FY 2024 Base Plans: - Continue design of artificial intelligence (AI) algorithms to inform and support command decision making by inferring adversarial intent, plans, and tactics from sensor data. - Continue effort to create new artificial intelligence (AI) algorithms to automate the parsing of naval communications to create a common operating picture for naval tactical operators. - Continue design of neural network algorithms to identify and counter adversarial deception. - Continue design of learning-enabled artificial intelligence (AI) algorithms to provide reactive and adaptive tactical and strategic planning for supporting small unit mission level operations. - Continue development of new artificial intelligence (AI) algorithms capable of developing tactical plans, utilizing existing games and military simulations to derive winning strategies. - Continue applied research for dynamic metadata that enable question and answering techniques. - Continue development of algorithms to understand and recognize patterns in common intelligence and tactical pictures, useful for decision support tools.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 3001 / *Marine Corps Landing Force Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue initial prototyping of Artificial Intelligence (AI) and machine learning systems to automate mission planning and mission re-planning. - Continue development of end-to-end deep reinforced learning-based systems that can control a very large force of manned and unmanned platforms. - Continue design and development of strong artificial intelligence decision support systems that avoid bad decisions even when presented with very noisy data. - Continue research in analytic algorithms and visualizations (e.g., smart graphs, network shaping metrics, actionable visualizations, and network fractures). - Continue research to help warfighters best employ deception systems, detect when adversaries engage their own systems, and design systems architecture to enable experimentation within virtual or live environments. - Initiate design and development of autonomous robotic solutions for conducting pervasive loitering surveillance in support of distributed operations. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 is due to increased investments in enhanced situational awareness, persistent surveillance, and tactical decision making through automated analysis of data and rapid integration of information and acquired knowledge.					
Title: USMC FNC Technology Candidates	4.696	4.987	6.086	0.000	6.086
Description: This R-2 Activity addresses the applied research associated with the Marine Corps' participation in the Department of the Navy's (DoN) Future Naval Capabilities (FNC) Program. The objective of the work in this Program Element (PE) is to develop and mature technologies needed by the Marine Corps to initiate FNCs in PE 0603640M Marine Corps Advanced Technology Development (ATD) that can be commenced at higher Technology Readiness Levels (TRLs). Investments in this activity are coordinated with similar and non-duplicative efforts in PE 0602750N Future Naval Capabilities Applied Research, where the Navy's participation in the FNC Program is funded. The FNC Program is structured to accelerate the transition of new technologies to the Fleet and Force. Each effort is assessed for its technology maturity and transition commitment. Funding for FNCs, which have Technology Readiness Levels (TRLs) of 4/5 to 6 and also have transition funding commitments from acquisition Programs of Record, are resourced in PE 0603640M Marine Corps Advanced Technology Development. Funding for technology candidates at lower TRLs (3 to 4) are resourced in this PE					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 3001 / *Marine Corps Landing Force Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
0602131M, Marine Corps Landing Force Technology. ONR works closely with the Resource Sponsors and acquisition stakeholders to develop high priority technological capabilities needed by the operational forces. FNC Budget Activity (BA) 2 investments develop candidate FNC technologies in an agile fashion by exploiting technology advances that respond rapidly to naval needs. This approach facilitates an optimum response when developing and maturing the technology options that can be developed further in PE 0603640M Marine Corps Advanced Technology Development (ATD). The FNC Program favors a high level of collaboration. PE R-2 activities are mostly organized by the Office of Naval Research (ONR) Departments, which are tasked to collaborate with the acquisition stakeholders and their resource sponsors. A complete accounting of the technology candidates being developed and a full disposition of each technology development effort funded in this PE is provided annually to the Congressional oversight committees. ***FY 2023 Plans:*** This activity will continue to focus on developing promising technologies emerging from the FNC Applied Research program that have been matured to a Technology Readiness Level of 4 to 5. Development efforts include, but are not limited to, technologies that: - Enable greater signature management of the Marine Air-Ground Task Force (MAGTF). - Support a multi-domain sensing of the electronic spectrum, Command and Control integration and automated collaboration of warfighting functions. - Enhance mobility, propulsion, autonomy, weapons, materials, logistics, vehicle architectures, and Electronic Warfare (to include cyber) protection for a light armored vehicle fleet. - Support improved warfighter training, performance, feedback and enhanced learning in live, virtual and constructive environments, and enhance warfighter health and endurance. - Optimize the balance between hard and flexible software development for future dynamic engagements in contested environments with adversaries.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 3001 / *Marine Corps Landing Force Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Produce new repair techniques to include the use of solid-state technologies such as cold-spray and additive friction stir welding for structural repairs. ***FY 2024 Base Plans:*** - Continue research in the area of Signature Management. - Continue research supporting multi-domain sensing of the electronic spectrum. - Continue the Command and Control Thrust with applied research in the area of integration and automated collaboration as a function of command and control. - Continue research to provide a secure tactical computing infrastructure allowing applications to be dynamically deployed to support mission tasking requirements. - Continue feasibility studies and prototype development to test new Logistics techniques and capabilities that support expeditionary ground operations. - Continue research in the area of on-site energy generation, storage and power management in support of Expeditionary Advanced Base Operations (EABO). ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 is due to increased investments in Signature management and research in the area of on-site energy generation, storage and power management in support of Expeditionary Advanced Base Operations (EABO).					
Title: Logistics ***Description:*** This activity investigates the practical discipline and real world application of the deployment, sustainment, reconstitution, and re-deployment of forces engaged in expeditionary operations. Logistics replaces mass with assured knowledge and speed, is equally capable ashore or afloat in austere environments, and is fully scalable to meet uncertain requirements. This includes efficient and responsive force sustainment, planning and directing logistics operations, logistics demand reduction, fleet maintenance, and expeditionary energy. Expeditionary Energy enhances combat capability of expeditionary warfighters by increasing the efficiency and effectiveness of energy production, storage, distribution and use. Beyond traditional energy efforts, this portfolio also looks at other issues, including energy-efficient behaviors and hybridization of energy sources. These pillars are thoroughly integrated and perpetually related in execution. ***FY 2023 Plans:***	6.146	6.400	6.400	0.000	6.400

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 3001 / *Marine Corps Landing Force Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research to predict vehicle health and prognostics of remaining useful life for military ground vehicles and equipment in support of logistics planning, execution and combat support. - advance enhancement of combat capability by increasing energy production, storage, and distribution including curbing energy consumption of the individual Marine and other tactical assets. - Continue activities to involve applied research into new, rugged, low cost, and high specific power solar cell technologies, including investigation into the stability of the solar cells. Investigate developing more energy efficient componentry as part of the Marine warfighter loadout.					
FY 2024 Base Plans: - Complete research to predict vehicle health and prognostics of remaining useful life for military ground vehicles and equipment in support of logistics planning, execution and combat support. - Complete research to advance enhancement of combat capability by increasing energy production, storage, and distribution including curbing energy consumption of the individual Marine and other tactical assets. - Complete activities to involve applied research into new, rugged, low cost, and high specific power solar cell technologies, including investigation into the stability of the solar cells. Investigate developing more energy efficient componentry as part of the Marine warfighter loadout. - Initiate research towards de-risking future resilient energy ecosystems that will rely on hybridized hydrogen-based architectures that include hydrogen production, storage, and integration with renewable energy and batteries. - Initiate to design and develop a light-weight, portable, highly efficient energy conversion system to harvest energy from the ocean to provide reliable, easy, and cheap renewable energy to dismounted warfighters. - Initiate development of two deep learning (DL)-based prognostic models based on event data and condition monitoring signals incorporating domain knowledge into prognostic models. - Initiate research regarding inhibitors to minimally trained operators performing first level repairs and identify solutions. - Initiate research into augmented reality (AR) human interface devices (HID) in support of effective heads up/ hands free use in battlefield environment when executing technical instructions for repair. - Initiate research to better understand the direction of ongoing digital supply chain/logistic information technology (Log IT) development to ensure leveraging to the maximum extent possible existing body of knowledge. - Initiate research leading to development of requirements for prognostic supply chain digital twin (SCDT) and model.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 3001 / *Marine Corps Landing Force Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate design of lighter and more effective body army through modeling and assemblage of layered materials that will protect against ballistic threats. - Initiate atmospheric exposure testing of novel poly(styrene-catechol) based adhesive pretreatment and ground vehicle demonstration for corrosion prevention. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant change from FY 2023 to FY 2024.					
Title: Maneuver	8.330	8.246	8.621	0.000	8.621
Description: This activity investigates new ways and means to land forces and material through contested sea-land surface interfaces to then conduct maneuver warfare. In order to enable future Amphibious Operations, research efforts will support autonomous operations across the sea-surf-ground environment, improved fuel efficiency and speed of amphibious vehicles, amphibious vehicle technologies, water performance, and amphibious payloads to change the dynamics of a surface amphibious assault. This includes the emergence of manned-unmanned teaming and autonomous vehicle collaboration. The technologies included in this work address areas of mobility, materials, propulsion, signature reduction, modularity, and unmanned systems. ***FY 2023 Plans:*** - Continue research that will focus on intelligent mobility technologies to enable greater capability in harsh off road and littoral environments, with efforts including predictive and adaptive mobility testing and demonstration. - Continue progress research to gain a better understanding of the vehicle-ground interface through terrain characterization and researching enhanced platform effectors that allow the system to adapt to varying terrain in near-real time, increasing operational tempo. - Continue research for amphibious vehicle autonomy through development of components for low-cost robotic autonomy kits (e.g. Sensing & Perception, Planning & Control, Localization, World Modeling and Integration) - Continue effort to develop sensors and autonomous behaviors to enable combat ground and amphibious vehicles to perform landing zone reconnaissance, create feint and decoys, deploy mine countermeasures,					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 3001 / *Marine Corps Landing Force Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
and provide direct/indirect fires for future deployment in contested landing environment through integration of payloads developed under other activities. ***FY 2024 Base Plans:*** - Continue research that will focus on intelligent mobility technologies to enable greater capability in harsh off road and littoral environments, with efforts including iterative predictive and adaptive mobility testing and demonstration. - Continue to research and study various technologies to improve off-road and littoral mobility and trafficability and to gain a better understanding of the vehicle-ground interface through terrain characterization and researching enhanced platform effectors that allow the system to adapt to varying terrain in near-real time, increasing operational tempo. - Continue research for amphibious vehicle autonomy through development of components for low-cost robotic autonomy kits (e.g. Sensing & Perception, Planning & Control, Localization, World Modeling and Integration) - Continue effort to develop sensors and autonomous behaviors to enable combat ground and amphibious vehicles to perform landing zone reconnaissance, create feint and decoys, deploy mine countermeasures, and provide direct/indirect fires for future deployment in contested landing environment through integration of payloads developed under other activities. - Initiate effort to provide persistent unmanned hydrographic sensing for wide-area maritime situational awareness in support of Expeditionary Advanced Base Operations. - Initiate research to design and develop autonomy capability for specific platforms in the USMC Mobile All-Domain Observation and Sensing System (MA-DOSS) and the Unmanned Swarming Amphibious Assault Craft (USAAC). ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 is due to the initiation of efforts to (1) provide persistent unmanned hydrographic sensing for wide-area maritime situational awareness in support of Expeditionary Advanced Base Operations and (2) design and develop autonomy capability for specific platforms in the USMC Mobile All-Domain Observation and Sensing System (MA-DOSS) and the Unmanned Swarming Amphibious Assault Craft (USAAC).					
Title: Future Concepts, Technology Assessment, And Roadmapping	1.377	2.284	1.991	0.000	1.991

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 3001 / *Marine Corps Landing Force Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Description: This activity supports the planning and integration of technology development efforts across the entire Program Element (PE). In conjunction with the Concepts Based Capabilities System and the Marine Corps Warfighting Laboratory, unique and novel concepts for advanced warfighting are developed and validated. Effectiveness analyses are conducted to identify the synergistic effects that can be achieved through the integration of emerging technology with innovative tactics, doctrine, and techniques. Technology assessments are conducted to determine the supporting technologies that have the highest impact across the warfare areas, and warrant further investment within this PE. Technology Roadmapping is conducted to help identify opportunities to leverage technology development within the Department of the Navy and the Department of Defense, as well as with the commercial sector and university communities. The resultant technology investment strategy is developed and used to guide out-year technology development efforts.					
FY 2023 Plans: Continue: - Continue to assess technologies and technology concepts that have potential alignment to the Marine Corps Operating Concept (MOC) as well as ability to support both Expeditionary Advanced Basing and Distributed Maritime Operation concepts. - Continue effort to create methods and tools for studying the effectiveness of autonomous systems operating in adversarial environments. The effort will allow naval personnel to explore and develop novel human-machine teaming concepts under simulated combat conditions. - Continue warfighter workshops and wargaming to understand highest potential for these technologies in order to shape investment priorities. - Continue and extend development of technology roadmaps, concepts, and holistic systems of systems approaches that fulfill the needs identified in in these concepts.					
FY 2024 Base Plans: - Continue to assess technologies and technology concepts that have potential alignment to the Marine Corps Operating Concept (MOC) as well as ability to support both Expeditionary Advanced Basing and Distributed Maritime Operation concepts. - Continue effort to create methods and tools for studying the effectiveness of autonomous systems operating in adversarial environments. The effort will allow naval personnel to explore and develop novel human-machine teaming concepts under simulated combat conditions. - Complete warfighter workshops and wargaming to understand highest potential for these technologies in order to shape investment priorities.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 3001 / *Marine Corps Landing Force Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Complete and extend development of technology roadmaps, concepts, and holistic systems of systems approaches that fulfill the needs identified in in these concepts. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease in funding from FY 2023 to FY 2024 is due to the completion of efforts to extend development of technology roadmaps, concepts, and holistic system of systems approaches that fulfill the needs identified in in these concepts and the completion of efforts to understand highest potential for warfighter workshops and wargaming.					
Accomplishments/Planned Programs Subtotals	44.683	48.367	54.108	0.000	54.108

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy											Date: March 2023	
Appropriation/Budget Activity 1319 / 2					R-1 Program Element (Number/Name) PE 0602131M / *Marine Corps Lndg Force Tech*				Project (Number/Name) 9999 / *Congressional Adds*			
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
9999: *Congressional Adds*	0.000	12.549	26.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	38.549

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Congressional Add: Marine Corps Asset Life-Cycle Management ***FY 2022 Accomplishments:*** Conduct applied research supporting Marine Corps Asset Life-Cycle Management ***FY 2023 Plans:*** N/A	1.448	0.000
Congressional Add: Unmanned Logistical Solutions ***FY 2022 Accomplishments:*** The project will develop a littoral sensor perception system to provide our littoral USVs with reliable perception of their littoral environment including other vessels and targets along with bathymetry, wave, surf and current conditions. ***FY 2023 Plans:*** The project will develop a littoral sensor perception system to provide our littoral USVs with reliable perception of their littoral environment including other vessels and targets along with bathymetry, wave, surf and current conditions.	7.240	7.500
Congressional Add: 5G biometric installation access control demonstration ***FY 2022 Accomplishments:*** Conduct applied research supporting 5G biometric installation access control demonstration ***FY 2023 Plans:*** Conduct applied research supporting 5G biometric installation access control demonstration	3.861	4.000
Congressional Add: Microtube heat exchangers ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct applied research in support of microtube heat exchangers.	0.000	4.500
Congressional Add: Modular multi-mode autonomous seeker ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct applied research in support of modular multi-mode autonomous seeker.	0.000	10.000
Congressional Adds Subtotals	12.549	26.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 9999 / *Congressional Adds*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy											Date: March 2023	
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602235N *I Common Picture Applied Research*							
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	50.371	51.911	52.090	-	52.090	53.601	54.734	56.001	57.229	Continuing	Continuing
0000: *Common Picture Applied Research*	0.000	50.371	51.911	52.090	-	52.090	53.601	54.734	56.001	57.229	Continuing	Continuing

A. Mission Description and Budget Item Justification

Activities and efforts in this program examine concepts and technologies that enable the transformation to Distributed Maritime Operations (DMO). Network centric capabilities rely on information to connect assets and provide timely and accurate understanding of the environment. The mission area requirements for rapid, accurate decision-making; dynamic, efficient, mission- focused communications and networks; and pervasive and persistent sensing drive network centric Science and Technology (S&T) investments.

Today's Sailors and Marines are enabled by Naval S&T. Since 1946, the Office of Naval Research (ONR) has fostered scientific research related to the maintenance of maritime superiority and national defense. ONR manages the Department of the Navy's (DON) portfolio of naval Basic and Applied research, and Advanced Technology Development investments to ensure naval forces can effectively deter conflict, but when called upon, fight, win and come home safe. Current investments hedge against uncertainty, providing solutions to commanders today, and options for the future. The Naval S&T budget supports higher guidance defined by the National Defense Strategy, and responds to requirements identified by the Secretary of the Navy through research priorities set by the Chief of Naval Research, coordinated across the Naval Research Enterprise (NRE), and outlined in the Naval R&D Framework.

This Program Element (PE) funds Applied Research, which is the systematic study to understand the means to meet a recognized and specific need. Most of the work in this PE can be classified between Technology Readiness Level (TRL) 2 (technology concept and/or application formulation) and TRL 4 (component and/or breadboard validation in laboratory environments).

Due to the number of efforts in this Program Element (PE), the programs described herein are representative of the work included in this PE.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602235N *I Common Picture Applied Research*

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	51.477	51.911	54.616	-	54.616
Current President's Budget	50.371	51.911	52.090	-	52.090
Total Adjustments	-1.106	0.000	-2.526	-	-2.526
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.106	0.000			
• Program Adjustments	0.000	0.000	-2.526	-	-2.526

Change Summary Explanation

Funding: $2.526M S&T reduction to comply with Defense Planning Guidance

Technical: No significant change

Schedule: No significant change

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602235N / *Common Picture Applied Research*	Project (Number/Name) 0000 / *Common Picture Applied Research*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
0000: *Common Picture Applied Research*	0.000	50.371	51.911	52.090	-	52.090	53.601	54.734	56.001	57.229	Continuing	Continuing

A. Mission Description and Budget Item Justification

Activities and efforts in this program examine concepts and technologies that enable the transformation to network centric warfare. Network centric capabilities rely on information to connect assets and provide timely and accurate understanding of the environment. The mission area requirements for rapid, accurate decision-making; dynamic, efficient, mission-focused communications and networks; and pervasive and persistent sensing drive network centric Science and Technology S&T investments.

The activities described in this Program Element (PE) address future Navy and Marine Corps capabilities needed to maintain maritime superiority and ensure national security. They are based on input from Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Office of the Chief of Naval Operations, and Headquarters Marine Corps) and are designed to exploit breakthroughs in science and technology in order to deliver maximum warfighting benefit to our sailors and marines. These efforts are aligned with shared priorities throughout the whole of RDT&E in order to quickly advance new capabilities from discovery to deployment across the warfighting domains.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Communication and Networks	6.159	6.345	8.124	0.000	8.124
Description: The overarching objective of this activity is to develop high throughput dynamic wireless communications and network technologies critical to the mission performance and robustness of naval communications for widely dispersed, mobile air, land, surface and submerged platforms. These platforms are often Size, Weight and Power (SWaP) limited, and will operate under constraints of cluttered Radio Frequency (RF) spectrum, harsh Electro-Magnetic Interference (EMI) and Beyond Line Of Sight (BLOS) conditions. The technical payoff is increased network data rates, interoperability across heterogeneous radios, dynamic bandwidth management, and greater mobile network connectivity. The operational payoff is that warfighters from the operational command to the tactical edge have near real-time access to information, knowledge and decision-making necessary to perform their tasks, including coalition and allied forces. Emphasis is on tactical edge communications and networks to fully realize net-centric warfare, bridging the Global Information Grid (GIG) and the 'disadvantaged user', e.g., small-deck combatants, submarines, unmanned vehicles, distributed sensors and ground units in urban and RF challenged environments. The current specific objectives are:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602235N / *Common Picture Applied Research*	**Project (Number/Name)** 0000 / *Common Picture Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Radios and Apertures: - Develop technologies for high band radio, electrically-small and actively scanned antennas, addressing critical issue of radio spectrum bandwidth efficiency, spectrum contention and clutter, agile frequency communications with dynamic spectrum access, all-digital front-end with wide dynamic range, power amplifier efficiency, multipath effects, saltwater propagation and Beyond Line Of Sight (BLOS) communications. - Develop algorithms and signal processing for space-time-frequency diversity communications, including measures for electronic protection, such as low-intercept, antijam waveforms and modulation. - Develop affordable antenna technologies for small size and weight, high radiation efficiency, and wideband operation with rapid beam-steering. - Develop alternatives to Radio Frequency (RF) communications in airborne and terrestrial environments as well as high data rate underwater communications for undersea warfare (distributed sensor netting, unmanned underwater vehicle data exfiltration, submarine Communications at Speed and Depth) using Electro-Optic/Infra-Red (EO/IR) technologies. - Develop secure, high bandwidth communications systems and the exploitation of existing and emerging network protocols that will avail development of new, Low Earth Orbit (LEO) based data transport mechanisms. Tactical Networking and Network Control/Management: - Develop advanced networking techniques for robust, highly dynamic environments; interoperable networks for secure communications and protocols, bandwidth and network management techniques that manage and allocate bandwidth across tactical and theater levels in support of net-centric operations. - Develop rapidly auto-configuring and self-organizing networks with efficient and survivable routing, secure authentication, mobility management and Quality-of-Service guarantee, while optimizing network resources. - Address low bandwidth, synchronization and reliability for Service Oriented Architecture (SOA)/Middleware Architecture in both Mobile Ad-hoc Networks (MANET) and infrastructure-based Internet Protocol (IP) backbone networks. - Develop cognitive network planning and operations engines whose criteria are based directly on mission objectives, while self-adapting and managing the spectrum allocation and radio resources in such a way that network operations, SOA community of interest, and computer network defense are integrated to form a single common tactical network picture that requires a minimum of human intervention and skill. ***FY 2023 Plans:*** Communication and Networks: - Continue research on communications with low probability of detection.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602235N / *Common Picture Applied Research*	**Project (Number/Name)** 0000 / *Common Picture Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research on novel path computation algorithms and autonomous distributed network control. - Continue research on efficient approaches for wideband, multi-beam, high-power communications. - Continue research on optical beam distortion and phase front corrections with machine learning and neural networks. - Continue research on quantum techniques for secure underwater magnetic and optical communications systems. - Continue research on artificial intelligence approaches to establish network policies based on Commander Intent. - Continue research on transmission security enhancements to 5G for tactical operations. - Continue research addressing several known problems in signal processing theory related to synchronization and detection theory specifically for covert communications waveforms. - Continue research on optimization techniques to develop robust data coordination systems for dynamic and denied naval environments.					
FY 2024 Base Plans: Communication and Networks: - Complete research on optical beam distortion and phase front corrections with machine learning and neural networks. - Continue research on communications with low probability of detection. - Continue research on novel path computation algorithms and autonomous distributed network control. - Continue research on efficient approaches for wideband, multi-beam, high-power communications. - Continue research on quantum techniques for secure underwater magnetic and optical communications systems. - Continue research on artificial intelligence approaches to establish network policies based on Commander Intent. - Continue research on transmission security enhancements to 5G for tactical operations. - Continue research addressing several known problems in signal processing theory related to synchronization and detection theory specifically for covert communications waveforms. - Continue research on optimization techniques to develop robust data coordination systems for dynamic and denied naval environments. - Initiate research into underwater blue-green optical communications technologies.					
FY 2024 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602235N / *Common Picture Applied Research*	**Project (Number/Name)** 0000 / *Common Picture Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase from FY 2023 to FY 2024 is due to high-priority research of autonomous systems and communication & networks.					
Title: Applied Information Sciences for Decision Making ***Description:*** The goal of this activity is to develop enablers for decision making and mission execution in order to achieve battlespace superiority. It focuses on the development of algorithms and software technologies that identify and integrate informational content from multiple sources, leading to decision aids that support user-cognitive processes. Because persistent sensors are generating massive amounts of data, the focus is on technologies that not only integrate information from diverse sources, but also provide indications of information significance in ways that support the user's decision needs, regardless of location and operational situation. To achieve this, it must be possible to automate understanding of the battlespace by identifying objects, determining relationships among the objects, recognizing activities, assessing intent, and automatically generating courses of action with associated risks and uncertainty. Effort will also be devoted to developing technology for increasing assurance and security for Communication, Command and Control (C3) information systems and technology for improving information discovery and information presentation in such systems. The Nano Electronics Technology activity is focused on developing ultra-low power, higher performance computing devices and components that are based on novel functionalities of nanometer scale materials and are enabled by improved understanding of nanomaterials, new devices and circuit design concepts, as well as new architectures uniquely suited for nanoscale systems. Applied research in artificial intelligence focuses on the unique challenges of the Naval domain by providing intelligent decision aids while operating in the complex spatio-temporal environments of distributed Naval forces. ***FY 2023 Plans:*** Quantum Information Sciences: - Continue research into the application of on-chip optical processing with distributed quantum states of light for suppressing noise for measurement and communication devices. - Continue research into efficient protocols to implement quantum information processing with atoms and photons. - Continue research into quantum approaches to solve hard decision problems with naval relevance that may outperform classical techniques. - Initiate research on robust devices compatible with long distance distribution of entanglement.	36.291	37.883	37.630	0.000	37.630

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602235N / *Common Picture Applied Research*	**Project (Number/Name)** 0000 / *Common Picture Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Computational Methods for Decision Making: - Complete development of algorithmic methods for detection of objects and activities in very low light environments. - Complete development of methods for robust recognition of activities in surveillance videos based on the integration of plan recognition and short-duration action recognition. - Complete a research on defender-attacker-defender problems that seek strategies for obtaining resilient operational systems under the threat of attack. - Continue development of methods for Unmanned Aerial Vehicle (UAV)-based video surveillance along roads and rivers that are partially occluded by tree canopies using a marsupial system consisting of a large UAV capable of long-duration flight and several small quadcopters. - Continue development of robust computer vision systems inspired by human visual system. - Continue investigation of Radio Frequency (RF) imaging for motion detection and activity recognition behind optically opaque walls. - Continue efforts using Machine Learning (ML) models to recognize and predict what the operator is doing, allowing the system to then facilitate the operator's goals. - Continue development of algorithms for unmanned surface vehicles that determine optimal sensor placement for detecting and tracking targets of interest in littoral areas, as well as to develop verification methods and tools to increase the operational assurance of the autonomous vehicles. - Continue development of methods for large-scale coordination and aggregation of individual preferences. - Continue development of methods for adaptive training on individual and group levels. - Continue development of methods for continuous learning and expertise assessment. - Continue development of mathematical models, theory, and solution methods for most effectively allocating scarce resources (funds, information, personnel, equipment) within competitive environments. - Continue analysis of information flow and dynamics of influence in large networks. - Continue development of tools for structured and distributed deliberation and decision-making. - Continue development of secure and privacy-preserving tools for information sharing. - Continue development of visual sense making capabilities for distributed Navy teams to successfully run operations in increasingly contested, diverse, multi-expertise, and highly data driven decisional contexts. - Initiate development of robust reinforcement learning methods for autonomous agents that can learn performing multiple tasks in several different environments. - Initiate research into stochastic integer programming models and algorithms to achieve strategic and tactical superiority in a variety of contexts.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602235N / *Common Picture Applied Research*	**Project (Number/Name)** 0000 / *Common Picture Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate research into developing practical integer programming approaches to solving binary classification problems. Nanoscale Electronics Technology: - Continue research on Two-Dimensional (2D) materials and related device and circuit functions. Specifically, the program will push the limit of 2D semiconductor transistors through van der Waals integration, explore surface and interface engineering of 2D heterostructures, devise and test devices and circuits with graded 2D materials. - Continue exploratory research on graphene based vacuum electronics. - Initiate research on electronic effects of "Moire" textures induced by broken symmetry between 2D atomic layers, for example in twisted bilayer graphene capable of assuming a sequence of correlated phases. Cyber Defense: - Complete thrusts into automated cryptographic design exploration. - Continue to conduct applied research toward dependable and resilient cyber systems, leveraging results from basic research program, and developing and evaluating technical approaches for future naval capabilities. The program investigates technologies addressing root causes of cyber vulnerability and enhancing efficiency, robustness and cyber resiliency for all classes of computing systems in naval enterprise systems. - Continue thrust in cyber decoys and disinformation, exploring how to automatically analyze the artifacts from cyber adversary campaigns for noise generation that could degrade and disrupt those campaigns. - Continue design and development of tools and techniques for understanding and improving security of cyber-physical systems, which are a critical area of focus for assuring mission success of naval platforms. The systematic extension of techniques in cyber fault tolerance are informing new resilience architectures for sensor processing systems, which continues to inform future planned follow-on efforts. - Continue efforts to improve the security of lookup and the security of entrance for Internet sites developing subdomain onion addresses for self-authenticating subdomains of registered domains that will work with ordinary browsers and will appear as alt names in Transport Layer Security (TLS) certificates. - Continue development of tools and techniques to model and understand adversary motivation and intent that scale beyond traditional artifact analysis in order to achieve robust, hardened and scalable cyber defense techniques that can be employed throughout Navy networks that address nation state adversary activities. - Initiate design of approaches to apply techniques from signal processing and machine learning to ingestion of granular system events in context of memory structure for advanced understanding of system state that would be more effective at discovering activity of stealthy adversaries.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602235N / *Common Picture Applied Research*	**Project (Number/Name)** 0000 / *Common Picture Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Data Analytics: - Continue development of methods for large-scale assessment and evaluation of distributed information. - Continue applied research in optimizing coordination, efficient exchange of information and integration of large amounts of data in real time among distributed operations centers. - Continue development of an architecture that supports distributed/resilient Maritime Operations Center operations that supports data in multi-level system with zero trust enforcement. - Continue development of disseminating data in a prioritized way and under zero-trust conditions between a shore-based multi-level system cloud environment and an on-premise cloud multi-level system at the tactical edge. - Initiate development of advanced data analytics to enable automated and orchestrated threat detection consistent with the DISA Zero Trust Reference Architecture to refine and extend Agile Enclave to provide secure data access in challenging warfighting environments. Science of Artificial Intelligence: - Continue applied research on principled computational frameworks for integrating domain knowledge and machine learning for fast robust learning of diverse, complex concepts and tasks with minimal supervision to analyze the sparse, noise and unlabeled data of the Naval domain. - Continue the application of new brain-inspired artificial intelligence algorithms and architectures for the development of compact neuromorphic hardware suitable for edge computing and signal processing in Naval platforms. - Continue the use Artificial Intelligence (AI) for enhanced collaborative complex decision-making and human-machine dialogue to increase the speed and quality of operational decisions. - Continue research on embedding AI in robotic systems to enable human-machine collaboration and robot training for hazardous missions. - Continue to integrate physical models with machine learning to enable predictive maintenance for autonomous Naval platforms and enable long duration autonomous missions. - Continue to conduct AI-based analysis of data from wearable sensors and task performance measures to monitor and optimize human performance. - Continue research on the ability to enable a humanoid robot to adapt skills learned in one environment or context, to new situations. Cues of the current context, including the environmental state or goals of the robot or its teammates, will modulate the execution of existing robotic skills, such as adjusting the robot's speed.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602235N / *Common Picture Applied Research*	**Project (Number/Name)** 0000 / *Common Picture Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate applied research to design embedded neuromorphic processors into intelligent autonomous systems to permit onboard analysis of target data to enable single-pass mine countermeasures missions. - Initiate applied research to validate AI algorithms to provide distributed perception in networks of interacting autonomous agents in the presence of varying levels of reliability and trust at both network and individual agent. - Initiate applied research on AI tools for multi-level optimization of shipyard maintenance scheduling to accelerate on time delivery of ships out of maintenance and improve ship availability and fleet readiness. - Initiate research techniques for training AI to perform tasks from human behavior and natural language instruction. Electromagnetic Warfare: - Continue the development and demonstration of a novel Electronic Attack (EA) capability. It will accomplish this by enhancement of a suite of Radio Frequency (RF) signature-related technologies. The result will provide a new capability to counter advanced threats.					
FY 2024 Base Plans: Quantum Information Sciences: - Complete research into the application of on-chip optical processing with distributed quantum states of light for suppressing noise for measurement and communication devices. - Continue research into efficient protocols to implement quantum information processing with atoms and photons. - Continue research into quantum approaches to solve hard decision problems with naval relevance that may outperform classical techniques. - Continue research on robust devices compatible with long distance distribution of entanglement. - Initiate research on applications of distributed entanglement in a quantum network. Computational Methods for Decision Making: - Complete development of methods for continuous learning and expertise assessment. - Complete development of mathematical models, theory, and solution methods for effectively allocating scarce resources (funds, information, personnel, equipment) within competitive environments. - Complete development of robust reinforcement learning methods for autonomous agents that can learn performing multiple tasks in several different environments. - Continue development of methods for large-scale coordination and aggregation of individual preferences. - Continue development of methods for adaptive training on individual and group levels.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602235N / *Common Picture Applied Research*	**Project (Number/Name)** 0000 / *Common Picture Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue analysis of information flow and dynamics of influence in large networks. - Continue development of tools for structured and distributed deliberation and decision-making. - Continue development of secure and privacy-preserving tools for information sharing. - Continue development of visual sense making capabilities for distributed Navy teams to successfully run operations in increasingly contested, diverse, multi-expertise, and highly data driven decisional contexts. - Continue research into stochastic integer programming models and algorithms to achieve strategic and tactical superiority in a variety of contexts. - Continue research into developing practical integer programming approaches to solving binary classification problems. - Continue development of methods for Unmanned Aerial Vehicle (UAV)-based video surveillance along roads and rivers that are partially occluded by tree canopies using a marsupial system consisting of a large UAV capable of long-duration flight and several small quadcopters. - Continue development of robust computer vision systems inspired by human visual system. - Continue investigation of Radio Frequency (RF) imaging for motion detection and activity recognition behind optically opaque walls. - Continue efforts using Machine Learning (ML) models to recognize and predict what the operator is doing, allowing the system to then facilitate the operator's goals. (NRL) - Continue development of algorithms for unmanned surface vehicles that determine optimal sensor placement for detecting and tracking targets of interest in littoral areas, as well as to develop verification methods and tools to increase the operational assurance of the autonomous vehicles. (NRL) - Initiate development of tools for synthesis of information, intelligence gathering and effective decision making. - Initiate research into logistics planning and scheduling in contested environments. - Initiate research in building reliable classifiers, based on a novel data augmentation approach, for robust object recognition. Nanoscale Electronics Technology: - Complete exploratory research on graphene based vacuum electronics. - Continue research on Two-Dimensional (2D) electronic materials and related device and circuit functions. Specifically, the program will push the limit of 2D semiconductor transistors through van der Waals integration of metallic contacts and gate dielectric stack, requiring exploration of surface and interface engineering of 2D heterostructures.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602235N / *Common Picture Applied Research*	**Project (Number/Name)** 0000 / *Common Picture Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research on electronic effects of "Moire" textures induced by broken symmetry between 2D atomic layers, for example in twisted bilayer graphene capable of assuming a sequence of correlated phases implementing a physical Hubbard model computation. Cyber Defense: - Complete thrust in cyber decoys and disinformation, exploring how to automatically analyze the artifacts from cyber adversary campaigns for noise generation that could degrade and disrupt those campaigns. - Complete efforts to improve the security of lookup and the security of entrance for Internet sites developing subdomain onion addresses for self-authenticating subdomains of registered domains that will work with ordinary browsers and will appear as alt names in Transport Layer Security (TLS) certificates. - Continue to conduct applied research toward dependable and resilient cyber systems leveraging results from basic research program, and developing and evaluating technical approaches for future naval capabilities. The program investigates technologies addressing root causes of cyber vulnerability and enhancing efficiency, robustness and cyber resiliency for all classes of computing systems in naval enterprise systems. - Continue design and development of tools and techniques for understanding and improving security of cyber-physical systems, which are a critical area of focus for assuring mission success of naval platforms. The systematic extension of techniques in cyber fault tolerance are informing new resilience architectures for information processing systems that ingest data from the physical and spectral environments. - Continue design of approaches to apply techniques from signal processing and machine learning to ingestion of granular system events in context of memory structure for advanced understanding of system state that would be more effective at discovering activity of stealthy adversaries. - Continue development of tools and techniques to model and understand adversary motivation and intent that scale beyond traditional artifact analysis in order to achieve robust, hardened and scalable cyber defense techniques that can be employed throughout Navy networks that address nation state adversary activities. (NRL) - Initiate development of initial prototypes that implement cyber counter proliferation techniques designed to automatically disrupt components necessary for execution of cyber malware campaigns. Data Analytics: - Complete development of disseminating data in a prioritized way and under zero-trust conditions between a shore-based multi-level system cloud environment and an on-premise cloud multi-level system at the tactical edge. - Continue development of methods for large-scale assessment and evaluation of distributed information.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602235N / *Common Picture Applied Research*	**Project (Number/Name)** 0000 / *Common Picture Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue applied research in optimizing coordination, efficient exchange of information and integration of large amounts of data in real time among distributed operations centers. - Continue development of an architecture that supports distributed/resilient Maritime Operations Center operations that supports data in multi-level system with zero trust enforcement. - Continue development of advanced data analytics to enable automated and orchestrated threat detection consistent with the DISA Zero Trust Reference Architecture to refine and extend Agile Enclave to provide secure data access in challenging warfighting environments. - Initiate development of Artificial Intelligence (AI)/Machine Learning (ML) techniques to consistently learn the data analytic environment and apply appropriate analytics to data exchange streams dynamically during challenging operational scenarios. Science of Artificial Intelligence: - Complete AI-based analysis of data from wearable sensors and task performance measures to monitor and optimize human performance. Outcome: a testable AI algorithm that will be used to assess and monitor heat injuries. - Continue applied research on principled computational frameworks for integrating domain knowledge and machine learning for fast robust learning of diverse, complex concepts and tasks with minimal supervision to analyze the sparse, noise and unlabeled data of the Naval domain. - Continue application of new brain-inspired artificial intelligence algorithms and architectures for the development of compact neuromorphic hardware suitable for edge computing and signal processing in Naval platforms. - Continue use of AI for enhanced collaborative complex decision-making and human-machine dialogue to increase the speed and quality of operational decisions. - Continue research on embedding AI in robotic systems to enable human-machine collaboration and robot training for hazardous missions. - Continue to integrate physical models with machine learning to enable predictive maintenance for autonomous Naval platforms and enable long duration autonomous missions. - Continue applied research to design embedded neuromorphic processors into intelligent autonomous systems to permit onboard analysis of target data to enable single-pass mine countermeasures missions. - Continue applied research to validate Artificial Intelligence (AI) algorithms to provide distributed perception in networks of interacting autonomous agents in the presence of varying levels of reliability and trust at both network and individual agent.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602235N / *Common Picture Applied Research*	**Project (Number/Name)** 0000 / *Common Picture Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue applied research on AI tools for multi-level optimization of shipyard maintenance scheduling to accelerate on time delivery of ships out of maintenance and improve ship availability and fleet readiness. - Continue to develop and assess techniques for training AI to extract Naval task procedures from natural language and chat data. - Continue research on the ability to enable a humanoid robot to adapt skills learned in one Naval environment or context, to new situations. Cues of the current context, including the environmental state or goals of the robot or its teammates, will modulate the execution of existing robotic skills, such as adjusting the robot's speed. (NRL) - Initiate research exploring the collaborative relationship between agents and humans, cooperating on common interest goals, with mutual engagement of all participants and coordinated efforts mediated by effective communication. Electromagnetic Warfare: - Continue the development and demonstration of a novel Electronic Attack (EA) capability. It will accomplish this by enhancement of a suite of Radio Frequency (RF) signature-related technologies. The result will provide a new capability to counter advanced threats. (NRL) ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024.					
Title: Multi-Source Integration and Combat Identification ***Description:*** This activity addresses Theater Air And Missile defense (TAMD), and responds to warfighter needs for rapid, high confidence Combat Identification (CID) of air and missile threats at long range, using real time and non-real time threat attributes and intelligence information. ***FY 2023 Plans:*** Electromagnetic Warfare: - Complete research into the use of models to determine the enhanced radar cross section of Hyper Velocity Vehicles (HVV) and provide improved prediction and interpretation from HVV flights for early detection/ identification and performance evaluation of these vehicles.	1.830	1.774	1.708	0.000	1.708

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602235N / *Common Picture Applied Research*	**Project (Number/Name)** 0000 / *Common Picture Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Complete efforts into efficient broadband two-dimensional high frequency transmit arrays for Over-The-Horizon (OTH) Radar. This will enable two dimensional transmit beam steering, adaptive transmit side lobe control and reduced prime power requirements for long range detection of objects in the environment. - Initiate development of sensors and sensor networks to locate and track any target of interest in the Maritime Domain. ***FY 2024 Base Plans:*** Electromagnetic Warfare: - Continue development of sensors and sensor networks to locate and track any target of interest in the Maritime Domain. (NRL) ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024.					
Title: Tactical Space Exploitation ***Description:*** The Tactical Space Exploitation initiative explores the application of new space craft technologies on small, light-weight and low-cost satellites, to enhance naval warfighting capabilities by taking advantage of the global access, revisit and connectivity provided by orbital platforms. To perform early-applied discovery Research and Development (R&D) to ensure Navy-Marine Corps access to critical space-associated capabilities on the ground, at sea, and in a contested space environment; research thrusts include spacecraft R&D in five strategic cross-cutting areas that lead to the fielding of systems which perform functions critically important to operations. These areas are: (1) Advanced Space Platform Technologies, such as development of new and prototype space systems that are tailored to specific threats, including technologies which reduce cost, mass, power and/ or extend on-orbit lifetimes, and sub-systems that advance propulsion and control capabilities towards precision maneuvering while minimizing fuel; (2) Next-generation Payloads and Sensors, including space robotic capabilities to address on-orbit inspection, servicing, repair, assembly, and mission life extension; (3) Connectivity for disadvantaged users that is rugged, high-bandwidth and space based; (4) Space Weather, and (5) Space Situational Awareness. ***FY 2023 Plans:***	6.091	5.909	4.628	0.000	4.628

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602235N / *Common Picture Applied Research*	**Project (Number/Name)** 0000 / *Common Picture Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Space Research and Spacecraft Technology: - Initiate early-applied discovery Research and Development (R&D) to ensure Navy-Marine Corps access to critical space-associated capabilities on the ground, at sea, and in a contested space environment. Research thrusts include space related R&D in three strategic cross-cutting areas that lead to the fielding of systems which perform functions critically important to Naval operations and addressing Navy/Marine Corps current and future needs and requirements. These areas are: 1) Advanced space technologies, such as development of new prototype and exploratory space systems that are relevant to maritime navigation, maritime domain awareness, and distributed maritime operations (DMO), including technologies which reduce cost, mass, power. 2) Next-generation payloads and sensors, including space-based environmental monitoring instruments and on-orbit autonomous calibration and/or data processing addressing the DON's Electromagnetic Environment (EME) needs. 3) Connectivity for disadvantaged maritime and littoral users that is rugged, high-bandwidth and space based. - Initiate efforts for the development and demonstration of new measurement and data assimilation capabilities to predict phenomena that influence Over-the-Horizon Radar (OTHR) and communication, which will advance OTHR related capabilities and communication avenues. - Initiate research efforts for the development of robust and reliable hypersonic air breathing platforms.					
FY 2024 Base Plans: Space Research and Spacecraft Technology: - Continue early-applied discovery Research and Development (R&D) to ensure Navy-Marine Corps access to critical space-associated capabilities on the ground, at sea, and in a contested space environment. Research thrusts include space related R&D in three strategic cross-cutting areas that lead to the fielding of systems which perform functions critically important to Naval operations and addressing Navy/Marine Corps current and future needs and requirements. These areas are: 1) Advanced space technologies, such as development of new prototype and exploratory space systems that are relevant to maritime navigation, maritime domain awareness, and Distributed Maritime Operations (DMO), including technologies which reduce cost, mass, power. 2) Next-generation payloads and sensors, including space-based environmental monitoring instruments and on-orbit autonomous calibration and/or data processing addressing the DON's Electromagnetic Environment (EME) needs.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602235N / *Common Picture Applied Research*	**Project (Number/Name)** 0000 / *Common Picture Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
3) Connectivity for disadvantaged maritime and littoral users that is rugged, high-bandwidth and space based. (NRL) - Continue efforts for the development and demonstration of new measurement and data assimilation capabilities to predict phenomena that influence Over-the-Horizon Radar (OTHR) and communication, which will advance OTHR related capabilities and communication avenues. (NRL) - Continue research efforts for the development of robust and reliable hypersonic air breathing platforms. (NRL) ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding decrease from FY 2023 to FY 2024 is to increase in higher-priority research of autonomous systems and communication & networks. Funds realigned within to PE 0602235N to Communications and Networks Activity.					
Accomplishments/Planned Programs Subtotals	50.371	51.911	52.090	0.000	52.090

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy												Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602236N *I Warfighter Sustainment Applied Res*							
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	114.681	121.707	74.722	-	74.722	76.773	76.152	76.440	76.908	Continuing	Continuing
0000: *Warfighter Sustainment Applied Res*	0.000	68.102	70.957	74.722	-	74.722	76.773	76.152	76.440	76.908	Continuing	Continuing
9999: *Congressional Adds*	0.000	46.579	50.750	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	97.329

A. Mission Description and Budget Item Justification

U.S. Sailors and Marines are key to mission success. This Program element (PE) supports research that advances artificial intelligence (AI) enabled decision aides, autonomy, human-machine teaming, augmented performance, command and control and protective equipment to ensure they outthink, outperform and outfight adversaries in a complex, maritime environment. This PE also supports developments in biocentric and advanced materials technologies to provide new options to enhance performance of warfighters and their platforms. This PE also supports the Office of Naval Research (ONR) Global mission to serve as the preeminent external facilitator for the Naval Research Enterprise. This is accomplished by establishing quality, relevant connections between the international research and development community, Naval fleet/forces, DOD, other US Government agencies and international partners.

Today's Sailors and Marines are enabled by Naval Science and Technology (S&T). Since 1946, the Office of Naval Research (ONR) has fostered scientific research related to the maintenance of maritime superiority and national defense. ONR manages the Department of the Navy's (DON) portfolio of Naval basic and applied research, and advanced technology development investments to ensure Naval forces can effectively deter conflict, but when called upon, fight, win and come home safe. Current investments hedge against uncertainty, providing solutions to commanders today, and options for the future. The Naval S&T budget supports higher guidance defined by the National Defense Strategy, and responds to requirements identified by the Secretary of the Navy through research priorities set by the Chief of Naval Research, coordinated across the Naval Research Enterprise (NRE), and outlined in the Naval R&D Framework.

This Program Element (PE) funds Applied Research, which is the systematic study to understand the means to meet a recognized and specific need. Most of the work in this PE can be classified between Technology Readiness Level (TRL) 2 (technology concept and/or application formulation) and TRL 4 (component and/or breadboard validation in laboratory environments).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602236N *I Warfighter Sustainment Applied Res*

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	117.738	70.957	71.592	-	71.592
Current President's Budget	114.681	121.707	74.722	-	74.722
Total Adjustments	-3.057	50.750	3.130	-	3.130
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	50.750			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-3.057	0.000			
• Program Adjustments	0.000	0.000	3.130	-	3.130
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 9999: *Congressional Adds*		
Congressional Add: *Polymer coatings for reduced ice and fouling adhesion*	4.827	5.000
Congressional Add: *Health and Safety Research of Underground Fuel Storage Facilities*	4.827	0.000
Congressional Add: *Hypersonics Material Acceleration*	4.827	5.000
Congressional Add: *Physics Based Neutralization of Threats to Human Tissues and Organs*	4.827	10.000
Congressional Add: *Advanced nanocomposite coatings*	5.792	0.000
Congressional Add: *Anticorrosion nanotechnology*	7.240	10.000
Congressional Add: *Development of chromate-free corrosion inhibitor coatings for marine application*	1.689	1.750
Congressional Add: *Engineered systems to preserve and restore hearing*	4.827	0.000
Congressional Add: *Human digital twin*	2.896	0.000
Congressional Add: *High mobility ground robots to assist dismounted infantry in urban operations*	4.827	0.000
Congressional Add: *Biomaterial exterior for hypersonic projectable*	0.000	5.000
Congressional Add: *Wearable sensors for injury predicition*	0.000	5.000
Congressional Add: *Long-term underwater autonomy*	0.000	5.000
Congressional Add: *Ultra-compact heat exchangers*	0.000	4.000

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602236N *I Warfighter Sustainment Applied Res*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Congressional Add Subtotals for Project: 9999	46.579	50.750
Congressional Add Totals for all Projects	46.579	50.750

Change Summary Explanation

Funding: The $3.130M increase is in support of Grid Vulnerability and On-Base Power and Water Resilience research objectives.

Technical: No significant change.

Schedule: No significant change

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602236N / *Warfighter Sustainment Applied Res*	Project (Number/Name) 0000 / *Warfighter Sustainment Applied Res*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
0000: *Warfighter Sustainment Applied Res*	0.000	68.102	70.957	74.722	-	74.722	76.773	76.152	76.440	76.908	Continuing	Continuing

A. Mission Description and Budget Item Justification

U.S. Sailors and Marines are key to mission success. This Program element (PE) supports research that advances artificial intelligence (AI) enabled decision aides, autonomy, human-machine teaming, augmented performance, command and control and protective equipment to ensure they outthink, outperform and outfight adversaries in a complex, maritime environment. This PE also supports developments in biocentric and advanced materials technologies to provide new options to enhance performance of warfighters and their platforms. This Program conducts applied research to address Warfighter protection and performance concerns, including efforts that focus on advanced Naval materials, biocentric technologies, decision support, intelligent and autonomous systems, human performance optimization, training and education technologies, social and cultural science, and biomedical technologies. This PE also supports the Office of Naval Research (ONR) Global mission to serve as the preeminent external facilitator for the Naval Research Enterprise. This is accomplished by establishing quality, relevant connections between the international research and development community, Naval fleet/forces, DOD, other US Government agencies and international partners.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Advanced Naval Materials	17.532	17.679	20.209	0.000	20.209
Description: Advanced Naval Materials efforts support several Science and Technology (S&T) Focus Areas, in particular Platform Design & Survivability, and perform research across a broad spectrum of technical areas including: advanced structural materials to increase the material pallet available to provide for paradigm shifting improvements in platform performance (i.e., detectability, susceptibility, recoverability, maintainability, capability, and survivability) at reduced weight and cost; advanced, high-performance materials for energy systems; corrosion mitigation strategies and tools; high-temperature materials for propulsion systems; and enhanced acoustic transducers and sensor materials.					
FY 2023 Plans: Materials: - Continue research on Agile Manufacturing - Integrated Computational Materials Engineering (ICME) toolkit infrastructure to establish and fully utilize a naval laboratory based capability to develop and predict performance of materials and components in an agile and accelerated manor to speed technology delivery and reduce qualification costs. - Continue ongoing research efforts to improve affordability and reliability of piezoelectric transduction materials. The focus will be on Acoustic Transduction Materials Technology to reduce SWaP and improve sensitivity of sensors and SONAR.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research to develop advanced structural alloys and composites, joining and repair technologies. - Continue research to pursue commercially viable processing for nano-engineered materials, including ceramics, metals, and materials systems. The focus will be on Nanostructured Materials Processing aimed at improved resilience of naval systems and platforms and capabilities for producing novel, high performance components; - Complete development of new, advanced, environmentally benign Anti-Fouling (AF)/Anti-Corrosive (AC) coating systems for Navy platforms. - Advance materials, processes and capabilities. Current efforts are focused on development of a high thermal conductivity later for high power electronic device application to improve performance. Sustainment & Logistics: - Continue applied research to investigate corrosion control technologies through investigation of corrosion inhibitor performance for coatings and corrosion mechanisms of compositionally complex alloys (CCA) and additive manufactured materials. Naval Power Systems: - Continue to advance applied research efforts to support development of naval materials in support of naval power systems. Platform Design and Engineering: - Continue to advance applied research efforts to support development of naval materials in support of naval platforms.					
FY 2024 Base Plans: Materials: - Continue ongoing research efforts to improve affordability and reliability of piezoelectric transduction materials. The focus will be on Acoustic Transduction Materials Technology to reduce SWaP and improve sensitivity of sensors and SONAR. - Continue research to develop advanced structural alloys and composites, joining and repair technologies. - Continue research to pursue commercially viable processing for nano-engineered materials, including ceramics, metals, and materials systems. The focus will be on Nanostructured Materials Processing aimed at improved resilience of naval systems and platforms and capabilities for producing novel, high performance components.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue advance materials, processes and capabilities. Continue efforts focus on the development of a high thermal conductivity later for high power electronic device application to improve performance. Complete - Agile Manufacturing - Integrated Computational Materials Engineering (ICME) toolkit infrastructure development. Sustainment & Logistics: - Continue applied research to investigate corrosion control technologies through investigation of corrosion inhibitor performance for coatings and corrosion mechanisms of compositionally complex alloys (CCA) and additive manufactured materials. Naval Power Systems: - Continue to advance applied research efforts for development of naval materials in support of naval power systems, including efforts associated with attritable fuel cells. Platform Design and Engineering: - Continue applied research efforts in support of advanced naval platform materials refining and concentrating efforts on advanced structural materials that improve Undersea Platform Survivability. - Initiate research to develop Advanced and Alternative Structural Alloys and Composites, as well as their associated Joining and Repair technologies. - Initiate applied research efforts in matrix materials and nano/micro-scale embedded structures useful for controlling platform signatures as well as their manufacturability in quantity. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY 2023 to FY 2024 is due to increased investment Grid Vulnerability and On-Base Power and Water Resilience relevant research efforts.					
Title: Biocentric Technologies ***Description:*** Applied research to develop knowledge and technologies for future Naval capabilities. Research areas include: bioinspired and biomimetic materials; synthetic biology for environmental surveillance and	8.228	9.328	9.668	0.000	9.668

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
materiel production; bioenergy harvesting and electronics; warfighter augmentation and resilience; and marine mammal health. This research provides secure and agile options to enhance performance, increase novel power and energy solutions to safely extend operational duration, and improve stealth, maneuverability, and mission capability of platforms and autonomous systems. ***FY 2023 Plans:*** Bio-Inspired Autonomous Systems: Continue: - Conduct applied research on bio-inspired underwater vehicle propulsion and control. - Mature advanced search behaviors for autonomous vehicles. - Applied research on bio-inspired cross-domain vehicles for amphibious and sea/air transitions. Complete: - Exploration of bio-inspired sonar integrated onto autonomous underwater vehicles for obstacle avoidance in congested waters. Initiate: - Integrate advanced flexible batteries into artificial muscle-based prototype underwater vehicle for field testing of speed and duration. Human Interaction with Autonomous Systems: (This thrust has been realigned to the Human Factors and Organizational Design Activity of this PE. The research has a human-machine teaming focus, which aligns better with the objectives of the Human Factors and Organizational Design Activity.) Naval Biosciences and Synthetic Biology for Naval Applications: (This thrust was previously part of the Biocentric Technology FY22 Plan. The name was changed to more accurately describe the research.) Continue: - Develop strategies to incorporate programmable microbial sensors for environmental monitoring into relevant Naval platforms. - Applied research focusing on deployment of self-burying, benthic microbial fuel cells at various depths to power new devices (e.g., a semi-submersible autonomous underwater vehicle (AUV)). Complete:					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Conduct studies of prebiotic food additives/probiotics for effects on microbiome and performance enhancement in human subjects, including divers and combat swimmers. - Develop gut microbiome-based tools to predict individual response to prebiotics for stress resilience. - Efforts to scale up production of biogenic mineral nanomaterials. Initiate: - Applied research in bio/bio-inspired materials for multi-spectral camouflage. - Applied research in bioengineering systems for the bioproduction/biodegradation of military relevant materials. Bioengineering and Life Sciences: Continue: - Conduct applied research to determine the role of lung membrane integrity in marine mammal respiratory diseases; establish therapeutics to prevent kidney stone formation in dolphins; facilitate surveillance of marine mammal viral pathogens in marine waters and indigenous mussels/oysters/clams, and implement dolphin vocalizations as a tool for diagnosing their well-being. Complete: - Development of a sandcastle worm inspired adhesive effective in seawater and transition it to a Future Naval Capability Program focused on seawater curing adhesive technologies for pier side replacement, or repair, of tiles on outer submarine hulls. - Applied research establishing highly efficient proton exchange membrane fuel cells for transportation applications, which improved their overall performance through catalyst and support engineering. Initiate: N/A Warfighter Augmentation and Resilience: Continue: - Conduct applied research in bio-inspired light polarization sensors and machine learning methods for predicting underwater geolocation and developing technology for underwater image dehazing. - Develop technologies to monitor and protect diver from environmental stressors by maturing and validating models that capture a human diver's heat loss and the ability of various wetsuit designs to provide thermal protection. - Support development of manned-unmanned teaming platforms to aide a diver in enhanced situational awareness and to expand diving windows of opportunity by eliminating current limitations such as restricted access (cold, depth, and enclosed spaces), visibility, and gas supply. Complete:					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Research on feasibility of sensor development for oxygen toxicity. This resulted from the ongoing FY22 and FY23 plan to continue identifying predictors of critical health and safety threats to divers through advanced physiological monitoring and algorithm development. Initiate: - Create new oxygen-generating and carbon dioxide-disposing diving mask that would replace existing rebreathers. - Applied gas channel research in the context of respiratory fitness and/or potential mitigation strategies for targeted gas management.					
FY 2024 Base Plans: Bio-Inspired Autonomous Systems Continue: - Conduct applied research on bio-inspired underwater vehicle propulsion and control as an effective alternative to current propulsion approaches. - Mature search behavior algorithms for autonomous vehicles to enhance object detection and recognition abilities. - Apply bio-inspired principles to design vehicles that can operate amphibiously and seamlessly transition from sea sub-surface to air operations. - Investigate application of flexible batteries to power underwater vehicle prototype. Naval Biosciences and Synthetic Biology for Naval Applications Continue: - Applied research in bio/bio-inspired materials for multi-spectral camouflage. - Applied research in bioengineering systems for the bioproduction/biodegradation of military relevant materials. - Applied research to incorporate microbial sensors on Naval platforms for environmental monitoring. - Applied research on the development of microbial fuel cells as power sources. Initiate: - Applied research on understanding and building bioelectronics systems for use in computing, data storage, and materials development. Marine Mammal Health (This thrust was previously part of the Bioengineering and Life Sciences FY23 Plan. The name was changed to more accurately describe the research.) Continue:					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Conduct applied research to determine the role of lung membrane integrity in marine mammal respiratory diseases - Establish therapeutics to prevent kidney stone formation in dolphins - Facilitate surveillance of marine mammal viral pathogens in marine waters and indigenous mussels/oysters/ clams - Implement dolphin vocalizations as a tool for diagnosing their well-being. Warfighter Augmentation and Resilience Continue: - Development of manned-unmanned teaming platforms to aid a diver in enhanced situational awareness and to expand diving windows of opportunity by eliminating current limitations such as restricted access (cold, depth, and enclosed spaces), visibility, and gas supply. - Translate basic research on oxygen separation and transport and carbon dioxide scrubbing into prototype oxygen-generating and carbon dioxide-disposing diving mask to replace existing rebreathers. - Applied research on gas management capabilities to support diver respiratory fitness. - Applied research in bio-inspired light polarization sensors and machine learning methods for predicting underwater geolocation and developing technology for underwater image dehazing. Complete: - Development of technologies that protect divers from environmental stressors by monitoring their heat loss and, assess new wetsuit designs to provide enhanced thermal protection. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY2023 to FY2024.					
Title: Human Factors and Organizational Design ***Description:*** Operational and tactical level decision-making requires making time-critical decisions with imperfect information. This activity seeks to understand how warfighters make decisions despite uncertainty, and research practical strategies for managing information for Naval warfighter decision-making. These applied research efforts will improve mixed social-technical systems design, system interface designs and human-level decision support in Naval contexts. Research areas include the development of techniques to enhance warfighter performance in managing human-machine teaming and decision-making.	5.829	6.018	6.130	0.000	6.130

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
FY 2023 Plans: Cognitive Science for Human-Machine Teaming and Computational Neuroscience: Continue: - Incorporate realistic neural systems into autonomous systems for more robust on-board perception and intelligence. - Conduct applied research on system interface designs and human-machine interaction methodologies that enable or enhance Naval Warfighter performance and human-machine teaming. This includes psychoacoustics and audio-visual scene interpretation implemented in computational models that serve as the front end for cognitive architectures. - Conduct applied research to develop agile humanoid robot teammates with enhancements including: (i) Embedding computer vision with visual-spatial reasoning; (ii) Auditory systems to enable human communication; and (iii) Neuromorphic (brain-like) processors. - Conduct applied research to train mission-capable robots to perform complex manipulation tasks, integrated with self-learning. Complete: - Construct new perceptual models for intelligent autonomous systems. Initiate: - Integrate vision and language for learning and communication in human-agent systems. Social Networks and Computational Social Science: Continue: - Conduct applied research in information environment assessment, civil-military communications, humanitarian assistance / disaster relief, information operations and strategic communication. - Conduct research to support improved course of action guidance and capabilities to detect and defuse disinformation, social hysteria, and group polarization campaigns. - Refine studies to develop effective tactics, techniques and procedures for military personnel operating in the information environment to discover, monitor and counter adversarial maneuvers in digital and social media. Complete: - Course of action guidance to detect and defuse disinformation, social hysteria and group polarization campaigns. Initiate:					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Applied research to explore socio-technical techniques and social decision making to affect stance, perception, identity and behavior of target audiences. Command Decision Making: Continue: - Research to automate and display recommendations and characterize uncertainty, derived from Machine Learning (ML) algorithms. Complete: - Applied research for a knowledge/skill brokering system that can detect individual knowledge weaknesses / gaps related to task performance and deliver tailored training tutorials as job aids. - Conduct applied research to assist with curation of community generated multi-media content and fusion with authoritative sources. Initiate: - Research automation algorithms for managing Man-Machine teaming & Scalability of Control to large numbers of autonomous entities (robots / swarms). - Applied research for a Collaborative Artificial Intelligence (Collaborative AI) decision support tool that allows AI to learn from human command and control tasks. Human Interaction with Autonomous Systems: (This thrust has been realigned from the Biocentric Technologies to the Human Factors and Organizational Design Activity of this PE. This research has a human-machine teaming focus, which aligns better with the objectives of the Human Factors and Organizational Design Activity.) Continue: - Conduct applied research to develop agile humanoid and quadruped robot teammates. This includes incorporation of computer vision, acoustic localization, reasoning and human communication. - Applied research on training mission-capable robots to perform complex manipulation skills essential for shipboard and urban operations. - Conduct applied research to develop technology to enhance diver performance with small autonomous underwater vehicle (AUV) assistants. This effort was previously described under Cognitive Science for Human-Machine Teaming and Computational Neuroscience, but aligns more closely to the objectives of Human Interaction with Autonomous Systems. Initiate:					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Incorporate cognitive architectures and visual reasoning on robotic teammates to enable enhanced cooperative behaviors. Naval Team Performance and Design: (This thrust was previously part of the Command Decision Making FY22 plan.) Continue: - Conduct research on team composition and social decision-making in order to design Naval decision tools that have reduced risk of human decision biases (e.g., implicit bias, preconceived notions, and social pressure). - Conduct Human System Integration research activities in areas of human factors engineering and physical design layout (habitability, safety, personnel survivability) of naval platforms in order to understand best possible conditions for effective decision-making Naval settings. Complete: N/A Initiate: - Conduct research on team composition, human factors, and decision making in order to design naval decision tools and processes that have reduced risk of human decision biases and heuristics as well as human performance errors related to combat/operational stress.					
FY 2024 Base Plans: Cognitive Science for Human-Machine Teaming and Computational Neuroscience Continue: - Assess feasibility of incorporating realistic neural systems into autonomous systems for more robust on-board perception and intelligence. - Conducting applied research on system interface designs and human-machine interaction methodologies that enable or enhance Naval Warfighter performance and human-machine teaming. - Conduct applied research to develop agile humanoid robot teammates with enhancements including: (i) Embedding computer vision with visual-spatial reasoning; (ii) Auditory systems to enable human communication; and (iii) Neuromorphic (brain-like) processors. - Conduct applied research to train mission-capable robots to perform complex manipulation tasks, integrated with the ability to recognize patterns and learn from data (self-learning). - Investigate the effectiveness of incorporating vision and language processes in robots to facilitate human-robot team performance learning and communication. Social Networks and Computational Social Science					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Continue: - Applied research in information environment assessment. - Investigate and assess tactics, techniques and procedures that enable military personnel operating in the information environment to discover, monitor and counter adversarial maneuvers in digital and social media. Complete: - Applied research in humanitarian assistance / disaster relief information collection. Initiate: - Research in new techniques to address military concerns in digital and social media. Command Decision Making Continue: - Research to automate and display recommendations and characterize uncertainty, derived from machine learning (ML) algorithms. - Research automation algorithms for managing man-machine teaming and scalability of control to large numbers of autonomous entities (robots / swarms). - Applied research to develop collaborative artificial intelligence (AI) decision support tools that learn from human command and control tasks. Initiate: - Study manned-unmanned teaming Command and Control (C2) solutions across different command echelons. Human Interaction with Autonomous Systems Continue: - Conduct applied research to incorporate computer vision, acoustic localization, reasoning and communication capabilities into humanoid and quadruped robot teammates. - Investigate best approaches to train mission-capable robots to perform complex manipulation skills essential for shipboard and urban operations. - Conduct applied research to understand how to enhance diver performance with small autonomous underwater vehicle (AUV) assistants. - Study approaches to incorporate cognitive architectures and visual reasoning processes on robotic teammates to enable enhanced cooperative, team-level, behaviors. Complete: N/A Initiate:					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Evaluations of mobility and manipulation ability of advanced humanoid robot prototypes on shipboard maintenance and urban building inspection tasks. Naval Team Performance and Design Continue: - Conduct applied research to understand human factors engineering and physical design parameters of naval platforms that optimize decision-making. - Understand the impact of team composition, human factors, stress and social decision making to reduce decision biases and performance errors in operational settings. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY2023 to FY2024.					
Title: Human Research Protection Program (HRPP)	2.711	2.798	2.850	0.000	2.850
Description: The Federal Policy for the Protection of Human Subjects is codified in the Department of Defense (DoD) as part 219 of title 32, Code of Federal Regulations (also known and hereinafter referred to as the "Common Rule"). DoD Instruction 3216.02 establishes policy and assigns responsibilities for the protection of human subjects in DoD-supported programs to implement the Common Rule and requires Heads of DoD Components to establish and oversee DoD Component policies and procedures that ensure compliance with federal and DoD requirements. The Secretary of the Navy Instruction (SECNAVINST) 3900.39E CH-1 identifies the Chief of Naval Research as providing support and expertise for human research protection in research conducted or supported by the Navy and Marine Corps Systems Commands and institutions, operational forces, training Commands, and Department of the Navy (DON)-supported research involving human subjects performed by non-DoD institutions. The Human Research Protection Program (HRPP) protects the rights, safety, and welfare of human subjects in research conducted or sponsored by the Navy and Marine Corps by: 1) ensuring that research involving human subjects complies with federal regulations, DoD Directives, DON Instructions, and Marine Corps Orders governing research protection requirements; and 2) providing education and training programs in human research ethics to all levels of staff involved in the review, approval, conduct, management, or support of DON human subjects research (HSR). ***FY 2023 Plans:***					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Continue: - Establish five new human research protection programs (HRPP). - Program Management of the DON Research Protections Information Technology Management System for management and compliance oversight of ongoing human research protections activities. - Continue providing education and training programs in human research ethics to all levels of staff involved in the review, approval, conduct, support or management of DON human subjects research. - Provide subject matter expertise and guidance on all DON-supported research involving human subjects. Complete: - Complete revisions of all DON-authored modules hosted on the Collaborative Institutional Training Initiative (CITI) Program. - Complete finalization of draft SECNAVINST 3900.39F and submit for coordination. The revised SECNAVINST 3900.39F will implement recent updates to the revised Common Rule and DoD Instruction 3216.02, thereby ensuring compliance across the navy and Marine Corps research enterprise. Initiate: - Develop the Research Protection Community of Excellence to share best practices across the DON research protection enterprise.					
FY 2024 Base Plans: Continue: - Establish five new human research protection programs (HRPP). - Program Management of the DON Research Protections Information Technology Management System (RPITMS) for management and compliance oversight of ongoing human research protections activities. - Continue providing education and training programs in human research ethics to all levels of staff involved in the review, approval, conduct, support or management of DON human subjects research. - Provide subject matter expertise and guidance on all DON-conducted and -supported research involving human subjects. - Continue developing the Research Protection Community of Excellence to share best practices across the DON research protection enterprise. - Conduct site visits (site inspections and assist visits) to Navy and Marine Corps Commands as part of the ongoing monitoring and quality improvement program for human research protections within the Department of					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
the Navy and in accordance with 32 CFR 219, DoD Instruction 3216.02, and Secretary of the Navy Instruction (SECNAVINST) 3900.39E CH-1. - Revise all human research protection program standard operating procedures to make consistent with 32 CFR 219, DoD Instruction 3216.02 and SECNAVINST 3900.39E CH-1. Initiate: - Review and revise the Office of Naval Research Instruction 3900.39B, "Protection of Human Subjects", bringing it into compliance with 32 CFR 219 and DoD Instruction 3216.02. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY2023 to FY2024.					
Title: Medical and Human Performance Technologies	8.518	8.790	8.953	0.000	8.953
Description: The overall objective of this activity is to sustain, extend, enhance, and repair warfighter endurance, resiliency and readiness while operating in multi-domain and expeditionary environments. This Activity includes two program areas: medical and human performance research. Efforts categorized as Human Performance Technologies focus on research before injury. Efforts categorized as Medical Technologies focus on research after injury. The human performance portion of this applied research activity centers on: improving performance of divers and submarine crews; developing biological markers of stress response; protecting warfighter performance and preventing injuries during exposure to high levels of acoustic or electromagnetic energy; and wearable physiological sensors to support safety and survivability of Naval forces during training and in operational environments. Results from these efforts will enhance readiness and lethality and will inform operational safety guidelines. The medical portion of this applied research activity addresses naval-unique threats and centers on: protecting warfighters from operational health threats; developing diagnostic and treatment capabilities for use in operational environments; and prototyping new capabilities to recover injured warfighters. Results from these efforts will improve the Fleet's ability to save lives, especially during prolonged field care.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
FY 2023 Plans: Medical Technologies: Continue: - Explore use of novel technologies including: nanotechnologies, microelectronics, artificial intelligence, non-invasive sensors, multifunctional materials and systems and protective equipment for improved warfighter survivability. - Mature application and treatment methods for novel anti-infectives for improved wound care. - Use modeling, microelectronics and novel composite materials for biomedical sensing and therapeutic care to prototype equipment (e.g., helmet system) to protect, sense, respond, and enhance human performance. - Conduct applied research to improve casualty care using autonomy and 'smart' systems with a focus on autonomous recovery of impaired/injured personnel during operations ashore and afloat. Complete: N/A Initiate: - Translate physics-based principles to prototypes for measuring material properties of biological tissues. Human Performance Technologies: Continue: - Conduct applied research to develop noise exposure and mitigation strategies, including communication technologies, sound localization, and noise mitigation strategies. - Applied research to determine biomedical effects of electromagnetic energy exposures. - Applied research to identify and validate countermeasures that prevent and mitigate the safety risks of decompression sickness, oxygen toxicity, and maintain a healthy metabolic balance for diver energy requirements to advance safe and optimized performance. - Applied research to develop novel biological sensors that autonomously monitor warfighter performance and physiology (e.g., analytes, blood pressure, heart rate, arterial saturation) in real-time. - Applied research to reduce high performance tactical jet noise through the evaluation of Noise Reduction Concepts. - Develop lab scale capability for the purpose of investigating jet noise at afterburner conditions. - Applied research to investigate approaches to excite natural instability wave of the jet flow. Complete: - The following effort resulted from the FY22 plan to continue applied research to develop countermeasures that prevent and mitigate the safety risks of decompression sickness, oxygen toxicity, and supplement metabolic					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
diver energy requirements to advance safe and optimized performance. The completed portion of this effort includes research on the ketogenic diet and supplementation transitioned to advanced development. - Research to develop diagnostic tools for identification of auditory injuries. - Transition successful novel biological and physiological sensor prototypes for performance and task-based outcomes to advanced development. Initiate: - Research on the feasibility of new underwater ultrasound devices to generate individualized and deterministic decompression profiles. - Applied research for the feasibility of providing spatial auditory information to enhance understanding of visual events occurring in operational settings. - Research to validate stress reactivity predictors in a military population to support the development of a performance prediction tool. - Explore large data sets of human biology and physiology to enhance algorithms underlying human performance sensor technologies. - Research studies on using the afterburner to reduce noise during take-off.					
FY 2024 Base Plans: Medical Technologies Continue: - Explore use of novel technologies to improve warfighter survivability in the maritime domain including: nanotechnologies, microelectronics, artificial intelligence, non-invasive sensors, multifunctional materials and systems and protective equipment. - Use modeling, microelectronics and novel composite materials for biomedical sensing and therapeutic care to prototype equipment (e.g., helmet system) to protect, sense, respond, and enhance human performance. - Conduct applied research on autonomous recovery of impaired/injured personnel during operations ashore and afloat to improve casualty care. Complete: - Development of novel anti-infectives for improved wound care. Initiate: - Develop field ready bandages using mature novel anti-infective wound care technology. - Assess feasibility of using physics-based principles to understand the constitutive properties of biological tissues to support human digital twin representations.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Human Performance Technologies Continue: - Applied research on communication technologies to enhance warfighter performance, including auditory cuing and alerting. - Investigate biomedical effects of electromagnetic energy exposures - Applied research to identify and validate capabilities that prevent and mitigate the safety risks of decompression sickness and oxygen toxicity. - Applied research to maintain a healthy metabolic balance for diver energy requirements to advance safe and optimized performance. - Applied research on the feasibility of new underwater ultrasound devices to generate individualized and deterministic decompression profiles to reduce the risk of decompression sickness. - Assess feasibility of using predictors of stress in a military population to understand the parameters for developing a performance prediction tool. - Applied research to reduce high performance tactical jet noise through the evaluation of noise reduction concepts. - Applied research to investigate approaches to excite natural instability wave of the jet flow. Complete: - Research on the spleen size as a function of modified breath control. This effort resulted from the FY23 plan to continue applied research to develop countermeasures that prevent and mitigate the safety risks of decompression sickness, oxygen toxicity, and supplement metabolic diver energy requirements to advance safe and optimized performance. - Applied research to develop novel biological sensor hardware that autonomously monitor warfighter performance and physiology (e.g., blood pressure, heart rate) in real-time. - Exploration of large data sets of human biology and physiology to enhance algorithms that will improve sensors that monitor human performance. - Development of lab scale capability for the purpose of investigating jet noise at afterburner conditions. Initiate: -Development of a novel biologic prophylactic and therapeutic for decompression sickness using an anti-inflammatory protein. - Applied research to develop novel augmented reality platforms that will autonomously track/display environmental factors and hazards for warfighters operating in environments with low or no visibility, and enhance warfighter performance in such scenarios. - Theoretical and computational study of jet noise control.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Evaluation of active control of jet noise via bi-modal excitation. - Resonance prediction and mitigation in rectangular twin-jets. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY2023 to FY2024.					
Title: The Office of Naval Research Global ***Description:*** Supports the Office of Naval Research (ONR) Global mission to serve as the preeminent external facilitator for the Naval Research Enterprise. This is accomplished by establishing quality, relevant connections between the international research and development community, Naval fleet/forces, DOD, other US Government agencies and international partners. Science Advisors (SA) This effort ensures that the operational Naval fleet/force help shape the DON investment in science and technology (S&T), develops teaming relationships to rapidly prototype, experiment, demonstrate and transition technology, supports development of technology-based capability options for Naval forces, and enables warfighting innovations based on technical and conceptual possibilities. The SA Program also informs capability-based war games using current and future technology to identify future capability strengths and shortfalls that assist in shaping the DON investment strategy. The ONR Global SA Program enables continuous communication and collaboration between the warfighters, the Naval Research & Development Enterprise, and strategic development commands. International science The ONR Global mission is also accomplished through PhD-level scientists located in Asia, Australia, Europe and South America, providing coverage in these regions as well as Africa, Indo-Pacific and the Middle East. ONR Global scientists actively search the globe for emerging scientific research and promising technologies, collaborating with international organizations and researchers through liaison visits and grants in innovative applied research. The direct impact of this investment is to leverage international research during increasingly dynamic global interdependence and improve the ability to solve DON S&T challenges through shared knowledge and technologies with partners. In addition, this investment builds global S&T awareness to	20.417	21.321	21.794	0.000	21.794

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
reduce the risk of potential technological surprise, and supports theater security cooperation goals to sustain cooperative relationships with an expanding set of international partners. International engagement ONR Global also supports international engagement with partner nations through the development and maintenance of bilateral and multilateral relationships, international agreements, and other activities that promote RDT&E collaboration and interoperability. ***FY 2023 Plans:*** Continue to: - Support all Science Advisor program efforts across Fleet and Forces Commands; objectively assess placement of current Science Advisors and requests for additional support in terms of impact to the Fleet and S&T return on investment. - Support PhD-level scientists, in multiple overseas deployed locations (Asia, Europe, South America, and Australia) by continuing to engage with international scientists and engineers through liaison visits to research institutions and continue actively fostering international collaboration by awarding research grants. Maintain and report on global technical awareness. - Support international engagement with ten partner nations, three multi-lateral groups, and support to the Northern Atlantic Treaty Organization (NATO), in order to increase collective Naval capability, capacity, and interoperability. ***FY 2024 Base Plans:*** Continue to: - Support all Science Advisor program efforts across Fleet and Forces Commands; objectively assess placement of current Science Advisors and requests for additional support in terms of impact to the Fleet and S&T return on investment. - Support PhD-level scientists, in multiple deployed overseas locations (Asia, Europe, South America, and Australia) to engage with international scientists and engineers through visits to research institutions and actively foster international collaboration by awarding research grants. Maintain and report on global technical awareness.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Support international meetings and agreements with ten partner nations, three multi-lateral groups, and the North Atlantic Treaty Organization (NATO), in order to increase collective Naval capability, capacity, and interoperability. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY2023 to FY2024.					
Title: Training Technologies ***Description:*** Applied research to enhance the ability to develop Naval forces from time of recruitment through separation from the military capable of competing and succeeding against novel threats and using novel, rapidly-fielded, technologies. This includes use of modern approaches for evaluation of knowledge, skills, and aptitude in school houses, field training, and point-of-need. Improved effectiveness is achieved by applying psychometric theory, data science, cognitive science, operations research, modeling and simulation, and computer sciences to the development, delivery, evaluation, and execution of training and education. Emphasis is on approaches that are robust at scale and can be implemented in a resource-constrained environment. ***FY 2023 Plans:*** Technologies for Naval Training: Continue: - Mature immersive environments (multi-player game) to train unit commanders in decision making, tactics, and strategies. - Expand new methods and techniques for enhancing problem solving ability of autonomous, artificial intelligence agents. - Develop methods and techniques to identify individual differences to optimize training. - Continue to mature game technology to build innovative job-performance and decision-aids using augmented reality. - Conduct applied research on learning-based techniques to improve decision-making and develop warfighters who are able to integrate and adapt to new technologies and threats. Complete: The following efforts resulted from the investment described in the FY21 and FY22 plans for this program:	4.867	5.023	5.118	0.000	5.118

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Research on the design of an electronic tutor to be transitioned to a Navy nuclear power technical school. - Research to design a tool for Navy recruiting. - Efforts to map knowledge and skills required to fight and win in future conflicts with unmanned ground robotic systems. Initiate: - Apply new methods for tailored training that exploits artificial intelligence agents. - Develop new techniques for obtaining and sharing of knowledge to improve individual and team performance in Naval applications. - Mature digital intelligent tutor technologies (e.g., reading tutor) by enhancing tutors ability to characterize and diagnose students errors and provide appropriate real-time remediation. - Incorporate Naval social/cultural norms into senior leadership models to inform training. - Effort to develop immersive environments (multi-player game) to train unit commanders in decision making, tactics, and strategies. Advanced Integrated Maritime Mission Modeling: Continue: - Expand work on Live-Virtual-Constructive simulation-based training technologies for Anti-submarine Warfare to include a greater range of simulated target types, behaviors, and scenarios. - Create training technologies to mitigate the effects of denied / degraded environments as well as cyber incursions on combat effectiveness. Complete: - The following effort resulted from the FY22 plan to create training technologies to enhance the ability of shipboard operators, supervisors and crypto-technicians to rapidly detect cyber incursions into their radar, GPS, radio, and remote imaging systems, and to efficiently mitigate the effects of these incursions on combat effectiveness. The completed portion of this effort includes training tools to detect cyber incursions in radar, Global Positioning System (GPS), radio, and remote imaging systems for shipboard operators, supervisors and crypto-technicians. Initiate: - Leverage work on Live, Virtual, and Constructive simulation-based training technologies for coordinated United Stated Marine Corps and United States Navy Strike Warfare in Naval Expeditionary Advanced Based Operations (EABO).					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Investigate the application of Adaptive Training methodologies into both shore and ship-based training curricula for Anti-Submarine Warfare. Learning to Integrate and Adapt to New Naval Technologies and Threats Initiate: - Applied research for learning-based techniques to improve decision-making and develop warfighters who are able to integrate and adapt to new Naval technologies and threats. Focus is on the delivery of interventions to representative populations and evaluation of such interventions. Emphasis is on tailored and scalable strategies. ***FY 2024 Base Plans:*** Technologies for Naval Training Continue: - Applied research on using immersive environments (multi-player game) to train unit commanders in decision making, tactics, and strategies. - Assess methods and techniques to identify individual differences to optimize training. - Study use of game technology and augmented reality to enhance job-performance and support decision making. - Applied research on learning-based techniques to improve decision-making and develop warfighters who are able to integrate and adapt to new technologies and threats. - Investigate new methods to use artificial intelligence to tailor training to the individual warfighter's needs. - Assess new techniques for obtaining and sharing of knowledge to improve individual and team performance in Naval environments. - Investigate approaches that enable digital intelligent tutor technologies to characterize and diagnose students errors and provide appropriate real-time remediation. - Assess feasibility of incorporating models of Naval social/cultural norms to enhance leadership training. Complete: - Expand new methods and techniques for enhancing problem solving ability of autonomous, artificial intelligence agents. Findings have supported associated applied research in AI. Advanced Integrated Maritime Mission Modeling Continue: - Assess feasibility of training technologies to mitigate the effects of denied / degraded environments as well as cyber incursions on combat effectiveness.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Investigate Live, Virtual, and Constructive simulation-based training technologies for Naval Expeditionary Advanced Based Operations (EABO). - Applied research on adaptive/individualized training techniques for shore and ship-based Live, Virtual, and Constructive Anti-Submarine Warfare and Navigation Team Training. Complete: - Studies on Live, Virtual, and Constructive simulation-based training technologies for Anti-Submarine Warfare to include a greater range of simulated target types, behaviors, and scenarios, transitioning to OPNAV N96/Fleet Training Wholeness Program. Initiate: - Applied research to understand performance metrics, data collection techniques, and analysis approaches that can be used to assess warfighter readiness across Carrier Strike Groups. - Investigate individualized cyber training in Live, Virtual, and Constructive shipboard environments. Learning to Integrate and Adapt to New Naval Technologies and Threats Continue: - Applied research on tailorable and scalable capabilities to improve decision-making and develop warfighters who are able to integrate and adapt to new Naval technologies and threats. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY2023 to FY2024.					
Accomplishments/Planned Programs Subtotals	68.102	70.957	74.722	0.000	74.722

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy												Date: March 2023
Appropriation/Budget Activity 1319 / 2					R-1 Program Element (Number/Name) PE 0602236N / *Warfighter Sustainment Applied Res*				Project (Number/Name) 9999 / *Congressional Adds*			
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
9999: *Congressional Adds*	0.000	46.579	50.750	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	97.329

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Congressional Add: Polymer coatings for reduced ice and fouling adhesion	4.827	5.000
FY 2022 Accomplishments: Analyze solids shedding mechanisms resulting in an improvement to ice release capabilities of Navy topside coatings and the biofouling release capabilities of Navy below the water line antifouling coatings.		
FY 2023 Plans: Analyze solids shedding mechanisms resulting in an improvement to ice release capabilities of Navy topside coatings and the biofouling release capabilities of Navy below the water line antifouling coatings.		
Congressional Add: Health and Safety Research of Underground Fuel Storage Facilities	4.827	0.000
FY 2022 Accomplishments: Develop plans and evaluate technologies to improve the health and safety of the underground Red Hill Fuel Storage Facility in Hawaii, and other underground fuel storage tanks in the Asia-Pacific AOR. Perform research for fuel tank inspect and repair protocols; advanced microscope analysis of tank corrosion products; concrete tank degradation inspection and retrofit; and advanced nanomaterials coating.		
FY 2023 Plans: Develop plans and evaluate technologies to improve the health and safety of the underground Red Hill Fuel Storage Facility in Hawaii, and other underground fuel storage tanks in the Asia-Pacific AOR. Perform research for fuel tank inspect and repair protocols; advanced microscope analysis of tank corrosion products; concrete tank degradation inspection and retrofit; and advanced nanomaterials coating.		
Congressional Add: Hypersonics Material Acceleration	4.827	5.000
FY 2022 Accomplishments: This funding is anticipated to use the membership and resources of the LIFT Institute to increase the manufacturing base for the US hypersonics industrial base. The work will focus on additive processing of large 3D structures, joining of dissimilar metals, establishment of powder supply chain for refractory metal alloys, and ICME tools leading to the development of new materials and processes, as well as characterization of existing materials and prediction of properties for future materials.		
FY 2023 Plans: Conduct Hypersonics Material Acceleration research.		
Congressional Add: Physics Based Neutralization of Threats to Human Tissues and Organs	4.827	10.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
FY 2022 Accomplishments: Conduct research into a multiscale, physics-based approach to for use in preventing and mitigating both mild traumatic brain injuries (mTBIs) and blast-induced traumatic brain injuries (bTBIs). Preventing and mitigating bTBI and mTBI requires advancing the understanding of injury at a cellular level, as the exact force magnitudes and directions that initiate TBI at the cellular scale are still unknown. Knowledge of neuronal TBI thresholds is a critical and currently missing component of developing improved protective equipment, as well as equipment that addresses the full range of injury. ***FY 2023 Plans:*** Research multiscale, physics-based approach to understanding traumatic brain injury. This research is essential for preventing and mitigating both mild traumatic brain injury (mTBI), directed energy TBI (DE-TBI) and blast TBI (bTBI).		
Congressional Add: Advanced nanocomposite coatings ***FY 2022 Accomplishments:*** Conduct applied research in advanced nanocomposite coatings ***FY 2023 Plans:*** N/A	5.792	0.000
Congressional Add: Anticorrosion nanotechnology ***FY 2022 Accomplishments:*** Conduct applied research supporting anticorrosion nanotechnology ***FY 2023 Plans:*** Conduct applied research supporting anticorrosion nanotechnology.	7.240	10.000
Congressional Add: Development of chromate-free corrosion inhibitor coatings for marine application ***FY 2022 Accomplishments:*** Conduct applied research for development of chromate-free corrosion inhibitor coatings for marine application ***FY 2023 Plans:*** Conduct applied research for development of chromate-free corrosion inhibitor coatings for marine application.	1.689	1.750
Congressional Add: Engineered systems to preserve and restore hearing ***FY 2022 Accomplishments:*** Conduct applied research in engineered systems to preserve and restore hearing ***FY 2023 Plans:*** N/A	4.827	0.000
Congressional Add: Human digital twin ***FY 2022 Accomplishments:*** Conduct applied research supporting human digital twin ***FY 2023 Plans:*** N/A	2.896	0.000
Congressional Add: High mobility ground robots to assist dismounted infantry in urban operations	4.827	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
FY 2022 Accomplishments: Conduct applied research for high mobility ground robots to assist dismounted infantry in urban operations ***FY 2023 Plans:*** N/A		
Congressional Add: Biomaterial exterior for hypersonic projectable ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct biomaterial exterior for hypersonic projectable research.	0.000	5.000
Congressional Add: Wearable sensors for injury predicition ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Research wearable sensors for injury prediction.	0.000	5.000
Congressional Add: Long-term underwater autonomy ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct long-term underwater autonomy research.	0.000	5.000
Congressional Add: Ultra-compact heat exchangers ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct research on ultra-compact heat exchangers.	0.000	4.000
Congressional Adds Subtotals	46.579	50.750

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602271N *I Electromagnetic Systems Applied Research*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	89.120	131.288	92.473	-	92.473	95.693	97.614	99.573	100.922	Continuing	Continuing
0000: *Electromagnetic Systems Applied Research*	0.000	83.328	92.288	92.473	-	92.473	95.693	97.614	99.573	100.922	Continuing	Continuing
9999: *Congressional Adds*	0.000	5.792	39.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	44.792

A. Mission Description and Budget Item Justification

Freedom of maneuver on a global scale for U.S. naval forces depends upon assured access to the electromagnetic spectrum and the ability to deny adversary exploitation. Electromagnetic technologies must fluidly deliver communication, surveillance electronic warfare and digital integration to understand, shape and defend the battlespace. The Electromagnetic Systems Applied Research Program addresses technology needs associated with Naval platforms for new capabilities in Electro-Optic and Infrared (EO/IR) Sensors, Surveillance, Electronic Warfare, Navigation, Solid State Electronics, Vacuum Electronics Power Amplifiers, and Nanoelectronics. The program supports development of technologies to enable capabilities in Missile Defense, Directed Energy, Platform Protection, Time Critical Strike, and Information Distribution. Activities and efforts within this Program have attributes that focus on enhancing the affordability of warfighting systems.

Today's Sailors and Marines are enabled by Naval Science and Technology (S&T). Since 1946, the Office of Naval Research (ONR) has fostered scientific research related to the maintenance of maritime superiority and national defense. ONR manages the Department of the Navy's (DON) portfolio of naval Basic and Applied research, and Advanced Technology Development investments to ensure naval forces can effectively deter conflict, but when called upon, fight, win and come home safe. Current investments hedge against uncertainty, providing solutions to commanders today, and options for the future. The Naval S&T budget supports higher guidance defined by the National Defense Strategy, and responds to requirements identified by the Secretary of the Navy through research priorities set by the Chief of Naval Research, coordinated across the Naval Research Enterprise (NRE), and outlined in the Naval R&D Framework.

This Program Element (PE) funds Applied Research, which is the systematic study to understand the means to meet a recognized and specific need. Most of the work in this PE can be classified between Technology Readiness Level (TRL) 2 (technology concept and/or application formulation) and TRL 4 (component and/or breadboard validation in laboratory environments).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602271N *I Electromagnetic Systems Applied Research*

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	91.041	92.444	94.160	-	94.160
Current President's Budget	89.120	131.288	92.473	-	92.473
Total Adjustments	-1.921	38.844	-1.687	-	-1.687
• Congressional General Reductions	-	-0.156			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	39.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.921	0.000			
• Program Adjustments	0.000	0.000	-1.687	-	-1.687
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 9999: *Congressional Adds*		
Congressional Add: *Dark Swarm in Degraded Environments*	5.792	0.000
Congressional Add: *Submerged electro-optical adaptive littoral sensor (SEALS) system prototypes*	0.000	5.000
Congressional Add: *Advanced antenna technology*	0.000	6.000
Congressional Add: *Dark swarm in degraded and denied enviorments*	0.000	6.000
Congressional Add: *Mini-full spectrum hyperspectral sensors for IEDs*	0.000	7.000
Congressional Add: *Open systems architecture for electronic warfare chiplets*	0.000	15.000
Congressional Add Subtotals for Project: 9999	5.792	39.000
Congressional Add Totals for all Projects	5.792	39.000

Change Summary Explanation

Financial: $1.687M reduction includes realignment of funds to higher priority S&T research.

Technical: No significant change.

Schedule: No significant change.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602271N / *Electromagnetic Systems Applied Research*	Project (Number/Name) 0000 / *Electromagnetic Systems Applied Research*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
0000: *Electromagnetic Systems Applied Research*	0.000	83.328	92.288	92.473	-	92.473	95.693	97.614	99.573	100.922	Continuing	Continuing

A. Mission Description and Budget Item Justification

Freedom of maneuver on a global scale for U.S. naval forces depends upon assured access to the electromagnetic spectrum and the ability to deny adversary exploitation. Electromagnetic technologies must fluidly deliver communication, surveillance electronic warfare and digital integration to understand, shape and defend the battlespace. This project addresses technology opportunities associated with Naval platforms for new capabilities in Electro-Optic and Infrared (EO/IR) Sensors, Surveillance, Electronic Warfare, Navigation, Solid State Electronics, Vacuum Electronics Power Amplifiers, and Nanoelectronics. The project supports development of technologies to enable capabilities in Missile Defense, Directed Energy, Platform Protection, Time Critical Strike, and Information Distribution. This project directly supports the Department of Defense Joint Warfighter Plan and the Defense Technology Area Plans. Activities and efforts within this program have attributes that focus on enhancing the affordability of warfighting systems. The program also provides for technology efforts to maintain proactive connectivity and collaboration between Department Of the Navy (DON) Science and Technology (S&T) and Joint, Navy, and Marine Corps commands worldwide. Due to the number of efforts in this Program Element (PE), the programs described herein are representative of the work included in this PE.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Electronic Warfare Technology	40.928	43.777	38.341	0.000	38.341
Description: The overarching objective of this activity is to develop technologies that enable the development of affordable, effective and robust Electronic Warfare (EW) systems across the entire Electromagnetic Spectrum (EMS) that will increase the operational effectiveness and survivability of U.S. Naval units. Technology development is focused on Distributed Electronic Warfare in support of Distributed Maritime Operations. Emphasis is placed on passive sensors and active and passive Countermeasure (CM) systems that exploit and counter a broad range of electromagnetic threats. The focus is on maintaining near perfect, real-time knowledge of the enemy; countering the threat of missiles against deployed Naval forces; precision identification and location of threat emitters; and development of technologies that have broad application across multiple disciplines within the EW mission area. This activity also includes developments to protect these technologies from external interference, and modeling and simulation required to support the development of these technologies. The current objectives are: - Electronic Warfare (EW) Radio Frequency (RF) Technology: Develop and demonstrate technologies in the RF spectrum (covering frequencies from kilohertz to terahertz) that include developments in detection, signal					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602271N / *Electromagnetic Systems Applied Research*	**Project (Number/Name)** 0000 / *Electromagnetic Systems Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
processing and passive/active techniques for wideband Electronic Attack (EA), Electronic Protection (EP) and the Electronic Support (ES) mission areas. - Electronic Warfare (EW) Electro-Optic/Infrared (EO/IR) Technology: Develop and demonstrate counter EO/IR technologies extending from the ultraviolet to the far infrared spectral bands. This includes advances in multispectral sensors, multiband sources, beam forming/steering, and signal processing and transmission. - EW Integrated and Networked Technology: Develop and demonstrate technologies that will enable an increased situational awareness and response across the Electromagnetic Spectrum (EMS) with broad spatial coverage using all available EW assets to provide coordinated, adaptive and networked EW sensing, protection and attack. - Advanced EW Enabling Technologies: Develop classified advanced electronic warfare technology in support of current and predicted capability requirements emphasizing distributive effects. ***FY 2023 Plans:*** Electronic Warfare (EW): - Complete early development and demonstrate implementation of Artificial Intelligence (AI) algorithms and deep learning techniques for adaptive Electronic Attack (EA) and Electronic Support (ES) applications on new AI compute processing architectures developed for Electronic Warfare (EW) applications. - Continue research in federated, coordinated, and integrated Electronic Warfare (EW) systems for the development of distributed Electronic Warfare (EW) technologies for Electronic Surveillance (ES), decoys and countermeasures, and Electronic Attack (EA) against adversary Command, Control, Communications, Computers, Intelligence, Surveillance, Reconnaissance and Targeting (C4ISRT). This EW research includes Electronic Protection (EP) for our own weapons and Command, Control, Communications, Computers, Cyber Defense, Intelligence, Surveillance and Reconnaissance (C5ISR) systems allowing them to operate in a heavily contested environment. - Continue research into developing AI-generated tactics against modern and emerging radar sources to improve naval mission effectiveness. - Continue research and development in the area of hard-kill and soft-kill coordination and planning. - Continue research into simultaneous multi-spectral (Radio Frequency (RF) and optical) countermeasure development to increase survivability across the entire electromagnetic spectrum and continue development of coordinated EW techniques between RF and Electro-Optic/Infrared (EO/IR) transmitters and receivers for single and distributed platforms. - Continue development and implementation of combined EW and cyber effects to increase the reach and effectiveness of each domain in support of distributed maritime operations.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue the development of artificial intelligence algorithms to automatically classify tracks for an advanced weapons system and to distinguish anomalous targets, which have not been previously seen by the combat system. - Continue the development of a quantitative understanding of the relationship between laser fluence profiles and resultant emission, determine to what extent fluctuation in irradiance and fluence profile affects spatial, temporal, and spectral characteristics of generated emission and demonstrate improved quantitative prediction of effects in laboratory and at range based upon deeper understanding. - Continue the development of a variable-ratio coupler approach to phase demodulation, allowing for the active tuning of a photonics based processor. Electromagnetic Warfare: - Continue diverse research spanning multiple projects across a broad spectrum of RF and EO/IR technologies that cover the detection of energy in the environment to the formulation of active and passive engagement techniques. - Continue efforts with focus on near-real-time geolocation of stationary (or slowly moving) RF emitters, and in particular, emerging threat radars employing unusual waveforms resulting in accurate geolocation. - Continue novel real-time signal processing techniques to dramatically increase the useful information content reported in receiver measurements of radar-band signals providing the warfighter with a low-ambiguity warning of detection. - Continue efforts to improve the effectiveness of emitter classification of modern radars for several functions including Automated Identification Systems (AIS) validation increasing Maritime Domain Awareness. - Continue research applying recently developed machine learning methods to the problem of functional classification of radar emissions and demonstrate the ability to perform the functional classification in real time to overcome the inadequacy conventional emitter classification methods. - Continue efforts focused on discovering and defeating unknown and adaptive radios by developing algorithms to observe their behavior, analyze their networking protocols, and optimize engagement techniques to interfere with their objectives. - Continue research to develop and demonstrate high gain distributed aperture technologies compatible with micro-jammer glide vehicles to increase the effective radiated power of a ground-based micro-jammer constellation to provide sufficient power to radars. - Continue development and demonstration of an evolvable Electronic Warfare (EW) transceiver design that optimizes cuing receiver processing to increase situational awareness and enable adaptive electronic attack					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
response in complex electromagnetic environments to provide effective processing of emergent complex radar modes. - Initiate the development of technology and waveforms to detect the emissions of and deny launch platform targeting radars and/or anti-ship missile seekers the capability to acquire and track ship targets across the electromagnetic spectrum.					
FY 2024 Base Plans: Electronic Warfare (EW): - Complete the development of a quantitative model to understand the relationship between laser fluence profiles and resultant emission; developed model will help determine to what extent fluctuation in irradiance and fluence profile affects spatial, temporal, and spectral characteristics of generated emission and demonstrate improved quantitative prediction of effects in laboratory and at range based upon a deeper understanding of laser-material interactions. - Complete the development of a variable-ratio coupler approach to phase demodulation , allowing for the active tuning of a photonics based processor. - Continue research in federated, coordinated, and integrated Electronic Warfare (EW) systems for the development of distributed EW technologies for Electronic Surveillance (ES), decoys and countermeasures, and Electronic Attack (EA) against adversary Command, Control, Communications, Computers, Intelligence, Surveillance, Reconnaissance and Targeting (C4ISRT). This EW research includes Electronic Protection (EP) for our own weapons and Command, Control, Communications, Computers, Cyber Defense, Intelligence, Surveillance and Reconnaissance (C5ISR) systems allowing them to operate in a heavily contested environment. - Continue research into developing Artificial Intelligence (AI)-generated tactics against modern and emerging radar sources to improve naval mission effectiveness. - Continue research and development in the area of hard-kill and soft-kill coordination and planning. - Continue research into simultaneous multi-spectral (Radio Frequency (RF) and optical) countermeasure development to increase survivability across the entire electromagnetic spectrum and continue development of coordinated EW techniques between RF and Electro-Optic/Infrared (EO/IR) transmitters and receivers for single and distributed platforms. - Continue development and implementation of combined EW and cyber effects to increase the reach and effectiveness of each domain in support of distributed maritime operations.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue the development of artificial intelligence algorithms to automatically classify tracks for an advanced weapons system and to distinguish anomalous targets, which have not been previously seen by the combat system. - Initiate research into distributed EA techniques to develop advanced, coordinated countermeasures against the entire kill chain from far left of launch through terminal phase; components of this research will also include hardware/software payload re-configurability, multi-functionality and heterogeneity in low size, weight and power formats. Electromagnetic Warfare: - Complete diverse research spanning multiple projects across a broad spectrum of RF and EO/IR technologies that cover the detection of energy in the environment to the formulation of active and passive engagement techniques. - Complete efforts with focus on near-real-time geolocation of stationary (or slowly moving) RF emitters, and in particular, emerging threat radars employing unusual waveforms resulting in accurate geolocation. - Complete novel real-time signal processing techniques to dramatically increase the useful information content reported in receiver measurements of radar-band signals providing the warfighter with a low-ambiguity warning of detection. - Complete efforts to improve the effectiveness of emitter classification of modern radars for several functions including Automated Identification Systems (AIS) validation increasing Maritime Domain Awareness. - Complete research applying recently developed machine learning methods to the problem of functional classification of radar emissions and demonstrate the ability to perform the functional classification in real time to overcome the inadequacy conventional emitter classification methods. - Complete efforts focused on discovering and defeating unknown and adaptive radios by developing algorithms to observe their behavior, analyze their networking protocols, and optimize engagement techniques to interfere with their objectives. - Complete research to develop and demonstrate high gain distributed aperture technologies compatible with micro-jammer glide vehicles to increase the effective radiated power of a ground-based micro-jammer constellation to provide sufficient power to radars. - Complete development and demonstration of an evolvable Electronic Warfare (EW) transceiver design that optimizes cuing receiver processing to increase situational awareness and enable adaptive electronic attack response in complex electromagnetic environments to provide effective processing of emergent complex radar modes.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue the development of technology and waveforms to detect the emissions of and deny launch platform targeting radars and/or anti-ship missile seekers the capability to acquire and track ship targets across the electromagnetic spectrum. - Initiate efforts into the development of a novel, high-power, Ultra-Wideband (UWB), Ka-band pulse source to prove the utility and effectiveness of unique UWB waveforms for multi-spectral defeat of Radio-Frequency (RF) multi-mode threat systems through modeling, simulation, and measurement. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** FY 2023 to FY 2024 decrease is due to higher-level requirements in physical oceanography, ocean acoustics, and Intelligence, Surveillance, Reconnaissance, Target Electro Optical/Infrared and (ISRT-EO/IR) research. Funds realigned to PE 0602435N and Activities Physical Oceanography and Task Force Ocean; and funds realigned within PE 0602271N to Activities Surveillance Technology and EO/IR Sensor Technologies.					
Title: EO/IR Sensor Technologies ***Description:*** The overarching objective is to develop technologies that enable affordable, wide area, persistent surveillance optical architectures. Included are modeling and simulation required to support the development of these technologies. Efforts will also include the development of optical Radio-Frequency (RF) components, infrared technologies including lasers and focal plane arrays using narrow bandgap semiconductors. The current specific objectives are: - Optically Based Terahertz (THz) and Millimeter Wave (MMW) Distributed Aperture Systems: Develop Optically Based Terahertz (THz) and Millimeter Wave distributed aperture systems for imaging through clouds, fog, haze and dust on air platforms. - Wide Area Optical Architectures: Develop wide area optical architectures for persistent surveillance for severely size constrained airborne applications. - Hyperspectral sensors and processing: Develop visible, shortwave Infrared (IR), mid-wave IR, and long-wave IR hyperspectral sensors, along with processing algorithms to detect anomalies and targets. - Coherent Laser Radar (LADAR): Develop and improve components for LADAR applications including fiber lasers, coherent focal planes, and advanced processing.	7.062	7.887	12.682	0.000	12.682

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Autonomous and Networked sensing: Develop algorithms and processing that supports autonomous sensing for Unmanned Autonomous Vehicles (UAV) platforms and that supports networked sensing over multiple sensors and/or sensor platforms. ***FY 2023 Plans:*** EO/IR Sensor Technologies: - Complete demonstration and test performance of previously developed sensitive passive Millimeter Wave (MMW) detectors for detection of targets in degraded visual environments (e.g., clouds, fog, haze and dust) and explore extending capability to sparse apertures to increase resolution. - Continue to develop novel techniques for Electro-Optic/Infrared (EO/IR) countermeasures to detect, track and/or jam sensors. - Continue demonstration and test real-time combat Identification (ID) algorithms for detecting and tracking simultaneous targets from networked, high-resolution, wide field of view, and persistent surveillance systems. - Continue work on active imaging laser systems to significantly extend operational range and imaging capabilities in degraded conditions (e.g., dense maritime fog). - Continue efforts to develop and test optical architectures to demonstrate simultaneous wide Field Of View (FOV) and high-resolution imaging for search, detection, classification, identification and targeting functions. - Continue research and development of novel ISR and counter-ISR applications with tailored optical beams. - Initiate research into extreme low light imaging cameras built using low-cost Si foundry services as a way to provide all domain imaging for some missions or platforms that can't afford infrared sensors. Electromagnetic Warfare: - Continue development of Electro-Optical/Infra-Red (EO/IR) and Radio Frequency (RF) technologies to improve imaging, target identification, threat detection, and engagement capabilities for the war fighter. - Continue development and demonstration of a low Size Weight and Power (SWaP) transceiver laser system with high accuracy, covert detection, and threat wavelength discrimination using Non-Mechanical Beam Steering technology (NMBS). - Continue development and optimization of Resonant-Cavity Infrared Detectors (RCIDs) that provide higher sensitivity and reduced optical clutter systems using active imaging. - Initiate demonstration of new high performance single band Short-Wave (SW) and dual band SW/Mid-Wave (MW) Infrared (IR) sensors that will substantially improve the Navy's primary night & day maritime MWIR systems, which will show that a broad range of Naval MWIR imagers can be upgraded with a much more					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
capable monolithic SW/MWIR dual band sensor technology, with minimal impact on Size Weight and Power (SWaP) and system cost.					
FY 2024 Base Plans: EO/IR Sensor Technologies: - Continue to develop novel techniques for Electro-Optic/Infrared (EO/IR) countermeasures to detect, track and/or jam sensors. - Continue demonstration and test real-time combat Identification (ID) algorithms for detecting and tracking simultaneous targets from networked, high-resolution, wide field of view, and persistent surveillance systems. - Continue work on active imaging laser systems to significantly extend operational range and imaging capabilities in degraded conditions (e.g., dense maritime fog). - Continue efforts to develop and test optical architectures to demonstrate simultaneous wide Field Of View (FOV) and high-resolution imaging for search, detection, classification, identification and targeting functions. - Continue research and development of novel ISR and counter-ISR applications with tailored optical beams. - Continue research into extreme low light imaging cameras built using low-cost Si foundry services as a way to provide all domain imaging for some missions or platforms that can't afford infrared sensors. Electromagnetic Warfare: - Complete development and demonstration of a low Size Weight and Power (SWaP) transceiver laser system with high accuracy, covert detection, and threat wavelength discrimination using Non-Mechanical Beam Steering technology (NMBS). - Complete development and optimization of Resonant-Cavity Infrared Detectors (RCIDs) that provide higher sensitivity and reduced optical clutter systems using active imaging. - Continue development of EO/IR and Radio Frequency (RF) technologies to improve imaging, target identification, threat detection, and engagement capabilities for the war fighter. - Continue the demonstration of new high performance single band Short-Wave (SW) and dual band SW/Mid-Wave (MW) Infrared (IR) sensors. These sensors will substantially improve the Navy's primary night & day maritime MWIR systems, which will show that a broad range of Naval MWIR imagers can be upgraded with a much more capable monolithic SW/MWIR dual band sensor technology, with minimal impact on Size Weight and Power (SWaP) and system cost.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate efforts to demonstrate analog signals via free-space optical (FSO) channel with sufficient fidelity, coherence and timing accuracy for RF signals to be useful for Electronic Support Measure (ESM) functions. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase from FY 2023 to FY 2024 is due to increased emphasis in Intelligence, Surveillance, Reconnaissance, Target Electro Optical/Infrared and (ISRT-EO/IR) research. Funds realigned within PE 0602271N from Vacuum Electronics Power Amplifiers and Electronic Warfare Technology Activities.					
Title: Navigation Technology ***Description:*** The overarching objective of this activity is to develop technologies that enable the development of affordable, effective and robust Position, Navigation and Timing (PNT) capabilities using non-Global Positioning System (GPS) navigation devices, and atomic clocks. This project will increase the operational effectiveness of U.S. Naval units. Emphasis is placed on GPS Anti-Jam (AJ) Technology; Precision Time and Time Transfer Technology; and Non- GPS Navigation Technology (Inertial aviation system, bathymetry, gravity and magnetic navigation). The focus is on the mitigation of GPS electronic threats, the development of atomic clocks that possess unique long-term stability and precision, and the development of compact, low-cost Inertial Navigation Systems (INS). The following are non-inclusive examples of plans for projects funded in this activity. ***FY 2023 Plans:*** Navigation Technology: - Complete research on automated celestial navigation for submarine platforms to increase operational effectiveness. - Complete research on thermal atomic beam inertial capability to improve non-Global Positioning System (GPS) navigation. - Complete development of navigation capability using very low frequency signals. - Continue research on next generation atomic clocks to improve long-term stability and precision. - Continue development of earth magnetic anomaly maps for improved magnetic navigation. - Continue development of a gravity navigation system using a strap down gravimeter.	11.087	14.366	14.515	0.000	14.515

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate development of magnetic anomaly aided navigation systems. ***FY 2024 Base Plans:*** Navigation Technology: - Continue research on next generation atomic clocks to improve long-term stability and precision. - Continue development of a gravity navigation system using a strap-down gravimeter. - Continue development of earth magnetic anomaly maps for improved magnetic navigation. - Continue development of magnetic anomaly-aided navigation systems. - Initiate development of collaborative navigation capability using multiple tactical networks. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024.					
Title: Solid State Electronics	9.347	10.140	9.795	0.000	9.795
Description: The overarching objective of this activity is to develop higher performance components and subsystems for all classes of military Radio-Frequency (RF) systems that are based on solid state physics phenomena and are enabled by improved understanding of these phenomena, new circuit design concepts and devices, and improvements in the properties of electronic materials. An important subclass are the Very High Frequency (VHF), Ultra-High Frequency (UHF), Microwave (MW), and Millimeter Wave (MMW) power amplifiers for Navy all-weather radar, surveillance, reconnaissance, electronic attack, communications, and smart weapon systems. Another subclass are the analog and high speed, mixed signal components that connect the electromagnetic signal environment into and out of digitally realized, specific function systems. These improved components are based on both Silicon (Si) and compound semiconductors (especially the wide bandgap materials and narrow bandgap materials), low and high temperature superconductors, novel nanometer scale structures and materials. Components addressed by this activity emphasize the MMW and Submillimeter Wave (SMMW) regions with an increasing emphasis on devices capable of operating in the range from 50 Gigahertz (GHz) to 10 Terahertz (THz). The functionality of the technology developed cannot be obtained through Commercial-Off- The-Shelf (COTS) as a result of the simultaneous requirements placed on power, frequency, linearity, operational and instantaneous bandwidth, weight, and size. Effort will involve					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
understanding the properties of engineered semiconductors as they apply to quantum information science and technology. ***FY 2023 Plans:*** Solid State Electronics: - Complete efforts into Acoustoelectric Scandium Aluminum Nitride (ScAlN) Radio-Frequency (RF) Signal Processing Devices (T080-21) and Continuous 3D-Cooled Atom Beam Gyroscope. - Continue research of solid-state devices for high frequency analog and digital operation; high efficiency, highly linear amplifiers for microwave, millimeter-wave, low-noise, and power applications; superconducting and other technologies which are prototyped to demonstrate the ability of these components to deliver superior functionality in a system environment. - Continue development and transition of nitrogen-polar based High-Electron-Mobility Transistor (HEMT) technology for advanced linear receivers and efficient transmitters. - Continue development of new materials, devices, components, and circuits that apply quantum phenomena of entanglement, superposition and/or wave function correlation for performance not achievable by classical methods. - Continue integrated circuit technologies in conventional superconductors and Gallium Nitride (GaN) as platforms for quantum-based functional components. - Continue development of superconducting GaN/niobium nitride heterostructures for Josephson junctions and Millimeter Wave (MMW) resonator circuits. - Continue Millimeter Wave (MMW) to Terahertz (THz) plasmonic photomixer-based focal plane arrays for imaging systems. - Continue development of chip-scale, acoustic RF signal processing components, utilizing acoustoelectric effect with high internal gain, in the 1 to 18 Gigahertz (GHz) range using a ScAlN based device architecture with enhanced power handling up to 10 W. - Continue development of Phase-Change Material (PCM) based couplers with dynamically controllable coupling coefficients to create broadband, low loss, high-tap-count analog canceler filters to provide enhanced TX/RX isolation. - Initiate metal nitride heterostructure mm-wave device investigations. - Initiate relaxed III-nitride channel mm-wave N-polar device development. - Initiate investigations into high throughput, large-area nano-scale lithography for plasmonic devices.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate development of new types of quantum based sensors for the measurement of motion and fields, which combine high sensitivity with features that improve the practicality of the technologies, to include continuous, high-bandwidth measurement, and low Size Weight and Power (SWaP).					
FY 2024 Base Plans: Solid State Electronics: - Complete development of chip-scale, acoustic Radio-Frequency (RF) signal processing components, utilizing acoustoelectric effect with high internal gain, in the 1 to 18 Gigahertz (GHz) range using a ScAlN based device architecture with enhanced power handling up to 10 W. - Complete development of Phase-Change Material (PCM) based couplers with dynamically controllable coupling coefficients to create broadband, low loss, high-tap-count analog canceler filters to provide enhanced TX/RX isolation. - Complete research activity in high throughput, large-area nano-scale lithography for plasmonic devices. - Continue metal nitride heterostructure mm-wave device investigations. - Continue research of solid-state devices for high frequency analog and digital operation; high efficiency, highly linear amplifiers for microwave, millimeter-wave, low-noise, and power applications; superconducting and other technologies which are prototyped to demonstrate the ability of these components to deliver superior functionality in a system environment. - Continue development and transition of nitrogen-polar based High-Electron-Mobility Transistor (HEMT) technology for advanced linear receivers and efficient transmitters. - Continue development of new materials, devices, components, and circuits that apply quantum phenomena of entanglement, superposition and/or wave function correlation for performance not achievable by classical methods. - Continue integrated circuit technologies in conventional superconductors and Gallium Nitride (GaN) as platforms for quantum-based functional components. - Continue development of superconducting GaN/niobium nitride heterostructures for Josephson junctions and Millimeter Wave (MMW) resonator circuits. - Continue Millimeter Wave (MMW) to Terahertz (THz) plasmonic photomixer-based focal plane. - Continue relaxed III-nitride channel mm-wave N-polar device development. - Continue development of new types of quantum based sensors for the measurement of motion and fields, which combine high sensitivity with features that improve the practicality of the technologies, to include continuous, high-bandwidth measurement, and low Size Weight and Power (SWaP). (NRL)					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate low-cost substrate GaN technology for ubiquitous mm-wave transceivers deployment. - Initiate efforts into the flexible manufacturing of High Power Amplifiers using MicroElectronics Transfer-printed Assembly (META). (NRL) ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024.					
Title: Surveillance Technology ***Description:*** The overarching objective of this activity is to develop advanced sensor and sensor processing systems for continuous, high volume, theater-wide air and surface surveillance, battle group surveillance, real time reconnaissance and ship defense. Major technology goals include long-range target detection and discrimination, Target Identification (ID) and fire control quality target tracking in adverse weather, background clutter and electronic countermeasure environments, affordable apertures, distributed sensing systems, and includes modeling and simulation required to support the development of these technologies. The current specific objectives are: 1) Radar Architectures, Sensors, and Software which address Ballistic Missile and Littoral Requirement Shortfalls: Develop radar architectures, sensors, and software, which address Ballistic Missile and Littoral requirement shortfalls including: sensitivity; clutter rejection; and flexible energy management. 2) Algorithms, Sensor Hardware, and Signal Processing Techniques for Automated Radar Based Contact Mensuration and Feature Extraction: Develop algorithms, sensor hardware, and signal processing techniques for automated radar based contact mensuration and feature extraction in support of asymmetric threat classification and persistent surveillance to address naval radar performance shortfalls caused by man-made jamming and Electronic Counter Measures (ECM), unfavorable maritime conditions, and atmospheric and ionosphere propagation effects. 3) Software and Hardware for a Multi-Platform, Multi-Sensor Surveillance System: Develop software and hardware for a multi-platform, multi-sensor surveillance system for extended situational awareness of the battlespace. ***FY 2023 Plans:*** Surveillance Technology: - Continue efforts to develop affordable and scalable advanced antenna apertures.	13.143	14.087	15.744	0.000	15.744

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue efforts to develop electronics and signal processing to enable Radio Frequency (RF) agility and waveform diversity to provide enhanced capability to find, fix, track, target, and assess targets and threats as well as provide automatic target identification. - Continue research in the use of interferometric, polarimetric, RF agility, and sophisticated signal processing algorithms to enable the detection, geolocation, tracking, and identification of targets in harsh natural and man-made clutter and interference. - Continue efforts to develop methods to mitigate Electronic Attack (EA) and Electromagnetic Interference (EMI) to RF sensors and networks. - Continue development low-cost dielectric lens antennas and material resilience in high power transmitters. - Continue development of hardware and software for arbitrary waveform generation for agile radar systems. - Continue development of low-cost components for High Frequency (HF) sensor systems with reduced size, weight, and power needs. - Continue development of distributed aperture radar systems with improved spatial and waveform agility. - Complete research in sensors, networking and communication connectivity for developing an affordable and fully automated network of collaborative time-coordinated mono-static and Multi-Input Multi-Output (MIMO), surveillance sensors providing real-time tracking, identification, targeting and engagement information with persistent wide area awareness. - Complete research to enable sensor Radio Frequency (RF) convergence, surveillance allocations, data fusion, multi-hypothesis decision-making, multi-target tracking, and methods for handling and fusing disparate and intermittent data sources. - Complete development of advanced signal processing and signal data converter. - Complete experimentation with fixed and mobile digital array radars to test and validate Multi-Input Multi-Output (MIMO) capabilities to provide improved detection, tracking, targeting, electronic protection and survivability. - Initiate development of front-end components and phased array architectures that enable concurrent wideband radar and Electronic Support (ES) functions. Electromagnetic Warfare: - Continue development of radar techniques for detection and identification of small Unmanned Autonomous Vehicles (UAV) and to develop classification and identification techniques for addressing evolving DHS/USMC requirements for assessing this type of threat in tactical environments. - Continue validation of algorithms using innovative concepts from discrete mathematics to accurately predict ship Radar Cross Section (RCS) so as better assess platform vulnerability.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue the development of innovative target detection and clutter suppression algorithms for Ultra-High Frequency (UHF) SAR that exploits fluctuation and motion within the scene to provide wide-area, automated detection of small targets at long ranges. - Complete the development of the maritime target detection capabilities of a Ultra-High Frequency (UHF) SAR through novel approaches to the fundamental challenge of separating target backscatter from ocean clutter by exploiting both differences in the manner in which the polarimetric signatures of the target and clutter vary as a function of aspect angle and RF frequency, as well as differences between target and clutter motion characteristics. - Initiate applied research into technology base for Radio Frequency (RF) surveillance using active and passive monostatic and distributed sensor concepts. Current efforts seek to contribute to this objective by developing and demonstrating improved planar antennas and cylindrical.					
FY 2024 Base Plans: Surveillance Technology: - Complete development of low-cost components for High Frequency (HF) sensor systems with reduced size, weight, and power needs. - Complete development low-cost dielectric lens antennas and material resilience in high power transmitters. - Continue development of front-end components and phased array architectures that enable concurrent wideband radar and Electronic Support (ES) functions. - Continue efforts to develop affordable and scalable advanced antenna apertures. - Continue efforts to develop electronics and signal processing to enable Radio Frequency (RF) agility and waveform diversity to provide enhanced capability to find, fix, track, target, and assess targets and threats as well as provide automatic target identification. - Continue research in the use of interferometric, polarimetric, Radio-Frequency (RF) agility, and sophisticated signal processing algorithms to enable the detection, geolocation, tracking, and identification of targets in harsh natural and man-made clutter and interference. - Continue efforts on methods to mitigate Electronic Attack (EA) and Electromagnetic Interference (EMI) to RF sensors and networks. - Continue development of hardware and software for arbitrary waveform generation for agile radar systems. - Continue development of distributed aperture radar systems with improved spatial and waveform agility. - Initiate development of novel field sensors and transducers for future radar architectures.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602271N / *Electromagnetic Systems Applied Research*	**Project (Number/Name)** 0000 / *Electromagnetic Systems Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate effort focused on novel signal processing architectures for phased array radar systems that efficiently implement non-traditional radar algorithms. Electromagnetic Warfare: - Complete development of radar techniques for detection and identification of small Unmanned Autonomous Vehicles (UAV) and to develop classification and identification techniques for addressing evolving DHS/USMC requirements for assessing this type of threat in tactical environments. - Complete validation of algorithms using innovative concepts from discrete mathematics to accurately predict ship Radar Cross Section (RCS) so as better assess platform vulnerability. (NRL) - Complete the development of innovative target detection and clutter suppression algorithms for Ultra-High Frequency (UHF) SAR that exploits fluctuation and motion within the scene to provide wide-area, automated detection of small targets at long ranges. - Continue applied research into technology base for RF surveillance using active and passive monostatic and distributed sensor concepts. Current efforts seek to contribute to this objective by developing and demonstrating improved planar antennas and cylindrical. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The funding increase from FY 2023 to FY 2024 is due to increased emphasis on Intelligence, Surveillance, Reconnaissance, Target Electro Optical/Infrared and (ISRT-EO/IR) research. Funds realigned with PE 0602271N from Vacuum Electronics Power Amplifiers and Electronic Warfare Technology Activities.					
Title: Vacuum Electronics Power Amplifiers	1.761	2.031	1.396	0.000	1.396
Description: The overarching objective of this activity is to develop Millimeter Wave (MMW) and sub-MMW power amplifiers for use in Naval all-weather radar, surveillance, reconnaissance, electronic attack, and communications systems. The technology developed cannot, for the most part, be obtained through Commercial Off The Shelf (COTS) as a result of the simultaneous requirements placed on power, frequency, bandwidth, weight, and size. Responding to strong interests from the various user communities, efforts are focused on the development of technologies for high-data-rate communications, electronic warfare and high-power radar applications at Millimeter Wave (MMW) and upper-MMW regime. The emphasis is placed on achieving high power at high frequency in a compact form factor. Technologies include utilization of spatially distributed electron					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602271N / *Electromagnetic Systems Applied Research*	**Project (Number/Name)** 0000 / *Electromagnetic Systems Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
beams in amplifiers, such as sheet electron beams and multiple-beams, and creation of simulation based design methodologies based on physics-based and geometry driven design codes. The current specific objectives are: - High Power Millimeter and Upper Millimeter Wave Amplifiers: Develop science and technology for high power millimeter and upper millimeter wave amplifiers including high current density diamond cathodes, sheet and multiple electron beam formation and mode suppression techniques in overmoded structures. - Lithographic Fabrication Techniques: Develop lithographic fabrication techniques for upper-millimeter wave amplifiers. - Accurate and Computationally Effective Device-Specific Multi-Dimensional Models for Electron Beams: Develop accurate and computationally effective device-specific multi-dimensional models for electron beam generation, large-signal and stability analysis to simulate device performance and improve the device characteristics. ***FY 2023 Plans:*** - Complete the development of broadband (3:1) traveling-wave-tube amplifier circuit using hybrid manufacturing techniques. - Complete the development of low-Size, Weight, and Power (SWaP)-C millimeter-wave traveling-wave tube amplifier technology for unmanned platforms, based on Additive Manufacturing and a high level of RF component integration. - Initiate the development of Millimeter Wave and sub-MMW power amplifiers for use in Naval all-weather radar, surveillance, reconnaissance, electronic attack, and communications systems. Efforts are focused on the development of technologies for high-data-rate communications, electronic warfare and high-power radar applications at MMW and sub-MMW regimes. ***FY 2024 Base Plans:*** - Continue the development of Millimeter Wave and sub-MMW power amplifiers for use in Naval all-weather radar, surveillance, reconnaissance, electronic attack, and communications systems. Efforts are focused on the development of technologies for high-data-rate communications, electronic warfare and high-power radar applications at MMW and sub-MMW regimes. ***FY 2024 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602271N / *Electromagnetic Systems Applied Research*	**Project (Number/Name)** 0000 / *Electromagnetic Systems Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** FY 2023 to FY 2024 decrease is due to higher-level requirements in Intelligence, Surveillance, Reconnaissance, Target Electro Optical/Infrared and (ISRT-EO/IR) research. Funds realigned within PE 0602271N to Activities Surveillance Technology and EO/IR Sensor Technologies.					
Accomplishments/Planned Programs Subtotals	83.328	92.288	92.473	0.000	92.473

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602271N / *Electromagnetic Systems Applied Research*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	5.792	39.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	44.792

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Congressional Add: Dark Swarm in Degraded Environments ***FY 2022 Accomplishments:*** Conduct applied Dark Swarm in Degraded Environments applied research. ***FY 2023 Plans:*** N/A	5.792	0.000
Congressional Add: Submerged electro-optical adaptive littoral sensor (SEALS) system prototypes ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct submerged electro-optical adaptive littoral sensor (SEALS) system prototypes research.	0.000	5.000
Congressional Add: Advanced antenna technology ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Develop dual-band antenna technologies and electronics to support additional functionality for E-2D.	0.000	6.000
Congressional Add: Dark swarm in degraded and denied enviorments ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct dark swarm in degraded and denied environments research.	0.000	6.000
Congressional Add: Mini-full spectrum hyperspectral sensors for IEDs ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct effort to develop and deliver a full-spectrum hyperspectral imagery (HSI) collection and analysis suite applicable for use from small unmanned aerial vehicles (UAVs)	0.000	7.000
Congressional Add: Open systems architecture for electronic warfare chiplets	0.000	15.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602271N / *Electromagnetic Systems Applied Research*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
FY 2022 Accomplishments: N/A ***FY 2023 Plans:*** Conduct open systems architecture for electronic warfare chiplets research.		
Congressional Adds Subtotals	5.792	39.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602435N *I Ocean Wrfghtg Env Applied Res*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	100.774	165.622	80.806	-	80.806	77.489	77.932	79.505	80.661	Continuing	Continuing
0000: *Ocean Wrfghtg Env Applied Res*	0.000	68.434	74.622	80.806	-	80.806	77.489	77.932	79.505	80.661	Continuing	Continuing
9999: *Congressional Adds*	0.000	32.340	91.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	123.340

A. Mission Description and Budget Item Justification

Assuring access to the global maritime domain is ensured by technologies that reliably and accurately sense and predict the ocean and littoral environment. Coordinated distributed maritime operations is only possible when timely, actionable information is delivered to commanders. This program element (PE) addresses applied research to develop and exploit tactical understanding of the ocean environment to maintain U.S. maritime superiority and ensure national security. Research performed in this PE transforms basic oceanographic, meteorological, ionospheric, geologic, acoustic, optical and chemical research into predictive models and technologies that provide new or enhanced warfare capabilities for the Battlespace Environment (BSE). The objectives of this program are met through direct observation of the physical environment by shipboard, airborne, and space-based platforms, piloted, remotely piloted, and fully autonomous; assimilation of these observations into predictive environmental models; and provision of critical environmental knowledge to tactical decision aids.

Today's Sailors and Marines are enabled by naval Science and Technology (S&T). Since 1946, the Office of Naval Research (ONR) has fostered scientific research related to the maintenance of maritime superiority and national defense. ONR manages the Department of the Navy's (DON) portfolio of naval Basic and Applied research, and Advanced Technology Development investments to ensure naval forces can effectively deter conflict, but when called upon, fight, win and come home safe. Current investments hedge against uncertainty, providing solutions to commanders today, and options for the future. The Naval S&T budget supports higher guidance defined by the National Defense Strategy, and responds to requirements identified by the Secretary of the Navy through research priorities set by the Chief of Naval Research, coordinated across the Naval Research Enterprise (NRE), and outlined in the Naval R&D Framework.

This Program Element (PE) funds Applied Research, which is the systematic study to understand the means to meet a recognized and specific need. Most of the work in this PE can be classified between Technology Readiness Level (TRL) 2 (technology concept and/or application formulation) and TRL 4 (component and/or breadboard validation in laboratory environments).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602435N *I Ocean Wrfghtg Env Applied Res*

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	103.586	74.622	75.626	-	75.626
Current President's Budget	100.774	165.622	80.806	-	80.806
Total Adjustments	-2.812	91.000	5.180	-	5.180
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	91.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.812	0.000			
• Program Adjustments	0.000	0.000	5.180	-	5.180
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 9999: *Congressional Adds*		
Congressional Add: *Task Force Ocean*	9.654	10.000
Congressional Add: *Ocean Acoustics for Monitoring*	0.000	8.000
Congressional Add: *Climate change hydraulic modeling risk analysis*	1.448	0.000
Congressional Add: *Continuous distributed sensing systems*	4.827	10.000
Congressional Add: *Research vessel cyber infrastructure improvements*	3.861	8.000
Congressional Add: *Ocean acoustics*	7.723	0.000
Congressional Add: *Operational demonstration of commercially available, long endurance USV*	4.827	0.000
Congressional Add: *Commercially available long endurance USV*	0.000	10.000
Congressional Add: *Naval special warfare undersea and maritime superiority*	0.000	5.000
Congressional Add: *Marine meterology*	0.000	5.000
Congressional Add: *Long Endurance Uncrewed Surface Vehicles*	0.000	35.000
Congressional Add Subtotals for Project: 9999	32.340	91.000
Congressional Add Totals for all Projects	32.340	91.000

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602435N *I Ocean Wrfghtg Env Applied Res*

Change Summary Explanation

Funding: The FY24 increase of $5,180K supports increase investment and emphasis on Physical Oceanography and Task Force Ocean research activities.

Schedule: No significant change.

Technical: No significant change.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602435N / *Ocean Wrfghtg Env Applied Res*	Project (Number/Name) 0000 / *Ocean Wrfghtg Env Applied Res*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
0000: *Ocean Wrfghtg Env Applied Res*	0.000	68.434	74.622	80.806	-	80.806	77.489	77.932	79.505	80.661	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project provides the foundational environmental knowledge for undersea, surface and air-based warfighting technologies and effective operations anywhere on the globe, as well as the operation of unattended sensors and unmanned air, surface and underwater vehicles. This project includes the Navy contribution to broader federal research such as the National Oceanographic Partnership Program (NOPP), efforts aimed at understanding and predicting the impacts of underwater sound on Marine Mammals, and efforts to improve extended range environmental prediction through coupled Earth system models. Major efforts of this project are devoted to gaining real-time knowledge of the Battlespace Environment (BSE), understanding the variability between processes in the world's ocean, atmosphere and coastal regions, and providing the on-scene commander with the capability to exploit the environment to tactical, operational, and strategic advantage. Research results are transitioned to the Fleet Numerical Meteorology and Oceanography Center and to the Naval Oceanographic Office where they are used to provide timely information about the natural environment for all fleet operations. Efforts include ocean and atmospheric analysis and prediction for real-time description of the operational environment from near space to the sub-seafloor, shallow water acoustics, sensors for undersea surveillance and weapon systems, and influences of the natural environment on Mine Countermeasures, Naval Mining, Anti-Submarine Warfare (ASW), Information Warfare, and Naval Special Warfare systems.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Coastal Geosciences/Optics	10.287	9.417	10.417	0.000	10.417
Description: The Coastal Geosciences/Optics activity develops knowledge of the littoral, nearshore and riverine environments in which physical, acoustical and optical processes are dominated by the presence of the sea or river bed and air-water interface. Predictive environmental models, custom climatological databases, adaptive sampling schemes, technologies for nearshore observations and advanced remote sensing capabilities provide critical foundational information for Naval Special Warfare, Mine and Expeditionary Warfare and Amphibious operations. This Program emphasizes field research in navally relevant environments, including many that require research outside the U.S. ***FY 2023 Plans:*** - Continue Satellite Based Sensing to improve the world's global bathymetry map from satellite data. Specific new efforts will utilize ICESAT for shoreline digital elevation models and connect with new investigations and methods extending altimetry-based seabed models up onto the continental shelves. Continue efforts focused on determining bathymetry from satellite based-remote sensing for shallow muddy and turbid waters.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602435N / *Ocean Wrfghtg Env Applied Res*	**Project (Number/Name)** 0000 / *Ocean Wrfghtg Env Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue Inner Shelf Processes studies of non-hydrostatic modeling of inner shelf processes, including internal waves and fronts. Initiate a systematic study of biases introduced into the inner shelf sea-surface-temperature field by the global ocean and atmospheric models. - Continue Remote Sensors optimization studies of adaptive sampling in the littorals using small unmanned platforms (air, surface, submerged). - Continue Optics studies of underwater image prediction. - Continue Sonar technology development to observe and map bottom currents and bathymetry from drifting, bottom- following sensors. - Continue research into exploiting various geoscience and optical environmental phenomena in the littoral ocean we will investigate and develop a novel remote sensing technology by exploring advanced machine learning methods for multi- spectral (optical and passive microwave) satellite observations to provide a high-resolution, holistic land surface analysis of surface vegetation and soil parameters and quantify their impact on numerical weather prediction (NWP) models. - Continue to build capabilities to predict topographic changes in sandy, coastal environments impacting traffic capability. - Continue to conduct research into exploiting various geoscience and optical environmental phenomena in the littoral ocean that will be investigated to develop a novel remote sensing technology by exploring advanced machine learning methods for multi-spectral (optical and passive microwave) satellite observations. This will provide a high-resolution, holistic land surface analysis of surface vegetation and soil parameters and quantify their impact on numerical weather prediction (NWP) models. Continue to build capabilities to predict topographic changes in sandy, coastal environments impacting trafficabiity. -Continue to focus on the development of suitable atmospheric correction, calibration, and optical inversion algorithm methods for the emerging and rapidly growing nano and microsatellite technologies. ***FY 2024 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602435N / *Ocean Wrfghtg Env Applied Res*	**Project (Number/Name)** 0000 / *Ocean Wrfghtg Env Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue Satellite Based Sensing to improve the world's global bathymetry map from satellite data. Specific new efforts will utilize ICESAT for shoreline digital elevation models and connect with new investigations and methods extending altimetry-based seabed models up onto the continental shelves. Continue efforts focused on determining bathymetry from satellite based-remote sensing for shallow muddy and turbid waters. - Continue Inner Shelf Processes studies of non-hydrostatic modeling of inner shelf processes, including internal waves and fronts. Initiate a systematic study of biases introduced into the inner shelf sea-surface-temperature field by the global ocean and atmospheric models. - Continue Remote Sensors optimization studies of adaptive sampling in the littorals using small unmanned platforms (air, surface, submerged). - Continue Optics studies of underwater image prediction. - Continue Sonar technology development to observe and map bottom currents and bathymetry from drifting, bottom- following sensors. - Continue research into exploiting various geoscience and optical environmental phenomena in the littoral ocean we will investigate and develop a novel remote sensing technology by exploring advanced machine learning methods for multi- spectral (optical and passive microwave) satellite observations to provide a high-resolution, holistic land surface analysis of surface vegetation and soil parameters and quantify their impact on numerical weather prediction (NWP) models. - Continue to build capabilities to predict topographic changes in sandy, coastal environments impacting traffic capability. - Continue to conduct research into exploiting various geoscience and optical environmental phenomena in the littoral ocean that will be investigated to develop a novel remote sensing technology by exploring advanced machine learning methods for multi-spectral (optical and passive microwave) satellite observations. This will provide a high-resolution, holistic land surface analysis of surface vegetation and soil parameters and quantify their impact on numerical weather prediction (NWP) models. Continue to build capabilities to predict topographic changes in sandy, coastal environments impacting trafficabiity.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602435N / *Ocean Wrfghtg Env Applied Res*	**Project (Number/Name)** 0000 / *Ocean Wrfghtg Env Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
-Continue to focus on the development of suitable atmospheric correction, calibration, and optical inversion algorithm methods for the emerging and rapidly growing nano and microsatellite technologies. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There increase from FY 2023 to FY 2024 includes increased emphasis and associated research in geoscience and optical environmental phenomena.					
Title: Marine Mammals and Biology ***Description:*** The goal of the Marine Mammals and Biology activity focus is to better understand and characterize the effects of underwater sounds produced by Navy acoustic sources on marine mammals. Studies address characterizing marine mammal and their ecosystems, quantifying effects of sound exposure on marine mammals, and improving the ability to monitoring and detect marine mammals in the open ocean. Research results supports Navy environmental compliance information needs and facilitates acquiring Letter of Authorizations from regulators that enable all Navy training and testing operations, and the development of appropriate state-of-the-art mitigation measures. ***FY 2023 Plans:*** - Continue Sound Effects Modeling research to quantify the behavioral and physiological effects to potentially population- level consequences of sound exposure on marine life. - Continue Marine Mammals research to design equipment and capability to quantify the gas management and kinetics in marine mammals to elucidate the mechanisms that enable marine mammals to dive to deep depths. - Continue Sound Reception Mechanisms in whales effort to conduct research to advance our understanding of sound reception mechanisms in large whales including the anatomy surrounding the ear and the whole head. - Continue Sonar Exposure research into the stress response of marine mammals to sonar exposure with an emphasis on quantifying the effects of prolonged exposure effects on immune system suppression, reproductive failure, accelerated aging, and slowed growth.	3.460	3.589	3.752	0.000	3.752

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602435N / *Ocean Wrfghtg Env Applied Res*	**Project (Number/Name)** 0000 / *Ocean Wrfghtg Env Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Marine Mammal Behavior: Continue research on potential effects of Navy sources on marine mammal behavior, life functions, vital rates and population level effects. ***FY 2024 Base Plans:*** -Continue Sound Effects Modeling research to quantify the behavioral and physiological effects to potentially population- level consequences of sound exposure on marine life. -Continue Marine Mammals research to design equipment and capability to quantify the gas management and kinetics in marine mammals to elucidate the mechanisms that enable marine mammals to dive to deep depths. -Continue Sound Reception Mechanisms in whales effort to conduct research to advance our understanding of sound reception mechanisms in large whales including the anatomy surrounding the ear and the whole head. -Continue Sonar Exposure research into the stress response of marine mammals to sonar exposure with an emphasis on quantifying the effects of prolonged exposure effects on immune system suppression, reproductive failure, accelerated aging, and slowed growth. -Continue Marine Mammal Behavior research on potential effects of Navy sources on marine mammal behavior, life functions, vital rates and population level effects ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024					
Title: Marine Meteorology ***Description:*** The Marine Meteorology and Space Weather activities develop observing technologies, predictive models, Numerical Weather Prediction (NWP) systems and Tactical Decision Aids (TDA) that describe the atmospheric and near space environments and their impacts on naval sensors and operations. This activity focuses on uniquely marine aspects of atmospheric science such as air-sea interaction, coupled ocean-atmosphere modeling, Electromagnetic (EM) and electro-optical (EO) propagation, coastal meteorology, tropical cyclone (TC) prediction, and thermosphere-ionosphere dynamics and prediction, especially in expeditionary regions that are otherwise under observed such as the maritime subtropics and the polar regions, and the use of remote sensing to obtain quantitative observations of atmospheric and ionospheric properties. Aspects of the	11.733	14.647	14.769	0.000	14.769

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602435N / *Ocean Wrfghtg Env Applied Res*	**Project (Number/Name)** 0000 / *Ocean Wrfghtg Env Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
atmospheric environment of particular interest include near-surface phenomena that affect refractivity, marine boundary layer dynamics that affect clouds, rain, visibility and fog, processes that control TC structure, track, and intensity, extended range prediction and the ability to make better decisions across the weather to climate continuum, and coupling between the lower atmosphere and the thermosphere/ ionosphere and how it affects tactical to regional High Frequency (HF) over the horizon radar and communication. Objectives of this activity are improved NWP systems and TDAs that provide nowcast and forecast skill at global, regional, and tactical scales for operational support, sensor and system development, and performance prediction. ***FY 2023 Plans:*** - Initiate exploration of utilizing fleet EO/IR sensors to estimate the aerosol, water vapor, and turbulent structure of the atmosphere for quantifiable state estimation and prediction for high energy laser applications. - Initiate the development of new decision aids that take weather and climate extremes into account for improved ship routing, fuel efficiency, and bases and infrastructure protection and optimization. - Initiate the development of utilizing low order models based on machine learning techniques to provide advanced computational efficiency for large member ensemble prediction systems. - Initiate a study on forecast skill as a function of lead time across model approaches for seamless decision support from hours to years. - Initiate how the land surface impacts predictability of boundary layer processes on weather from weekly to sub-seasonal timescales using Navy atmospheric models and predictability tools to quantify feedbacks and affects. Data Assimilation and Modeling: Continue collection of field observations; quality control and process oriented analyses; and development of data assimilation and modeling technologies. Continue Unified Data Assimilation initiative to improve data assimilation technologies across the atmosphere, thermosphere, ocean, wave, and sea ice sub-disciplines - Through the Sensor systems: Continue applied research and studies aimed at increasing knowledge content of data from remote sensing and through-the-sensor systems as well as improving the representation of dynamical and physical processes, coupled atmosphere/thermosphere/ocean/wave/ice/land processes, atmospheric predictability, and methodologies for probabilistic forecasting and characterization of uncertainty. These studies					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602435N / *Ocean Wrfghtg Env Applied Res*	**Project (Number/Name)** 0000 / *Ocean Wrfghtg Env Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
include efforts to develop appropriate techniques to obtain atmospheric environmental data from airborne and space-borne sensors. -Tactical Decision Aids: Continue efforts focused on parameters that affect Radar, Radio Communications, Imaging Sensors, and Laser propagation in the marine environment with the goal of representing the real current and forecast atmosphere in tactical decision aids. - Continue to extend research of boundary layer processes, focusing on impact to state variables and their gradients. - Continue improved characterization of clouds, aerosols, and optical turbulence as they affect propagation of high energy laser systems. - Numerical Weather Prediction: Continue applied research to improve and optimize the Navy's regional and global numerical weather prediction systems by increasing resolution and incorporating new physics and numerical methods to provide much more accurate forecasts from the Tropics to the Arctic. Conduct applied research on a next-generation global model that incorporates efficient numerical methods, variable resolution grids, improved representation of physics, and that can operate efficiently on future computational systems. - Tropical Cyclone Forecast Models: Continue to develop and improve tropical cyclone forecast models to more accurately predict the rapid intensification of strong tropical cyclones. As these capabilities mature, shift focus into increasing ability to leverage better observing data, data assimilation techniques, and algorithmic analysis of storm structure and character to better understand and predict phenomenology. - Atmospheric Prediction: Continue efforts on the design, performance, analysis and underlying theory of global-to-tactical scale numerical simulations specifically designed to represent atmospheric environmental processes and phenomena. - Continue to investigate how the land surface impacts predictability of boundary layer processes on weather from weekly to sub-seasonal timescales using Navy atmospheric models and predictability tools to quantify feedbacks and affects.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602435N / *Ocean Wrfghtg Env Applied Res*	**Project (Number/Name)** 0000 / *Ocean Wrfghtg Env Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue to improve Naval simulation and prediction capabilities of the dynamic and thermodynamic processes in the atmosphere and ocean on a wide spectrum of scales, and to quantify and better represent the uncertainty in these predictions. This includes improvements to the forecast models, as well as improvements to ensemble forecast systems, which provide uncertainty estimates of forecasts and probabilistic predictions of particular events. As the Navy conducts a significant portion of its operations near the ocean surface up to a height of several thousand feet above the surface, in a region typically known as the atmospheric boundary layer, it is critical that our simulation and prediction capabilities of the dynamic and thermodynamic processes in this region, as well as new and emerging observational capabilities such as unmanned vehicles, are accurate.					
FY 2024 Base Plans: - Continue exploration of utilizing fleet EO/IR sensors to estimate the aerosol, water vapor, and turbulent structure of the atmosphere for quantifiable state estimation and prediction for high energy laser applications. - Continue the development of new decision aids that take weather and climate extremes into account for improved ship routing, fuel efficiency, and bases and infrastructure protection and optimization. - Continue the development of utilizing low order models based on machine learning techniques to provide advanced computational efficiency for large member ensemble prediction systems. - Continue a study on forecast skill as a function of lead time across model approaches for seamless decision support from hours to years. - Continue how the land surface impacts predictability of boundary layer processes on weather from weekly to sub-seasonal timescales using Navy atmospheric models and predictability tools to quantify feedbacks and affects. - Continue collection of field observations; quality control and process oriented analyses; and development of data assimilation and modeling technologies. Continue Unified Data Assimilation initiative to improve data assimilation technologies across the atmosphere, thermosphere, ocean, wave, and sea ice sub-disciplines - Continue applied research and studies aimed at increasing knowledge content of data from remote sensing and through-the-sensor systems as well as improving the representation of dynamical and physical processes, coupled atmosphere/thermosphere/ocean/wave/ice/land processes, atmospheric predictability, and					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602435N / *Ocean Wrfghtg Env Applied Res*	**Project (Number/Name)** 0000 / *Ocean Wrfghtg Env Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
methodologies for probabilistic forecasting and characterization of uncertainty. These studies include efforts to develop appropriate techniques to obtain atmospheric environmental data from airborne and space-borne sensors. - Continue efforts focused on parameters that affect Radar, Radio Communications, Imaging Sensors, and Laser propagation in the marine environment with the goal of representing the real current and forecast atmosphere in tactical decision aids. - Continue to extend research of boundary layer processes, focusing on impact to state variables and their gradients. - Continue improved characterization of clouds, aerosols, and optical turbulence as they affect propagation of high energy laser systems. - Continue applied research to improve and optimize the Navy's regional and global numerical weather prediction systems by increasing resolution and incorporating new physics and numerical methods to provide much more accurate forecasts from the Tropics to the Arctic. Conduct applied research on a next-generation global model that incorporates efficient numerical methods, variable resolution grids, improved representation of physics, and that can operate efficiently on future computational systems. - Continue to develop and improve tropical cyclone forecast models to more accurately predict the rapid intensification of strong tropical cyclones. As these capabilities mature, shift focus into increasing ability to leverage better observing data, data assimilation techniques, and algorithmic analysis of storm structure and character to better understand and predict phenomenology. - Continue efforts on the design, performance, analysis and underlying theory of global-to-tactical scale numerical simulations specifically designed to represent atmospheric environmental processes and phenomena. - Continue to investigate how the land surface impacts predictability of boundary layer processes on weather from weekly to sub-seasonal timescales using Navy atmospheric models and predictability tools to quantify feedbacks and affects.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602435N / *Ocean Wrfghtg Env Applied Res*	**Project (Number/Name)** 0000 / *Ocean Wrfghtg Env Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue to improve Naval simulation and prediction capabilities of the dynamic and thermodynamic processes in the atmosphere and ocean on a wide spectrum of scales, and to quantify and better represent the uncertainty in these predictions. This includes improvements to the forecast models, as well as improvements to ensemble forecast systems, which provide uncertainty estimates of forecasts and probabilistic predictions of particular events. As the Navy conducts a significant portion of its operations near the ocean surface up to a height of several thousand feet above the surface, in a region typically known as the atmospheric boundary layer, it is critical that our simulation and prediction capabilities of the dynamic and thermodynamic processes in this region, as well as new and emerging observational capabilities such as unmanned vehicles, are accurate. - Initiate a study on forecast skill as a function of lead time across model approaches for seamless decision support from hours to years. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024					
Title: National Oceanographic Partnership Program (NOPP) ***Description:*** This activity focuses on Navy investments in the National Oceanographic Partnership Program (NOPP). NOPP, established by the US Congress (Public Law 104-201) in FY97, is a unique collaboration among U.S. federal agencies involved in conducting, funding, or utilizing results of ocean research. NOPP's value to the Navy derives from the capacity of the partnership to enable and ensure multi-agency efforts where such collaboration enhances efficiency or effectiveness, reduces costs, or both. NOPP topics address scientific problems that cross agency missions, fall in gaps between agencies or are too large for any single agency to fund. ***FY 2023 Plans:*** - Continue National Oceanographic Partnership Program (NOPP) to focus topics of interest to multiple federal agencies that share ocean-related missions and are effectively investigated via partnerships. Topics include ocean, atmosphere, and coastal dynamical process studies; development of sensors, communications, and data acquisition approaches and methodologies for ocean research; modernization of ocean research and observation infrastructure; and studies of soundscapes in the ocean related to marine mammal research.	8.684	9.007	9.414	0.000	9.414

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602435N / *Ocean Wrfghtg Env Applied Res*	**Project (Number/Name)** 0000 / *Ocean Wrfghtg Env Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue Oceanographic Observations and Modeling studies focused on model verification, constraint of boundary conditions and fluxes of mass, heat and momentum across them (air-sea, deep ocean-seabed, land-sea), and responses to storm and/or persistent forcing. - Continue Space Based Sensors effort for the development and utilization of small space-based sensors for oceanographic and atmospheric dynamics research. - Next Generation Oceanographic sensors: Continue development of miniaturized, low- power, next generation sensors for ocean measurements including soft materials. - Continue hurricane coastal impact forecasting, including space-based remote sensing for multi-dimensional digital elevation models, suitable to initialize and ground-truth forecasts.					
FY 2024 Base Plans: - Continue National Oceanographic Partnership Program (NOPP) to focus topics of interest to multiple federal agencies that share ocean-related missions and are effectively investigated via partnerships. Topics include ocean, atmosphere, and coastal dynamical process studies; development of sensors, communications, and data acquisition approaches and methodologies for ocean research; modernization of ocean research and observation infrastructure; and studies of soundscapes in the ocean related to marine mammal research. - Continue Oceanographic Observations and Modeling studies focused on model verification, constraint of boundary conditions and fluxes of mass, heat and momentum across them (air-sea, deep ocean-seabed, land-sea), and responses to storm and/or persistent forcing. - Continue Space Based Sensors effort for the development and utilization of small space-based sensors for oceanographic and atmospheric dynamics research. - Next Generation Oceanographic sensors: Continue development of miniaturized, low- power, next generation sensors for ocean measurements including soft materials. - Continue hurricane coastal impact forecasting, including space-based remote sensing for multi-dimensional digital elevation models, suitable to initialize and ground-truth forecasts.					
FY 2024 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602435N / *Ocean Wrfghtg Env Applied Res*	**Project (Number/Name)** 0000 / *Ocean Wrfghtg Env Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024					
Title: Task Force Ocean (formerly Ocean Acoustics) ***Description:*** The Task Force Ocean activity focuses on the impact of the natural ocean environment on acoustic wave phenomena in support of undersea warfare and underwater force protection operations. This activity studies underwater acoustic propagation, scattering from ocean boundaries, and ambient noise issues that impact the development and employment of acoustic systems. The littoral zone has been the ocean environment of greatest interest. Aspects of this environment, that greatly impact underwater acoustic systems, are the shallow water, the consequent closeness and physical significance of the ocean bottom, and the complexities inherent to rapid changes of the ocean structure. The objectives of this program are met through measuring, analyzing, modeling and simulating, and exploiting ocean acoustic factors to gain advantage over potential adversaries using undersea acoustic systems. Results of this activity support acoustic sensor and system development, performance prediction, and tactical decision aids. This activity will also focuses on efforts addressing research needs identified by Task Force Ocean that will enable tactical maneuver for the future submarine force. The efforts funded by this Program Element (PE) fall generally into two topic areas: Analysis and understanding of the impact of environmental conditions on sonar data, and the development of reduced order ocean-acoustic models to enable environmental awareness and prediction on forward platforms. ***FY 2023 Plans:*** - Continue efforts centered on intensive data collection and modeling of the Atlantis II region of the New England Seamounts, The area was chosen to balance scientific and operational priorities. Specific efforts will focus on improved understanding of the complex relationships amongst a large number of ocean processes and variables that include sound propagation, ambient sound, ocean and atmosphere physical processes, and biological communities. The objectives to achieve include development of innovative tools that provide insight into uncertainty that may be suitable for transition to tactical decision aids. Objectives also include prototype development of new sensors and systems that address ocean observing and exploitation requirements from Naval Oceanography at large to the unit level, as well as novel exploitation of existing sensing infrastructure. Coupled/ hybrid assimilation techniques that leverage a combination of numerical modeling and AI/ML will also be developed and tested using a variety of approaches including through the sensor collection and real time analysis.	23.057	27.328	30.086	0.000	30.086

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602435N / *Ocean Wrfghtg Env Applied Res*	**Project (Number/Name)** 0000 / *Ocean Wrfghtg Env Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue Anti-Submarine Warfare effort to conduct applied research developing improved Anti-Submarine Warfare (ASW) performance assessment models and tactical decision aids to plan ASW operations, evaluate effectiveness of ASW systems, and enable environmental adaptive system control - Continue Sensors development to provide Anti-Submarine Warfare (ASW) sensor and system performance models, realistic simulations, and measures of effectiveness. This includes incorporating and exploiting critical environmental knowledge and requires coupling ocean dynamics and acoustics, ambient noise characterization in the littorals. It also includes applied research in acoustic and optical scattering and propagation characterization, through-the-sensor measurement techniques for in situ environmental parameters, measurement and prediction of uncertainty, and development of tactical decision tools. Conduct research efforts to enable environmental awareness and tactical exploitation of the environment by forward naval platforms. Activities will include the development of technologies and algorithms to incorporate in situ environmental sensing into an on-scene environmental characterization capability, inversion of sensor data to infer the local environment, and the development of capabilities to exploit the ocean environment for tactical advantage. Research efforts are informed by activities conducted by Task Force Ocean, which involve academic researchers, industry partners, and the operational Navy. - Continue Passive Sonar work to further applied research to enhance passive sonar performance capability in the Arctic environment by developing a better passive sonar performance prediction model and new acoustic ice-characterization methods. - Continue Environmental Acoustics development of ensemble prediction products that exploit improved computational speeds for both underwater and atmospheric acoustics. - Continue Sensors development of improved performance prediction products that exploit emerging space based sensing/ characterization for rough bubbly surface boundaries. - Continue efforts that will lead to in-situ estimation of environmental parameters; optimized sensing and behaviors by adapting in dynamic and uncertain environments; and capturing uncertainty in system performance prediction and tactical decision aids for ASW, MIW, and Seabed Warfare.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602435N / *Ocean Wrfghtg Env Applied Res*	**Project (Number/Name)** 0000 / *Ocean Wrfghtg Env Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue development of parameterizations to predict the contribution from breaking waves to acoustic ambient noise, quantifying the increased accuracy vice using wind speed alone. - Continue development and advances to ambient noise characterization, source property and location estimation, expansion of varied data assimilation methodologies and improvements to metrics used for such capabilities in a variety of acoustic scenarios. - Continue development of parameterizations to predict the contribution from breaking waves to acoustic ambient noise, quantifying the increased accuracy vice using wind speed alone. - Continue efforts that will lead to in-situ estimation of environmental parameters; optimized sensing and behaviors by adapting in dynamic and uncertain environments; and capturing uncertainty in system performance prediction and tactical decision aids for ASW, MIW, and Seabed Warfare					
FY 2024 Base Plans: - Continue efforts centered on intensive data collection and modeling of the Atlantis II region of the New England Seamounts, The area was chosen to balance scientific and operational priorities. Specific efforts will focus on improved understanding of the complex relationships amongst a large number of ocean processes and variables that include sound propagation, ambient sound, ocean and atmosphere physical processes, and biological communities. The objectives to achieve include development of innovative tools that provide insight into uncertainty that may be suitable for transition to tactical decision aids. Objectives also include prototype development of new sensors and systems that address ocean observing and exploitation requirements from Naval Oceanography at large to the unit level, as well as novel exploitation of existing sensing infrastructure. Coupled/ hybrid assimilation techniques that leverage a combination of numerical modeling and AI/ML will also be developed and tested using a variety of approaches including through the sensor collection and real time analysis. - Continue Anti-Submarine Warfare effort to conduct applied research developing improved Anti-Submarine Warfare (ASW) performance assessment models and tactical decision aids to plan ASW operations, evaluate effectiveness of ASW systems, and enable environmental adaptive system control - Continue Sensors development to provide Anti-Submarine Warfare (ASW) sensor and system performance models, realistic simulations, and measures of effectiveness. This includes incorporating and exploiting					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602435N / *Ocean Wrfghtg Env Applied Res*	**Project (Number/Name)** 0000 / *Ocean Wrfghtg Env Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
critical environmental knowledge and requires coupling ocean dynamics and acoustics, ambient noise characterization in the littorals. It also includes applied research in acoustic and optical scattering and propagation characterization, through-the-sensor measurement techniques for in situ environmental parameters, measurement and prediction of uncertainty, and development of tactical decision tools. Conduct research efforts to enable environmental awareness and tactical exploitation of the environment by forward naval platforms. Activities will include the development of technologies and algorithms to incorporate in situ environmental sensing into an on-scene environmental characterization capability, inversion of sensor data to infer the local environment, and the development of capabilities to exploit the ocean environment for tactical advantage. Research efforts are informed by activities conducted by Task Force Ocean, which involve academic researchers, industry partners, and the operational Navy. - Continue Passive Sonar work to further applied research to enhance passive sonar performance capability in the Arctic environment by developing a better passive sonar performance prediction model and new acoustic ice-characterization methods. - Continue Environmental Acoustics development of ensemble prediction products that exploit improved computational speeds for both underwater and atmospheric acoustics. - Continue Sensors development of improved performance prediction products that exploit emerging space based sensing/ characterization for rough bubbly surface boundaries. - Continue efforts that will lead to in-situ estimation of environmental parameters; optimized sensing and behaviors by adapting in dynamic and uncertain environments; and capturing uncertainty in system performance prediction and tactical decision aids for ASW, MIW, and Seabed Warfare. - Continue development of parameterizations to predict the contribution from breaking waves to acoustic ambient noise, quantifying the increased accuracy vice using wind speed alone. - Continue development and advances to ambient noise characterization, source property and location estimation, expansion of varied data assimilation methodologies and improvements to metrics used for such capabilities in a variety of acoustic scenarios.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602435N / *Ocean Wrfghtg Env Applied Res*	**Project (Number/Name)** 0000 / *Ocean Wrfghtg Env Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue efforts that will lead to in-situ estimation of environmental parameters; optimized sensing and behaviors by adapting in dynamic and uncertain environments; and capturing uncertainty in system performance prediction and tactical decision aids for ASW, MIW, and Seabed Warfare - Initiate efforts centered on data collection and modeling in regions of the mid-Atlantic Ridge. Specific efforts will focus on developing algorithms for improved understanding of the complex relationships amongst a number of ocean, atmosphere, and bottom properties that affect sound propagation and signal detection, including ambient sound. The objectives to achieve include development of innovative tools that provide insight into uncertainty that may be suitable for transition to tactical decision aids. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The funding increase from FY 2023 to FY 2024 supports increased emphasis in ocean battlespace and expeditionary access research. Funds realigned from PE 0602271N, Vacuum Electronics and Power Amplifiers, and Electronic Warfare Technology activities.					
Title: Physical Oceanography ***Description:*** The Physical Oceanography activity develops knowledge of the physics of the ocean to enable tactical naval use and exploitation of the battlespace. This is achieved through the development of predictive models of the water mass structure, waves, currents, and air-sea interactions and developing measurement/observation technology. Other applications utilize knowledge of the interaction of the water column hydrodynamics and the acoustics to predict the undersea transmission characteristics and sources of uncertainty in these statistics. Utilizing knowledge of the ocean surface physics, the physical oceanography program seeks to exploit the combination of remotely sensed data, in-situ data, and adaptively sampled data to optimize predictions of ocean currents and water column structure. These predictions, custom databases, adaptive sampling schemes and data programs serve Surface Warfare, Anti-Submarine Warfare, Naval Special Warfare, and Mine and Expeditionary Warfare operations. Oceanographic field research that uses active acoustic transmissions requires modeling of the acoustic effects of sound on marine life in order to meet Navy environmental requirements. ***FY 2023 Plans:***	11.213	10.634	12.368	0.000	12.368

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue efforts into investigating new techniques and capabilities to improve our ability to handle large amounts of ocean data (including SWOT altimetry data) available in the near future for assimilation into analysis and forecast systems. This includes translating the data assimilation problem to wavelet space in order to accurately correct the model background while largely retaining the realistic fractal dynamics generated by the model physics and the sparsification of covariance matrices. - Continue to model/simulate ocean current variability, including the deep ocean boundary providing improved ocean environmental information for Seabed Warfare. Model/simulate high-resolution coupled wave-circulation-sediment transport on multiple timescales including storm event and seasonal timescales providing the capability to estimate environmental conditions in shallow water (<100 m) to support MIW and NSW. - Continue Sensors effort to conduct testing and integration of turbulence sensors and other ocean oceanographic sensors into unmanned platforms to expand ocean sampling capabilities. Continue development of autonomous sensors and platforms for use in the Arctic ocean environment. Continue field campaigns to study ocean processes and dynamics, ocean model development, and data assimilation from the open ocean to the nearshore environments. Continue to conduct studies to develop new or enhance existing shipboard, in-situ, airborne, and space borne sensors and appropriate inversion and through the sensor techniques to obtain physical oceanographic environmental data. - Continue Data Assimilation development to coupled modeling approaches including air-ice-wave- ocean-land models. - Continue Earth System Prediction Models development of the capability to utilize Earth System Prediction Models to forecast the global ocean using ensemble prediction methods to enable risk assessment with skill to 30 days. - Continue Ocean Battlespace efforts to develop a new capability for accurate and rapid characterization of the local ocean battlespace utilizing the ability of gliders to work in coordinated teams and 4-dimensional variation assimilation to maximize impact of the glider data in a high-resolution local forecast model for more accurate ocean predictions. - Continue Task Force Ocean research coordinated with Task Force Ocean including efforts to develop new and enhance existing shipboard, in-situ, airborne, and space-borne sensors, appropriate inversion methods,					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
and through the sensor techniques to obtain physical oceanographic environmental data in conjunction with acoustical observations. - Continue new techniques and capabilities to improve our ability to handle the near future large amounts of ocean data (including SWO altimetry data) available for assimilation into analysis and forecast systems. This includes translating the data assimilation problem to wavelet space in order to accurately correct the model background while largely retaining the realistic fractal dynamics generated by the model physics and the sparsification of covariance matrices.					
FY 2024 Base Plans: - Continue efforts into investigating new techniques and capabilities to improve our ability to handle large amounts of ocean data (including SWOT altimetry data) available in the near future for assimilation into analysis and forecast systems. This includes translating the data assimilation problem to wavelet space in order to accurately correct the model background while largely retaining the realistic fractal dynamics generated by the model physics and the sparsification of covariance matrices. - Continue to model/simulate ocean current variability, including the deep ocean boundary providing improved ocean environmental information for Seabed Warfare. Model/simulate high-resolution coupled wave-circulation-sediment transport on multiple timescales including storm event and seasonal timescales providing the capability to estimate environmental conditions in shallow water (<100 m) to support MIW and NSW. - Continue Sensors effort to conduct testing and integration of turbulence sensors and other ocean oceanographic sensors into unmanned platforms to expand ocean sampling capabilities. Continue development of autonomous sensors and platforms for use in the Arctic ocean environment. Continue field campaigns to study ocean processes and dynamics, ocean model development, and data assimilation from the open ocean to the nearshore environments. Continue to conduct studies to develop new or enhance existing shipboard, in-situ, airborne, and space borne sensors and appropriate inversion and through the sensor techniques to obtain physical oceanographic environmental data. - Continue Data Assimilation development to coupled modeling approaches including air-ice-wave- ocean-land models.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue Earth System Prediction Models development of the capability to utilize Earth System Prediction Models to forecast the global ocean using ensemble prediction methods to enable risk assessment with skill to 30 days. - Continue Ocean Battlespace efforts to develop a new capability for accurate and rapid characterization of the local ocean battlespace utilizing the ability of gliders to work in coordinated teams and 4-dimensional variation assimilation to maximize impact of the glider data in a high-resolution local forecast model for more accurate ocean predictions. - Continue Task Force Ocean research coordinated with Task Force Ocean including efforts to develop new and enhance existing shipboard, in-situ, airborne, and space-borne sensors, appropriate inversion methods, and through the sensor techniques to obtain physical oceanographic environmental data in conjunction with acoustical observations. - Continue new techniques and capabilities to improve our ability to handle the near future large amounts of ocean data (including SWO altimetry data) available for assimilation into analysis and forecast systems. This includes translating the data assimilation problem to wavelet space in order to accurately correct the model background while largely retaining the realistic fractal dynamics generated by the model physics and the sparsification of covariance matrices. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY 2023 to FY 2024 is due to emphasis on ocean battlespace and expeditionary access as well as bio-derived materials and systems required to conduct operations at sea. Funds realigned from PE 0602271N, Vacuum Electronics and Power Amplifiers, and Electronic Warfare Technology activities.					
Accomplishments/Planned Programs Subtotals	68.434	74.622	80.806	0.000	80.806

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

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D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
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COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	32.340	91.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	123.340

A. Mission Description and Budget Item Justification

Developed a customized integrated sensor to enable new unmanned systems data collections in complex operating environments. Tested the integrated sensor performance in various environmental conditions to identify performance expectations and performance model development.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Congressional Add: Task Force Ocean	9.654	10.000
FY 2022 Accomplishments: Continue exploration of analytic techniques linking physical oceanographic variability with acoustic propagation, including field efforts to collect relevant data sets. The development and use of artificial intelligence and machine learning techniques for large ocean and acoustic data sets. Through-the-sensor environmental characterization, including assimilation into nested local environmental prediction models. Explored and developed advanced signal processing techniques that incorporate local ocean structure, including ambient noise characterization		
FY 2023 Plans: Continue exploration of analytic techniques linking physical oceanographic variability with acoustic propagation, including field efforts to collect relevant data sets. The development and use of artificial intelligence and machine learning techniques for large ocean and acoustic data sets. Through-the-sensor environmental characterization, including assimilation into nested local environmental prediction models. Explored and developed advanced signal processing techniques that incorporate local ocean structure, including ambient noise characterization.		
Congressional Add: Ocean Acoustics for Monitoring	0.000	8.000
FY 2022 Accomplishments: N/A		
FY 2023 Plans: Conduct exploration of analytic techniques linking physical oceanographic variability with acoustic propagation, including field efforts to collect relevant data sets. Conduct development and research of artificial intelligence and machine learning techniques for large ocean and acoustic data sets. Conduct through-the-sensor environmental characterization, including assimilation into nested local environmental prediction models. Explore and developed advanced signal processing techniques that incorporate local ocean structure, including ambient noise characterization		
Congressional Add: Climate change hydraulic modeling risk analysis	1.448	0.000

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
FY 2022 Accomplishments: Conduct climate change hydraulic modeling risk analysis applied research ***FY 2023 Plans:*** N/A		
Congressional Add: Continuous distributed sensing systems ***FY 2022 Accomplishments:*** Conduct applied research in continuous distributed sensing systems ***FY 2023 Plans:*** Conduct applied research in continuous distributed sensing systems.	4.827	10.000
Congressional Add: Research vessel cyber infrastructure improvements ***FY 2022 Accomplishments:*** Conduct research vessel cyber infrastructure improvements for applied research ***FY 2023 Plans:*** Conduct research vessel cyber infrastructure improvements for applied research.	3.861	8.000
Congressional Add: Ocean acoustics ***FY 2022 Accomplishments:*** Conduct applied research in ocean acoustics ***FY 2023 Plans:*** N/A	7.723	0.000
Congressional Add: Operational demonstration of commercially available, long endurance USV ***FY 2022 Accomplishments:*** Conduct basic research supporting the operational demonstration of commercially available, long endurance USV ***FY 2023 Plans:*** N/A	4.827	0.000
Congressional Add: Commercially available long endurance USV ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Continue to develop commercially available long endurance Unmanned Surface Vehicle (USV).	0.000	10.000
Congressional Add: Naval special warfare undersea and maritime superiority ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Continue to develop Naval special warfare undersea and maritime superiority through various at sea experiments.	0.000	5.000
Congressional Add: Marine meterology	0.000	5.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602435N / *Ocean Wrfghtg Env Applied Res*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
FY 2022 Accomplishments: N/A ***FY 2023 Plans:*** This activity focuses on uniquely marine aspects of atmospheric science such as air-sea interaction, coupled ocean-atmosphere modeling, Electromagnetic (EM) and electro-optical (EO) propagation, coastal meteorology, tropical cyclone (TC) prediction, and thermosphere-ionosphere dynamics and prediction, especially in expeditionary regions that are otherwise under observed such as the maritime subtropics and the polar regions, and the use of remote sensing to obtain quantitative observations of atmospheric and ionospheric properties.		
Congressional Add: Long Endurance Uncrewed Surface Vehicles ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Focus on development of specialized Autonomous platforms, sensors, autonomous behaviors, signal processors, AI/ML techniques, and improved endurance capacity.	0.000	35.000
Congressional Adds Subtotals	32.340	91.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy											Date: March 2023	
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602651M *I JT Non-Lethal Wpns Applied Res*							
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	6.213	6.659	7.419	-	7.419	8.090	8.345	8.512	8.682	Continuing	Continuing
0000: *JT Non-Lethal Wpns Applied Res*	0.000	6.213	6.659	7.419	-	7.419	8.090	8.345	8.512	8.682	Continuing	Continuing

A. Mission Description and Budget Item Justification

The DoD Non-Lethal Weapons (NLW) Program was established by the FY96 National Defense Authorization Act. The Office of the Secretary of Defense designated the Commandant of the Marine Corps (CMC) as the DoD NLW Executive Agent (EA). The EA exercises centralized responsibility for joint research and development of nonlethal weapons and technology through the Joint Non-Lethal Weapons Program (JNLWP). The Office of the Under Secretary of Defense for Acquisition and Sustainment (A&S) serves as the OSD Principal Staff Assistant and oversees, in consultation with the Under Secretary of Defense for Policy, the DoD NLW Executive Agent.

The efforts described in this Program Element (PE) reflect science and technology (S&T) investment decisions by the Joint Non-Lethal Weapons Integrated Product Team, a multi-service flag level corporate board that provides executive oversight and management for the JNLWP for the CMC. This direction is based on the requirements and capabilities sought by the Services and the Coast Guard, as identified in the DoD's Non-Lethal Weapons Joint Capabilities Based Assessment Document. This coordinated joint S&T development approach addresses mutual capability gaps and assures the most relevant non-lethal technologies, capabilities and equipment are provided to the operating forces while eliminating duplicative service S&T investment. These applied research initiatives feed non-lethal capabilities which directly support the National Defense Strategy (NDS) objective of strategic competition by providing options to the joint force in pursuit of national objectives in legal or policy constrained scenarios, as well as complementing the use of lethal effects in complex combat scenarios, for example, in urban environments with large civilian populations. Ongoing NLW Intermediate Force Capability (IFC) studies, analyses and exercise efforts with NATO and Allies also support NDS objectives to strengthen alliances and partnerships. Resulting capabilities facilitate a fully integrated non-lethal competency as a complement to lethal firepower, providing force application options for below lethal threshold engagements.

This program funds the applied research, study, assessment, and demonstration of technologies that could provide a non-lethal capability or target effect. Investment areas include applied research related to: non-lethal directed energy weapons (lasers, millimeter wave and high power microwave) for counter-personnel and counter materiel missions; non-lethal acoustic and optical technologies; advanced non-lethal materials (including materials for vehicle/vessel stopping and counter-facility applications); associated human effects and effectiveness for new non-lethal stimuli; injury potential and effectiveness of directed energy, electric incapacitation, ocular, and acoustic based non-lethal technologies; and developing models of crowd behavior and dynamics.

This PE funds Applied Research, which is the systematic study to understand the means to meet a recognized and specific need. Most of the work in this PE can be classified between Technology Readiness Level (TRL) 2 (technology concept and/or application formulation) and TRL 4 (component and/or breadboard validation in laboratory environments).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602651M *I JT Non-Lethal Wpns Applied Res*

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	6.405	6.700	7.419	-	7.419
Current President's Budget	6.213	6.659	7.419	-	7.419
Total Adjustments	-0.192	-0.041	0.000	-	0.000
• Congressional General Reductions	-	-0.041			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.192	0.000			

Change Summary Explanation

Funding: No significant change

Technical: No significant change

Schedule: No significant change

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602651M / *JT Non-Lethal Wpns Appli ed Res*	Project (Number/Name) 0000 / *JT Non-Lethal Wpns Applied Res*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
0000: *JT Non-Lethal Wpns Applied Res*	0.000	6.213	6.659	7.419	-	7.419	8.090	8.345	8.512	8.682	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project funds the applied research, study, assessment, and demonstration of technologies that could provide a non-lethal capability or target effect. Investment areas include applied research related to: non-lethal directed energy weapons (lasers, millimeter wave and high power microwave) for counter-personnel and counter-materiel missions; non-lethal acoustic and optical technologies; advanced non-lethal materials (including materials for vehicle/vessel stopping and counter-facility applications); associated human effects and effectiveness for new non-lethal stimuli; injury potential and effectiveness of directed energy, electric stun, ocular, and acoustic based non-lethal technologies; and developing models of crowd behavior and dynamics.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: (U) Joint Non-Lethal Weapons	6.213	6.659	7.419	0.000	7.419
FY 2023 Plans: Continue: -Research and investigation of intermediate force effects and emergent technologies with the potential to further address the Joint Requirements Oversight Council (JROC)-approved non-lethal counter-personnel and counter-material capability gaps. Results will support the transition of viable technologies to higher levels of development and demonstration to further mitigate the JROC-approved joint non-lethal effects capability-gaps. Current efforts include: -Explore new non-lethal effects and evaluate alternative innovative applications of existing technologies to address future non-lethal capability needs as escalation of force platforms. -Conduct counter-personnel research addressing further optimization of non-lethal human effects, and enhanced understanding of human target behavioral effects. -Conduct applied research to characterize Non-Lethal Weapons (NLWs) and Intermediate Force Capability (IFC) phenomena, and to assess target human effects and weapon effectiveness, including the development of dose response and injury correlates for new Non-Lethal Weapons (NLW) technologies. -Assess and study new technologies related to NLW effectiveness and behavioral response, such as advancing the understanding of Flash Bang effects on humans to support novel non-explosive alternatives to pyrotechnic non-lethal devices. -Conduct counter-materiel research to include the investigation of novel intermediate force capabilities for increased delivery and employment options for applications such as vehicle and vessel stopping, and the further optimization of intermediate force materials for integration into future escalation of force platforms.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602651M / *JT Non-Lethal Wpns Appli ed Res*	**Project (Number/Name)** 0000 / *JT Non-Lethal Wpns Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
-Conduct feasibility and design studies for high peak power radio frequency directed energy sources and other high power microwave directed energy technologies (e.g., lasers, millimeter-waves) with extended range applications and longer duration of effect. -Investigate and conceptual design research of high power microwave technologies to enable improved performance and reduce overall size, weight, power consumption, thermal cooling requirements, and overall system costs (SWAP-C). Complete: - Complete specific "Human Effects" (HE) dose response studies portion of the NLW IFC characterization effort directed at effects of NLW on areas such as the human thorax, lower abdomen, head, arms, and legs. These HE studies better inform the development of theoretical advanced total body models to support future NLW and IFC technology design parameters for counter-personnel applications. Initiate: - Research and investigation of novel NLW and IFC effects (such as novel dazzlers, flashbang, smoke, sting ball, and directed energy (DE) capabilities) to ultimately integrate onto future manned, unmanned, and autonomous weapons delivery platforms.					
FY 2024 Base Plans: Continue: -Research and investigation of intermediate force effects and emergent technologies with the potential to further address the Joint Requirements Oversight Council (JROC)-approved non-lethal counter-personnel and counter-material capability gaps. Results will support the transition of viable technologies to higher levels of development and demonstration to further mitigate the JROC-approved joint non-lethal effects capability-gaps. -Explore new non-lethal effects and evaluate alternative innovative applications of existing technologies to address future non-lethal capability needs as escalation of force platforms. -Conduct counter-personnel research addressing further optimization of non-lethal human effects, and enhanced understanding of human target behavioral effects. -Conduct applied research to characterize Non-Lethal Weapons (NLWs) and Intermediate Force Capability (IFC) phenomena, and to assess target human effects and weapon effectiveness, including the development of dose response and injury correlates for new Non-Lethal Weapons (NLW) technologies. -Assess and study new technologies related to NLW effectiveness and behavioral response, such as advancing the					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602651M / *JT Non-Lethal Wpns Appli ed Res*	**Project (Number/Name)** 0000 / *JT Non-Lethal Wpns Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
understanding of Flash Bang effects on humans to support novel non-explosive alternatives to pyrotechnic non-lethal devices. -Conduct counter-materiel research to include the investigation of novel intermediate force capabilities for increased delivery and employment options for applications such as vehicle and vessel stopping, and the further optimization of intermediate force materials for integration into future escalation of force platforms. -Conduct feasibility and design studies for high peak power radio frequency directed energy sources and other high power microwave directed energy technologies (e.g., lasers, millimeter-waves) with extended range applications and longer duration of effect. -Investigate and conceptual design research of high power microwave technologies to enable improved performance and reduce overall size, weight, power consumption, thermal cooling requirements, and overall system costs (SWAP-C). - Research and investigation of novel NLW and IFC effects (such as novel dazzlers, flashbang, smoke, sting ball, and directed energy (DE) capabilities) to ultimately integrate onto future manned, unmanned, and autonomous weapons delivery platforms. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 will be used to 1) expand applied research to establish relationships associated with Flashbang Non-Lethal Weapons (NLWs) effectiveness; develop predictive model and simulation capabilities for impulse noise and effectiveness to support ongoing and future flashbang development activities to include non-pyrotechnic flashbang devices. This research will lead to the development of a better understanding of psychological constructs including sensory integration, sensory and cognitive integration, sensory overload, sensory competition, and cognitive workload underlying flashbang stimuli, and 2) increase Human Electro-Muscular Incapacitation (HEMI) bioeffects research, to include M&S, human subject and animal research to establish mechanisms for effects and injuries and to continue research and model development focused on generalizing results to apply to various future HEMI applications and technologies.					
Accomplishments/Planned Programs Subtotals	6.213	6.659	7.419	0.000	7.419

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602651M / *JT Non-Lethal Wpns Appli ed Res*	**Project (Number/Name)** 0000 / *JT Non-Lethal Wpns Applied Res*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602747N *I Undersea Warfare Applied Res*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	104.687	104.111	61.503	-	61.503	60.213	61.423	62.657	63.665	Continuing	Continuing
0000: *Undersea Warfare Applied Res*	0.000	56.178	58.111	61.503	-	61.503	60.213	61.423	62.657	63.665	Continuing	Continuing
9999: *Congressional Adds*	0.000	48.509	46.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	94.509

A. Mission Description and Budget Item Justification

The Undersea Warfare Applied Research Program Element (PE) funds applied research efforts in undersea target detection, classification, localization, tracking, and neutralization. Associated efforts focus on new Anti-Submarine Warfare (ASW) operational concepts that promise to improve wide-area surveillance, detection, localization, tracking, and attack capabilities against quiet adversary submarines operating in noisy and cluttered shallow water environments. Related efforts are aimed at leveraging technologies that will protect the country's current capital investment in surveillance, submarine, surface ship, and air ASW assets. Research focused on understanding the impacts on marine mammals of manmade underwater sound is also conducted in the PE.

The activities described in this PE address future Navy and Marine Corps capabilities needed to maintain maritime superiority and ensure national security. Targeted capabilities are based on input from Naval Research Enterprise stakeholders including combatant commands, Office of the Chief of Naval Operations (OPNAV) and Headquarters Marine Corps and are designed to exploit breakthroughs in science and technology in order to deliver maximum undersea warfighting benefit to our sailors and marines.

Today's Sailors and Marines are enabled by naval Science and Technology (S&T). Since 1946, the Office of Naval Research (ONR) has fostered scientific research related to the maintenance of maritime superiority and national defense. ONR manages the Department of the Navy's (DON) portfolio of naval Basic and Applied research, and Advanced Technology Development investments to ensure naval forces can effectively deter conflict, but when called upon, fight, win and come home safe. Current investments hedge against uncertainty, providing solutions to commanders today, and options for the future. The Naval S&T budget supports higher guidance defined by the National Defense Strategy, and responds to requirements identified by the Secretary of the Navy through research priorities set by the Chief of Naval Research, coordinated across the Naval Research Enterprise (NRE), and outlined in the Naval R&D Framework.

This Program Element (PE) funds Applied Research, which is the systematic study to understand the means to meet a recognized and specific need. Most of the work in this PE can be classified between Technology Readiness Level (TRL) 2 (technology concept and/or application formulation) and TRL 4 (component and/or breadboard validation in laboratory environments).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602747N *I Undersea Warfare Applied Res*

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	107.734	58.111	59.278	-	59.278
Current President's Budget	104.687	104.111	61.503	-	61.503
Total Adjustments	-3.047	46.000	2.225	-	2.225
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	46.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-3.047	0.000			
• Program Adjustments	0.000	0.000	2.225	-	2.225
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 9999: *Congressional Adds*		
Congressional Add: *Persistent Maritime Surveillance*	9.654	10.000
Congressional Add: *Undersea sensing and communications*	3.861	5.000
Congressional Add: *Resident Undersea Autonomous Robotics*	6.757	0.000
Congressional Add: *Academic partnerships for innovative research*	24.134	25.000
Congressional Add: *Energetic global awareness*	1.931	0.000
Congressional Add: *Bomb technicians training innovations*	2.172	0.000
Congressional Add: *Energetics awareness*	0.000	3.000
Congressional Add: *Mobile test-bed for UUVs*	0.000	3.000
Congressional Add Subtotals for Project: 9999	48.509	46.000
Congressional Add Totals for all Projects	48.509	46.000

Change Summary Explanation

Schedule: FY 2024 increase due to realignment of funds from PE 0602782N Mine/Obstacle Detection Activity for increased research efforts pertaining to Anti-Submarine Warfare (ASW) Distributed Search.

Technical: No significant change.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602747N *I Undersea Warfare Applied Res*

Funding: No significant change.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602747N / *Undersea Warfare Applied Res*	Project (Number/Name) 0000 / *Undersea Warfare Applied Res*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
0000: *Undersea Warfare Applied Res*	0.000	56.178	58.111	61.503	-	61.503	60.213	61.423	62.657	63.665	Continuing	Continuing

A. Mission Description and Budget Item Justification

This PE funds applied research efforts in undersea target detection, classification, localization, tracking, and neutralization. Associated efforts focus on new ASW operational concepts that promise to improve wide-area surveillance, detection, localization, tracking, and attack capabilities against quiet adversary submarines operating in noisy and cluttered shallow water environments. Related efforts are aimed at leveraging technologies that will protect the country's current capital investment in surveillance, submarine, surface ship, and air ASW assets.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Anti-Submarine Warfare (ASW) Distributed Search	14.388	14.882	20.981	0.000	20.981
Description: ASW Distributed Search focuses on the development of technologies for the tactical search for undersea targets ranging from hours to weeks, using automated sensor systems deployed around operating areas, including along key transit routes to protect naval/maritime forces, around temporarily fixed sea base regions and naval force operating areas, or around fixed defensive regions and areas of interest, such as key US/Allied ports. "Search" is conducted in concentrated areas, typically exploiting cues received from surveillance systems. The objective is to develop rapidly deployable systems employing automated detection and classification capabilities for use in both shallow and deep water operating environments. Related efforts include the development of distributed systems; Unmanned Undersea Vehicle-based and affordable off-board deployable sensing systems employing persistent detection concepts and components; and active acoustic sensing and processing techniques, navy-unique transduction and underwater networking technologies. These efforts provide an extended reach of organic platform-based systems through the use of new sensor concepts, improved materials for advanced sensors, optimized deployment, employment, and automated operation of distributed sensor fields.					
FY 2023 Plans: - Continue Active Sonar development of advanced signal and information processing for high duty cycle active sonar. Further development of concepts for next-generation active sonar system automation, leveraging the latest advances in machine learning and artificial intelligence. Continue non-acoustic, orthogonal concepts that complement and augment active sonar concepts.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602747N / *Undersea Warfare Applied Res*	**Project (Number/Name)** 0000 / *Undersea Warfare Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue Sensors applied research in improved sensor technology to include both passive and active acoustic and optical sensing to extend the capabilities of platform-based systems as well as innovative sensor technology for off-board and rapidly deployable systems. - Continue Signal Processing development of advanced signal and information processing for high duty cycle active sonar. Continue to leverage advances in machine learning, e.g. deep learning, to improve performance in clutter type classification and clutter/target discrimination in current active sonar systems. Continue to leverage advances in artificial intelligence, with the objective to develop next-generation intelligent active sonar systems that optimally adapt operating parameters for the operating environment. - Continue development of technologies and techniques for exploiting structural acoustic vulnerabilities of adversary undersea platforms conducting an at sea trial. - Continue efforts that will lead to optimized sensing and behaviors by adapting in dynamic and uncertain environments; cooperative vehicle autonomy with increased endurance; data exfiltration and networking to expand reach; next generation sensors (acoustic and non-acoustic); adaptive, autonomous technologies to detect, classify, and track underwater mobile threats. - Continue development of technologies and signal processing, verified through sea trials that exploit the structural acoustics of undersea vehicles and structures.					
FY 2024 Base Plans: - Continue Active Sonar development of advanced signal and information processing for high duty cycle active sonar. Further development of concepts for next-generation active sonar system automation, leveraging the latest advances in machine learning and artificial intelligence. Continue non-acoustic, orthogonal concepts that complement and augment active sonar concepts. - Continue Sensors applied research in improved sensor technology to include both passive and active acoustic and optical sensing to extend the capabilities of platform-based systems as well as innovative sensor technology for off-board and rapidly deployable systems. - Continue Signal Processing development of advanced signal and information processing for high duty cycle active sonar. Continue to leverage advances in machine learning, e.g. deep learning, to improve performance in					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602747N / *Undersea Warfare Applied Res*	**Project (Number/Name)** 0000 / *Undersea Warfare Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
clutter type classification and clutter/target discrimination in current active sonar systems. Continue to leverage advances in artificial intelligence, with the objective to develop next-generation intelligent active sonar systems that optimally adapt operating parameters for the operating environment. - Continue development of technologies and techniques for exploiting structural acoustic vulnerabilities of adversary undersea platforms conducting an at sea trial. - Continue efforts that will lead to optimized sensing and behaviors by adapting in dynamic and uncertain environments; cooperative vehicle autonomy with increased endurance; data exfiltration and networking to expand reach; next generation sensors (acoustic and non-acoustic); adaptive, autonomous technologies to detect, classify, and track underwater mobile threats. - Continue development of technologies and signal processing, verified through sea trials that exploit the structural acoustics of undersea vehicles and structures. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The funding increase from FY 2023 to FY 2024 is due to required growth in the ASW Distributed Search to address issues in mine warfare performance assessment and anti-submarine warfare distributed search & performance assessment. Funds realigned within PE 0602747N from Anti-Submarine Warfare (ASW) Surveillance Activity, and from PE 0602782N Mine/Obstacle Detection Activity.					
Title: Anti-Submarine Warfare (ASW) Precision Localization ***Description:*** ASW Precision Localization focuses on the development and demonstration of technologies which use information from surveillance or search systems to determine an area of uncertainty (AOU) relative to target range, bearing, and depth adequate to handoff to an attack system. Precision Localization employs non-acoustic techniques such as magnetic and optical sensing to localize submerged threats. The objective is to increase magnetic sensor range and robustness, enable deployment on Unmanned Air Vehicles (UAVs), and increase optical sensing search rates. Efforts include the development of non-traditional tracking and advanced magnetic and electric field sensors and processing. These technologies will provide a decreased AOU size thus enabling the effective use of smaller, more versatile torpedoes as well as increased performance gain in detection, targeting, tracking/trailing, and homing via target acquisition and covert prosecution.	3.448	3.573	3.645	0.000	3.645

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602747N / *Undersea Warfare Applied Res*	**Project (Number/Name)** 0000 / *Undersea Warfare Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
FY 2023 Plans: -Continue Precision Localization research on advanced sensing modalities and sampling approaches. Investigate alternative methods for Precision Localization leveraging magnetic and electric field sensing technologies and incorporating alternative technologies and approaches. -Continue sensors research into novel methods to develop smaller and power efficient, high performance magnetic, electric field, acoustic, and novel sensors. Continue research on advanced concepts for processing arrays of independent sensors to create adaptive information theoretic sensor systems. Continue applied research into information theoretic optical sampling and telemetry characteristics to better support sensor performance and data integrity; improve the effectiveness of photonic sensor operations across the air-water interface; and extend the distance optical sensors can effectively operate within the water column. -Continue Remote and Optical Sensing research into remote methods of sensing target signatures. Continue research on optical sensing for precision localization and to better exploit the information capacity available in photonic systems to increase sensor performance.					
FY 2024 Base Plans: -Continue Precision Localization research on advanced sensing modalities and sampling approaches. Investigate alternative methods for Precision Localization leveraging magnetic and electric field sensing technologies and incorporating alternative technologies and approaches. -Continue sensors research into novel methods to develop smaller and power efficient, high performance magnetic, electric field, acoustic, and novel sensors. Continue research on advanced concepts for processing arrays of independent sensors to create adaptive information theoretic sensor systems. Continue applied research into information theoretic optical sampling and telemetry characteristics to better support sensor performance and data integrity; improve the effectiveness of photonic sensor operations across the air-water interface; and extend the distance optical sensors can effectively operate within the water column.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602747N / *Undersea Warfare Applied Res*	**Project (Number/Name)** 0000 / *Undersea Warfare Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
-Continue Remote and Optical Sensing research into remote methods of sensing target signatures. Continue research on optical sensing for precision localization and to better exploit the information capacity available in photonic systems to increase sensor performance. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024					
Title: Anti-Submarine Warfare (ASW) Surveillance ***Description:*** ASW Surveillance focuses on improving detection, classification, and localization capabilities in large ocean areas relative to the capabilities of existing ASW surveillance systems. The related technologies support the conduct of covert, wide-area surveillance ranging from one day to six months. The objectives are to develop and demonstrate technologies that provide clandestine indications and warnings in far forward and contested operating areas, and in complex operational environments against all submarine threats, including new threats with unknown target signatures and tactics. Covertness implies use of non-observable platforms and/or deployed automated sensors employing passive sonar, or other non-detectable methods. The surveillance process includes initial detection and classification. Efforts include the development of Unmanned Undersea Vehicle-based and affordable, off-board deployable sensing systems employing a wide variety of surveillance concepts and components. These efforts focus on alternative detection phenomena, vector/tensor sensors, automated acoustic processing, more compact and longer lasting power sources, and high bandwidth, acoustic communications links. ***FY 2023 Plans:*** - Continue Sonar signal processing related research to develop artificial intelligence technology providing optimized sonar system line-ups that adjust themselves in real time to the current undersea environment. - Continue Sonar exploitation of the information content of ambient noise, creating novel tactical detection methods that exploit ambient noise information content and conducting at sea measurements to validate. - Continue Sonar development and assessment of signal approaches for low complexity sonars, focusing on passive analysis and the generation of actionable warnings. Validate single processing approaches using at sea data.	22.568	23.308	20.201	0.000	20.201

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602747N / *Undersea Warfare Applied Res*	**Project (Number/Name)** 0000 / *Undersea Warfare Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue Sensor studies to improve performance of acoustic vector sensors, vector magnetometers, electrochemical sensors and three-axis magnetometers. - Continue Sensors development of automation approaches that will modernize undersea passive acoustic detection and classification techniques conducting a major at sea trial to collect data for algorithm training and assessment. - Continue Underwater Vehicle Propulsion development of approaches for fluid-loaded elastic structures and soft-bodied unmanned underwater vehicle propulsion. - Continue Underwater Vehicle Propulsion development of technologies for a solar sea glider focused on develop a wavelength tailored photovoltaic cell with selectable layers for use at surface and sub-surface conditions and begin to look at mitigation approaches to bio-fouling. - Continue Signal Processing investigating applicable non-acoustic methods of detection and classification of ultra-quiet, low-Doppler submarines in complex operating environments. Initiate applied research to exploit recent advances in basic / theoretical computer science to efficiently implement signal processing and artificial-intelligence algorithms using mathematical approaches including randomized methods. - Continue efforts that will lead to optimized sensing and behaviors by adapting in dynamic and uncertain environments; cooperative vehicle autonomy with increased endurance; data exfiltration and networking to expand reach; next generation sensors (acoustic and non-acoustic); adaptive, autonomous technologies to detect, classify, and track underwater mobile threats; and new processing techniques which increase performance and expand the tactical utility of current systems.					
FY 2024 Base Plans: - Continue Sonar signal processing related research to develop artificial intelligence technology providing optimized sonar system line-ups that adjust themselves in real time to the current undersea environment. - Continue Sonar exploitation of the information content of ambient noise, creating novel tactical detection methods that exploit ambient noise information content and conducting at sea measurements to validate.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602747N / *Undersea Warfare Applied Res*	**Project (Number/Name)** 0000 / *Undersea Warfare Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue Sonar development and assessment of signal approaches for low complexity sonars, focusing on passive analysis and the generation of actionable warnings. Validate single processing approaches using at sea data. - Continue Sensor studies to improve performance of acoustic vector sensors, vector magnetometers, electrochemical sensors and three-axis magnetometers. - Continue Sensors development of automation approaches that will modernize undersea passive acoustic detection and classification techniques conducting a major at sea trial to collect data for algorithm training and assessment. - Continue Underwater Vehicle Propulsion development of approaches for fluid-loaded elastic structures and soft-bodied unmanned underwater vehicle propulsion. - Continue Underwater Vehicle Propulsion development of technologies for a solar sea glider focused on develop a wavelength tailored photovoltaic cell with selectable layers for use at surface and sub-surface conditions and begin to look at mitigation approaches to bio-fouling. - Continue Signal Processing investigating applicable non-acoustic methods of detection and classification of ultra-quiet, low-Doppler submarines in complex operating environments. Initiate applied research to exploit recent advances in basic / theoretical computer science to efficiently implement signal processing and artificial-intelligence algorithms using mathematical approaches including randomized methods. - Continue efforts that will lead to optimized sensing and behaviors by adapting in dynamic and uncertain environments; cooperative vehicle autonomy with increased endurance; data exfiltration and networking to expand reach; next generation sensors (acoustic and non-acoustic); adaptive, autonomous technologies to detect, classify, and track underwater mobile threats; and new processing techniques which increase performance and expand the tactical utility of current systems. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602747N / *Undersea Warfare Applied Res*	**Project (Number/Name)** 0000 / *Undersea Warfare Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
The funding decrease from FY 2023 to FY 2024 is due to required growth in the ASW Distributed Search to address issues in mine warfare performance assessment and anti-submarine warfare distributed search & performance assessment. Funds realigned within PE 0602747N to Anti-Submarine Warfare (ASW) Distributed Search Activity.					
Title: Marine Mammals	2.450	2.539	2.591	0.000	2.591
Description: The goal of the Marine Mammals and Biology activity focus is to better understand and characterize the effects of underwater sounds produced by Navy acoustic sources on marine mammals. Studies address characterizing marine mammal and their ecosystems, quantifying effects of sound exposure on marine mammals, and improving the ability to monitoring and detect marine mammals in the open ocean. Research results supports Navy environmental compliance information needs and facilitates acquiring Letter of Authorizations from NOAA regulators that enable all Navy training and testing operations, and the development of appropriate state-of-the-art mitigation measures. The marine mammals research conducted in this Program Element (PE) represents part of a total effort executed in coordination with complementary research performed in PE 0602435N Ocean Warfighting Environment Applied Research. ***FY 2023 Plans:*** - Continue efforts include applied research in areas including monitoring and detection, integrated ecosystem, and effects of Anti- Submarine Warfare (ASW) sonar on marine mammals. - Continue Passive Acoustic Monitoring research efforts on passive acoustics and other technology supporting wide area surveillance, including the development and testing of new autonomous hardware platforms and signal processing algorithms for detection, classification, and localization of marine mammals. Continue research using animal tagging and passive acoustic monitoring to quantify behaviors, movement and distribution of marine mammals relative to key environmental properties and sonar exposure, both incidental and experimental. - Continue Sonar Exposure research to quantify the behavioral and physiological effects to potentially population-level consequences of sonar exposure on marine life to develop risk criteria for Navy's sound effects modeling, and develop quantitative inputs for modeling biologically significant effects on marine mammal populations. Navy sound effects modeling is used in Environmental Impact Statements, and subsequent Letters					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602747N / *Undersea Warfare Applied Res*	**Project (Number/Name)** 0000 / *Undersea Warfare Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
of Authorization issued by the NOAA regulator that enable all Navy Anti- Submarine Warfare (ASW) exercises and testing. - Continue Marine Mammals with further research to design equipment and capability to quantify the gas management and kinetics in marine mammals to evaluate the mechanisms that enable marine mammals to dive to deep. - Continue Sound Reception Mechanisms in Whales to pursue research to advance our understanding of sound reception mechanisms in large whales including the anatomy surrounding the ear and the whole head to improve and validate finite element models of sound propagation through various tissues. - Continue Marine Mammal Behavior research into the stress response of marine mammals to ASW sonar exposure with an emphasis on quantifying the effects of prolonged exposure effects on immune system suppression, reproductive failure, accelerated aging, and slowed growth. Conduct research on potential effects of Navy ASW sonar sources on marine mammal behavior, life functions, vital rates, and population level effects. The goal is to understand and quantify the effects of naval activities on species or stocks of marine mammals, including effects on annual rates of recruitment and survival. - Continue Environmental Compliance research to provide tools to support environmental compliance efforts and decision making related to how marine mammals can be affected by anthropogenic sounds. ***FY 2024 Base Plans:*** - Continue efforts include applied research in areas including monitoring and detection, integrated ecosystem, and effects of Anti- Submarine Warfare (ASW) sonar on marine mammals. - Continue Passive Acoustic Monitoring research efforts on passive acoustics and other technology supporting wide area surveillance, including the development and testing of new autonomous hardware platforms and signal processing algorithms for detection, classification, and localization of marine mammals. Continue research using animal tagging and passive acoustic monitoring to quantify behaviors, movement and distribution of marine mammals relative to key environmental properties and sonar exposure, both incidental and experimental. - Continue Sonar Exposure research to quantify the behavioral and physiological effects to potentially population-level consequences of sonar exposure on marine life to develop risk criteria for Navy's sound effects					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602747N / *Undersea Warfare Applied Res*	**Project (Number/Name)** 0000 / *Undersea Warfare Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
modeling, and develop quantitative inputs for modeling biologically significant effects on marine mammal populations. Navy sound effects modeling is used in Environmental Impact Statements, and subsequent Letters of Authorization issued by the NOAA regulator that enable all Navy Anti- Submarine Warfare (ASW) exercises and testing. - Continue Marine Mammals with further research to design equipment and capability to quantify the gas management and kinetics in marine mammals to evaluate the mechanisms that enable marine mammals to dive to deep. - Continue Sound Reception Mechanisms in Whales to pursue research to advance our understanding of sound reception mechanisms in large whales including the anatomy surrounding the ear and the whole head to improve and validate finite element models of sound propagation through various tissues. - Continue Marine Mammal Behavior research into the stress response of marine mammals to ASW sonar exposure with an emphasis on quantifying the effects of prolonged exposure effects on immune system suppression, reproductive failure, accelerated aging, and slowed growth. Conduct research on potential effects of Navy ASW sonar sources on marine mammal behavior, life functions, vital rates, and population level effects. The goal is to understand and quantify the effects of naval activities on species or stocks of marine mammals, including effects on annual rates of recruitment and survival. - Continue Environmental Compliance research to provide tools to support environmental compliance efforts and decision making related to how marine mammals can be affected by anthropogenic sounds. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024					
Title: Undersea Weaponry ***Description:*** Undersea Weaponry focuses on the development of technologies for current and next-generation, offensive and defensive weapons capable of engaging submarines, surface ships and threat torpedoes. Specific efforts focus on increasing probability of kill and probability of counter-kill by improving sensor performance,	13.324	13.809	14.085	0.000	14.085

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602747N / *Undersea Warfare Applied Res*	**Project (Number/Name)** 0000 / *Undersea Warfare Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
engagement tactics, vehicle propulsion and warhead lethality. New weapon and delivery concepts are being assessed. Detailed information regarding Undersea Weaponry Applied Research program plans and objectives is at a higher classification. ***FY 2023 Plans:*** - Continue applied research related to critical Science and Technology (S&T) for Rapid-Reaction Undersea Weapons and Counter-Measures, High-Speed Vehicle Technology, Undersea Warheads Technology, RPG-of-the-Sea and Air-Independent Power and Energy. Support related field activities under the Torpedo Field/Lab Experimentation Program. - Continue applied research to assess transition potential of technologies developed under the High-Speed Vehicle Technology and determine program continuation. ***FY 2024 Base Plans:*** - Continue applied research related to critical Science and Technology (S&T) for Rapid-Reaction Undersea Weapons and Counter-Measures, High-Speed Vehicle Technology, Undersea Warheads Technology, RPG-of-the-Sea and Air-Independent Power and Energy. Support related field activities under the Torpedo Field/Lab Experimentation Program. - Continue applied research to assess transition potential of technologies developed under the High-Speed Vehicle Technology and determine program continuation. - Initiate expanding efforts associated with sensing and warhead testing ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024					
Accomplishments/Planned Programs Subtotals	56.178	58.111	61.503	0.000	61.503

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602747N / *Undersea Warfare Applied Res*	**Project (Number/Name)** 0000 / *Undersea Warfare Applied Res*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602747N / *Undersea Warfare Applied Res*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	48.509	46.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	94.509

A. Mission Description and Budget Item Justification

Efforts for Undersea Warfare Applied Research

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Congressional Add: Persistent Maritime Surveillance ***FY 2022 Accomplishments:*** Conduct basic research supporting persistent maritime surveillance ***FY 2023 Plans:*** Conduct basic research supporting persistent maritime surveillance	9.654	10.000
Congressional Add: Undersea sensing and communications ***FY 2022 Accomplishments:*** Regional research teams from several universities will jointly pursue applied research related to oceanographic processes, models and innovative technologies. Peer-reviewed scientific publications and final technical reports are the anticipated deliverables. ***FY 2023 Plans:*** Regional research teams from several universities will jointly pursue applied research related to oceanographic processes, models and innovative technologies. Peer-reviewed scientific publications and final technical reports are the anticipated deliverables.	3.861	5.000
Congressional Add: Resident Undersea Autonomous Robotics ***FY 2022 Accomplishments:*** The OSU/APL-UW effort will develop critical technologies and at-sea testing to develop an undersea testbed for resident autonomy. ***FY 2023 Plans:*** N/A	6.757	0.000
Congressional Add: Academic partnerships for innovative research ***FY 2022 Accomplishments:*** Conduct academic partnerships for innovative research applied research ***FY 2023 Plans:*** Conduct academic partnerships for innovative research applied research	24.134	25.000
Congressional Add: Energetic global awareness ***FY 2022 Accomplishments:*** Conduct energetic global awareness applied research ***FY 2023 Plans:*** N/A	1.931	0.000
Congressional Add: Bomb technicians training innovations	2.172	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602747N / *Undersea Warfare Applied Res*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
FY 2022 Accomplishments: Conduct applied research supporting bomb technicians training innovations ***FY 2023 Plans:*** N/A		
Congressional Add: Energetics awareness ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct research in energetics awareness.	0.000	3.000
Congressional Add: Mobile test-bed for UUVs ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct research in mobile test-bed for UUVs.	0.000	3.000
Congressional Adds Subtotals	48.509	46.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602750N *I Future Naval Capabilities Applied Research*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	193.392	177.141	182.662	-	182.662	183.064	186.596	190.337	193.778	Continuing	Continuing
0000: *Future Naval Capabilities Applied Research*	0.000	167.327	173.641	182.662	-	182.662	183.064	186.596	190.337	193.778	Continuing	Continuing
9999: *Congressional Adds*	0.000	26.065	3.500	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	29.565

A. Mission Description and Budget Item Justification

The Office of Naval Research (ONR) works closely across the Department of the Navy (DON) and Naval Research Enterprise (NRE) to develop warfighting capabilities that address operational force's highest priorities..

While leveraging technology innovation is critical to maintaining a decisive edge, maintaining a pipeline of new capabilities requires balancing flexibility and risk, in order to deliver solutions to known requirements, and experiment with potential game-changing ideas informed by higher DoN and DoD guidance. This PE funds Future Naval Capabilities (FNC) Technology Candidates, which are at lower Technology Readiness Level (TRLs), and is focused on maturing technologies to higher TRLs to reduce FNC transition risk. Efforts in this PE are coordinated with related work in the USMC Technology Candidates Activity of PE 0602131M Marine Corps Landing Force Technology.

This Program Element (PE) funds Applied Research, which is the systematic study to understand the means to meet a recognized and specific need. Most of the work in this PE can be classified between TRL 2 (technology concept and/or application formulation) and TRL 4 (component and/or breadboard validation in laboratory environments).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	198.233	173.641	182.662	-	182.662
Current President's Budget	193.392	177.141	182.662	-	182.662
Total Adjustments	-4.841	3.500	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	3.500			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-4.841	0.000			
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602750N *I Future Naval Capabilities Applied Research*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 9999: *Congressional Adds*		
Congressional Add: *Improved Detection of Submarine Threats*	4.827	0.000
Congressional Add: *Long endurance, autonomous, mobile acoustic detection systems*	21.238	0.000
Congressional Add: *Operational readiness via next-generation satellites*	0.000	3.500
Congressional Add Subtotals for Project: 9999	26.065	3.500
Congressional Add Totals for all Projects	26.065	3.500

Change Summary Explanation

Funding: No significant change

Technical: No significant change

Schedule: No significant change

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602750N / *Future Naval Capabilities Applied Research*	Project (Number/Name) 0000 / *Future Naval Capabilities Applied Research*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
0000: *Future Naval Capabilities Applied Research*	0.000	167.327	173.641	182.662	-	182.662	183.064	186.596	190.337	193.778	Continuing	Continuing

A. Mission Description and Budget Item Justification

Future Naval Capabilities (FNC) budget activity (BA) 2 investments develop candidate FNC technologies in an agile fashion by exploiting technology advances that respond rapidly to Naval needs. This approach facilitates an optimum response when developing and maturing the technology options that can be developed further in Program Element (PE) 0603673N, Future Naval Capabilities Advanced Technology Development.

The FNC Program favors a high level of collaboration. PE R-2 activities are mostly organized by the Office of Naval Research (ONR) Science and Technology Departments, which are tasked to collaborate with the acquisition stakeholders and their resource sponsors. A complete accounting of the technology candidates being developed and a full disposition of each technology development effort funded in this PE is provided annually to the Congressional oversight committees.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Expeditionary Maneuver Warfare (EMW) and Combating Terrorism	15.799	16.599	17.723	0.000	17.723
Description: The objective of this activity is to develop and mature technologies in asymmetric and irregular warfare, distributed operations, information warfare, survivability and self-defense to a point where they can be proposed and continued as FNCs in PE 0603673N, Future Naval Capabilities Advanced Technology Development. ***FY 2023 Plans:*** Human Performance Education and Training Thrust: - Continue research in new training technologies, knowledge products, architectures, and systems. - Continue research to accelerate mental, emotional and cognitive decision-making skills. - Continue research to improve human-machine teaming. - Continue research in the areas of detecting, localizing and neutralization of mines and improvised explosive devices that challenge the ability to operate in contested maritime environments. - Initiate efforts to develop and evaluate modeling and simulation-based capabilities to accelerate performance in training and education settings and increase readiness in the expeditionary environment. This includes the continuation of Warfighter Training research completed in PE 0602131M in FY22. Logistics Thrust: - Continue research to enhance movement of troops and equipment from ship to inland objectives.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602750N / *Future Naval Capabilities Applied Research*	**Project (Number/Name)** 0000 / *Future Naval Capabilities Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research to develop higher material readiness and reduce the length of the supply chain for small units. This includes the continuation of New Repair Techniques research completed in PE 0602131M in FY22. - Continue Fleet Vehicle research completed in PE 0602131M in FY22 by continuing research in the area of unmanned platform power systems. - Initiate research in the area of advanced manufacturing materials. - Initiate applied research in the area of small scale, energy efficient water purification in support of distributed operations and Expeditionary Advance Base Operations (EABO). Force Protection Thrust: - Continue research to improve warfighter effectiveness in command, control, computers and communication, intelligence, surveillance and reconnaissance in the area of electromagnetic spectrum analysis and signature management. This includes the continuation of Flexible Software Development research completed in PE 0602131M in FY22. - Complete applied research to defend against adversarial unmanned vehicles in the area of Counter Small Unmanned Aerial Systems (UAS). This effort will transition to Advanced Technology Demonstration. - Complete applied research to enhance long-range fires capabilities in the area of Ground Based Air Defense High Energy Laser. This effort will transition to Advanced Technology Demonstration. - Initiate research in the area of increased range and lethality for small form factor weapon systems in support of EABO. Firepower Thrust: - Initiate effort to conduct feasibility demonstration of a missile launcher capable of launching multiple calibers of militarily relevant munitions from a single platform.					
FY 2024 Base Plans: Human Performance Education and Training Thrust: Complete: - Research in new training technologies, knowledge products, architectures, and systems. - Research to accelerate mental, emotional and cognitive decision-making skills. - Research to improve human-machine teaming. - Research in the areas of detecting, localizing and neutralization of mines and improvised explosive devices that challenge the ability to operate in contested maritime environments.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602750N / *Future Naval Capabilities Applied Research*	**Project (Number/Name)** 0000 / *Future Naval Capabilities Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Efforts to develop and evaluate modeling and simulation-based capabilities to accelerate performance in training and education settings and increase readiness in the expeditionary environment. This includes the continuation of Warfighter Training research completed in PE 0602131M in FY22. Logistics Thrust: Continue: - Research in the area of advanced manufacturing materials. - Applied research in the area of small scale, energy efficient water purification in support of distributed operations and Expeditionary Advance Base Operations (EABO). Complete: - Research to enhance movement of troops and equipment from ship to inland objectives. - Research to develop higher material readiness and reduce the length of the supply chain for small units. This includes the continuation of New Repair Techniques research completed in PE 0602131M in FY22. - Fleet Vehicle research completed in PE 0602131M in FY22 by continuing research in the area of unmanned platform power systems. Force Protection Thrust: Continue: - Research to improve warfighter effectiveness in command, control, computers and communication, intelligence, surveillance and reconnaissance in the area of electromagnetic spectrum analysis and signature management. This includes the continuation of Flexible Software Development research completed in PE 0602131M in FY22. - Research in the area of increased range and lethality for small form factor weapon systems in support of EABO. Firepower Thrust: - Continue effort to conduct feasibility demonstration of a missile launcher capable of launching multiple calibers of militarily relevant munitions from a single platform. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602750N / *Future Naval Capabilities Applied Research*	**Project (Number/Name)** 0000 / *Future Naval Capabilities Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
The increase in funding from FY2023 to FY2024 is due to the increased investments in Logistics and Firepower research in the area of advanced manufacturing materials and in feasibility demonstration of a missile launcher capable of launching multiple calibers of militarily relevant munitions from a single platform.					
Title: C4ISR and Special Projects ***Description:*** The objective of this activity is to develop and mature technologies in data science, mathematical optimization, computational and information sciences, quantum information sciences, electronics, command and control (C2), combat systems, communications, cyber security, cyber operations, electronic warfare (EW), sensing and surveillance, and precision timing and navigation (PTN), as well as technologies for surface and airborne vehicles, and cruise missile defense weapons to a point where they can be proposed and continued as Future Naval Capabilities (FNC) in program element (PE) 0603673N, Future Naval Capabilities Advanced Technology Development. ***FY 2023 Plans:*** Communications and Networking Thrust: - Continue analyzing Fifth generation (5G) security and protocol to identify vulnerabilities to close security gaps to increase resiliency and robustness against adversarial attack. - Continue maturing promising over the horizon communications that include low probability of detection and low probability of intercept features to enable distributed maritime operations. - Continue developing hardware and software routing and applications for resilient networking in contested warfighting scenarios and improving data dissemination across both forward and back fit Joint heterogeneous networks. - Initiate multi-beam communications for data dissemination and unmanned and autonomous control applications. - Initiate development of promising low-frequency RF and optical technologies for multi-platform communication capabilities. Intelligence, Decision-Making Superiority, C2 and Combat Systems Thrust: - Continue developing frameworks for cross platform intelligent resource management and data dissemination providing both enhanced Distributed Maritime Operations and system resilience. - Continue developing capabilities that allow commanders to rapidly and confidently move from data-to-options-to-informed decision both at the Maritime Operations Center and Afloat.	46.496	45.141	46.971	0.000	46.971

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate optimization of machine learning and AI algorithms for planning to execution synchronization of hard kill, cyber and electromagnetic engagements. - Initiate development of advanced computing for machine learning on the tactical edge. Full Spectrum Cyber Thrust: - Continue developing tools for convergence and coordinate cyber and EW effects. - Continue maturing innovative cyber approaches to enhance naval platform and warfighting resilience, safety, reliability and efficiency. - Initiate machine learning for automation of cyber defense approaches. - Initiate efforts to automate identification and leveraging of over-permissioned protocol implementations. Electromagnetic Warfare Thrust: - Continue developing technologies, techniques and algorithms that degrade, neutralize, or destroy an adversary's C5ISR capabilities. - Continue developing cross platform technologies to mature electro-magnetic techniques that rely on geographic separation of platform sensors to deliver enhanced operational capabilities. - Continue developing and maturing the necessary component technologies for spectrum access both in EO and RF that enable defeat of adversarial sensors and systems. - Initiate counter ISR technology to defeat and degrade EO sensor and seekers. Surveillance, Sensors and Phenomenology Thrust: - Continue developing and implementing novel hardware, algorithms and high speed processing to enable detection of advanced maritime threats in both manmade and natural clutter at stand-off ranges. - Continue developing and implementing new electro-optic and infrared sensing capabilities including digital readouts for improved passive sensing of difficult threats in cluttered backgrounds. - Continue providing advanced sensor processing that improve Intelligence, Surveillance, Reconnaissance and Targeting of hard targets. - Continue developing key technologies for off-board RF illumination sources to enable Multi-Input Multi-Output and receive-only sensing in a distributed environment. Quantum, Positioning, Navigation, and Timing Thrust:					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate development of quantum gravimetry mapping and navigation techniques.					
FY 2024 Base Plans: Communications and Networking Thrust Continue: - Analyzing Fifth generation (5G) security and protocol to identify vulnerabilities to close security gaps to increase resiliency and robustness against adversarial attack. - Maturing promising over the horizon communications that include low probability of detection and low probability of intercept features to enable distributed maritime operations. - Continue multi-beam communications for data dissemination and unmanned and autonomous control applications. Complete: - Development of hardware and software routing and applications for resilient networking in contested warfighting scenarios and improving data dissemination across both forward and back fit Joint heterogeneous networks. - Development of promising low-frequency RF and optical technologies for multi-platform communication capabilities. Initiate: - Development of software defined modem technologies for waveform interoperability, low probability of intercept and joint service compatibility. Intelligence, Decision-Making Superiority, C2 and Combat Systems Thrust Continue: - Developing frameworks for cross platform intelligent resource management and data dissemination providing both enhanced Distributed Maritime Operations and system resilience. - Developing capabilities that allow commanders to rapidly and confidently move from data-to-options-to-informed decision both at the Maritime Operations Center and Afloat. - Optimization of machine learning and AI algorithms for planning to execution synchronization of hard kill, cyber and electromagnetic engagements. - Development of advanced computing for machine learning on the tactical edge. Full Spectrum Cyber Thrust Continue:					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Developing tools for convergence and coordinate cyber and EW effects. - Machine learning for automation of cyber defense approaches. - Efforts to automate identification and leveraging of over-permissioned protocol implementations. Complete: - Maturing innovative cyber approaches to enhance naval platform and warfighting resilience, safety, reliability and efficiency. Initiate: - Efforts to exploit protocol weaknesses for naval applications. Electromagnetic Warfare Thrust Continue: - Developing technologies, techniques and algorithms that degrade, neutralize, or destroy an adversary's C5ISR capabilities. - Developing cross platform technologies to mature electro-magnetic techniques that rely on geographic separation of platform sensors to deliver enhanced operational capabilities. - Developing and maturing the necessary component technologies for spectrum access both in EO and RF that enable defeat of adversarial sensors and systems. - Counter ISR technology to defeat and degrade EO sensor and seekers. Surveillance, Sensors and Phenomenology Thrust Continue: - Developing and implementing novel hardware, algorithms and high speed processing to enable detection of advanced maritime threats in both manmade and natural clutter at stand-off ranges. - Developing and implementing new electro-optic and infrared sensing capabilities including digital readouts for improved passive sensing of difficult threats in cluttered backgrounds. - Providing advanced sensor processing that improve Intelligence, Surveillance, Reconnaissance and Targeting of hard targets. Complete: - Development of key technologies for off-board RF illumination sources to enable Multi-Input Multi-Output and receive-only sensing in a distributed environment. Initiate: - Polarimetric techniques for improving clutter and identification in maritime radars.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Quantum, Positioning, Navigation, and Timing Thrust - Continue development of quantum gravimetry mapping and navigation techniques. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY 2023 to FY 2024 is due to additional efforts to improve counter intelligence, surveillance and reconnaissance (ISR) capabilities for distributed maritime operations.					
Title: Ocean Battlespace Sensing	25.818	31.977	30.095	0.000	30.095
Description: The objective of this activity is to enable maritime domain access and distributed operations for Naval forces in contested environments through superior maritime battlespace awareness and threat detection, identification and neutralization. Specifically, activities will develop and mature technologies that ultimately support Mine and Expeditionary Warfare, Undersea Warfare, and Environmental Information Warfare. Activities will also develop and mature methods and technological approaches for environmental sensing and prediction for the maritime battlespace. The desired outcome for efforts in this activity is to mature the applied research results to a point where they can be focused on particular enabling capabilities and proposed to be continued as Future Naval Capabilities (FNC) in program element (PE) 0603673N, Future Naval Capabilities Advanced Technology Development. Additionally, a subset of technologies explored herein are intended to support expeditionary access and will be further matured, focused, and ultimately demonstrated under the USMC's Advanced Technology Demonstration effort in PE 0603640M MC Advanced Technology Demo. ***FY 2023 Plans:*** Mine and Expeditionary Warfare Thrust: - Complete the investigation of housing designs to both maximize range and improve lethality for aerial mine subcomponents. - Complete initial design and integration of unmanned platform capability for alternate deployment options. - Completed advanced minesweeping capabilities for unmanned surface vehicles. Technology transitioned to Magnetic and Acoustic Generation Next Unmanned Superconducting Sweep (MAGNUSS) Future Naval Capability. - Initiate area coverage rate mine warfare capability in contested shallow water to surf zone to support expeditionary operations in the South Pacific.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Undersea Warfare Thrust: - Continue to develop acoustic sources for floating and mobile anti-submarine warfare (ASW) sensing systems. - Continue testing of glider towed arrays for detection of ASW threats in the ocean environment. - Complete investigation of undersea data networking technologies for employing multi-modal communication devices for reduced latency and bandwidth, and assured connectivity. - Complete development of a large, low-noise volumetric array that can be deployed in an A-size sonobuoy that will have superior detection performance against relevant targets. - Initiate development of signal processing and displays to improve performance and reduce vulnerability for submarine active sonar. - Initiate development of computational methods to detect very quiet submarine targets by combining evidence from multiple arrays. - Initiate development of unmanned undersea vehicle (UUV) navigation concepts that fuse multiple sensing modalities into a single solution to improve performance in long duration complex environments. Ocean, Atmosphere and Space Sciences Thrust: - Complete development of new decision aid to support intelligence, surveillance and reconnaissance (ISR) mission planning tools for four-dimensional atmospheric cloud/particle prediction and impact electro-optical (EO), infrared (IR) and high-energy laser (HEL) sensors. - Complete new government-owed, open architecture paradigm in Space-Based Environmental Monitoring (SBEM) data processing and delivery needed to improve timely, accurate decision making in the maritime battlespace environment. - Complete development of high frequency (HF) signal of opportunity processing, ionospheric propagation, and ocean surface scatter algorithms to add data fusion, and prognostic capability to regional assessments to support Navy HF communications networks at sea. - Complete development of a prototype radio frequency (RF) communications and signature management tool for small unit maneuver in the coastal and terrestrial environments to assess the environmental variability spatially and temporally. - Complete development of a prototype decision support tool for tactical aircraft that can assess the most likely current refractivity environment and diagnose current observed anomalous RF propagation to exploit or mitigate environmental effects on radar and electronic warfare (EW) search performance.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Complete initial development of forward model components (e.g., coefficients), compression techniques of high-resolution ocean model reassembly on a forward deployed communications-disadvantaged platform. - Initiate development of a methodology of modeling and measurement of EO/IR naval sensors in various weather conditions to determine and predict performance in non-ideal environmental conditions.					
FY 2024 Base Plans: Mine and Expeditionary Warfare Thrust Continue: - Imitate Development of high area coverage rate mine warfare capability for contested environments to support naval maneuver in Western Pacific; includes development of enabling machine learning algorithms, autonomous behavior, and hardware design. Undersea Warfare Thrust Continue: - In-water comparative analysis/testing of glider towed arrays for detection of ASW threats in the ocean environment; leverage emerging glider technologies for increased endurance and consider novel array fabrication to characterize best fit for variety of ocean environments. - Development of signal processing and displays to improve performance and reduce vulnerability for submarine active sonar. - Development of computational methods to detect very quiet submarine targets by combining evidence from multiple arrays. Complete: - Development of acoustic sources for floating and mobile anti-submarine warfare (ASW) sensing systems. - Development of unmanned undersea vehicle (UUV) navigation concepts that fuse multiple sensing modalities into a single solution to improve performance in long duration complex environments. Initiate: - Development of algorithms and software for making probabilistic USW-related sensor performance forecasts that can be used in strike group and theater anti-submarine warfare mission plans. Environmental Information Warfare Thrust (This thrust was previously named Ocean, Atmosphere and Space Sciences Thrust in the FY2023 plans. The name was changed to more accurately describe the research.) Continue:					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Development of algorithms to assess and predict the impact of the atmospheric aerosols and turbulence on the performance of electro-optic and infra-red naval sensors. - Algorithm development for improved cloud visibility assessment by leveraging new government-owed, open architecture paradigm in Space-Based Environmental Monitoring (SBEM) data processing and delivery needed to improve timely, accurate decision making in the maritime battlespace environment. - To apply system learning to tactical environment assessment and prediction in support of aviation applications. - Development of improvements to polar ionosphere sensing and prediction for a regional full-physics model leveraging recently developed sensors and advances in polar space weather science. Complete: - New government-owed, open architecture paradigm in Space-Based Environmental Monitoring (SBEM) data processing and delivery needed to improve timely, accurate decision making in the maritime battlespace environment. - Development of a prototype radio frequency (RF) communications and signature management tool for small unit maneuver in the coastal and terrestrial environments to assess the environmental variability spatially and temporally. Initiate: - Development of a fully coupled ionospheric-thermospheric model to permit greatly improved multi-day forecasts for propagation conditions of HF communications and radars. - Characterization of Earth science model error in decision support tools by examining forecast fidelity from short-term (hourly) to sub-climate (monthly) timescales using a hierarchy of data quality, from full coupled dynamical simulations to regional, statistical, and climatological guidance. - Development of the numerical representation of improved tropospheric-stratospheric interaction and mesospheric data assimilation for gravity wave processes leading to extended range prediction of extreme weather events. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The funding decrease from FY2023 to FY2024 is tied to the completion of the development of prototype radio frequency communications and signature management tool for small unit maneuver in the coastal and terrestrial environments to assess the environmental variability spatially and temporally. Additionally, projects have been completed regarding the new government-owed, open architecture paradigm in Space-Based Environmental					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Monitoring data processing and delivery needed to improve timely, accurate decision making in the maritime battlespace environment.					
Title: Sea Warfare and Weapons	32.946	30.926	33.368	0.000	33.368
Description: The objective of this activity is to develop and mature technologies that enable superior warfighting capabilities for surface and sub-surface naval platforms and undersea weaponry to a point where they can be proposed and continued as Future Naval Capabilities in program element (PE) 0603673N, Future Naval Capabilities Advanced Technology Development. ***FY 2023 Plans:*** Initiate the following: - Efforts associated with rocket-propelled grenade (RPG)-of-the-Sea to develop and test components for a man-portable, easy-to-deploy undersea weapon effective against small surface craft. Use a build-test-build approach to refine, either individually or in combination, components for sensors, guidance, fuzing and propulsion. - Efforts associated with Wide Arc Swath Profiler (WASP) to Develop, test and assess the viability and utility of a new guidance mode for undersea weapons and vehicles. Continue the following: - Autonomous Determination of Vessel Intent (ID) efforts to develop and test an algorithm that will autonomously determine the intent of another vessel. (Initiated in FY22) - Autonomous Tactical Behaviors for M/LUSVs (ATBM/L) efforts to develop, integrate and transition mission executive and behaviors capability to USVs, such that the capability can be used on any UMAA-compliant USV. - Autonomic Readiness Management (ARM) efforts to build an onboard hardware/software infrastructure and integration to operational decision support for onboard data acquisition and analysis using AI/ML based models. - Robust Unmanned Platform Power System (RUPPS) effort to focus on the component modeling, system modeling, simulation, and subscale experimentation activities to demonstrate the suitability of modular, high endurance, alternative power system technology for Unmanned Surface Vessel platforms (USV). (Initiated in FY21) - Propulsion Gas Turbine Materials Upgrade (GTMAT) efforts to enable sustained higher engine service temperatures to meet increased ship power needs/capabilities and maintain engine life (Initiated in FY21) - Flux-Core Additive Manufacturing (FCAM) efforts enable metal additive manufacturing afloat without creating a large logistics burden to carry shielding gas. (Initiated in FY22)					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- COTS Battery Phase II (COTS B II) research to develop and demonstrate a custom battery design that uses automotive industry commercial-off-the-shelf (COTS) battery hardware and lifecycle data-driven reliability approaches to battery management. (Initiated in FY22) - Electrical Ship Asset efforts: aging modelling and Reliability and Condition Assessment (ESARCA) efforts to investigate methods that lead to effective use of electrical insulation materials on ships employing high voltage electrical equipment. (Initiated in FY22) - Digital Evaluation of Implodable Composite Payloads (DEIComP) effort involves developing a suite of validated digital engineering tools and experimental findings that will improve prediction accuracy and improve speed and affordability of implodable integration with the fleet while increasing deployed technologies and survivability. (Initiated in FY22) - Flow Induced Machinery Noise Silencing (FIMNS) efforts to develop an increased knowledge base and an improved computational toolset for the design of efficient and reduced acoustic noise submarine machinery system blowers, cooling fans, and treatments; and deliver a prototype quiet cooling fan. (Initiated in FY22) - Stern Area System+ (SAS+) efforts to develop and demonstrate, through laboratory and in-water tests, algorithms which allow SAS to perform a new function to replace a legacy system, with enhanced capability, in the VIRGINIA Class. (Initiated in FY22) - Own Ship Electro-Magnetic Monitoring (OSEM) efforts to complete external sensor requirements and specifications development, continue sensor design, and develop the sensor qualification test plan. (Initiated in FY22) - Low-Observable Communications Mast for Undersea Platforms (LOCM-UP) efforts to reduce the radar cross section (RCS) and overall counterdetection risk of the submarine multifunction mast (MFM) while maintaining or increasing broad spectrum communications capability. (Initiated in FY22) - Corrosion-Informed Materials Section and Design Tool (CIMaD Tool) efforts to develop a DoN corrosion materials database and associated corrosion simulation algorithms, and validate a set of simulation algorithms using the developed database to predict corrosion damage which is critical to pursue a research to design against corrosion prior to production of DoN assets. (Initiated in FY22) - Next Generation Structural Steel for Enhanced Platform Capability (10% Ni Steel) efforts to develop processing conditions for adequate NIL-Ductility temperature, crack arrest, and stress-corrosion cracking (SCC) resistance; develop machine-learning process-structure-properties models to predict behavior and development of welding consumables and processes requiring no preheat. (Initiated in FY22) Complete the following: - AVIA efforts by delivering details from testing and simulation to the new ATBM/L technical candidate.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Digital twin related efforts by proposing to transition to an INP. - Condition Based Maintenance (CBM) efforts to deliver prototype EDAPO hardware and software modules for vehicle PHMS. - VIPB efforts by delivering models for the shaft-line components to the Future Naval Capability. - Own Ship Acoustic Monitoring efforts by delivering technical details from monitoring, studies and training to support transition to the Future Naval Capability. - Transparent Marine Antifouling Coatings (TMAC) efforts by delivering proposed down-select coatings for scale-up and additional testing.					
FY 2024 Base Plans: Naval Power Systems Continue: - COTS Battery Phase II (COTS B II) research to develop and demonstrate a custom battery design that uses automotive industry commercial-off-the-shelf (COTS) battery hardware and lifecycle data-driven reliability approaches to battery management. Complete: - Electrical Ship Asset efforts: aging modelling and Reliability and Condition Assessment (ESARCA) efforts to investigate methods that lead to effective use of electrical insulation materials on ships employing high voltage electrical equipment. - Robust Unmanned Platform Power System (RUPPS) component modeling, system modeling, simulation, and subscale experimentation activities to demonstrate the suitability of modular, high endurance, alternative power system technology for Unmanned Surface Vessel platforms (USV). (Completed in FY23) FY24-start RUPPS FNC proposed. - High Density Kinetic Energy Storage System (HD KESS) efforts to prove the feasibility of a non-battery Energy Magazine. (Initiated in FY23) - Propulsion Gas Turbine Materials Upgrade (GTMAT) efforts to enable sustained higher engine service temperatures to meet increased ship power needs/capabilities and maintain engine life. FY24-start GTMAT FNC proposed. Initiate: - Feasibility studies to explore next generation applications of Naval Power Systems in Navy and Marine Corps environments. Platform Design and Engineering					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Continue: - Autonomous Determination of Vessel Intent (ID) efforts to develop and test an algorithm that will autonomously determine the intent of another vessel Complete: - Digital Evaluation of Implodable Composite Payloads (DEIComP) effort involves developing a suite of validated digital engineering tools and experimental findings that will improve prediction accuracy and improve speed and affordability of implodable integration with the fleet while increasing deployed technologies and survivability. (Completed in FY23) - Low-Observable Communications Mast for Undersea Platforms (LOCM-UP) efforts to reduce the radar cross section (RCS) and overall counterdetection risk of the submarine multifunction mast (MFM) while maintaining or increasing broad spectrum communications capability. - Stern Area System+ (SAS+) efforts to develop and demonstrate, through laboratory and in-water tests, algorithms which allow SAS to perform a new function to replace a legacy system, with enhanced capability, in the VIRGINIA Class. - Own Ship Electro-Magnetic Monitoring (OSEM) efforts to complete external sensor requirements and specifications development, continue sensor design, and develop the sensor qualification test plan. - Flow Induced Machinery Noise Silencing (FIMNS) efforts to develop an increased knowledge base and an improved computational toolset for the design of efficient and reduced acoustic noise submarine machinery system blowers, cooling fans, and treatments; and deliver a prototype quiet cooling fan. - Digital Engineering that creates a digital thread connecting full platform lifecycle will be proposed as FY25 INP New Start. - Autonomous Tactical Behaviors for M/LUSVs (ATBM/L) efforts to develop, integrate and transition mission executive and behaviors capability to USVs, such that the capability can be used on any UMAA-compliant USV. (project terminated prior to initiation) - Autonomic Readiness Management (ARM) efforts to build an onboard hardware/software infrastructure and integration to operational decision support for onboard data acquisition and analysis using AI/ML based models. (project terminated prior to initiation) Initiate: - Feasibility studies to explore next generation applications of Platform Design and Engineering in Navy and Marine Corps environments. Undersea Weapons Continue: N/A					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Complete: - Efforts associated with rocket-propelled grenade (RPG)-of-the-Sea by transitioning a new and novel undersea weapon concept to the special warfare community. - Efforts associated with Wide Arc Swath Profiler (WASP) to develop, test and assess the viability and utility of a new guidance mode for undersea weapons and vehicles. Initiate: - Feasibility studies to explore next generation applications of Undersea Weapons in Navy and Marine Corps environments. Materials, Manufacturing, Sustainment & Logistics Continue: - Corrosion-Informed Materials Section and Design Tool (CIMaD Tool) efforts to develop a DoN corrosion materials database and associated corrosion simulation algorithms, and validate a set of simulation algoritghms using the developed database to predict corrosion damage which is critical to pursue a research to design against corrosion prior to production of DoN assets. Complete: - Flux-Core Additive Manufacturing (FCAM) efforts enable metal additive manufacturing afloat without creating a large logistics burden to carry shielding gas. - Next Generation Structural Steel for Enhanced Platform Capability (10% Ni Steel) efforts to develop processing conditions for adequate NIL-Ductility temperature, crack arrest, and stress-corrosion cracking (SCC) resistance; develop machine-learning process-structure-properties models to predict behavior and development of welding consumables and processes requiring no preheat. (Completed in FY23) Initiate: - Feasibility studies to explore next generation applications of Materials, Manufacturing, Sustainment and Logistics in Navy and Marine Corps environments. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY2023 to FY2024 will be used to advance efforts associated with the various core competency areas for Sea Warfare and Weapons.					
Title: Warfighter Performance	16.238	18.343	24.248	0.000	24.248

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Description: The objective of this activity is to conduct research and mature technologies that enhance Naval warfighting effectiveness and efficiency within the broad array of Warfighter Performance science and technology domains (Decision Sciences, Information Warfare and Future Conflict, Manpower, Personnel, Training and Education, Intelligent and Autonomous Systems, Biocentric Technologies, Medical, Human Performance) to a point where they can be proposed and continued as Future Naval Capabilities (FNC) in program element (PE) 0603673N, Future Naval Capabilities Advanced Technology Development. ***FY 2023 Plans:*** Advanced Analytics and Decision Making Thrust: - Continue development of an information warfare training system that teaches tactics, techniques and procedures for decisive, effective engagement that is suitable for public affairs, information operations, psychological operations, and intelligence operations. - Complete development of automated data fusion and asset allocation techniques that support the E-2D Hawkeye tactical airborne early warning aircraft's role in orchestrating Carrier Strike Group air defense. Integrate into Virtual/Constructive training environments and enable E-2D crew to train as it fights. - Initiate technology to automatically identify man-made structures in high resolution 3D datasets by defining use cases, workflows, outline methods, and algorithms for existing software applications. Program will reduce the task load for defining structures by identifying specific features unique to man-made structures and using them to outline the structures. - Initiate feasibility studies to explore next generation applications of advanced analytics and decision making in Navy and Marine Corps environments. Autonomy, Artificial Intelligence and Robotics Thrust: - Complete development of information model for expressing and managing mission priorities and authorities between unmanned vehicles, autonomous systems and warfighters to enable transfer of tactical control of vehicles and/or their payloads during missions in contested communications environments. - Initiate development of techniques to manage data sharing requirements to support logistics tools and minimize bandwidth requirement to enable meta-optimization across multiple planners and tactical decision aids. - Initiate feasibility studies to explore next generation applications of autonomy, artificial intelligence, and robotics in Navy and Marine Corps environments. Manpower, Performance, Protection, and Medical Support Thrust:					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue development of models that provide decision support tools during the selection and assignment process of military personnel in order to maximize organizational effectiveness. - Complete development of a flexible, dry dive suit enabling mobility for divers to work on the bottom of the ocean to accomplish the majority of tasks that previously required a 'wet diver' and cannot be accomplished by robotics. - Initiate development of a Modular, Live-Virtual-Constructive integrated warfare environment to support training, mission rehearsal, and assessment of Carrier Strike Group and Air Wing forces while at sea. - Initiate feasibility studies to explore next generation applications of manpower, performance, protection, and medical support in Navy and Marine Corps environments. Materials Thrust: - Complete maturation of a low viscosity corrosion preventative wash primer to increase paint adhesion for the repair of tiles on submarines. - Complete characterization of a biomimetic and a bioinspired seawater curing adhesive to assess its suitability for adhering submarine hull treatment to steel submarine hulls. - Initiate feasibility studies to explore next generation applications of materials in Navy and Marine Corps environments. ***FY 2024 Base Plans:*** Advanced Analytics and Decision Making Thrust Continue: - Investigating capabilities that will define use cases, workflows, outline methods, and algorithms for existing software applications to automatically identify man-made structures in high resolution 3D datasets. - Complete: - Applied research on an information warfare training system that teaches tactics, techniques and procedures for decisive, effective engagement that is suitable for public affairs, information operations, psychological operations, and intelligence operations. Initiate: - Studies on automated planner coordination and optimization tools for mission logistics, increasing combat readiness with actionable information. This includes methodology and proof of concept software to couple mission, logistics, and route planning in SecDevOps environment. - Feasibility studies to explore next generation applications of advanced analytics and decision making in Navy and Marine Corps environments.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Autonomy, Artificial Intelligence and Robotics Thrust Complete: - Studies on techniques to manage data sharing requirements to support logistics tools and minimize bandwidth requirement to enable meta-optimization across multiple planners and tactical decision aids. Initiate: - Applied research on a family of robotic autonomous systems with modular sensor and force protection payloads that are interoperable between multiple platform variants. - Feasibility studies to explore next generation applications of autonomy, artificial intelligence, and robotics in Navy and Marine Corps environments. Manpower, Performance, Protection, and Medical Support Thrust Continue: - Expanding models that provide decision support tools during the selection and assignment process of military personnel in order to maximize organizational effectiveness. - Applied research on a Modular, Live-Virtual-Constructive integrated warfare environment to support training, mission rehearsal, and assessment of Carrier Strike Group and Air Wing forces while at sea. Initiate: - Applied research to develop capabilities that will improve instructor performance and proficiency, leading to enhanced student learning outcomes. - Investigations on adaptive training approaches that include automated assessment and adaptive scenarios to accelerate training of ship handling skills for bridge personnel. - Feasibility studies to explore next generation applications of manpower, performance, protection, and medical support in Navy and Marine Corps environments. Materials Thrust - Initiate feasibility studies to explore next generation applications of materials in Navy and Marine Corps environments.					
FY 2024 OCO Plans: N/A					
FY 2023 to FY 2024 Increase/Decrease Statement:					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
The increase in funding from FY2023 to FY2024 will be used to initiate efforts in: 1) automated planner coordination and optimization tools for mission logistics; 2) robotic autonomous systems for force protection; 3) capabilities to improve instructor performance and proficiency; and 4) adaptive, automated training for ship bridge personnel.					
Title: Naval Air Warfare and Weapons ***Description:*** The objective of this activity is to develop and mature technologies in directed energy, energetic materials, autonomy, electromagnetic launch, and high speed conventional air and surface weapons to a point where they can be proposed and continued as Future Naval Capabilities in PE 0603673N, Future Naval Capabilities Advanced Technology Development. ***FY 2023 Plans:*** Kinetic Weapons Thrust: - Continue investigating advanced material and structural capabilities in aerodynamics for high-speed/hypersonic weapons. - Continue the investigation of advanced air-to-surface/ground seeker technologies, focusing largely on efficacy in a hypersonic regime. - Continue maturing design concepts, fabricating sample components, and performing preliminary testing to inform future system level design trades. - Continue leveraging ongoing reactive materials initiatives for application to additional munitions and weapons. Establish weight/volume versus range increase potential for conceptual warhead designs. Establish warhead interface constraints for system integration. - Continue developing novel energy/power generation, management and storage technologies applicable to advanced future missile capabilities and requirements. - Complete investigating novel concepts for solid rocket motor initiation, safety and thrust profile management. - Complete maturing key solid fuel ramjet technologies for increasing range, speed and maneuverability for missiles and projectiles. - Complete leveraging ongoing collaborative weapons technologies for application to additional munitions and weapons. - Initiate feasibility studies for tactical decision aids that support advanced strike weapons. - Initiate feasibility studies and possible development of terminal defense fire control architectures that support low cost and easy integration onto ships and into expeditionary forces for terminal defense suitable for multiple engagement weapons.	30.030	30.655	30.257	0.000	30.257

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602750N / *Future Naval Capabilities Applied Research*	**Project (Number/Name)** 0000 / *Future Naval Capabilities Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Directed Energy / Electric Weapons Thrust: - Continue maturing technologies leading to development of directed energy for self-defense of high value, low density aircraft against next generation advanced threats. Includes solid state and pulsed laser systems. - Continue designing, developing and testing of solid state, High-Power Microwave (HPM) systems for enhanced lethality. - Continue the initial susceptibility testing of Out Board Motor assets utilizing developed waveforms from FY21, modeling potential dynamic engagements matched to Joint Counter UAS operational requirements, and performing scaled demonstration of waveform engagement capability facility. - Continue the system design, build and testing of solid state High Power Microwave (HPM) Nonlinear Transmission Line (NLTL) power combining and phased array phase control evaluation, and platform integration study, and dynamic swarm CUAS HPM lethality testing. - Continue testing of an ensonification device to determine effects of range and amplitude. - Continue developing a conceptual RM warhead designs for 40mm grenade configurations. - Complete evaluating High Power Microwave (HPM) technologies used in counter electronic missions to defeat swarms of small Unmanned Aerial Systems (UAS). - Complete assessing the feasibility of near term solid-state HPM technologies to provide low cost and flexible counter UAS capability. - Complete conceptual designs for HPM weapons to increase defensive weapon capabilities of expeditionary ship classes against small vessels and swarming small UAS threats. - Initiate the development of compact High Power Microwave (HPM) antenna technology with reduced size, weight and cost to enable integration into Marine Corps tactical ground vehicles. - Initiate the advancement of HPM tunable source technology to adapt to evolving airborne threats. Aviation Platforms Thrust: - Continue Investigating and maturing system of systems concepts and associated technologies necessary to fully implement manned-unmanned teaming operations. - Continue maturing technologies leading to development of kinetic kill for self-defense of high value, low density aircraft against next generation advanced threats. This includes kinetic-kill defenses against adversary hypersonic weapons research and developing conceptual approaches for a podded Wide Body Defense System suitable for naval high value air assets. - Complete maturing Fuel Bladder Technologies by fabricating and testing crashworthy and self-sealing large panels.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602750N / *Future Naval Capabilities Applied Research*	**Project (Number/Name)** 0000 / *Future Naval Capabilities Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate the investigation and design of a suite of drag reduction concepts for Naval big wing aircraft, in order to improve flight performance. ***FY 2024 Base Plans:*** Kinetic Weapons Thrust Continue: - Investigating advanced material and structural capabilities in aerodynamics for high-speed/hypersonic weapons. - Investigation of advanced air-to-surface/ground seeker technologies, focusing largely on efficacy in a hypersonic regime. - Maturing design concepts, fabricating sample components, and performing preliminary testing to inform future system level design trades. - Leveraging ongoing reactive materials initiatives for application to additional munitions and weapons. Establish weight/volume versus range increase potential for conceptual warhead designs. Establish warhead interface constraints for system integration. - Feasibility studies for tactical decision aids that support advanced strike weapons. - Feasibility studies and possible development of terminal defense fire control architectures that support low cost and easy integration onto ships and into expeditionary forces for terminal defense suitable for multiple engagement weapons. Complete: - Developing novel energy/power generation, management and storage technologies applicable to advanced future missile capabilities and requirements. Initiate: - Investigation into varied technologies that could mitigate impacts of adverse navigational environments upon weapon systems employed in denied areas. - Investigation into advanced propulsion techniques for high speed weapons; main focus on air-breathing concepts. Directed Energy / Electric Weapons Thrust Continue: - Maturing technologies leading to development of directed energy for self-defense of high value, low density aircraft against next generation advanced threats. Includes solid state and pulsed laser systems.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602750N / *Future Naval Capabilities Applied Research*	**Project (Number/Name)** 0000 / *Future Naval Capabilities Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initial susceptibility testing of Out Board Motor assets utilizing developed waveforms from FY21, modeling potential dynamic engagements matched to Joint Counter UAS operational requirements, and performing scaled demonstration of waveform engagement capability facility. - Development of compact High Power Microwave (HPM) antenna technology with reduced size, weight and cost to enable integration into Marine Corps tactical ground vehicles. - Advancement of HPM tunable source technology to adapt to evolving threats. Complete: - Designing, developing and testing of solid state, High-Power Microwave (HPM) systems for enhanced lethality. - System design, build and testing of solid state High Power Microwave (HPM) Nonlinear Transmission Line (NLTL) power combining and phased array phase control evaluation, and platform integration study, and dynamic swarm CUAS HPM lethality testing. Transition to Joint CUAS Office. - Testing of an ensonification device to determine effects of range and amplitude. - Developing a conceptual RM warhead designs for 40mm grenade configurations. Initiate: - Development of advanced C-ISR disabling and jamming techniques. Aviation Platforms Thrust Continue: - Investigating and maturing system of systems concepts and associated technologies necessary to fully implement manned-unmanned teaming operations. - Maturing technologies leading to development of kinetic kill for self-defense of high value, low density aircraft against next generation advanced threats. Complete: - Investigation and design of a suite of drag reduction concepts for Naval big wing aircraft, in order to improve flight performance. Initiate: - Investigation into concepts and technologies necessary to achieve greater operational capability from unmanned aerial systems. - Investigation into a suite of technologies leading to more robust shipboard recovery capabilities for air platforms (manned and unmanned). ***FY 2024 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602750N / *Future Naval Capabilities Applied Research*	**Project (Number/Name)** 0000 / *Future Naval Capabilities Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY2023 to FY2024.					
Accomplishments/Planned Programs Subtotals	167.327	173.641	182.662	0.000	182.662

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602750N / *Future Naval Capabilities Applied Research*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	26.065	3.500	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	29.565

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Congressional Add: Improved Detection of Submarine Threats ***FY 2022 Accomplishments:*** Conduct applied research for improved detection of submarine threats. ***FY 2023 Plans:*** N/A	4.827	0.000
Congressional Add: Long endurance, autonomous, mobile acoustic detection systems ***FY 2022 Accomplishments:*** Conduct long endurance, autonomous, mobile acoustic detection systems applied research ***FY 2023 Plans:*** N/A	21.238	0.000
Congressional Add: Operational readiness via next-generation satellites ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct research supporting operational readiness via next-generation satellites.	0.000	3.500
Congressional Adds Subtotals	26.065	3.500

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602782N *I Mine and Expeditionary Warfare Applied Research*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	40.983	48.649	30.435	-	30.435	32.932	33.591	34.263	34.948	Continuing	Continuing
0000: *Mine and Expeditionary Warfare Applied Research*	0.000	31.329	31.649	30.435	-	30.435	32.932	33.591	34.263	34.948	Continuing	Continuing
9999: *Congressional Adds*	0.000	9.654	17.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	26.654

A. Mission Description and Budget Item Justification

Sea mines remain a significant threat to ships. In fact, fifteen U.S. Navy ships have been sunk or damaged by mines since World War II, almost four times more than any other weapon. The Mine and Expeditionary Warfare Applied Research Program Element (PE) provides technologies for Naval Mine Countermeasures (MCM), Expeditionary Warfare, U.S. Naval sea mining, Naval Special Warfare (NSW), and Joint Tri-Service Explosive Ordnance Disposal (EOD) as well as continuing support to research vessels of the U.S. Academic Research Fleet for operations and maintenance that enable applied research at sea. This program strongly aligns with the Joint Chiefs of Staff Joint Warfighting Capability Objectives through the development of technologies to achieve military objectives with minimal casualties and collateral damage. This investment will enable Ship-to-Objective Maneuver (STOM) and focus on technologies that will provide the Naval Force with the capability to dominate the battlespace, project power from the sea, and support forces ashore with particular emphasis on rapid MCM operations. These efforts concentrate on the development and transition of technologies for the MCM-related and Urban Asymmetric/Expeditionary Warfare Operations (UAEO)-related Future Naval Capabilities (FNC) Enabling Capabilities (ECs).

The Mine and Obstacle Detection and Neutralization efforts include technologies for clandestine and overt minefield reconnaissance, organic ship self-protection, organic mine hunting and neutralization/breaching. The Urban Asymmetric Operation effort includes critical warfighting functions such as Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR), fires, maneuver, sustainment, etc. The Naval Special Warfare and Explosive Ordnance Disposal technology efforts concentrate on the development of technologies for safe near-shore mine detection, diver mobility and survivability, and ordnance disposal operations. The activities described in this PE address future Navy and Marine Corps capabilities needed to maintain maritime superiority and ensure national security. They are based on input from Naval Research Enterprise stakeholders including the Naval enterprises, the combatant commands, Office of the Chief of Naval Operations (OPNAV) and Headquarters Marine Corps and are designed to exploit breakthroughs in science and technology in order to deliver maximum warfighting benefit to our sailors and Marines. These efforts align with shared priorities throughout the whole of RDT&E in order to quickly advance new capabilities from discovery to deployment across the warfighting domains.

Today's Sailors and Marines are enabled by naval Science and Technology (S&T). Since 1946, the Office of Naval Research (ONR) has fostered scientific research related to the maintenance of maritime superiority and national defense. ONR manages the Department of the Navy's (DON) portfolio of naval Basic and Applied research, and Advanced Technology Development investments to ensure naval forces can effectively deter conflict, but when called upon, fight, win and come home safe. Current investments hedge against uncertainty, providing solutions to commanders today, and options for the future. The Naval S&T budget supports higher guidance defined by the National Defense Strategy, and responds to requirements identified by the Secretary of the Navy through research priorities set by the Chief of Naval Research, coordinated across the Naval Research Enterprise (NRE), and outlined in the Naval R&D Framework.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602782N *I Mine and Expeditionary Warfare Applied Research*

This Program Element (PE) funds Applied Research, which is the systematic study to understand the means to meet a recognized and specific need. Most of the work in this PE can be classified between Technology Readiness Level (TRL) 2 (technology concept and/or application formulation) and TRL 4 (component and/or breadboard validation in laboratory environments).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	42.160	31.649	32.285	-	32.285
Current President's Budget	40.983	48.649	30.435	-	30.435
Total Adjustments	-1.177	17.000	-1.850	-	-1.850
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	17.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.177	0.000			
• Program Adjustments	0.000	0.000	-1.850	-	-1.850
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 9999: *Congressional Adds*		
Congressional Add: *Human fusion tech for EOD robot applications*	9.654	0.000
Congressional Add: *Expendable energetic unmanned aerial system (UAS)*	0.000	7.000
Congressional Add: *Solid state magnetic gradiometers for UUVs*	0.000	10.000
Congressional Add Subtotals for Project: 9999	9.654	17.000
Congressional Add Totals for all Projects	9.654	17.000

Change Summary Explanation

Funding: FY 2024 decrease due to realignment of funds to PE 0602747N Anti-Submarine Warfare (ASW) Distributed Search Activity.

Technical: No significant change.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602782N *I Mine and Expeditionary Warfare Applied Research*

Schedule: No significant change

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602782N / *Mine and Expeditionary Warfare Applied Research*	Project (Number/Name) 0000 / *Mine and Expeditionary Warfare Applied Research*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
0000: *Mine and Expeditionary Warfare Applied Research*	0.000	31.329	31.649	30.435	-	30.435	32.932	33.591	34.263	34.948	Continuing	Continuing

A. Mission Description and Budget Item Justification

This Project focuses on reducing the time involved in conducting Mine Countermeasure (MCM) operations and increasing safe standoff from minefields. It develops and transitions technologies for MCM-related and UAEO-related Future Naval Capabilities (FNC). The MIW effort includes technologies for clandestine and overt minefield reconnaissance, organic ship self-protection, organic mine-hunting, neutralization/breaching and clearance. The Littoral Warfare effort includes critical warfighting functions such as C4ISR, fires, maneuver, sustainment. The sea mining effort emphasizes technologies for future sea mines. The Naval Special Warfare and Explosive Ordnance technology efforts concentrate on the development of technologies to enhance diver capabilities including: safe near-shore mine sensing, mobility and survivability, and ordnance disposal operations.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Mine Technology	2.055	2.095	2.137	0.000	2.137
Description: This activity primarily focuses on developing and demonstrating technologies to support on-demand battlespace shaping through advanced undersea weapons and next generation mining concepts. Efforts include Command & Control to support remote control, advanced sensing technologies, compatibility with options for unmanned delivery, detection & classification, and targeting solutions. Mine technology research supports Fleet demand for capability and prototype development for next generation naval mining concepts. ***FY 2023 Plans:*** - Continue Target Detection Devices (Mine & Expeditionary Warfare): Continue efforts in developments in advanced sensors and algorithmic capabilities that are applicable toward existing target detection devices (TDDs), development of concepts for remote controlled mines, and assessment of sea mine technologies in order to maintain a level of expertise in naval mines. Specific effort will include advanced sensing modalities for improved discrimination. The objective is to achieve a miniaturized, highly capable TDD to advance legacy mine capacity. - Continue Naval Mine Subcomponents (Mine & Expeditionary Warfare): Continue efforts in alternative packaging and miniaturization of naval mine subcomponents. Specific efforts include advanced sensing, remote					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602782N / *Mine and Expeditionary Warfare Applied Research*	**Project (Number/Name)** 0000 / *Mine and Expeditionary Warfare Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
control and communications, and advanced energetics. The objective is to achieve alternative capability to incrementally advance legacy mine capacity, and find new capability within legacy delivery mechanisms. ***FY 2024 Base Plans:*** - Continue Target Detection Devices (Mine & Expeditionary Warfare): Continue efforts in developments in advanced sensors and algorithmic capabilities that are applicable toward existing target detection devices (TDDs), development of concepts for remote controlled mines, and assessment of sea mine technologies in order to maintain a level of expertise in naval mines. Specific effort will include advanced sensing modalities for improved detection, classification, and discrimination. The objective is to achieve a miniaturized, highly capable TDD to advance legacy mine capacity. - Continue Naval Mine Subcomponents (Mine & Expeditionary Warfare): Continue efforts in alternative packaging and miniaturization of naval mine subcomponents. Specific efforts include advanced sensing, remote control and communications, and advanced energetics. The objective is to achieve alternative capability to incrementally advance legacy mine capacity, and find new capability within legacy delivery mechanisms ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024					
Title: Mine/Obstacle Detection ***Description:*** This activity focuses on applied research to enable longer detection ranges and precise detection and mine location with fewer false alarms in a variety of challenging environments. It supports Mine Warfare (MIW) related Future Naval Capabilities (FNCs). Efforts include novel sonar technologies for longer range detection and classification of mine-like targets or obstacles on or near the seafloor, magnetic gradiometer sensing, electro-optic (EO) technology for buried mine identification, and sensor integration onto Unmanned Underwater Vehicles (UUVs). EO sensor research develops algorithms to enable image processing for rapid overt reconnaissance from an Unmanned Aerial Systems (UAS). Efforts include the development of processing, classification and data fusion techniques to reduce operator workload, and an expert system used to predict mine burial. Efforts also support development of MCM Mission Modules for Littoral Combat Ships. The program is strongly aligned with the Oceanographer of the Navy and the research topics addressed by this activity reflect the priorities for improved forecasts of the operational environment and the development and use	18.660	18.574	17.099	0.000	17.099

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
of autonomous systems. These efforts support collection of environmental observations and operations and maintenance of research vessels of the U.S. Academic Research Fleet to enable science at sea. Field research within this activity that using active acoustic transmissions requires modeling of the acoustic effects of sound on marine life in order to meet Navy environmental requirements. ***FY 2023 Plans:*** - Continue Autonomous Vehicles (Mine & Expeditionary Warfare) efforts to develop approaches for coupling between autonomous vehicles and their sensor payloads. Continue efforts to characterize flow generated by biomimetic propulsion approaches. Initiate development of a learning and planning framework, conducting field experiments that demonstrate simultaneous exploration and navigation in an unknown environments while attempting to execute a complex mission.(NRL) - Continue Mine Countermeasures (MCM) Data (Mine & Expeditionary Warfare) efforts to aggregate, curate and interrogate real and simulated data sets for in-situ algorithm adaptation, optimization, and performance assessment. The objective is to enable unmanned systems to operate flexibly across a wide range of dynamic and unstructured environments. - Continue MCM Sensor (Mine & Expeditionary Warfare development of next-generation small, highly capable MCM sensors. Specific efforts include sensors, electronics, and computing technology. The objective is to increase deployment options for unmanned systems. - Continue Mine & Expeditionary Warfare (Target Recognition and Signal Processing) machine learning algorithm development efforts that yield principled understanding of sensor information content, are robust to challenging operating conditions and produce human-interpretable or traceable predictions. - Continue Threat Detection/Robotic Techniques (Mine & Expeditionary Warfare development of robotic technologies to respond to detected threats. Specific effort will include dexterity, haptics and algorithms to achieve human-like behaviors. The objective is to sense and interact with the environment and threats. - Continue advance underwater optical imager technology focusing on laboratory measurements in various turbidity conditions and environments.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602782N / *Mine and Expeditionary Warfare Applied Research*	**Project (Number/Name)** 0000 / *Mine and Expeditionary Warfare Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue development and demonstration of adaptive control systems for bio-inspired unmanned underwater vehicles advancing oscillating fin propulsor models, and embedding these models on vehicle hardware. - Continue development of a learning and planning framework, conducting field experiments that demonstrate simultaneous exploration and navigation in an unknown environments while attempting to execute a complex mission. - Continue efforts that will lead to optimized sensing and behaviors by adapting in dynamic and uncertain environments; cooperative vehicle autonomy with increased endurance; data exfiltration and networking to expand reach; next generation sensors (acoustic and non-acoustic); adaptive, autonomous technologies to detect, classify underwater mobile threats. ***FY 2024 Base Plans:*** - Continue Autonomous Vehicles (Mine & Expeditionary Warfare) efforts to develop approaches for coupling between autonomous vehicles and their sensor payloads. Continue efforts to characterize flow generated by biomimetic propulsion approaches. Continue development and demonstration of adaptive control systems for bio-inspired unmanned underwater vehicles advancing oscillating fin propulsor models, and embedding these models on vehicle hardware. The objective is to increase vehicle efficiency, maneuverability and sensing effectiveness in complex environments. - Continue Mine Countermeasures (MCM) Data (Mine & Expeditionary Warfare) efforts to aggregate, curate and interrogate real and simulated data sets for in-situ algorithm adaptation, optimization, and performance assessment. The objective is to enable unmanned systems to operate flexibly across a wide range of dynamic and unstructured environments. - Continue MCM Sensor (Mine & Expeditionary Warfare) development of next-generation small, highly capable MCM sensors. Specific efforts include sensors, electronics, and computing technology. The objective is to increase deployment options for unmanned systems. - Continue Mine & Expeditionary Warfare (Target Recognition and Signal Processing) machine learning algorithm development efforts that yield principled understanding of sensor information content, are robust to					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
challenging operating conditions and produce human-interpretable or traceable predictions. The objective is to improve operator trust in autonomous system behavior and improve automated performance. - Continue Threat Detection/Robotic Techniques (Mine & Expeditionary Warfare development of robotic technologies to respond to detected threats. Specific effort will include dexterity, haptics and algorithms to achieve human-like behaviors. The objective is to sense and interact with the environment and threats. - Continue advanced underwater optical imager technology focusing on laboratory measurements in various turbidity conditions and environments. The objective is improve optical sensing performance in turbid environments. - Continue development and demonstration of adaptive control systems for bio-inspired unmanned underwater vehicles advancing oscillating fin propulsor models, and embedding these models on vehicle hardware. - Continue development of a learning and planning framework, conducting field experiments that demonstrate simultaneous exploration and navigation in an unknown environments while attempting to execute a complex mission. The objective is to improve autonomous search capabilities for unmanned systems. - Continue development of cooperative autonomous underwater vehicle behaviors that adapt to dynamic and uncertain environments. Continue efforts that lead to increased vehicle endurance, improved data exfiltration rates, and sophisticated networking capabilities to expand reach. Continue development of autonomous technologies to detect, classify underwater mobile threats. The objective is to improve the search/localization effectiveness and mission duration of autonomous systems. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The funding decrease from FY 2023 to FY 2024 is due to required growth in the ASW Distributed Search to address issues in mine warfare performance assessment and anti-submarine warfare distributed search & performance assessment. Funds realigned to PE 0602747N Anti-Submarine Warfare (ASW) Distributed Search Activity.					
Title: Mine/Obstacle Neutralization	0.432	0.449	0.458	0.000	0.458

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602782N / *Mine and Expeditionary Warfare Applied Research*	**Project (Number/Name)** 0000 / *Mine and Expeditionary Warfare Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Description: This activity includes applied research to support selected Mine Countermeasures-related Future Naval Capabilities (FNC) for the rapid neutralization of mines and obstacles, and sea mine jamming techniques to increase surface ship safe standoff from threat mines. It includes computational tools and models to assess mine and obstacle vulnerability and lethality of novel approaches for neutralization to support various far-term Surf Zone and Beach Zone mine and obstacle breaching system concepts. ***FY 2023 Plans:*** - Continue Rapid Neutralization of Mines and Obstacles effort in rapid neutralization of mines and obstacles including development of lethality and vulnerability models, technology concept assessments, and approaches for neutralization of mines and obstacles in all water depths, the surf zone, beach and inland. The objective is to enable maneuver of joint forces from ship to inland objective. - Continue Advanced Minesweeping effort in advanced minesweeping including development of compact, efficient approaches for sweeping advanced influence mines. The objective is to increase the safe standoff of various tactical platforms and surface ships. - Continue Robotics development of robotic technologies to respond to detected targets including work on dexterity, haptics and algorithms to achieve human-like behaviors. The objective is to interact with the mine and/or obstacle to achieve neutralization, clearance, render-safe or removal for exploitation. ***FY 2024 Base Plans:*** - Continue Rapid Neutralization of Mines and Obstacles effort in rapid neutralization of mines and obstacles including development of lethality and vulnerability models, technology concept assessments, and approaches for neutralization of mines and obstacles in all water depths, the surf zone, beach and inland. The objective is to enable maneuver of joint forces from ship to inland objective. - Continue Advanced Minesweeping effort in advanced minesweeping including development of compact, efficient approaches for sweeping advanced influence mines. The objective is to increase the safe standoff of various tactical platforms and surface ships.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602782N / *Mine and Expeditionary Warfare Applied Research*	**Project (Number/Name)** 0000 / *Mine and Expeditionary Warfare Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue Robotics development of robotic technologies to respond to detected targets including work on dexterity, haptics and algorithms to achieve human-like behaviors. The objective is to interact with the mine and/or obstacle to achieve neutralization, clearance, render-safe or removal for exploitation. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024					
Title: Special Warfare/EOD ***Description:*** The goal of this effort is to develop technologies to extend stand-off of special operations and Explosive Ordnance Disposal (EOD) forces in clandestine hydrography, mine clearance and port security missions while increasing the range and effectiveness of divers. Advanced technologies are needed to gain access to areas contaminated by area-denial sensors and/or booby traps. Developed technologies will transition to the Joint Service EOD Program, the Naval EOD Program, or the DOD Technical Response Group. This activity includes applied research in sensor technology for Naval Special Warfare (NSW) and EOD autonomous and handheld sonar systems to increase detection range and accuracy in harsh environments. Other efforts include such mission support technology improvements as communications, navigation and life support for UUVs and human divers. ***FY 2023 Plans:*** - Continue Advanced Robotic Techniques efforts in advanced robotic technologies including development of human-like manipulators and haptics. The objective is to provide access to underwater, buried and surface munitions and enable standoff operations with high precision. - Continue Platforms development of air, surface and subsurface platforms to conduct operations in the littorals to improve diver situational awareness, mobility and safety, address drag reduction, diver propulsion, communications, navigation, thermal envelope, life support and contamination protection. - Continue Ordnance Detection efforts for sensors to detect munitions and improvised explosive devices. Specific efforts include compact electromagnetic, optical and next generation magnetometer sensors which are held-hand or robot deployable. The objective is to improve performance by achieving a lower false alarm rates and higher probability of detection.	10.182	10.531	10.741	0.000	10.741

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602782N / *Mine and Expeditionary Warfare Applied Research*	**Project (Number/Name)** 0000 / *Mine and Expeditionary Warfare Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue Sensor Techniques effort to develop compact sensor technologies to diagnose explosive threats and unexploded ordnance including the development of hand-held or robot deployable sensor technologies. The objective is to determine the status of explosive threats and unexploded ordnance. - Continue Neutralization Explosive Threats effort to develop technologies to enable render-safe or neutralization of explosive threats and unexploded ordnance. The objective is to enable precision render-safe or neutralization operations at standoff distances. - Continue Unmanned Systems Situational Awareness development of onboard processing in unmanned systems to enable environmental situational awareness (SA) in the littorals. - Continue Rapid Operational Clearance efforts to develop technologies to rapidly clear operational areas of munitions. The objective is to decrease the amount of time needed for services to clear munitions and conduct clearance operations at standoff.					
FY 2024 Base Plans: - Continue Advanced Robotic Techniques efforts in advanced robotic technologies including development of human- like manipulators and haptics. The objective is to provide access to underwater, buried and surface munitions and enable standoff operations with high precision. - Continue Platforms development of air, surface and subsurface platforms to conduct operations in the littorals to improve diver situational awareness, mobility and safety, address drag reduction, diver propulsion, communications, navigation, thermal envelope, life support and contamination protection. - Continue Ordnance Detection efforts for sensors to detect munitions and improvised explosive devices. Specific efforts include compact electromagnetic, optical and next generation magnetometer sensors which are held-hand or robot deployable. The objective is to improve performance by achieving a lower false alarm rates and higher probability of detection. - Continue Sensor Techniques effort to develop compact sensor technologies to diagnose explosive threats and unexploded ordnance including the development of hand-held or robot deployable sensor technologies. The objective is to determine the status of explosive threats and unexploded ordnance.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602782N / *Mine and Expeditionary Warfare Applied Research*	**Project (Number/Name)** 0000 / *Mine and Expeditionary Warfare Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue Neutralization Explosive Threats effort to develop technologies to enable render-safe or neutralization of explosive threats and unexploded ordnance. The objective is to enable precision render-safe or neutralization operations at standoff distances. - Continue Unmanned Systems Situational Awareness development of onboard processing in unmanned systems to enable environmental situational awareness (SA) in the littorals. - Continue Rapid Operational Clearance efforts to develop technologies to rapidly clear operational areas of munitions. The objective is to decrease the amount of time needed for services to clear munitions and conduct clearance operations at standoff. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024					
Accomplishments/Planned Programs Subtotals	31.329	31.649	30.435	0.000	30.435

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602782N / *Mine and Expeditionary Warfare Applied Research*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	9.654	17.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	26.654

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Congressional Add: Human fusion tech for EOD robot applications ***FY 2022 Accomplishments:*** Conduct human fusion tech for EOD robot applications applied research ***FY 2023 Plans:*** N/A	9.654	0.000
Congressional Add: Expendable energetic unmanned aerial system (UAS) ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct research in expendable energetic unmanned aerial system.	0.000	7.000
Congressional Add: Solid state magnetic gradiometers for UUVs ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct research in solid state magnetic gradiometers for UUVs.	0.000	10.000
Congressional Adds Subtotals	9.654	17.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy											Date: March 2023	
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602792N *I Innovative Naval Prototypes (INP) Applied Res*							
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	143.842	145.637	133.828	-	133.828	134.128	132.198	130.405	133.522	Continuing	Continuing
0000: *Innovative Naval Prototypes (INP) Applied Res*	0.000	2.406	3.000	0.000	-	0.000	16.978	37.000	55.846	123.817	Continuing	Continuing
2958: *Cyberspace Activities*	0.000	25.208	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	25.208
3416: *HIJENKS*	0.000	9.619	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.619
3423: *LOCUST*	0.000	19.934	25.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	44.934
3450: *AMOS*	0.000	6.253	8.320	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	14.573
3451: *CLAWS*	0.000	25.095	2.475	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	27.570
3452: *ELEKTRA*	0.000	3.848	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3.848
3453: *Hypersonic Booster*	0.000	9.432	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.432
3455: *MINERVA*	0.000	3.847	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3.847
3456: *Full Spectrum Undersea Warfare*	0.000	20.312	39.600	42.570	-	42.570	42.570	42.570	41.314	0.000	0.000	228.936
3461: *MASS*	0.000	4.352	4.950	7.920	-	7.920	0.000	0.000	0.000	0.000	0.000	17.222
3462: *DEALRS*	0.000	5.804	6.930	10.890	-	10.890	6.930	0.000	0.000	0.000	0.000	30.554
3463: *MATes*	0.000	4.836	6.435	9.900	-	9.900	9.900	4.950	4.804	0.000	0.000	40.825
3506: *Compact Agile Interceptors*	0.000	0.000	0.000	1.500	-	1.500	2.000	0.000	0.000	0.000	0.000	3.500
3507: *Chimera*	0.000	0.000	0.000	15.537	-	15.537	37.910	40.798	25.606	7.757	Continuing	Continuing
3508: *Curious Orion*	0.000	0.000	0.000	1.800	-	1.800	1.800	0.000	0.000	0.000	0.000	3.600
5891: *INP Operational Analysis, Support and Experimentation Activity*	0.000	0.000	4.461	2.000	-	2.000	2.000	2.000	1.903	1.948	Continuing	Continuing
5892: *Full Spectrum Information Warfare*	0.000	0.000	4.000	7.000	-	7.000	0.000	0.000	0.000	0.000	0.000	11.000
5893: *Decision Superiority*	0.000	0.000	1.700	1.200	-	1.200	0.000	0.000	0.000	0.000	0.000	2.900
5894: *Direct-X*	0.000	0.000	2.500	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.500

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy													Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602792N *I Innovative Naval Prototypes (INP) Applied Res*								
5895: *DMO through IAS*	0.000	0.000	2.950	4.500	-	4.500	0.000	0.000	0.000	0.000	0.000	7.450
5896: *Echidna*	0.000	0.000	1.777	0.750	-	0.750	0.000	0.000	0.000	0.000	0.000	2.527
5897: *Hypersonic Technologies*	0.000	0.000	8.000	6.000	-	6.000	0.000	0.000	0.000	0.000	0.000	14.000
5899: *Precision Fire Control*	0.000	0.000	23.539	22.261	-	22.261	14.040	4.880	0.932	0.000	0.000	65.652
9999: *Congressional Adds*	0.000	2.896	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.896

A. Mission Description and Budget Item Justification

The Office of Naval Research (ONR) portfolio includes efforts that solve problems, respond to mission requirements, and perform exploratory research for new and breakthrough capabilities, which will define the future of U.S. Naval forces. Larger in scope, scale, and risk Innovative Naval Prototypes (INP) are selected for their high-payoff and potential to revolutionize operational concepts. Due to high technical risk, INPs typically have long durations with no more than three years between decision points. They mature technologies from a Technology Readiness Level (TRL) of 2 or 3 to a TRL of 6. As such, INPs require both the Applied Research, detailed in this PE; and Advanced Technology Development (ATD) funding, detailed in PE 0603801N. Developing INPs requires a systematic expansion and application of knowledge to develop useful materials, devices, and systems oriented toward the design and development of prototypes applicable to specific mission area requirements. The efforts funded within this PE translate promising basic research into solutions for broadly defined military needs. These efforts include developing breadboard hardware and algorithms that establish the initial feasibility and practicality of proposed solutions to technological challenges, such as concept exploration efforts, studies, investigations, and non-system specific technology efforts. Applied Research INPs do not develop hardware for service use; rather they provide feeder technology that can be demonstrated in prototypes in the ATD portion of the INP program.

Information security concerns preclude full disclosure of project efforts, research activities, and technology development plans within this exhibit. Detailed information will be provided to the Congressional oversight committees.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602792N *I Innovative Naval Prototypes (INP) Applied Res*

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	155.976	120.637	133.828	-	133.828
Current President's Budget	143.842	145.637	133.828	-	133.828
Total Adjustments	-12.134	25.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	25.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-8.339	0.000			
• SBIR/STTR Transfer	-3.795	0.000			
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 9999: *Congressional Adds*		
Congressional Add: *Accelerate proliferated LEO narrowband capability*	2.896	0.000
Congressional Add Subtotals for Project: 9999	2.896	0.000
Congressional Add Totals for all Projects	2.896	0.000

Change Summary Explanation

Funding: No significant change

Technical: No significant change

Schedule: No significant change

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 0000 / *Innovative Naval Prototypes (INP) Applied Res*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
0000: *Innovative Naval Prototypes (INP) Applied Res*	0.000	2.406	3.000	0.000	-	0.000	16.978	37.000	55.846	123.817	Continuing	Continuing

A. Mission Description and Budget Item Justification

The efforts described in this Project address the Applied Research associated with the Innovative Naval Prototypes (INP) Program. These investments represent game-changing technologies with the potential to revolutionize operational concepts. They are disruptive in nature, as they would dramatically change the way naval forces fight. Due to high technical risk, INPs typically have long duration but have no more than three years between decision points. They mature technologies from a Technology Readiness Level (TRL) of 2 or 3 to a TRL of 6. As such, INPs require both Budget Activity (BA) 2 and BA3 funding. The BA3 INP funds are specified in a separate Program Element (PE), 0603801N Innovative Naval Prototypes (INP) Adv Tec Dev. INPs do not develop hardware for service use; rather they provide feeder technology that can be demonstrated in prototypes in the 6.3 portion of the INP program. Developing INPs requires a systematic expansion and application of knowledge to develop useful materials, devices, and systems oriented toward the design and development of prototypes applicable to specific mission area requirements. The efforts funded within this PE translate promising basic research into solutions for broadly defined military needs. These efforts include developing breadboard hardware and algorithms that establish the initial feasibility and practicality of proposed solutions to technological challenges, such as concept exploration efforts, studies, investigations, and non-system specific technology efforts. The Department of the Navy would have to make significant acquisition decisions to integrate the new technological capabilities into naval warfighting systems. INPs are selected by a process that involves senior leadership in the Department of the Navy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Directed Energy / Electric Weapons ***Description:*** Effective in FY 2023, the Directed Energy/Electric Weapons Activity was discontinued and its funding was realigned to the new stand-alone Proj:5891 Operational Analysis, Support and Experimentation Activity to broaden the spectrum of promising applied research efforts investigated within this Project. ***FY 2023 Plans:*** N/A ***FY 2024 Base Plans:*** N/A ***FY 2024 OCO Plans:*** N/A	2.406	0.000	0.000	0.000	0.000
Title: INP Applied Research	0.000	3.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 0000 / *Innovative Naval Prototypes (INP) Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Description: The efforts described in this Project address the Applied Research associated with the Innovative Naval Prototypes (INP) Program. These investments represent game-changing technologies with the potential to revolutionize operational concepts. They are disruptive in nature, as they would dramatically change the way naval forces fight. Due to high technical risk, INPs typically have long duration but have no more than three years between decision points. They mature technologies from a Technology Readiness Level (TRL) of 2 or 3 to a TRL of 6. As such, INPs require both Budget Activity (BA) 2 and BA3 funding. The BA3 INP funds are specified in a separate Program Element (PE), 0603801N Innovative Naval Prototypes (INP) Adv Tec Dev. INPs do not develop hardware for service use; rather they provide feeder technology that can be demonstrated in prototypes in the 6.3 portion of the INP program. Developing INPs requires a systematic expansion and application of knowledge to develop useful materials, devices, and systems oriented toward the design and development of prototypes applicable to specific mission area requirements. The efforts funded within this PE translate promising basic research into solutions for broadly defined military needs. These efforts include developing breadboard hardware and algorithms that establish the initial feasibility and practicality of proposed solutions to technological challenges, such as concept exploration efforts, studies, investigations, and non-system specific technology efforts. The Department of the Navy would have to make significant acquisition decisions to integrate the new technological capabilities into naval warfighting systems. INPs are selected by a process that involves senior leadership in the Department of the Navy. ***FY 2023 Plans:*** Initiate applied research in support of the development of the Applied Research INP proposals. Specific efforts include the following: - Investigate investments which may represent game-changing technologies with the potential to revolutionize operational concepts. - Explore concepts that are disruptive in nature and would dramatically change the way naval forces fight. ***FY 2024 Base Plans:*** Continue applied research in support of the development of the Applied Research INP proposals. Specific efforts include the following: - Investigate investments which may represent game-changing technologies with the potential to revolutionize operational concepts.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 0000 / *Innovative Naval Prototypes (INP) Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Explore concepts that are disruptive in nature and would dramatically change the way naval forces fight. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease in funding from FY 2023 to FY 2024 in Proj 0000 INP Applied Research is due to the completion of applied technology efforts which led to the approved FY 2024 Project 3507 Chimera INP. Additional FY 2024 INP Project 0000 funds are not programmed due to the distribution of funds to new Seedlings and INPs.					
Accomplishments/Planned Programs Subtotals	2.406	3.000	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 2958 / *Cyberspace Activities*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
2958: *Cyberspace Activities*	0.000	25.208	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	25.208

A. Mission Description and Budget Item Justification

This Project contains all Applied Research Innovative Naval Prototype (INP) investments that are developing new technologies for cyber warfare. Potential adversaries are investing in advanced technologies that will challenge our advantages in the critical information domain. Nation states and non-state actors seek to degrade our command and control capabilities, networks and computer systems. Cyber threats continue to grow and rapidly proliferate. Technologies developed in this R-2 Activity will enable the warfighter to take immediate, appropriate action at any time, against any desired adversary, target or network by assuring that autonomous, continuous analyses of intelligence, persistent surveillance and open information sources have, at all times, optimized the possible courses of action based on commander's guidance. Technologies within this activity will foster operational endurance and enable sustained operations and resiliency for warfighters and platforms through enhanced cyber security/protection.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Cyber	25.208	0.000	0.000	0.000	0.000
Description: This Project contains all Applied Research Innovative Naval Prototype (INP) investments that are developing new technologies for cyber warfare. Potential adversaries are investing in advanced technologies that will challenge our advantages in the critical information domain. Nation states and non-state actors seek to degrade our command and control capabilities, networks and computer systems. Cyber threats continue to grow and rapidly proliferate. Technologies developed in this R-2 Activity will enable the warfighter to take immediate, appropriate action at any time, against any desired adversary, target or network by assuring that autonomous, continuous analyses of intelligence, persistent surveillance and open information sources have, at all times, optimized the possible courses of action based on commander's guidance. Technologies within this activity will foster operational endurance and enable sustained operations and resiliency for warfighters and platforms through enhanced cyber security/protection.					
FY 2023 Plans: N/A					
FY 2024 Base Plans: N/A					
FY 2024 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 2958 / *Cyberspace Activities*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
N/A					
Accomplishments/Planned Programs Subtotals	25.208	0.000	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0603801N /2958: *Cyberspace Activities*	15.416	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	44.796

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 3416 / *HIJENKS*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3416: *HIJENKS*	0.000	9.619	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.619

A. Mission Description and Budget Item Justification

HIJENKS is a non-kinetic High Power Microwave (HPM) payload integrated on an airborne platform will enable the prosecution of multiple targets with area coverage across each target and open targets previously restricted due to collateral damage. HIJENKS increases operational access by disrupting land-based infrastructure facilities tied to adversary systems, decreases cost exchange ratios through non-kinetic engagement, and addresses targets previously restricted due to collateral damage concerns/moral hardening. It expands the competitive space in the electromagnetic spectrum to disrupt, degrade, and destroy critical electronic targets. The Activity identified in Project Unit 3416 specifically addresses Applied Research in support of the HIJENKS INP effort.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: HIJENKS	9.619	0.000	0.000	0.000	0.000
Description: The High Power Joint Electromagnetic Non-Kinetic Strike (HIJENKS) program is a proof-of-concept demonstration of a multi-target, advanced airborne High Power Microwave (HPM) payload capable of disrupting electronic targets non-kinetically. HIJENKS is capable of disrupting land-based electronic system infrastructure and engaging multiple targets with a single airborne weapon, increasing operational access/ decreasing cost exchange ratios, providing area lethality with increased pulse rate, providing options to address limitations on collateral damage, increasing standoff range and expanding magazine depth. HIJENKS will advance the current state-of-the-art in HPM technology and demonstrate the near-term operational benefits of integrating HPM-based Electronic Warfare/Electronic Attack (EW/EA) into the current force structure. ***FY 2023 Plans:*** N/A ***FY 2024 Base Plans:*** N/A ***FY 2024 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	9.619	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 3416 / *HIJENKS*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0603801N/3416: *HIJENKS*	7.392	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	21.022

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 3423 / *LOCUST*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3423: *LOCUST*	0.000	19.934	25.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	44.934

A. Mission Description and Budget Item Justification

Adversary military modernization and increasing contested domains require a shift in approach "...to strike diverse targets inside adversary air and missile defense networks to destroy mobile power-projection platforms. This will include capabilities to enhance close combat lethality in complex terrain." The Low-Cost UAV Swarming Technology (LOCUST) effort will develop and deliver autonomy, C2 architecture, and a series of modular payloads on a robust, scalable, flexible, multifunctional UAV system; employable from surface, sub-surface, airborne, and ground manned and un-manned systems to provide a dispersed, resilient, and adaptive capability to gain a competitive military advantage. LOCUST will provide ISR and precision loitering munitions capable of being launched from air, surface, ground, and sub-surface platforms to conduct both singular and swarm operations across battlespace in conjunction with Joint and manned operations. It will demonstrate multi-domain launch and strike operations, heterogeneous air platform payloads, unmanned from unmanned operations, distributed control of the strike mission, and refined cost elements for critical technologies that have supply chain assurance addressed. The Activity identified in Project Unit 3423 specifically addresses Applied Research in support of the LOCUST INP effort.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: LOCUST	19.934	25.000	0.000	0.000	0.000
Description: Adversary military modernization and increasing contested domains require a shift in approach "...to strike diverse targets inside adversary air and missile defense networks to destroy mobile power-projection platforms. This will include capabilities to enhance close combat lethality in complex terrain." The Low-Cost UAV Swarming Technology (LOCUST) effort will develop and deliver autonomy, C2 architecture, and a series of modular payloads on a robust, scalable, flexible, multifunctional UAV system; employable from surface, sub-surface, airborne, and ground manned and un-manned systems to provide a dispersed, resilient, and adaptive capability to gain a competitive military advantage. LOCUST will provide ISR and precision loitering munitions capable of being launched from air, surface, ground, and sub-surface platforms to conduct both singular and swarm operations across battlespace in conjunction with Joint and manned operations. It will demonstrate multi-domain launch and strike operations, heterogeneous air platform payloads, unmanned from unmanned operations, distributed control of the strike mission, and refined cost elements for critical technologies that have supply chain assurance addressed.					
FY 2023 Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 3423 / *LOCUST*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Activities will further the development of key enabling technologies supporting the INDOPACOM requested operational need. These developments include advances in autonomy, machine learning and automatic target recognition, and modelling and simulation. FY 2023 funds added for Advanced Concept of Operations. ***FY 2024 Base Plans:*** N/A ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease from FY 2023 to FY 2024 is due to the LOCUST Project's completion in FY 2023.					
Accomplishments/Planned Programs Subtotals	19.934	25.000	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0603801N/3423: *LOCUST*	12.271	67.300	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	91.755
• RDTEN/0603382N/3423: *LOCUST*	3.270	40.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	50.156

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 3450 / *AMOS*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3450: *AMOS*	0.000	6.253	8.320	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	14.573

A. Mission Description and Budget Item Justification

The Arctic Mobile Observing System (AMOS) effort will develop a prototype mobile sensing system that can be deployed anywhere in the Arctic via the development of a sea ice-based buoy node that will enable the critical infrastructure (power, communication, environmental intelligence) to provide the Navy with a persistent Arctic presence at lower cost than manned platforms. AMOS is a mobile observing system of systems node that enables 2-way communications, under-ice vehicle navigation, and extended-duration autonomy in the complex Arctic environment. AMOS will provide a persistent, mobile, autonomous capability to monitor the operational environment and maritime operations of potential adversaries in the Arctic Ocean. The Activity identified in Project Unit 3450 specifically addresses Applied Research in support of the AMOS INP effort.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: AMOS	6.253	8.320	0.000	0.000	0.000
Description: The Arctic Mobile Observing System (AMOS) effort will develop a prototype mobile sensing system that can be deployed anywhere in the Arctic via the development of a sea ice-based buoy node that will enable the critical infrastructure (power, communication, environmental intelligence) to provide the Navy with a persistent Arctic presence at lower cost than manned platforms. AMOS is a mobile observing system of systems node that enables 2-way communications, under-ice vehicle navigation, and extended-duration autonomy in the complex Arctic environment. AMOS will provide a persistent, mobile, autonomous capability to monitor the operational environment and maritime operations of potential adversaries in the Arctic Ocean. ***FY 2023 Plans:*** Continue applied research in support of the development of the Arctic Mobile Observing System (AMOS). Specific efforts include: - Continue at-sea experimentation to determine sensing and communications limits from gliders, floats & UUVs to navigation and communications buoys. - Continue evaluation of platform sensor and power consumption including UUV docking and data transmission studies during at-sea experimentation. - Continue float dispersement studies during at-sea experimentation. Complete the following modeling, evaluation, and assessment activities prior to final prototype deployment: - Complete sensor/platform design & establish power budget for the final prototype. - Complete 2-way communications evaluation & final system design for prototype build.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 3450 / *AMOS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Initiate final Arctic deployment of full AMOS prototype for test and evaluation ***FY 2024 Base Plans:*** N/A ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease in funding from FY 2023 to FY 2024 in Proj: 3450 AMOS is due to program completion.					
Accomplishments/Planned Programs Subtotals	6.253	8.320	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0603801N/3450: *AMOS*	3.268	4.478	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	12.010

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 3451 / *CLAWS*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3451: *CLAWS*	0.000	25.095	2.475	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	27.570

A. Mission Description and Budget Item Justification

The CLAWS INP effort will develop an autonomous unmanned undersea weapon system capable of providing offensive effects to the Combatant Commanders beyond Phase 0 inside the first island chain. It will clandestinely extend the reach of large UUVs and increase the mission areas into kinetic effects. CLAWS will deliver algorithms to enable all families of UUVs to operate in complex, dynamic and degraded environments. CLAWS will demonstrate autonomous missions in denied waters, develop and demonstrate autonomous technologies for survivability of large UUVs, and develop autonomy and launch capabilities for special mission payloads. CLAWS will be able to complete missions 1&2 against near peer adversary defenses, maintain critical communication with Navy C2/Fires and provide critical ISR information. The Activity identified in Project Unit 3451 specifically addresses Applied Research in support of the CLAWS INP effort.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: CLAWS	25.095	2.475	0.000	0.000	0.000
Description: The CLAWS INP effort will develop an autonomous unmanned undersea weapon system capable of providing offensive effects to the Combatant Commanders beyond Phase 0 inside the first island chain. It will clandestinely extend the reach of large Unmanned Underwater Vehicles (UUVs) and increase the mission areas into kinetic effects. CLAWS will deliver algorithms to enable all families of UUVs to operate in complex, dynamic and degraded environments. CLAWS will demonstrate autonomous missions in denied waters, develop and demonstrate autonomous technologies for survivability of large UUVs, and develop autonomy and launch capabilities for special mission payloads. CLAWS will be able to complete missions 1&2 against near peer adversary defenses, maintain critical communication with Navy Command and Control (C2) and Fires and provide critical ISR information.					
FY 2023 Plans: - Complete applied research for the development of autonomous payloads for extra-large unmanned undersea vehicles operating in denied and contested areas. Payloads will be both kinetic and non-kinetic. Additional effort will include development of autonomy to increase the operator trust for kinetic payloads in contested areas and the development of autonomy and command and control required for swarm payload from extra-large unmanned undersea vehicle. Specific FY 2023 objectives include:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 3451 / *CLAWS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Demonstration of autonomy algorithms to link with C2 system for deployment of effect for cross domain unmanned system - Develop of autonomy for deployment for non-kinetic effect in varying environmental conditions including modest sea states and cloud cov-Develop autonomy to leverage onboard environmental measurements and C2 reach back to provide mission advantage. Integrate Navy Oceanographic model results into UUV mission planning. Complete: Final report and knowledge transfer of technology to navy acquisition. ***FY 2024 Base Plans:*** N/A ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease in funding from FY 2023 to FY 2024 in Proj: 3451 CLAWS is due to program completion.					
Accomplishments/Planned Programs Subtotals	25.095	2.475	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0603801N/3451: *CLAWS*	13.467	7.810	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	35.667

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 3452 / *ELEKTRA*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3452: *ELEKTRA*	0.000	3.848	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3.848

A. Mission Description and Budget Item Justification

Complex multi-domain threats can overwhelm the operator and individual platforms ability to defend the force. The ELEKTRA INP effort is developing "Human on the Loop" Artificial Intelligence (AI) enabled algorithms to perform force level kinetic/non-kinetic kill chain optimization and coordination across multiple domains at machine to machine speeds to increase the lethality and survivability of the Force. ELEKTRA will demonstrate AI/ML ability to coordinate kinetic/non kinetic effects autonomously with heterogeneous platforms, the ability to operate in degraded environments for hours and the ability to coordinate and execute domain kill chains simultaneously. It will deploy artificial intelligent (AI) and machine learning (ML) architecture, neural networked computing and large data handling to enable real time, force level effects assignment, coordination and resource management. The Activity identified in Project Unit 3452 specifically addresses Applied Research in support of the ELEKTRA INP effort.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: ELEKTRA	3.848	0.000	0.000	0.000	0.000
Description: Complex multi-domain threats can overwhelm the operator and individual platforms ability to defend the force. The ELEKTRA INP effort is developing "Human on the Loop" Artificial Intelligence (AI) enabled algorithms to perform force level kinetic/non-kinetic kill chain optimization and coordination across multiple domains at machine to machine speeds to increase the lethality and survivability of the Force. ELEKTRA will demonstrate AI/machine learning (ML) ability to coordinate kinetic/non kinetic effects autonomously with heterogeneous platforms, the ability to operate in degraded environments for hours and the ability to coordinate and execute domain kill chains simultaneously. It will deploy an AI/ML architecture, neural networked computing and large data handling to enable real time, force level effects assignment, coordination and resource management. ***FY 2023 Plans:*** N/A ***FY 2024 Base Plans:*** N/A ***FY 2024 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	3.848	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 3452 / *ELEKTRA*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0603801N/3452: *ELEKTRA*	12.345	9.845	4.924	-	4.924	6.022	0.000	0.000	0.000	0.000	43.378

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 3453 / *Hypersonic Booster*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3453: *Hypersonic Booster*	0.000	9.432	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.432

A. Mission Description and Budget Item Justification

The Hypersonic Booster INP is intended to leverage the best ongoing hypersonic air-breathing vehicle technologies and tailor those to address naval requirements for CVN compatibility and F/A 18E/F carriage. Originally founded upon a redesign/resizing of the DARPA Hypersonic Air-breathing Weapon Concept (HAWC) prototype, the Hypersonic Booster INP will consider all promising hypersonic air-breathing prototype vehicle candidate concepts that have already undergone significant government-industry investment and will lead to achievement of Navy goals; to include cost, schedule and performance. This INP has chosen a multiphase approach to ensure that the most promising concept and associated performer are chosen to deliver this breakthrough technology. The Activity identified in Project Unit 3453 specifically addresses Applied Research in support of the Hypersonic Booster INP effort.

In FY 2023, Proj: 3453 Hypersonic Booster was terminated, and its funding realigned to other projects in this program element.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Hypersonic Booster	9.432	0.000	0.000	0.000	0.000
Description: The Hypersonic Booster INP is intended to leverage the best ongoing hypersonic air-breathing vehicle technologies and tailor those to address naval requirements for CVN compatibility and F/A 18E/F carriage. Originally founded upon a redesign/resizing of the DARPA Hypersonic Air-breathing Weapon Concept (HAWC) prototype, the Hypersonic Booster INP will consider all promising hypersonic air-breathing prototype vehicle candidate concepts that have already undergone significant government-industry investment and will lead to achievement of Navy goals; to include cost, schedule and performance. This INP has chosen a multiphase approach to ensure that the most promising concept and associated performer are chosen to deliver this breakthrough technology. The Activity identified in Project Unit 3453 specifically addresses Applied Research in support of the Hypersonic Booster INP effort. In FY 2023, Proj: 3453 Hypersonic Booster is terminated and its funding realigned to other projects in this program element. ***FY 2023 Plans:*** N/A ***FY 2024 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 3453 / *Hypersonic Booster*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
N/A ***FY 2024 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	9.432	0.000	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 3455 / *MINERVA*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3455: *MINERVA*	0.000	3.847	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3.847

A. Mission Description and Budget Item Justification

The need to operate in a multiple domain environment against highly capable peers requires improved decision quality and reduced decision timelines. MINERVA will develop AI and Machine-Learning (ML) capabilities to improve mission planning, intelligence gathering, execution and assessment. Minerva will deliver next-generation decision aids by combining operations research with emerging AI capabilities to create learning, self-adaptive automation that supports Composite Warfare Commander's (CWC) and their staffs at the Fleet, Force and Group echelons. It will establish a DevOps environment that includes warfighter staffs in the development and integration of new capabilities. The Activity identified in Project Unit 3455 specifically addresses Applied Research in support of the MINERVA INP effort.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: MINERVA	3.847	0.000	0.000	0.000	0.000
Description: The need to operate in a multiple domain environment against highly capable peers requires improved decision quality and reduced decision timelines. MINERVA will develop AI and Machine-Learning (ML) capabilities to improve mission planning, intelligence gathering, execution and assessment. Minerva will deliver next-generation decision aids by combining operations research with emerging AI capabilities to create learning, self-adaptive automation that supports Composite Warfare Commander's (CWC) and their staffs at the Fleet, Force and Group echelons. It will establish a DevOps environment that includes warfighter staffs in the development and integration of new capabilities. ***FY 2023 Plans:*** N/A ***FY 2024 Base Plans:*** N/A ***FY 2024 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	3.847	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 3455 / *MINERVA*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0603801N/3455: *MINERVA*	12.489	11.814	6.894	-	6.894	7.031	0.000	0.000	0.000	0.000	48.535

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 3456 / *Full Spectrum Undersea Warfare*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3456: *Full Spectrum Undersea Warfare*	0.000	20.312	39.600	42.570	-	42.570	42.570	42.570	41.314	0.000	0.000	228.936

A. Mission Description and Budget Item Justification

The Full Spectrum Undersea Warfare (FSUSW) Project will develop new technology for offensive and defensive warfare conducted on the seabed, in the sea (i.e. subsea), and from the sea. FSUSW focuses on Theatre Undersea Warfare (TUSW), Joint Targeting and Strike, and Subsea and Seabed Warfare (SSW). There are five thrust areas of FSUSW that are key to enabling Chief of Naval Operations Guidance (CNOG), Distributed Maritime Operations (DMO), and the Commandant's Stand in Force with manned and unmanned warfighting capability. These thrust areas were specifically chosen in direct collaboration with STRATCOM, INDO-PACOM, Fleet and Undersea Warfare Commanders and validated with regular Flag officer engagements. These applied research efforts will enable future undersea weapon systems (e.g., Maritime Strike Tomahawk and ADCAP variants), COCOM campaigns, and operational plans. FSUSW thrust areas include 1) Undersea effectors, 2) Integrated expeditionary subsea system of systems, 3) Multi-Vehicle Torpedo Tube Development System (MVTTDS), 4) Undersea UAV for Over-The-Horizon (OTH) effects and 5) Undersea Launched Devices to enable Commanding Officers and Regional Combatant Commander effects. The five thrust areas are technically and operationally interconnected.

The efforts described in this Project address the Applied Research associated with the Innovative Naval Prototypes (INP) Program. These investments represent game changing technologies with the potential to revolutionize operational concepts. They are disruptive in nature, as they would dramatically change the way naval forces fight. Due to high technical risk, INPs typically have long duration but have no more than three years between decision points. They mature technologies from a Technology Readiness Level (TRL) of 2 or 3 to a
TRL of 6. As such, INPs require both Budget Activity (BA) 2 and BA3 funding. The BA3 INP funds are specified in a separate Program Element (PE), 0603801N Innovative Naval Prototypes (INP) Adv Tec Dev in the Undersea Warfare Efforts, Project 3458.

Information security concerns preclude fully detailed descriptions of project efforts, research activities, and technology development plans. Specific information on each project and activity will be provided separately to the Congressional oversight committees.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Undersea Warfare Efforts	20.312	39.600	42.570	0.000	42.570
Description: The FSUSW Project will develop new technology for offensive and defensive warfare conducted on the seabed, in the sea (i.e. subsea), and from the sea. FSUSW will address three thrusts identified in the Undersea Warfare Development Command's document, "Full Spectrum Undersea Warfare Concept of Operations (CONOPS)". These thrusts are: advanced offensive missions for submarines, subsea and seabed warfare, and distributed undersea warfare. Distributed undersea warfare technology will enable full participation					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 3456 / *Full Spectrum Undersea Warfare*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
of all undersea warfare assets in the Navy's Distributed Maritime Operations concept. FSUSW missions this Project addresses include Anti-Submarine Warfare (ASW), Anti Surface Warfare, Strike, Intelligence, Surveillance, and Reconnaissance, Mine Warfare, and Subsea and Seabed Warfare (SSW). The FSUSW Project includes the Affordable Mobile ASW Surveillance System (AMASS) research and will leverage technology developed in the separate PE 06022792N, Project Unit 3450, AMOS. ***FY 2023 Plans:*** Continue: - Train and evaluate autonomy and automatic target recognition for joint undersea surveillance and targeting UUV - Conduct scaled experimentation and full scale interoperability in support of manned platform task execution, - Conduct live, virtual, constructive experimentation - Continue applied research development for larger undersea launched devices - Continue development of navigation and power alternatives that could have a notable mission performance. Complete: - Reliability and packing of components for small devices - Testing - Small diameter device host platform optimization. Initiate: - Train acoustic unmanned detection algorithms for specific joint undersea surveillance and targeting UUV tasks - Independently and autonomously conduct specific undersea tasks - Design and initial prototype of undersea UAV and countermeasures with advanced autonomy, enabling warfighting task execution without humans in the loop for larger sized ***FY 2024 Base Plans:*** Continue: - Train and evaluate autonomy and automatic target recognition for joint undersea surveillance and targeting UUV and Submarine Launched UAV. - Train acoustic unmanned detection algorithms for specific joint undersea surveillance and targeting UUV tasks. - Independently and autonomously conduct specific undersea tasks. - Conduct scaled experimentation and full scale interoperability in support of manned platform task execution, - Conduct live, virtual, constructive experimentation.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 3456 / *Full Spectrum Undersea Warfare*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue applied research development for larger undersea launched devices. - Continue development of navigation and power alternatives that could have a notable mission performance. - Design and initial prototype of undersea UAV and countermeasures with advanced autonomy, enabling warfighting task execution without humans in the loop for larger sized. Complete: - Spiral two of Submarine Launched UAV hardware and software development, incorporating autonomy functions for select missions. - 3rd generation UUV modular resilient design tool function. - Integration and testing of counter ISR&T devices spiral 1 form factor. - Automatic detection and classification spiral 1 suite for joint undersea surveillance and targeting (JUST). Initiate: - Spiral three for small diameter UAV and spiral two for decoy devices. - Train acoustic unmanned detection algorithms for specific joint undersea surveillance and targeting (JUST) UUV tasks. -Development of 6.75 inch autonomy for unmanned undersea and air vehicles. - Testing of autonomy for expeditionary undersea node. - Testing of autonomy for under the wall 2027 UUV. - Virtual experimentation to evaluate 3rd generation UUV modular resilient design tool concepts within model based systems engineering framework. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 in Proj: 3456 FSUSW is due to expanding the sizes of devices developed and support spiral development which enables an additional spiral development cycle to commence for 3 inch UAV and counter ISR&T devices.					
Accomplishments/Planned Programs Subtotals	20.312	39.600	42.570	0.000	42.570

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 3456 / *Full Spectrum Undersea Warfare*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 3461 / *MASS*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3461: *MASS*	0.000	4.352	4.950	7.920	-	7.920	0.000	0.000	0.000	0.000	0.000	17.222

Note

This activity is being broken out from PE 0603801N Project Unit 3459 Super Swarm to provide increased visibility and focus on this technical challenge area at the BA2 level.

A. Mission Description and Budget Item Justification

The rising use of air, surface, and sub-surface unmanned and autonomous systems requires a paradigm shift in the development, production, and life-cycle management of these systems in order to gain a competitive advantage against adversarial capabilities as well as allow for fielding of significant numbers (1000's to 10,000's) in an increasingly budget-constrained acquisition environment. The growth in rapid prototyping and additive manufacturing technologies presents an opportunity to capitalize on these advances though applied research efforts focused on scale-up both in terms of rapid production of relevant quantities as well as greatly increasing the physical size of platforms produced far beyond what is currently achievable. Manufacturing of Autonomous Systems at Scale (MASS) efforts will utilize wide range of advanced manufacturing methods combined with adaptive digital design processes with "Design for Low-Cost Platform Attriteability" as a major attribute to avoid the platform cost growths normally associated with exquisite systems development. This also represents the ability to rapidly modify platform attributes based on evolving operational needs and quickly insert into build process without costly retooling. Secondary goals focus on increasing commonality of critical components across platforms and design of these in modular fashion in order to manage supply chain vulnerability. Lastly, the project will look at ability to place manufacturing capability as far forward/afloat as possible to reduce the logistics tail and speed delivery of capability at-scale into the fleet. The activity identified in Project Unit 3461 MASS specifically addresses Applied Research in support of the MASS effort.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Manufacture of Autonomous Systems at Scale (MASS)	4.352	4.950	7.920	0.000	7.920
Description: The rising use of air, surface, and sub-surface unmanned and autonomous systems requires a paradigm shift in the development, production, and life-cycle management of these systems in order to gain a competitive advantage against adversarial capabilities as well as allow for fielding of significant numbers (1000's to 10,000's) in an increasingly budget-constrained acquisition environment. The growth in rapid prototyping and additive manufacturing technologies presents an opportunity to capitalize on these advances though applied research efforts focused on scale-up both in terms of rapid production of relevant quantities as well as greatly increasing the physical size of platforms produced far beyond what is currently achievable. Manufacturing of Autonomous Systems at Scale (MASS) efforts will utilize wide range of advanced manufacturing methods combined with adaptive digital design processes with "Design for Low-Cost Platform Attriteability" as a major attribute to avoid the platform cost growths normally associated with exquisite systems development. This also represents the ability to rapidly modify platform attributes based on evolving operational needs and					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 3461 / *MASS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
quickly insert into build process without costly retooling. Secondary goals focus on increasing commonality of critical components across platforms and design of these in modular fashion in order to manage supply chain vulnerability. Lastly, the project will look at ability to place manufacturing capability as far forward/afloat as possible to reduce the logistics tail and speed delivery of capability at-scale into the fleet. The activity identified in Project Unit 3461 MASS specifically addresses Applied Research in support of the MASS effort. ***FY 2023 Plans:*** Continue: Continue Manufacturing of Autonomous Systems at Scale (MASS) efforts to utilize wide range of advanced manufacturing methods for based on design for attritability. Continue MASS digital design efforts to couple rapid adaptive processes focused on large scale (both size and quantity) platforms of interest. Complete: Complete MASS down-selection of technologies for experimentation. Complete design workshops for experimentation. Initiate: Initiate design modeling and simulation for composite and metallic large structural alternatives for attritable Super Swarm (Project 3459) agents and Deployment and Employment of Autonomous Long Range Systems (DEALRS) (Project 3462) swarm delivery marsupial host platforms. New design modifications will be based on FY22 design feedback. Initiate methods for supply chain assurance for critical and common components and manufacturing capability for swarm agents as far forward/afloat as possible. Initiate ruggedization of equipment for forward manufacturing. ***FY 2024 Base Plans:*** - Continue Manufacturing of Autonomous Systems at Scale (MASS) efforts to utilize wide range of advanced manufacturing methods for based on design for attainability. - Continue/Complete modeling and simulation for composite and metallic large structural alternatives for attainable Super Swarm (Project 3459) agents and Deployment and Employment of Autonomous Long Range Systems (DEALRS) (Project 3462) swarm delivery marsupial host platforms.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 3461 / *MASS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue/Complete analysis of supply chain assurance and component manufacturing methodologies for platforms of interest. - Continue/Complete ruggedization of equipment for forward manufacturing incorporating supply chain considerations. - Complete digital design efforts to couple rapid adaptive processes focused on large scale (both size and quantity) platforms of interest. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 is due to multiple iterations of digital design process with validation through manufacturing of concept end-item. 6.2 INP program completes in FY 2024.					
Accomplishments/Planned Programs Subtotals	4.352	4.950	7.920	0.000	7.920

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0603801N/3461: *mASS*	0.883	3.957	4.950	-	4.950	4.950	0.000	0.000	0.000	0.000	14.740

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 3462 / *DEALRS*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3462: *DEALRS*	0.000	5.804	6.930	10.890	-	10.890	6.930	0.000	0.000	0.000	0.000	30.554

Note

This activity is being broken out from PE 0603801N Project Unit 3459 Super Swarm to provide increased visibility and focus on this technical challenge area at the BA2 level.

A. Mission Description and Budget Item Justification

Adversary Anti-Access and Area Denial (A2/AD) capabilities continue to improve but remain focused on targeting specific US and joint force capabilities. The Deployment and Employment of Autonomous Long Range Systems (DEALRS) project will develop technologies that sidestep, operate below the threshold, or deplete adversary A2/AD capabilities. DEALRS will specifically develop technologies to enable low-cost unmanned systems that can maneuver across theater-level ranges to penetrate, operate within, and launch strikes from within adversary A2/AD system coverage. This project will develop technologies to increase the range and endurance of autonomous systems while maintaining tactically relevant speeds, loiter times, and signatures with low cost. It will also address technologies that enable the marsupial launch of terminal engagement autonomous unmanned systems across all domains from larger and/or longer-range host systems that bring them to the launch area and the associated technologies needed to ensure roboticized and autonomous startup and launch of the marsupial systems without human intervention. The Activity identified in Project Unit 3462 DEALRS specifically addresses Applied Research in support of the INP effort.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: DEALRS	5.804	6.930	10.890	0.000	10.890
FY 2023 Plans: Continue: - Continue efforts to explore concepts for the DEALRS across all domains. Efforts will focus on swarm agent range/ endurance enhancements as well as marsupial host / children swarm delivery concepts to allow extremely large numbers of systems to traverse long distances with minimal human intervention to bring them into the operations area. - Continue efforts to demonstrate concepts for DEALRS across all domains. Efforts will focus on scaling up promising concepts to demonstrate trans-Oceanic deployment and employment of large numbers of unmanned systems to deliver desired effects in the areas of operation. Initiate: - Initiate efforts for scale-up of promising full-system designs and components for objective Deployment and Employment of Autonomous Long Range Systems (DEALRS) swarm delivery marsupial host platform. Design will be informed by FY22 and early FY23 activities.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 3462 / *DEALRS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate concept exploration of alternative launcher methodologies to increase numbers of swarm platforms can be transported and deployed. Effort will be informed by FY22 / early FY23 Super Swarm (Project 3459) and Manufacture of Autonomous Systems at Scale (MASS) (Project 3461) activities. ***FY 2024 Base Plans:*** Continue: - Efforts to explore concepts for the DEALRS across all domains. Efforts will focus on swarm agent range/ endurance enhancements as well as marsupial host / children swarm delivery concepts to allow extremely large numbers of systems to traverse long distances with minimal human intervention to bring them into the operations area. - Continue concept exploration of alternative launcher methodologies to increase numbers of swarm platforms can be transported and deployed. Effort will be informed by FY22 / early FY23 Super Swarm (Project 3459) and Manufacture of Autonomous Systems at Scale (MASS) (Project 3461) activities. - Continue to demonstrate concepts for DEALRS across all domains. Efforts will focus on scaling up promising concepts to demonstrate trans-Oceanic deployment and employment of large numbers of unmanned systems to deliver desired effects in the areas of operation. - Continue efforts for scale-up of promising full-system designs and components for objective Deployment and Employment of Autonomous Long Range Systems (DEALRS) swarm delivery marsupial host platform. Design will be informed by FY22 and early FY23 activities. Initiate: - Construction of test-bed sections of marsupial platforms for use in evaluating sub-components such as those needed for needed for trans-oceanic operations as well as payload integration methodologies. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 in Proj: 3462 DEALRS is due to the exploration of several launcher concepts suitable for a variety of swarm assets enabling different missions.					
Accomplishments/Planned Programs Subtotals	5.804	6.930	10.890	0.000	10.890

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 3462 / *DEALRS*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0603801N/3462: *DEALRS*	0.837	4.948	5.940	-	5.940	5.940	7.920	7.686	0.000	Continuing	Continuing

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 3463 / *MATes*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3463: *MATes*	0.000	4.836	6.435	9.900	-	9.900	9.900	4.950	4.804	0.000	0.000	40.825

Note

This activity is being broken out from PE 0603801N Project Unit 3459 Super Swarm to provide increased visibility and focus on this technical challenge area at the BA2 level.

A. Mission Description and Budget Item Justification

Traditionally, the utilization of autonomous systems is either operationally segregated from manned operations or requires a significant amount of human oversight when operating in conjunction with manned assets, which mitigates some of the advantage from using them. The goal of the Manned and Autonomous Teams (MATes) project is to develop autonomic robotic technology and collaborative autonomous behaviors that seamlessly operate across all domains in conjunction with manned units, allowing for real-time adaptation and optimization in a manner that streamlines the element of human interaction needed to share mission goals. This technology will monitor human or manned system teammate state, behavior, mission, and adversary threat status to anticipate and act in a tactically appropriate manner that is predictable, communicable, and trusted by the human/manned teammates and which enables autonomous system optimization in coordination with the human/manned teammate and mission objectives. Intuitive human/autonomous system interfaces will be developed to allow focus on higher-order decision-making tasks by the operators allowing for large numbers of autonomous systems (100's or 1000's) to be managed in support of manned operations. The activity identified in Project Unit 3463 MATes specifically addresses Applied Research in support of the MATes effort.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Manned and Autonomous Teams	4.836	6.435	9.900	0.000	9.900
Description: Traditionally, the utilization of autonomous systems is either operationally segregated from manned operations or requires a significant amount of human oversight when operating in conjunction with manned assets, which mitigates some of the advantage from using them. The goal of the Manned and Autonomous Teams (MATes) project is to develop autonomic robotic technology and collaborative autonomous behaviors that seamlessly operate across all domains in conjunction with manned units, allowing for real-time adaptation and optimization in a manner that streamlines the element of human interaction needed to share mission goals. This technology will monitor human or manned system teammate state, behavior, mission, and adversary threat status to anticipate and act in a tactically appropriate manner that is predictable, communicable, and trusted by the human/manned teammates and which enables autonomous system optimization in coordination with the human/manned teammate and mission objectives. Intuitive human/autonomous system interfaces will be developed to allow focus on higher-order decision-making tasks by the operators allowing for large numbers of autonomous systems (100's or 1000's) to be managed in support of manned operations. The					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 3463 / *MATes*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
activity identified in Project Unit 3463 MATes specifically addresses Applied Research in support of the MATes effort. ***FY 2023 Plans:*** Continue: Continue efforts to explore autonomy, perception, and command and control (C2) concepts for Manned and Autonomous Teams (MATES) conducting complex multi-domain operations in proximity to each other along a spectrum of missions. Autonomous systems will be swarm agents developed through Super Swarm (Project 3459) and Deployment and Employment of Autonomous Long Range Systems (DEALRS) (Project 3462). Autonomy, perception, and agent/ vehicle control schemes will be informed by Manufacture of Autonomous Systems at Scale (MASS) (Project 3461). Missions range from fully autonomous to highly supervised requiring an agile optimization as real-world factors change. Continue efforts to explore autonomy, perception, and command and control (C2) concepts for MATES conducting complex multi-domain operations in proximity to each other along a spectrum of missions. Initiate: Initiate activities researching an artificial theory of mind for Super Swarm (Project 3459) agents, allowing them to perceive current manned blue teammate behavior states and derive and act on anticipated future states and potential reactions to state changes. ***FY 2024 Base Plans:*** Continue: - Efforts to explore autonomy, perception, and command and control (C2) concepts for Manned and Autonomous Teams (MATES) conducting complex multi-domain operations in proximity to each other along a spectrum of missions. Autonomous systems will be swarm agents developed through Super Swarm (Project 3459) and Deployment and Employment of Autonomous Long Range Systems (DEALRS) (Project 3462). Autonomy, perception, and agent/ vehicle control schemes will be informed by Manufacture of Autonomous Systems at Scale (MASS) (Project 3461). Missions range from fully autonomous to highly supervised requiring an agile optimization as real-world factors change. - Activities researching an artificial theory of mind for Super Swarm (Project 3459) agents, allowing them to perceive current manned blue teammate behavior states and derive and act on anticipated future states and potential reactions to state changes.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 3463 / *MATes*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Complete efforts to explore autonomy, perception, and command and control (C2) concepts for MATES conducting complex multi-domain operations in proximity to each other along a spectrum of missions. Initiate: - Artificial theory of mind regarding other blue, red, and white manned and unmanned agents, allowing for the projection/anticipation of intent and future states of those agents. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 due to additional complexity of experimenting with non-deterministic autonomous systems.					
Accomplishments/Planned Programs Subtotals	4.836	6.435	9.900	0.000	9.900

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0603801N/3463: *MATes*	0.768	3.958	4.950	-	4.950	4.950	13.860	13.451	0.000	Continuing	Continuing

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 3506 / *Compact Agile Interceptors*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3506: *Compact Agile Interceptors*	0.000	0.000	0.000	1.500	-	1.500	2.000	0.000	0.000	0.000	0.000	3.500

Note

Project 3506 is a new start program in FY 2024.

A. Mission Description and Budget Item Justification

The US Navy lacks both in capability and capacity interceptors that have the ability to defeat complex raids of hypersonic missiles, cruise missiles and surface vessels. The Compact Agile Interceptor INP will use small diameter missiles to achieve a higher packing efficiency. Disruptive seeker technology, which weighs mere ounces will replace wasted pounds of payload weight and allow for higher speed missile interceptors. The seedling will evaluate multiple propulsion technologies including solid fuel ramjets, highly loaded grain propellants, and active throttling of solid rockets. The missiles airframe may be staged to enable the interceptor(s) the greatest agility to overmatch the threat. Multiple warhead technologies will be evaluated including reactive materials, kinetic warheads, and tailorable fragment warheads. The Activity identified in Project Unit 3506 specifically addresses Applied Research in support of the Compact Agile Interceptors INP effort.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Compact Agile Interceptors	0.000	0.000	1.500	0.000	1.500
Description: The US Navy lacks both in capability and capacity interceptors that have the ability to defeat complex raids of hypersonic missiles, cruise missiles and surface vessels. The Compact Agile Interceptor INP will use small diameter missiles to achieve a higher packing efficiency. Disruptive seeker technology, which weighs mere ounces will replace wasted pounds of payload weight and allow for higher speed missile interceptors. The seedling will evaluate multiple propulsion technologies including solid fuel ramjets, highly loaded grain propellants, and active throttling of solid rockets. The missiles airframe may be staged to enable the interceptor(s) the greatest agility to overmatch the threat. Multiple warhead technologies will be evaluated including reactive materials, kinetic warheads, and tailorable fragment warheads. The Activity identified in Project Unit 3506 specifically addresses Applied Research in support of the Compact Agile Interceptors INP effort.					
FY 2023 Plans: N/A					
FY 2024 Base Plans: Initiate:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 3506 / *Compact Agile Interceptors*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initial Mission Analysis to establish Capability & Limitations of Engagement Envelope - Propulsion/Payload Study to establish Missile Architecture and Technology Design Objectives ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 in Proj: 3506 Compact Agile Interceptors is due to the initiation of the program.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	1.500	0.000	1.500

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 3507 / *Chimera*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3507: *Chimera*	0.000	0.000	0.000	15.537	-	15.537	37.910	40.798	25.606	7.757	Continuing	Continuing

Note

Project 3507 is a new start in FY 2024 for the Chimera INP

A. Mission Description and Budget Item Justification

Details at a higher classification

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Chimera	0.000	0.000	15.537	0.000	15.537
FY 2023 Plans: N/A					
FY 2024 Base Plans: Details at a higher classification					
FY 2024 OCO Plans: N/A					
FY 2023 to FY 2024 Increase/Decrease Statement: The increase in funding from FY 2023 to FY 2024 in Proj: 3507 Chimera is due to the initiation of the program. Details at a higher classification.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	15.537	0.000	15.537

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 3508 / *Curious Orion*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3508: *Curious Orion*	0.000	0.000	0.000	1.800	-	1.800	1.800	0.000	0.000	0.000	0.000	3.600

Note

FY 2024 in Project: 3508 Curious Orion is a new start due to the initiation of the program.

A. Mission Description and Budget Item Justification

The USN lacks a breadth of tools to find fix and finish high end maritime threats across specific environments and conditions. Curious Orion will develop a unique capability to exploit specific phenomenology produced by submerged bodies in operationally relevant areas that are of specific interest to the U.S. Navy. The Activity identified in Project Unit 3508 specifically addresses Applied Research in support of the Curious Orion INP effort.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Curious Orion	0.000	0.000	1.800	0.000	1.800
Description: The USN lacks a breadth of tools to find fix and finish high end maritime threats across specific environments and conditions. Curious Orion will develop a unique capability to exploit specific phenomenology produced by submerged bodies in operationally relevant areas that are of specific interest to the U.S. Navy. The Activity identified in Project Unit 3508 specifically addresses Applied Research in support of the Curious Orion INP effort.					
FY 2023 Plans: N/A					
FY 2024 Base Plans: FY 2024: -Initiate updated detection algorithms and clutter reduction techniques -Commence data collections to validate detection models and start development of military utility analysis. -Initiate sensor design based upon potential platforms					
FY 2024 OCO Plans: N/A					
FY 2023 to FY 2024 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 3508 / *Curious Orion*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
The increase in funding from FY 2023 to FY 2024 in Proj: 3508 Curious Orion is due to the initiation of the program.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	1.800	0.000	1.800

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy												Date: March 2023
Appropriation/Budget Activity 1319 / 2					R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*				Project (Number/Name) 5891 / *INP Operational Analysis, Support and Experimentation Activity*			
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
5891: *INP Operational Analysis, Support and Experimentation Activity*	0.000	0.000	4.461	2.000	-	2.000	2.000	2.000	1.903	1.948	Continuing	Continuing

A. Mission Description and Budget Item Justification

Effective in FY23, efforts in the Directed Energy/Electric Weapons Activity within Proj: 3400 INP Applied Research in PE 0602792N are broken out into this stand-alone Proj: 5891 Operational Analysis, Support and Experimentation Activity to broaden the spectrum of promising applied research efforts investigated within this Project and to provide additional acquisition oversight, fiscal clarity, and adherence to financial management practices at the Project level.

The efforts described in this Project address the Applied Research associated with Innovative Naval Prototype (INP) Operational Analysis, Support and Experimentation Activity efforts that are used to further explore the development of future INP topics and proposals. These efforts evaluate, study/analyze and/or perform any basic applied research-focused investigative experimentation activities which will support the identification of potential INP topics for future investment consideration. The use of Operational Analysis, Support and Experimentation Activity funds can help accelerate and/or create a flexible response to emerging requirements or threats by identifying a potential INP topic for consideration in a more time-efficient and/or effective manner.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: INP Operational Analysis, Support and Experimentation	0.000	4.461	2.000	0.000	2.000
Description: Effective in FY23, efforts in the Directed Energy/Electric Weapons Activity within Proj: 3400 INP Applied Research in PE 0602792N are broken out into this stand-alone Proj: 5891 Operational Analysis, Support and Experimentation to broaden the spectrum of promising applied research efforts investigated within this Project and to provide additional acquisition oversight, fiscal clarity, and adherence to financial management practices at the Project level. The efforts described in this Project address the Applied Research associated with Innovative Naval Prototype (INP) Operational Analysis, Support and Experimentation efforts that are used to further explore the development of future INP topics and proposals. These efforts evaluate, study/analyze and/or perform any basic applied research-focused investigative experimentation activities which will support the identification of potential INP topics for future investment consideration. The use of Operational Analysis, Support and Experimentation funds can help accelerate and/or create a flexible response to emerging requirements or threats by identifying a potential INP topic for consideration in a more time-efficient and/or effective manner.					
FY 2023 Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 5891 / *INP Operational Analysis, Support and Experimentation Activity*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate program support and applied research activities associated with exploring the development of future INP topics and proposals. - Evaluate, study/analyze and/or perform any basic applied research-focused investigative experimentation activities to inform and identify potential future INP investment areas. ***FY 2024 Base Plans:*** - Continue program support and applied research activities associated with exploring the development of future INP topics and proposals. - Evaluate, study/analyze and/or perform any basic applied research-focused investigative experimentation activities to inform and identify potential future INP investment areas. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease in funding from FY 2023 to FY 2024 in Proj: 5891 INP Operational Analysis, Support and Experimentation is due the success of applied research efforts in FY 2023, which are resulting in future INP investments, and reducing the need for applied research efforts in FY 2024.					
Accomplishments/Planned Programs Subtotals	0.000	4.461	2.000	0.000	2.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 5892 / *Full Spectrum Information Warfare*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
5892: *Full Spectrum Information Warfare*	0.000	0.000	4.000	7.000	-	7.000	0.000	0.000	0.000	0.000	0.000	11.000

A. Mission Description and Budget Item Justification

The Full Spectrum Information Warfare (FSIW) effort will develop integrated holistic Counter-C5ISRT capability, techniques and CONOPS to defeat adversarial capacity growth to include the effects of the maritime environment on tactics and effectiveness in order to provide the proliferation of C-C5ISRT payloads on small to large platforms and software to calculate EM propagation and take into account environmental conditions from "DC to Daylight" e.g. from VLF/HF through optical frequencies to optimize both passive and active C-C5ISRT technology use.

The efforts described in this Project address the Applied Research associated with concept of a "Seedling". These "Seedling" efforts are short duration applied research efforts to explore technology concepts which have the potential to provide revolutionary and/or disruptive warfighting capability. As a "Seedling" concept matures, a determination is made whether or not a continuing INP effort is warranted or appropriate. "Seedlings" are typically one to two year efforts and use applied research to analyze the feasibility of technology and subsystems to assess if the technologies can be proposed as an INP. They will research lower TRL technologies to explore technology concepts and lay preliminary groundwork for an INP proposal to continue technology development and full-scale technology/operational demonstrations.

The Activity identified in this Project Unit specifically addresses Applied Research in support of the FSIW INP effort.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Full Spectrum Information Warfare	0.000	4.000	7.000	0.000	7.000
Description: The Full Spectrum Information Warfare (FSIW) effort will develop integrated holistic Counter-C5ISRT capability, techniques and CONOPS to defeat adversarial capacity growth to include the effects of the maritime environment on tactics and effectiveness in order to provide the proliferation of C-C5ISRT payloads on small to large platforms and software to calculate EM propagation and take into account environmental conditions from "DC to Daylight" e.g. from VLF/HF through optical frequencies to optimize both passive and active C-C5ISRT technology use. The efforts described in this Project address the Applied Research associated with concept of a "Seedling". These "Seedling" efforts are short duration applied research efforts to explore technology concepts which have the potential to provide revolutionary and/or disruptive warfighting capability. As a "Seedling" concept matures, a determination is made whether or not a continuing INP effort is warranted or appropriate. "Seedlings" are typically one to two year efforts and use applied research to analyze the feasibility of technology and subsystems to assess if the technologies can be proposed as an INP. They will research lower TRL technologies to explore					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 5892 / *Full Spectrum Information Warfare*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
technology concepts and lay preliminary groundwork for an INP proposal to continue technology development and full-scale technology/operational demonstrations. The Activity identified in this Project Unit specifically addresses Applied Research in support of the FSIW INP effort. ***FY 2023 Plans:*** Initiate applied research in support of the development of Full Spectrum Information Warfare (FSIW). Specific efforts include the following: - Develop a test scenario with real tropospheric and ionospheric conditions based on one of the EW Field Demos (for example in the LSE or Rough Series). Identify cases of observed extended or reduced ranges, clutter, and detectability and compare predicted to observed conditions. - Analyze emerging material science for possible breakthroughs in passive countermeasures - Investigate cyber vulnerabilities in imagers and potential threat AI/ML algorithms - Investigate a high-level architecture for MUM-T C-C5ISRT employment - Extend current planning aids for space-based ISR to surface and airborne fixed/ mobile systems. ***FY 2024 Base Plans:*** Complete applied research in support of the development of Full Spectrum Information Warfare (FSIW). Specific efforts include the following: - Develop a test scenario under real world conditions based on one of the EW Field Demos (for example in the LSE or Rough Series). Identify cases of observed changes in range, clutter, and detectability and compare sensor performance to that predicted under those conditions. - Analyze emerging material science for countermeasure applications. - Investigate cyber vulnerabilities in imagers and AI/ML algorithms. - Investigate a high-level architecture for MUM-T employment. - Extend current ISR planning aids to include both fixed and mobile surface and airborne systems. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 5892 / *Full Spectrum Information Warfare*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
The increase in funding from FY 2023 to FY 2024 in Proj: 5892 Full Spectrum Information Warfare (FSIW) is due taking the promising studies and ideas identified in FY 2023 and develop them into prototypes with modeling and simulation or low order demos that could include hardware.					
Accomplishments/Planned Programs Subtotals	0.000	4.000	7.000	0.000	7.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 5893 / *Decision Superiority*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
5893: *Decision Superiority*	0.000	0.000	1.700	1.200	-	1.200	0.000	0.000	0.000	0.000	0.000	2.900

A. Mission Description and Budget Item Justification

The Decision Superiority (DS) effort will improve the speed and quality of decisions when conducting undersea warfare activities at the tactical edge that does not require persistent communication reach back. This will be achieved through the development of Decision Aids (DAs) using a holistic Human-Machine-Teaming (HMT) and training approaches and processes to optimize warfighter decisions (e.g. sonar operations, maintenance repair, personnel rotations).

The efforts described in this Project address the Applied Research associated with concept of a "Seedling". These "Seedling" efforts are short duration applied research efforts to explore technology concepts which have the potential to provide revolutionary and/or disruptive warfighting capability. As a "Seedling" concept matures, a determination is made whether or not a continuing INP effort is warranted or appropriate. "Seedlings" are typically one to two year efforts and use applied research to analyze the feasibility of technology and subsystems to assess if the technologies can be proposed as an INP. They will research lower TRL technologies to explore technology concepts and lay preliminary groundwork for an INP proposal to continue technology development and full-scale technology/operational demonstrations.

The Activity identified in this Project Unit specifically addresses Applied Research in support of the Decision Superiority INP effort.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Decision Superiority	0.000	1.700	1.200	0.000	1.200
Description: The Decision Superiority (DS) effort will improve the speed and quality of decisions when conducting undersea warfare activities at the tactical edge that does not require persistent communication reach back. This will be achieved through the development of Decision Aids (DAs) using a holistic Human-Machine-Teaming (HMT) and training approaches and processes to optimize warfighter decisions (e.g. sonar operations, maintenance repair, personnel rotations). The efforts described in this Project address the Applied Research associated with concept of a "Seedling". These "Seedling" efforts are short duration applied research efforts to explore technology concepts which have the potential to provide revolutionary and/or disruptive warfighting capability. As a "Seedling" concept matures, a determination is made whether or not a continuing INP effort is warranted or appropriate. "Seedlings" are typically one to two year efforts and use applied research to analyze the feasibility of technology and subsystems to assess if the technologies can be proposed as an INP. They will research lower TRL technologies to explore technology concepts and lay preliminary groundwork for an INP proposal to continue technology development and full-scale technology/operational demonstrations.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 5893 / *Decision Superiority*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
The Activity identified in this Project Unit specifically addresses Applied Research in support of the Decision Superiority INP effort. ***FY 2023 Plans:*** Initiate applied research in support of the development of the Decision Superiority (DS) INP. Specific efforts include the following: - Studies and operational characterization of problems, tasks, data, decisions, and metrics related to undersea warfare. - Modeling and simulation architecture development to inform iterative development, training, and evaluation in a realistic mission environment. HMT design and evaluation analysis to support warfighter decisions making related to emerging technologies. - Develop adaptive training process informed by identified warfighter decisions, HMT evaluation process, and operational metrics - Develop and conduct initial research studies related to mental endurance and decision making performance to inform personnel rotation and scheduling technologies ***FY 2024 Base Plans:*** Complete applied research in support of the development of Decision Superiority. Specific efforts include the following: - Studies and operational characterization of problems, tasks, data, decisions, and metrics related to undersea warfare on submarines to support decision superiority research efforts. - Modeling and simulation architecture development to inform iterative development, training, and evaluation in a realistic mission environment that will be used to support human machine teaming design and evaluation analysis. This analysis will support decision making in the submarine control room. - Develop adaptive training processes informed by identified warfighter decisions and human machine teaming designs to improve decision making on submarines and impact operational metrics. - Develop and conduct initial research studies related to mental endurance and decision making performance to inform technologies for personnel scheduling. ***FY 2024 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 5893 / *Decision Superiority*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease in funding from FY 2023 to FY 2024 in Proj: 5897 Decision Superiority is due to the completion of the initial requirement analysis.					
Accomplishments/Planned Programs Subtotals	0.000	1.700	1.200	0.000	1.200

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 5894 / *Direct-X*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
5894: *Direct-X*	0.000	0.000	2.500	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.500

A. Mission Description and Budget Item Justification

The Direct-X effort will develop space based ISRT with direct downlink into kill chains supporting all domain effects in a Distributed Maritime Operations construct. The focus is on advances in the following lines of effort:
P1 - Orchestration, tasking and resilient C3
P2 - Threat prioritized low cost on orbit payloads
P3 - On orbit processing and analyitic AI/ML
P4 - Direct-to-shooter kill chains
P5 - On orbit effects

The efforts described in this Project address the Applied Research associated with concept of a "Seedling". These "Seedling" efforts are short duration applied research efforts to explore technology concepts which have the potential to provide revolutionary and/or disruptive warfighting capability. As a "Seedling" concept matures, a determination is made whether or not a continuing INP effort is warranted or appropriate. "Seedlings" are typically one to two year efforts and use applied research to analyze the feasibility of technology and subsystems to assess if the technologies can be proposed as an INP. They will research lower TRL technologies to explore technology concepts and lay preliminary groundwork for an INP proposal to continue technology development and full-scale technology/operational demonstrations.

The Activity identified in this Project Unit specifically addresses Applied Research in support of the Direct-X INP effort.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Direct-X	0.000	2.500	0.000	0.000	0.000
Description: The Direct-X effort will develop space based ISRT with direct downlink into kill chains supporting all domain effects in a Distributed Maritime Operations construct. The focus is on advances in the following lines of effort: P1 - Orchestration, tasking and resilient C3 P2 - Threat prioritized low cost on orbit payloads P3 - On orbit processing and analyitic AI/ML P4 - Direct-to-shooter kill chains P5 - On orbit effects The efforts described in this Project address the Applied Research associated with concept of a "Seedling". These "Seedling" efforts are short duration applied research efforts to explore technology concepts which have					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 5894 / *Direct-X*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
the potential to provide revolutionary and/or disruptive warfighting capability. As a "Seedling" concept matures, a determination is made whether or not a continuing INP effort is warranted or appropriate. "Seedlings" are typically one to two year efforts and use applied research to analyze the feasibility of technology and subsystems to assess if the technologies can be proposed as an INP. They will research lower TRL technologies to explore technology concepts and lay preliminary groundwork for an INP proposal to continue technology development and full-scale technology/operational demonstrations. The Activity identified in this Project Unit specifically addresses Applied Research in support of the Direct-X INP effort. ***FY 2023 Plans:*** Initiate applied research in support of the development of the Direct-X INP. Specific efforts include the following: - Feasibility studies to identify state-of-the-art technologies that support these five lines of effort, and analyze them to capture technological gaps for enabling the DX concept. - Determine the sequencing of payloads to threats - Study outcomes and analysis of technological gaps to develop an investment strategy for an envisioned reconfigurable Naval constellation- ultimately converging on multifunction systems to support mission areas. ***FY 2024 Base Plans:*** N/A ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease in funding from FY 2023 to FY 2024 in Proj: 5894 Direct-X is due to program completion.					
Accomplishments/Planned Programs Subtotals	0.000	2.500	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 5894 / *Direct-X*

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 5895 / *DMO through IAS*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
5895: *DMO through IAS*	0.000	0.000	2.950	4.500	-	4.500	0.000	0.000	0.000	0.000	0.000	7.450

A. Mission Description and Budget Item Justification

The Distributed Maritime Operations though Intelligent Autonomous Systems (DMO-IAS) effort will demonstrate IAS teams that can maneuver and close sea denial detect through engage/ assess kill-chains over tactically relevant ranges and extended mission durations, that maintain survivability through avoidance of detection, and that do not rely on vulnerable command and control systems. It will explore novel sensing, autonomy, and communications approaches that can be applied to other Navy IAS programs that enable robust, resilient IAS kill-chains.

The efforts described in this Project address the Applied Research associated with concept of a "Seedling". These "Seedling" efforts are short duration applied research efforts to explore technology concepts which have the potential to provide revolutionary and/or disruptive warfighting capability. As a "Seedling" concept matures, a determination is made whether or not a continuing INP effort is warranted or appropriate. "Seedlings" are typically one to two year efforts and use applied research to analyze the feasibility of technology and subsystems to assess if the technologies can be proposed as an INP. They will research lower TRL technologies to explore technology concepts and lay preliminary groundwork for an INP proposal to continue technology development and full-scale technology/operational demonstrations.

The Activity identified in this Project Unit specifically addresses Applied Research in support of the DMO through IAS INP effort.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: DMO through IAS	0.000	2.950	4.500	0.000	4.500
Description: The Distributed Maritime Operations though Intelligent Autonomous Systems (DMO-IAS) effort will demonstrate IAS teams that can maneuver and close sea denial detect through engage/ assess kill-chains over tactically relevant ranges and extended mission durations, that maintain survivability through avoidance of detection, and that do not rely on vulnerable command and control systems. It will explore novel sensing, autonomy, and communications approaches that can be applied to other Navy IAS programs that enable robust, resilient IAS kill-chains. The efforts described in this Project address the Applied Research associated with concept of a "Seedling". These "Seedling" efforts are short duration applied research efforts to explore technology concepts which have the potential to provide revolutionary and/or disruptive warfighting capability. As a "Seedling" concept matures, a determination is made whether or not a continuing INP effort is warranted or appropriate. "Seedlings" are typically one to two year efforts and use applied research to analyze the feasibility of technology and subsystems to assess if the technologies can be proposed as an INP. They will research lower TRL technologies to explore					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 5895 / *DMO through IAS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
technology concepts and lay preliminary groundwork for an INP proposal to continue technology development and full-scale technology/operational demonstrations. The Activity identified in this Project Unit specifically addresses Applied Research in support of the DMO through IAS INP effort. ***FY 2023 Plans:*** Initiate applied research in support of the development of Distributed Maritime Operations through Intelligent Autonomous Systems (DMO through IAS). Specific efforts include the following: - Conduct operationally oriented study and simulation experiment to refine the potential of AI enabled IAS platforms - conducting collaborative DMO. - Integrate autonomy, onboard AI processing, and comms modalities onto surrogate UxS (draw from existing INP efforts). - Conduct live, force-on-force experiment against fleet assets to determine and validate kill-chain vulnerabilities and opportunities. - Lessons learned will inform efficacy and impact of a potential follow-on effort along with defined technical objectives and proposed paths for autonomy, sensing, AI, platform performance, and C2. ***FY 2024 Base Plans:*** - Complete applied research efforts in support of the development of DMO through IAS. Specific efforts include the following: - Conduct operationally oriented study and simulation experiment to refine the potential of AI enabled IAS platforms - conducting collaborative DMO. - Integrate autonomy, onboard AI processing, and comms modalities onto surrogate UxS (draw from existing INP efforts). - Conduct live, force-on-force experiment against fleet assets to determine and validate kill-chain vulnerabilities and opportunities. - Lessons learned will inform efficacy and impact of a potential follow-on effort along with defined technical objectives and proposed paths for autonomy, sensing, AI, platform performance, and C2. ***FY 2024 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 5895 / *DMO through IAS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 in Proj: 5895 Distributed Maritime Operations through Intelligent Autonomous Systems (DMO through IAS) is due to planned force-on-force experiment against fleet assets to determine and validate kill-chain vulnerabilities and opportunities.					
Accomplishments/Planned Programs Subtotals	0.000	2.950	4.500	0.000	4.500

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 5896 / *Echidna*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
5896: *Echidna*	0.000	0.000	1.777	0.750	-	0.750	0.000	0.000	0.000	0.000	0.000	2.527

A. Mission Description and Budget Item Justification

The Echidna effort will develop additive capability and additive capacity which is classified. It will explore new mine development, to include improved sensing for a highly complex environment and target, improved lethality, endurance and power technologies, cost-effective additive manufacturing subcomponent technologies, and flexible, platform-agnostic engineering design (to include safe & arming device) to allow for novel and adaptable concepts of employment (CONEMP)

The efforts described in this Project address the Applied Research associated with concept of a "Seedling". These "Seedling" efforts are short duration applied research efforts to explore technology concepts which have the potential to provide revolutionary and/or disruptive warfighting capability. As a "Seedling" concept matures, a determination is made whether or not a continuing INP effort is warranted or appropriate. "Seedlings" are typically one to two year efforts and use applied research to analyze the feasibility of technology and subsystems to assess if the technologies can be proposed as an INP. They will research lower TRL technologies to explore technology concepts and lay preliminary groundwork for an INP proposal to continue technology development and full-scale technology/operational demonstrations.

The Activity identified in this Project Unit specifically addresses Applied Research in support of the Echidna INP effort.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Echidna	0.000	1.777	0.750	0.000	0.750
Description: The Echidna effort will develop additive capability and additive capacity which is classified. It will explore new mine development, to include improved sensing for a highly complex environment and target, improved lethality, endurance and power technologies, cost-effective additive manufacturing subcomponent technologies, and flexible, platform-agnostic engineering design (to include safe & arming device) to allow for novel and adaptable concepts of employment (CONEMP) The efforts described in this Project address the Applied Research associated with concept of a "Seedling". These "Seedling" efforts are short duration applied research efforts to explore technology concepts which have the potential to provide revolutionary and/or disruptive warfighting capability. As a "Seedling" concept matures, a determination is made whether or not a continuing INP effort is warranted or appropriate. "Seedlings" are typically one to two year efforts and use applied research to analyze the feasibility of technology and subsystems to assess if the technologies can be proposed as an INP. They will research lower TRL technologies to explore technology concepts and lay preliminary groundwork for an INP proposal to continue technology development and full-scale technology/operational demonstrations.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 5896 / *Echidna*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
The Activity identified in this Project Unit specifically addresses Applied Research in support of the Echidna INP effort. ***FY 2023 Plans:*** Initiate applied research in support of the development of the Echidna INP. Specific efforts include the following: - Thrust 1: Lethality study, to include M&S for housing, and comparative analysis with legacy warhead and new explosive formulation - Thrust 2: Analysis of Alternatives (AoA) for dynamic sensing environment, target analysis - Thrust 3: Update 2021 ONR Subsea & Seabed Power (SSP) Roadmap to address Mining gaps. Establish T/O for endurance parameters, environmental considerations, approach for deployment. - Thrust 4: Additive manufacturing study for subcomponent technologies, to include prototype application Exit criteria for Phase 1: Integration schedule for subcomponent design (Thrust 1-3), and parallel subcomponent design and comparative analysis of test articles in representative environment (Thrust 4) ***FY 2024 Base Plans:*** Complete Phase 1 applied research studies to support the development of the Echidna INP, including the following: - Thrust 1: Lethality study, to include M&S for housing, and comparative analysis with legacy warhead and new explosive formulation - Thrust 2: Analysis of Alternatives (AoA) for dynamic sensing environment, target analysis - Thrust 3: Updated ONR Subsea & Seabed Power (SSP) Roadmap to address Mining gaps with established T/O endurance parameters, environmental considerations, approach for deployment. - Thrust 4: Additive manufacturing study for subcomponent technologies, to include prototype application - Notional integration schedule for subcomponent design (Thrust 1-3) - Notional parallel subcomponent design and comparative analysis of test articles in representative environment (Thrust 4) ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 5896 / *Echidna*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
The decrease in funding from FY 2023 to FY 2024 in Proj: 5896 Echidna is due to reduced activities planned/ required in the final year of the Echidna Seedling effort.					
Accomplishments/Planned Programs Subtotals	0.000	1.777	0.750	0.000	0.750

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 5897 / *Hypersonic Technologies*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
5897: *Hypersonic Technologies*	0.000	0.000	8.000	6.000	-	6.000	0.000	0.000	0.000	0.000	0.000	14.000

A. Mission Description and Budget Item Justification

The Hypersonic Technologies effort will develop technologies that support the unique operational and environment aspects of hypersonic weapon systems. Efforts include: advanced materials; propulsion; stability and control; seekers and sensors; guidance, navigation, and control; and payloads and energetics.

The efforts described in this Project address the Applied Research associated with concept of a "Seedling". These "Seedling" efforts are short duration applied research efforts to explore technology concepts which have the potential to provide revolutionary and/or disruptive warfighting capability. As a "Seedling" concept matures, a determination is made whether or not a continuing INP effort is warranted or appropriate. "Seedlings" are typically one to two year efforts and use applied research to analyze the feasibility of technology and subsystems to assess if the technologies can be proposed as an INP. They will research lower TRL technologies to explore technology concepts and lay preliminary groundwork for an INP proposal to continue technology development and full-scale technology/operational demonstrations.

The Activity identified in this Project Unit specifically addresses Applied Research in support of the Hypersonic Technologies INP effort.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Hypersonic Technologies	0.000	8.000	6.000	0.000	6.000
Description: The Hypersonic Technologies effort will develop technologies that support the unique operational and environment aspects of hypersonic weapon systems. Efforts include: advanced materials; propulsion; stability and control; seekers and sensors; guidance, navigation, and control; and payloads and energetics. The efforts described in this Project address the Applied Research associated with concept of a "Seedling". These "Seedling" efforts are short duration applied research efforts to explore technology concepts which have the potential to provide revolutionary and/or disruptive warfighting capability. As a "Seedling" concept matures, a determination is made whether or not a continuing INP effort is warranted or appropriate. "Seedlings" are typically one to two year efforts and use applied research to analyze the feasibility of technology and subsystems to assess if the technologies can be proposed as an INP. They will research lower TRL technologies to explore technology concepts and lay preliminary groundwork for an INP proposal to continue technology development and full-scale technology/operational demonstrations. The Activity identified in this Project Unit specifically addresses Applied Research in support of the Hypersonic Technologies INP effort.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 5897 / *Hypersonic Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
FY 2023 Plans: Initiate applied research in support of the development of the Hypersonic Technologies INP. Specific efforts include the following: - Award a Base Contract, under which the vendor would deliver S&T-tailored system requirements and an S&T-tailored preliminary design. - Initiate of a Contract Option One effort, which would culminate with an S&T-tailored critical design. ***FY 2024 Base Plans:*** Complete applied research in support of the development of Hypersonic Technologies for risk reduction for a potential future INP. Specific efforts include the following: - Award Option One contract(s) for key component technology element(s) that shall culminate in an S&T tailored Critical Design Review(s). - Initiate award of additional contracting option(s), leveraging critical design(s), in key component technology element(s). ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease in funding from FY 2023 to FY 2024 in Proj: 5897 Hypersonic Technologies is due to reduced activities planned/required in the final year of the this Seedling effort.					
Accomplishments/Planned Programs Subtotals	0.000	8.000	6.000	0.000	6.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 5899 / *Precision Fire Control*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
5899: *Precision Fire Control*	0.000	0.000	23.539	22.261	-	22.261	14.040	4.880	0.932	0.000	0.000	65.652

A. Mission Description and Budget Item Justification

The Precision Fire Control (PFC) effort will develop a fire control architecture that delivers high precision, high update rate guidance solutions to enable cruise missile defense with small, low-cost interceptors and dramatically increase number of interceptors per ship or Expeditionary Advanced Base. It will develop fire control capability for multiple interceptors (missiles and gun projectiles) that contribute to layered defense of surface combatants, expeditionary forces, and homeland protection. Develop PFC-enabled low-cost missile (LCM) based on existing 2.75" rocket components.

The Activity identified in this Project Unit specifically addresses Applied Research in support of the PFC INP effort.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Precision Fire Control	0.000	23.539	22.261	0.000	22.261
Description: The Precision Fire Control (PFC) effort will develop a fire control architecture that delivers high precision, high update rate guidance solutions to enable cruise missile defense with small, low-cost interceptors and dramatically increase number of interceptors per ship or Expeditionary Advanced Base. It will develop fire control capability for multiple interceptors (missiles and gun projectiles) that contribute to layered defense of surface combatants, expeditionary forces, and homeland protection. Develop PFC-enabled low-cost missile (LCM) based on existing 2.75" rocket components. The Activity identified in this Project Unit specifically addresses Applied Research in support of the PFC INP effort. ***FY 2023 Plans:*** Initiate applied research in support of the development of the Precision Fire Control (PFC) INP. Specific efforts include the following: - Leverage results of prior fire control architecture studies, experiments, and current technologies to complete requirements and functional designs for fire control hardware and software. - Begin prototyping of PFC fire control elements and HVP flight test units. - Internal warfare center investments are contributing to concept exploration and performance predictions ***FY 2024 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	**Project (Number/Name)** 5899 / *Precision Fire Control*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
FY24 Plan: - Continue applied research of a fire control architecture that delivers high precision and update rate guidance solution to enable cruise missile defense with multiple low-cost interceptors (missiles and gun projectiles). - Complete requirements for Precision Fire-Control (PFC) technologies and interceptors [Hyper Velocity Projectile (HVP) and Low Cost Terminal Defense Missile (LCTDM)]. - Continue prototyping of PFC fire control elements and HVP flight test units. - Conduct preliminary design studies for PFC technologies and LCTDM. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant change in funding from FY23 to FY24 in Proj: 5899 Precision Fire Control (PFC).					
Accomplishments/Planned Programs Subtotals	0.000	23.539	22.261	0.000	22.261

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0603801N/5899: *Precision Fire Control*	0.000	0.527	8.673	-	8.673	10.352	19.520	14.394	0.000	Continuing	Continuing

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *Innovative Naval Prototypes (INP) Applied Res*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	2.896	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.896

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Congressional Add: Accelerate proliferated LEO narrowband capability	2.896	0.000
FY 2022 Accomplishments: Conduct accelerate proliferated LEO narrowband capability applied research		
FY 2023 Plans: N/A		
Congressional Adds Subtotals	2.896	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602861N *I Science & Tech Management - ONR Field Acts*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	79.149	81.296	85.063	-	85.063	87.424	89.295	91.185	93.065	Continuing	Continuing
0000: *Science & Tech Management - ONR Field Acts*	0.000	75.754	78.397	79.879	-	79.879	82.134	83.882	85.663	87.433	Continuing	Continuing
0824: *Science & Technology Managment*	0.000	3.395	2.899	5.184	-	5.184	5.290	5.413	5.522	5.632	Continuing	Continuing

A. Mission Description and Budget Item Justification

This Program Element (PE) is for the Office of Naval Research (ONR) to cover corporate expenses including salaries, Information Technology (IT), Financial Improvement Plan (FIP) efforts, Defense Finance and Accounting Service (DFAS) Billings, and some of the day-to-day logistical costs. The vast majority of these items represent fixed costs associated with Scientists and Engineers supporting the Navy's Science and Technology (S&T) Programs.

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	79.254	81.296	83.447	-	83.447
Current President's Budget	79.149	81.296	85.063	-	85.063
Total Adjustments	-0.105	0.000	1.616	-	1.616
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.105	0.000			
• Rate/Misc Adjustments	0.000	0.000	1.616	-	1.616

Change Summary Explanation

Funding: Funding increase for civilian labor costs.

Technical: No significant change.

Technical: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602861N / *Science & Tech Management - ONR Field Acts*	Project (Number/Name) 0000 / *Science & Tech Management - ONR Field Acts*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
0000: *Science & Tech Management - ONR Field Acts*	0.000	75.754	78.397	79.879	-	79.879	82.134	83.882	85.663	87.433	Continuing	Continuing

Note

N/A

A. Mission Description and Budget Item Justification

This project supports ONR leadership, management and direction for the Naval S&T program. This project funds ONR HQ Non-Management Headquarters Activities (Non-MHA) salaries, communications, and other fixed costs. ONR sponsors scientific advances, which lead to Future Naval Capabilities (FNCs), supporting the Fleet's ability to operate from a position of technological superiority. Functions performed include (1) scientific and technical direction of the nationwide 6.1 basic research program with colleges, universities, non-profit organizations and Naval Laboratories and Warfare Centers; (2) scientific and technical direction of the 6.2 applied research program through the Naval R&D laboratories and Warfare Centers and industry; (3) scientific and technical direction of the Naval 6.3 advanced technology development program through the Navy's R&D laboratories, Warfare Centers and industry; (4) management, resource formulation, program assessment, and contract negotiation/administration of the Navy basic research, applied research and advanced technology development program; and (5) coordination of the Navy's Technology Base program within the context of total DoD/Government (e.g., National Science Foundation, National Academy of Sciences) R&D initiatives in order to maximize scientific advances. This project also supports ONR Non-MHA management and direction for the following Navy-wide programs: Small Business Innovation Research, Naval Research Advisory Committee, Navy Patent Program, Historically Black Colleges and Universities/Minority Institutions Program, Navy Manufacturing Technology Program and the Ballistic Missile Submarine Nuclear (SSBN) Security Technology Program.

Additionally, this project funds ONR field salaries, communications, and other fixed costs.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: (U) Science & Tech Management - ONR Field Acts	75.754	78.397	79.879	0.000	79.879
Description: This Project provides funds for Non-MHA Labor costs associated with executing ONR's mission to discover, develop, and transition innovative science and technology (S&T) to meet current and future needs of naval forces. The funds in this project pay the salaries of Scientific and Engineering and corporate business personnel who direct the execution of the Navy's basic research, applied research, and advanced technology development programs at the nation's universities/colleges, Navy laboratories, Warfare Centers, and private industry.					
FY 2023 Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602861N / *Science & Tech Management - ONR Field Acts*	**Project (Number/Name)** 0000 / *Science & Tech Management - ONR Field Acts*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
This project provides for all labor costs of ONR Headquarters in support of the entire Navy S&T program. The funds in this project pay the salaries of Scientific and Engineering and corporate business personnel who direct the execution of the Navy's basic research, applied research, and advanced technology development programs at the nation's universities/colleges, Navy laboratories, Warfare Centers, and private industry. This project provides for all basic labor costs of ONR activities in support of the entire Navy S&T program. ***FY 2024 Base Plans:*** This project provides for all labor costs of ONR Headquarters in support of the Navy S&T program. The funds in this project pay the salaries of Scientific and Engineering and corporate business personnel who direct the execution of the Navy's basic research, applied research, and advanced technology development programs at the nation's universities/colleges, Navy laboratories, Warfare Centers, and private industry. This project provides for all basic labor costs of ONR activities in support of the entire Navy S&T program. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY 2023 to FY 2024 is for civilian ray raises.					
Accomplishments/Planned Programs Subtotals	75.754	78.397	79.879	0.000	79.879

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602861N / *Science & Tech Management - ONR Field Acts*	Project (Number/Name) 0824 / *Science & Technology Managment*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
0824: *Science & Technology Managment*	0.000	3.395	2.899	5.184	-	5.184	5.290	5.413	5.522	5.632	Continuing	Continuing

Note

Realignment of funds internally in the PE to create PRJ 0824 for fiscal clarity of non-labor support functions.

A. Mission Description and Budget Item Justification

This Project provides funds for Non-Labor costs associated with executing ONR's mission to discover, develop, and transition innovative science and technology (S&T) to meet current and future needs of naval forces. Most all the funds in this project are fixed costs, such as communications, training, and other support functions.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Science and Technology Management	3.395	2.899	5.184	0.000	5.184
Description: This Project provides funds for Non-Labor costs associated with executing ONR's mission to discover, develop, and transition innovative science and technology (S&T) to meet current and future needs of naval forces. The majority of the cost in this project are fixed costs, such as communications, training, and other support functions. ***FY 2023 Plans:*** Continue to meet costs of mission execution ***FY 2024 Base Plans:*** Continue to meet costs of mission execution ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY 2023 to FY 2024 reflects the need to meet increase non-labor costs associated with executing ONR's mission.					
Accomplishments/Planned Programs Subtotals	3.395	2.899	5.184	0.000	5.184

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602861N / *Science & Tech Management - ONR Field Acts*	**Project (Number/Name)** 0824 / *Science & Technology Managment*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603123N *I Force Protection Advanced Technology*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	35.010	59.933	29.512	-	29.512	29.721	29.520	28.030	18.463	Continuing	Continuing
2912: *Force Protection Advanced Technology*	0.000	18.577	14.374	26.912	-	26.912	27.056	26.856	25.344	15.723	Continuing	Continuing
3049: *Force Protection*	0.000	2.436	2.559	2.600	-	2.600	2.665	2.664	2.686	2.740	Continuing	Continuing
9999: *Congressional Adds*	0.000	13.997	43.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	56.997

A. Mission Description and Budget Item Justification

This PE addresses advanced technology development associated with providing the capability of Platform and Force Protection for the U.S. Navy. This program supports the development of technologies associated with mission capable, persistent and survivable Naval platforms (surface, subsurface, terrestrial and air) in the areas of Platform Design & Engineering, Power, Energy & Propulsion, and Materials. The program develops technologies for enhanced capability of Naval aviation aircraft platforms in terms of mission effectiveness, platform range, responsiveness, survivability, observability, readiness, safety and life cycle cost. It also develops new Naval air vehicle concepts and high impact, scalable Naval air vehicle technologies. The program also develops advanced technologies, critical to protecting naval installations, to provide seamless full spectrum protection against asymmetric attack by improving the ability to: detect and identify developing and immediate threats; shape our responses through improved situational awareness and decision making; shield personnel, mission critical facilities, infrastructure, and operating fleet assets; maintain essential functions; and sustain and restore critical services in the aftermath of an incident.

Today's Sailors and Marines are enabled by naval Science and Technology (S&T). Since 1946, the Office of Naval Research (ONR) has fostered scientific research related to the maintenance of maritime superiority and national defense. ONR manages the Department of the Navy's (DON) portfolio of naval Basic and Applied research, and Advanced Technology Development investments to ensure naval forces can effectively deter conflict, but when called upon, fight, win and come home safe. Current investments hedge against uncertainty, providing solutions to commanders today, and options for the future. The Naval S&T budget supports higher guidance defined by the National Defense Strategy, and responds to requirements identified by the Secretary of the Navy through research priorities set by the Chief of Naval Research, coordinated across the Naval Research Enterprise (NRE), and outlined in the Naval R&D Framework.

This Program Element (PE) funds Advanced Technology Development (ATD) that includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment. Efforts in this PE generally have Technology Readiness Levels TRL) of 4 (component and/or breadboard validation in laboratory environment.), 5 (component and/or breadboard validation in relevant environment.), or 6 (system/subsystem model or prototype demonstration in a relevant environment).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603123N *I Force Protection Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	36.161	16.933	17.262	-	17.262
Current President's Budget	35.010	59.933	29.512	-	29.512
Total Adjustments	-1.151	43.000	12.250	-	12.250
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	43.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.151	0.000			
• Program Adjustments	0.000	0.000	12.250	-	12.250
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 9999: *Congressional Adds*		
Congressional Add: *Power electronics building block*	5.792	6.000
Congressional Add: *Carbon nanotube energy storage flywheel*	3.861	0.000
Congressional Add: *Laser peening of jet engines*	4.344	5.000
Congressional Add: *High-energy & high power density i-ion battery magazines (HEBM) in defense appl.*	0.000	8.000
Congressional Add: *Ultra-efficient power gen. & energy storage tech. for next gen. USV*	0.000	10.000
Congressional Add: *Design and simulation for additive technologies*	0.000	10.000
Congressional Add: *Deployable additive manufacturing of composite UUVs*	0.000	4.000
Congressional Add Subtotals for Project: 9999	13.997	43.000
Congressional Add Totals for all Projects	13.997	43.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603123N / *Force Protection Advanced Technology*	Project (Number/Name) 2912 / *Force Protection Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
2912: *Force Protection Advanced Technology*	0.000	18.577	14.374	26.912	-	26.912	27.056	26.856	25.344	15.723	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project addresses advanced technology development associated with providing the capability of Platform and Force Protection for the U.S. Navy. This project supports the development of technologies associated with mission capable, persistent and survivable Naval platforms (surface, subsurface, terrestrial, and air) in the areas of Platform Design & Engineering, Power, Energy & Propulsion, and Materials. This project develops technologies for enhanced capability of Naval aviation aircraft platforms in terms of mission effectiveness, platform range, responsiveness, survivability, observability, readiness, safety and life cycle cost. It also develops new Naval air vehicle concepts and high impact, scalable Naval air vehicle technologies.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Surface Ship and Submarine Hull Mechanical and Electrical (HM&E)	12.522	8.051	20.462	0.000	20.462
Articles:	-	-	-	-	-
Description: This project addresses advanced technology development associated with providing the capability of Platform and Force Protection for the U.S. Navy. This project supports the development of technologies associated with mission capable, persistent and survivable manned/unmanned naval platforms (surface, subsurface and terrestrial) in the areas of Platform Design & Engineering, Power, Energy & Propulsion and Materials. The primary research efforts within this activity are focused on Development of Advanced Manufacturing & Sustainment Technologies, Advanced Naval Power Systems Development, and Advanced Platform Development.					
FY 2023 Plans: - Complete Autonomous Unmanned Surface Vessel (USV): expand advanced research related to the development of planing hull platforms. The technologies resulting from these efforts are being further developed for use on unmanned surface vessels. - Initiate development of Advanced Manufacturing & Sustainment Technologies: Next-Gen Naval Platforms will require new materials, at a high manufacturing readiness level, to meet the required platform performance requirements and power and energy density for advanced systems, as well as cost, manufacturability, resiliency, and to reduce the sustainment burden.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603123N / *Force Protection Advanced Technology*	**Project (Number/Name)** 2912 / *Force Protection Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate development of Advanced Naval Power Systems: New Naval Platforms will require very high energy density, integrated power systems that require very low maintenance (people and cost), as well as operate in a resilient fashion. - Initiate development of Advanced Platforms: This effort will focus on developing a framework and integrating component technologies into a mature platform design capability and subsystems for next generation fully autonomous platforms and reduced crew size to reduce the logistics burden and increase warfighting capability. ***FY 2024 Base Plans:*** - Continue development of Advanced Naval Power Systems: Crewed and Uncrewed Naval Platforms demand high power/energy density, integrated modular power systems that require very low maintenance (people and cost), low fuel consumption, and highly resilient operation for extended mission duration. Cross-platform application is of interest, and forward-fit/back-fit application of the technology will be addressed. -Continue development of Advanced Platforms: This effort focuses on developing a framework and integrating component technologies into a mature platform design capability and subsystems for next generation fully autonomous platforms and reduced crew size to reduce the logistics burden and increase warfighting capability. - Continue development of Advanced Manufacturing & Sustainment Technologies: Next-Gen Naval Platforms will require new materials, at a high manufacturing readiness level, to meet the required platform performance requirements and power and energy density for advanced systems, as well as cost, manufacturability, resiliency, and to reduce the sustainment burden. -Initiate efforts on Advanced Platform Autonomy focusing on the integration of Hull, Mechanical, & Electrical and Autonomous Systems and component technologies designed to improve warfighter and platform performance and efficiencies. -Initiate effort on Advanced Platform Resiliency focusing on the integration of technologies necessary to improve the efficiency and resiliency of manned and unmanned naval platforms. ***FY 2024 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603123N / *Force Protection Advanced Technology*	**Project (Number/Name)** 2912 / *Force Protection Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The funding increase from FY 2023 to FY 2024 is required for increased investment in supporting improved Ship Efficiencies.					
Title: Aircraft Technology	6.055	6.323	6.450	0.000	6.450
Articles:	-	-	-	-	-
Description: The Aircraft Technology activity develops technologies for enhanced capability of Naval aviation aircraft platforms in terms of mission effectiveness, platform range, responsiveness, survivability, observability, readiness, safety and life cycle cost. It also develops new Naval air vehicle concepts and high impact, scalable Naval air vehicle technologies, such as helicopter and tiltrotor rotor drive systems, aerodynamics, propulsion systems, materials and structures for future and legacy air vehicles. This activity directly supports the Naval Research and Development Framework Priorities of Operational Endurance and Scalable Lethality. ***FY 2023 Plans:*** Continue Conduct technology development and maturation through Next Generation Propulsion Enablers (NGP-E) with major engine manufacturers on the highest priority, long lead propulsion, power and thermal management technologies, including: - Advanced, adaptive and modular controls. - Advanced casing treatments and compression systems for increased operability and efficiency. - More compact combustion and augmentation systems, utilizing rotating detonation combustion. - More thermally efficient variable displacement fuel pumps - Enable "hot" fuels as an additional heat sink and provide improved energy. Complete Due to unanticipated schedule delays, efforts to further develop future Navy carrier aircraft enabling technologies are being extended into and will complete in FY23. Critical Technology development efforts are focused on major engine manufacturers developing highest priority, long lead propulsion system turbine engine technologies." ***FY 2024 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603123N / *Force Protection Advanced Technology*	**Project (Number/Name)** 2912 / *Force Protection Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Continue: Conduct technology development and maturation through Next Generation Propulsion Enablers (NGP-E) with major engine manufacturers on the highest priority, long lead propulsion, power and thermal management technologies, including: - Advanced, adaptive and modular controls. - Advanced casing treatments and compression systems for increased operability and efficiency. - More thermally efficient variable displacement fuel pumps. Complete: - More compact combustion and augmentation systems, utilizing rotating detonation combustion. - Enable "hot" fuels as an additional heat sink and provide improved energy. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change between FY 2023 and FY 2024.					
Accomplishments/Planned Programs Subtotals	18.577	14.374	26.912	0.000	26.912

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603123N / *Force Protection Advanced Technology*	Project (Number/Name) 3049 / *Force Protection*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3049: *Force Protection*	0.000	2.436	2.559	2.600	-	2.600	2.665	2.664	2.686	2.740	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Develop advanced technologies, critical to protecting naval installations, to provide seamless full spectrum protection against asymmetric attack by improving the ability to: detect and identify developing and immediate threats; shape our responses through improved situational awareness and decision making; shield personnel, mission critical facilities, infrastructure, and operating fleet assets; maintain essential functions; and sustain and restore critical services in the aftermath of an incident. Technologies developed will also seek to reduce the required manpower and skill levels devoted to the force protection mission, improving performance and reducing costs for the Navy.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Emerging Threats	2.436	2.559	2.600	0.000	2.600
Articles:	-	-	-	-	-
Description: Naval Installations are a critical component in support of Navy global force projection. These installations, and the Navy ships, submarines, and aircraft located on them, are under increasing risk from asymmetric attack, including from new threat vectors such as unmanned air, surface, and subsurface vehicles. This project is focused on the development advanced technologies necessary for the protection of Naval Installations. Technical efforts address the detect -to-engage-to-assess requirements for Naval Installations by improving the ability to: sense and identify threats; support improved situational awareness and decision making; and develop effective countermeasures. Technologies developed will also seek to reduce the required manpower and skill levels devoted to the force protection mission.					
FY 2023 Plans: - Continue Autonomous Maritime Asset Protection System (AMAPS): conduct final demonstration of autonomous assessment and response UAS capability to evaluate Unauthorized Access events on naval installation land and waterside perimeters. - Continue Day/night all weather sensors: conduct final demonstration of capability to detect, track, and identify small unmanned air threats using multi-static radar, Active Millimeter Wave (AMMW) and Dual Band Infrared electro-optic sensors. Optimize sensor performance and operator effectiveness using Automated Target Recognition algorithms.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603123N / *Force Protection Advanced Technology*	**Project (Number/Name)** 3049 / *Force Protection*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue Automated Target Recognition algorithms: develop and demonstrate improved harbor security sonar capabilities to detect Unmanned Underwater Vehicles (UUVs) to include; increased volumetric coverage, passive detection and tracking algorithms, and new classification algorithms to address more capable threats. Develop capability to track and assess multiple simultaneous threat UUVs in harbors and approach channels. - Complete development and conduct final demonstration of the RPG-S kinetic response capability to interdict threat Unmanned Underwater Vehicles (UUV) detected in naval installation harbors. ***FY 2024 Base Plans:*** - Complete Autonomous Maritime Asset Protection System (AMAPS). - Complete development and demonstration of day/night all weather sensors designed to detect, track, and identify small air and surface threats to Naval Installations. - Continue Automated Target Recognition algorithms for small air, surface, and subsurface threats. - Continue harbor security sonar capability improvements to detect Unmanned Underwater Vehicles (UUVs) to include; increased volumetric coverage, passive detection and tracking algorithms, and new classification algorithms to address more capable threats. - Continue development of the capability to track, assess, and mitigate multiple simultaneous threat UUVs in harbors and approach channels. - Initiate an expeditionary demonstration of capabilities in an operational environment. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change between FY 2023 and FY 2024.					
Accomplishments/Planned Programs Subtotals	2.436	2.559	2.600	0.000	2.600

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603123N / *Force Protection Advanced Technology*	**Project (Number/Name)** 3049 / *Force Protection*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603123N / *Force Protection Advanced Technology*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	13.997	43.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	56.997
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Congressional Add: Power electronics building block ***FY 2022 Accomplishments:*** Conduct power electronics building block advanced technology development ***FY 2023 Plans:*** Conduct power electronics building block advanced technology development.	5.792	6.000
Congressional Add: Carbon nanotube energy storage flywheel ***FY 2022 Accomplishments:*** Conduct carbon nanotube energy storage flywheel advanced technology development ***FY 2023 Plans:*** N/A	3.861	0.000
Congressional Add: Laser peening of jet engines ***FY 2022 Accomplishments:*** Conduct Laser peening of jet engines advanced technology development. ***FY 2023 Plans:*** Conduct Laser peening of jet engines advanced technology development.	4.344	5.000
Congressional Add: High-energy & high power density i-ion battery magazines (HEBM) in defense appl. ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct high-energy & high-power density i-ion battery magazines (HEBM) in defense applications research.	0.000	8.000
Congressional Add: Ultra-efficient power gen. & energy storage tech. for next gen. USV ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct ultra-efficient power generation and energy storage technology for next generation Unmanned Surface Vehicles (USV) research.	0.000	10.000
Congressional Add: Design and simulation for additive technologies	0.000	10.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603123N / *Force Protection Advanced Technology*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
FY 2022 Accomplishments: N/A ***FY 2023 Plans:*** Conduct design and simulation for additive technologies research.		
Congressional Add: Deployable additive manufacturing of composite UUVs ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct deployable additive manufacturing of composite Unmanned Underwater Vehicles (UUV) research.	0.000	4.000
Congressional Adds Subtotals	13.997	43.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603271N *I Electromagnetic Systems Advanced Technology*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	11.762	16.253	8.418	-	8.418	8.537	8.708	8.883	9.061	Continuing	Continuing
2913: *Electromagnetic Systems Advanced Technology*	0.000	7.901	8.253	8.418	-	8.418	8.537	8.708	8.883	9.061	Continuing	Continuing
9999: *Congressional Adds*	0.000	3.861	8.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	11.861

A. Mission Description and Budget Item Justification

The Navy and Marine Corps' sophisticated electronics systems place heavy demands on the electromagnetic spectrum to accommodate information flow, defensive and offensive detection, tracking, and weapon system engagement. In distributed maritime operations, each of these platforms provides a set of capabilities that can be further combined for progressively larger and more complex operations. The Electromagnetic Systems Advanced Technology program addresses Radio Frequency (RF) technology for Surface and Aerospace Surveillance sensors and systems, Electronic Warfare (EW) sensors and systems, RF Communication Systems, Multi-Function sensor systems, and Position, Navigation and Timing (PNT) capabilities. Activities and efforts in this Program Element (PE) address technologies critical to enabling the transformation of discrete functions to network centric warfare capabilities, which simultaneously perform Radar, EW, and Communications and Network functions across platforms through multiple, simultaneous and continuous communications/data links.

Today's Sailors and Marines are enabled by Naval Science and Technology (S&T). Since 1946, the Office of Naval Research (ONR) has fostered scientific research related to the maintenance of maritime superiority and national defense. ONR manages the Department of the Navy's (DON) portfolio of naval Basic and Applied research, and Advanced Technology Development investments to ensure naval forces can effectively deter conflict, but when called upon, fight, win and come home safe. Current investments hedge against uncertainty, providing solutions to commanders today, and options for the future. The Naval S&T budget supports higher guidance defined by the National Defense Strategy, and responds to requirements identified by the Secretary of the Navy through research priorities set by the Chief of Naval Research, coordinated across the Naval Research Enterprise (NRE), and outlined in the Naval R&D Framework.

This PE funds Advanced Technology Development (ATD) that includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment. Efforts in this PE generally have Technology Readiness Levels (TRL) of 4 (component and/or breadboard validation in laboratory environment.), 5 (component and/or breadboard validation in relevant environment.), or 6 (system/subsystem model or prototype demonstration in a relevant environment).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603271N *I Electromagnetic Systems Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	12.146	8.253	8.418	-	8.418
Current President's Budget	11.762	16.253	8.418	-	8.418
Total Adjustments	-0.384	8.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	8.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.384	0.000			
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 9999: *Congressional Adds*		
Congressional Add: *Advanced machine learning and artificial intelligence*	3.861	0.000
Congressional Add: *Advanced maritime target processing*	0.000	3.000
Congressional Add: *Augmented, context-based identity awareness*	0.000	5.000
Congressional Add Subtotals for Project: 9999	3.861	8.000
Congressional Add Totals for all Projects	3.861	8.000

Change Summary Explanation

funding: No significant change.

Technical: No significant change.

Schedule: No significant change.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603271N / *Electromagnetic Systems Advanced Technology*	Project (Number/Name) 2913 / *Electromagnetic Systems Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
2913: *Electromagnetic Systems Advanced Technology*	0.000	7.901	8.253	8.418	-	8.418	8.537	8.708	8.883	9.061	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Work in this project addresses cost-effective Radio Frequency (RF) technology for Surface and Aerospace Surveillance sensors and systems, Electronic Warfare (EW) sensors and systems, RF Communication Systems, Multi-Function sensor systems, and Position, Navigation and Timing (PNT) capabilities.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Electronic and Electromagnetic Systems	4.124	4.307	4.393	0.000	4.393
Articles:	-	-	-	-	-
Description: The overarching objective of the Electronic and Electromagnetic Systems Activity is to develop, test, and demonstrate Communications, Electronic Attack (EA), Electronic Surveillance (ES), Electronic Warfare (EW), and Radar functions. A portion of this Program Element (PE) is devoted to mid-term technology development in close concert with acquisition programs of record. The products of these efforts are planned for transition at the end of their schedule into the associated acquisition program of record. Technology development is focused on Distributed Electronic Warfare in support of Distributed Maritime Operations. Major thrust within the Electronics and Electromagnetic Systems program are: a) Advanced EW Enabling Technologies - Develop classified advanced electronic warfare technology in support of current and predicted capability requirements. ***FY 2023 Plans:*** Advanced Electronic Warfare Enabling Technologies: - Continue research in the areas of Electronic Support (ES); decoys and countermeasures against weapon tracking and guidance systems; Electronic Attack (EA) against adversary Command, Control, Communications, Computers, Cyber Defense, Intelligence, Surveillance, Reconnaissance and Targeting (C5ISRT). - Continue development of Electronic Protection (EP) for our own weapons and C5ISRT from intentional and unintentional interference. - Continue efforts based on analysis of results of FY21 test and evaluation activities. Informed by this now completed analyses of results of test and evaluation activities in FY21 and other years, initiate refinement of EW					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603271N / *Electromagnetic Systems Advanced Technology*	**Project (Number/Name)** 2913 / *Electromagnetic Systems Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
concepts, techniques and designs. Examine the improved and novel approaches regularly based on available analytical products, and update as required. - Continue implementation of modified and additional Electronic Warfare (EW) capabilities, and initiate the use of Live, Virtual, and Constructive (LVC) methods for technology identification and exploration, including concepts of employment and training. ***FY 2024 Base Plans:*** Advanced Electronic Warfare Enabling Technologies: - Continue research in the areas of Electronic Support (ES); decoys and countermeasures against weapon tracking and guidance systems; Electronic Attack (EA) against adversary Command, Control, Communications, Computers, Cyber Defense, Intelligence, Surveillance, Reconnaissance and Targeting (C5ISRT). - Continue development of Electronic Protection (EP) for our own weapons and C5ISRT from intentional and unintentional interference. - Continue efforts based on analysis of results of FY23 test and evaluation activities. Based on results of test and evaluation activities in FY23 and other years, continue refinement of EW concepts, techniques and designs. Examine updated, improved approaches regularly based on available analytical products, and modify as required. - Continue implementation of modified and additional Electronic Warfare (EW) capabilities, and initiate the use of Live, Virtual, and Constructive (LVC) methods for technology identification and exploration, including concepts of employment and training. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024.					
Title: Global Positioning System (GPS) and Navigation Technology	3.777	3.946	4.025	0.000	4.025
Articles:	-	-	-	-	-
Description: The overarching objective of this activity is to develop technologies that enable the development of affordable, effective and robust Position, Navigation and Timing (PNT) capabilities using non-Global Positioning System (GPS) navigation devices, or atomic clocks. This activity will increase the operational effectiveness of U.S. Naval units. The focus is on the mitigation of GPS electronic threats, the development of atomic clocks that					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603271N / *Electromagnetic Systems Advanced Technology*	**Project (Number/Name)** 2913 / *Electromagnetic Systems Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
possess unique long-term stability and precision, and the development of compact, low-cost, Inertial Navigation Systems (INS). ***FY 2023 Plans:*** Position, Navigation and Timing (PNT): - Continue research on waveforms for precision two-way time transfer techniques to mitigate GPS electronic threats. - Continue research into mounted alternative navigation systems for USMC specific platforms to improve operational effectiveness. - Continue research into Low Earth Orbit constellation receivers for naval platforms to improve operational effectiveness. - Continue the development of components and systems to support alternative PNT solutions, e.g., Optical Doppler Velocity Log and Micro-Electromechanical Systems based gyroscopes. - Complete research on miniature fiber optic inertial capability to improve non-Global Positioning System (GPS) navigation. ***FY 2024 Base Plans:*** Position, Navigation and Timing (PNT): - Complete research on waveforms for precision two-way time transfer techniques to mitigate Global Positioning System (GPS) electronic threats. - Continue research into mounted alternative navigation systems for USMC specific platforms to improve operational effectiveness. - Continue research into Low Earth Orbit constellation receivers for naval platforms to improve operational effectiveness. - Continue the development of components and systems to support alternative PNT solutions, e.g., Optical Doppler Velocity Log and Micro-Electromechanical Systems based gyroscopes. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024.					
Accomplishments/Planned Programs Subtotals	7.901	8.253	8.418	0.000	8.418

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603271N / *Electromagnetic Systems Advanced Technology*	**Project (Number/Name)** 2913 / *Electromagnetic Systems Advanced Technology*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603271N / *Electromagnetic Systems Advanced Technology*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	3.861	8.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	11.861
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Navy and Marine Corps' sophisticated electronics systems must continually be updated to accommodate increasing information flow, harsh electromagnetic operating conditions, defensive/offensive detection, tracking, and weapon system engagement needs. All Digital Radar Technology, already the core technology to an Air Force advanced threat emulator program, may be fully leveraged via the Electromagnetic Systems Advanced Technology Program to meet additional near term Department of Navy operational needs. With the requested funding, the Office of Naval Research will conduct an All Digital Radar Technology Advanced Technology Demonstration (ATD) and evaluation. The project will expand utilization beyond current advanced threat simulator applications, construct a U.S. prototype demo and evaluation and when appropriate, facilitate technology transfer to the United States..

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Congressional Add: Advanced machine learning and artificial intelligence ***FY 2022 Accomplishments:*** Conduct advanced machine learning and artificial intelligence technology development ***FY 2023 Plans:*** N/A	3.861	0.000
Congressional Add: Advanced maritime target processing ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct effort to develop advanced algorithms for detection of small maritime targets in clutter and provide for airborne testing.	0.000	3.000
Congressional Add: Augmented, context-based identity awareness ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Develop advanced machine learning algorithms with new dimensions of data for extracting naval threat identification and to provide for airborne data collection.	0.000	5.000
Congressional Adds Subtotals	3.861	8.000

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603271N / *Electromagnetic Systems Advanced Technology*	**Project (Number/Name)** 9999 / *Congressional Adds*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603273N *I Science & Technology for Nuclear Re-entry Systems*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	0.000	65.735	112.329	-	112.329	118.618	124.635	120.320	122.866	Continuing	Continuing
3095: *Nuclear Delivery Systems*	0.000	0.000	65.735	112.329	-	112.329	118.618	124.635	120.320	122.866	Continuing	Continuing

A. Mission Description and Budget Item Justification

This Program Element and Project supports Department of Defense (DOD) priorities for enduring science and technology (S&T) for nuclear re-entry systems. This effort will provide pre-program of record advanced technology development that will effectively address evolving threats and maintain operational effectiveness while also aligning with the highest level guidance for nuclear forces. This effort will contribute to preserving the viability of the nuclear deterrent in a cost-effective manner by reducing technical and programmatic risk associated with execution of the overall nuclear modernization program. These ends will be reached by developing technologies to inform future system requirements, establishing interagency partnerships for re-entry system test platform development, and coordinating with existing programs for next generation strategic system development.

The Strategic Weapons System (SWS) greatly benefited from steady Research and Development (R&D) investments during a succession of development and production programs between 1955 and 1990. Because development of a Trident D5 missile follow-on system did not begin immediately, as had been done for previous systems (A1, A2, A3, C3, C4), research and development funding for submarine launched ballistic missile (SLBM) systems significantly declined in the early 1990s. As the U.S. moved to a paradigm of nuclear force sustainment, enterprise investments aimed at improving delivery system capability to counter new threats were reduced. Consequently, the pipeline for advanced technology development for nuclear delivery systems atrophied. The Department of Defense (DoD) has recognized the need to begin investing in new delivery systems, but there has been a significant, several decades long reduction in foundational nuclear R&D invests made outside of major acquisition programs. The gap in R&D investments has driven programs, which are often risk averse and schedule driven to mature existing technology as part of the acquisition program to control risk. This approach can result in fielding technologies that are
not adequately suited to adapt to future threats. Another consequence of this decade's long reduction has been a reduction in workforce capable of supporting advanced technology development. A workforce with skills and requisite clearances needed to solve next-generation technical challenges and a right-sized technology maturation pipeline remain a common threat of high risk across the nuclear enterprise.

Enabling SWS flexibility and affordability is critical to ensure survivability and credibility of the weapon system. In conjunction with STRATCOM Priorities and collaboration with Air Force, the Nuclear Delivery Systems (NDS) funding will identify and mature technologies for the Reentry System (Aeroshell, Fuzing, and Guidance) and SWS enablers that can be readily incorporated into life-extended or next-generation flight and shipboard systems. These technologies will focus on responding to an evolving target base and develop capabilities for changes in missions, adversaries, war-fighting priorities, or emergent deterrence requirements.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603273N *I Science & Technology for Nuclear Re-entry Systems*

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	0.000	65.735	84.310	-	84.310
Current President's Budget	0.000	65.735	112.329	-	112.329
Total Adjustments	0.000	0.000	28.019	-	28.019
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Rate/Misc Adjustments	0.000	0.000	28.019	-	28.019

Change Summary Explanation

The increase of $46.594M from FY 2023 to FY 2024 is due to ramp up of technology development, maturation, and integration activities, as well as related efforts to support commencement of initial ground testing in FY 2024. Additionally, the increase provides for D5LE advanced missile interface S&T to enable end-to-end system level tests of S&T subsystems in addition to the planned component testing, aiding future possible transition to programs of record.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603273N / *Science & Technology for Nuclear Re-entry Systems*	Project (Number/Name) 3095 / *Nuclear Delivery Systems*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3095: *Nuclear Delivery Systems*	0.000	0.000	65.735	112.329	-	112.329	118.618	124.635	120.320	122.866	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This S&T effort will focus on development of modern technologies, subsystems and components for reentry systems and the demonstration and maturation of those technologies to a Technology Readiness Level of 6 in relevant ground and flight test environments. These activities will reduce the operational, programmatic and technological risk facing modernization of Navy reentry systems.

The Nuclear Delivery Systems funding preserves critical SWS survivability against credible threats such as Ballistic Missile Defense Systems and Anti-Submarine Warfare (ASW) on SSBN (OHIO and COLUMBIA) platforms. SWS efficacy will be less dynamic in responding if technological enhancements and developments do not outpace these corresponding threats. The most significant portion of the funding will focus on investments to develop prototypes for integration and demonstration in FY 2025 through FY 2027 to outpace the threat and de-risk future programs. These technologies are enablers for sustaining and life extending programs, allowing SSP to accomplish the following:

- Technology Maturation - Mature and demonstrate technologies in Reentry (i.e. Aeroshell, Fuzing, and Guidance) that will enable efficient insertion of SWS capability into future programs through the adaptability and flexibility. Aeroshell refinement will be completed to support the capability demonstration.

- Reentry Enablers Advancements - Technology maturation of certain reentry subsystem and SWS subsystems directly in support of reentry will be investigated to support the adaptability and flexibility needed to support the reentry capability demonstrations.

The SWS NDS R&D also consists of funding to support the demonstration and test of the technologies developed under this project in a relevant environment. Advancing these technologies to a Technology Readiness Level of 6 or greater will allow for the transition into current and future weapon systems. The demonstrations will consist of:
- Ground tests in FY 2024 through FY 2026.
- Advanced ground tests via hardware in the loop facilities to integrate multiple subsystems across the SWS architecture in FY 2024 through FY 2027.
- Integration cost for Flight Experiments - As part of the SWS yearly flight demonstrations the funding will support the integration of the technologies onto scheduled and funded flight test.

Further information can be provided at a higher classification level.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Enabling Technology	0.000	38.906	68.801	0.000	68.801

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603273N / *Science & Technology for Nuclear Re-entry Systems*	**Project (Number/Name)** 3095 / *Nuclear Delivery Systems*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Articles:	-	-	-	-	-
Description: Develop and mature advanced technologies and concepts to support advanced Nuclear Delivery Systems and SWS requirements and address emerging threats. Rapidly respond to evolving warfighter priorities and emerging requirements via development of SWS enabling technologies, and capability demonstrations.					
FY 2023 Plans: Enabling Technology - Initiate development of advanced fuzing solutions that are able to maintain operational effectiveness against emerging targeting challenges and develop alternative safety and surety features required for nuclear systems. - Initiate development of NDS guidance system software to enable reentry Guidance, Navigation and Control (GN&C) technologies to support SWS integration ground testing and future flight tests. - Analyze guidance hardware changes to support further enabling reentry GN&C technologies. - Develop fire control and mission planning software to allow for enabling technology evaluation and support SWS integration ground testing and future flight test opportunities. - Initiate studies and evaluation for targeting effectiveness. - Initiate studies and evaluation for data transfer capability to flight system components. Further information can be provided at a higher classification level.					
FY 2024 Base Plans: - Continue development of advanced fuzing solutions that are able to maintain operational effectiveness against emerging targeting challenges and develop alternative safety and surety features required for nuclear systems. - Continue development of NDS guidance system software to enable reentry Guidance, Navigation and Control (GN&C) technologies to support SWS integration ground testing and future flight tests. - Continue to analyze guidance hardware changes to support further enabling reentry GN&C technologies. - Continue to develop fire control and mission planning software to allow for enabling technology evaluation and support SWS integration ground testing and future flight test opportunities. - Continue studies and evaluation for targeting effectiveness. - Continue studies and evaluation for data transfer capability to flight system components. - Begin long-lead item procurement and preparation for component testing - Begin development of advanced sensor technology for subcomponent parts					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603273N / *Science & Technology for Nuclear Re-entry Systems*	**Project (Number/Name)** 3095 / *Nuclear Delivery Systems*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Further information can be provided at a higher classification level. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY 2023 to FY 2024 is due to ramp of technology development, maturation, and integration activities; as well as related efforts to support commencement of initial and integrated/advanced ground testing in FY 2024.					
Title: Reentry Capability Demonstration 1	0.000	10.907	25.848	0.000	25.848
Articles:	-	-	-	-	-
FY 2023 Plans: Reentry Capability Demonstration 1 - Begin development of Aeroshell technologies to support future threats and flexibility. - Begin development of Fuzing technologies to support future threats and flexibility. - Begin design and conduct assessments to Trident flight test and strategic warhead/Reentry Body (RB) design concepts. - Initiate development of system architecture models of the capability demonstration effort. - Develop program execution plan for the experiment. - Models to describe the system architecture of proposed experiment effort. Further information can be provided at a higher classification level.					
FY 2024 Base Plans: Reentry Capability Demonstration 1 - Continue development of Aeroshell technologies to support future threats and flexibility. - Continue development and integration concepts of Fuzing technologies to support future threats and flexibility. - Continue design and conduct assessments to Trident flight test and strategic warhead/Reentry Body (RB) design concepts. - Continue development of system architecture models of the capability demonstration effort. - Maintain program execution plan for the experiment. - Models to describe the system architecture of proposed experiment effort. - Begin Long lead procurement of hardware to support flight testing					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603273N / *Science & Technology for Nuclear Re-entry Systems*	**Project (Number/Name)** 3095 / *Nuclear Delivery Systems*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Begin development of detailed technical design of experiment and preparation for preliminary design review (PDR) RCD 1 and RCD 2 have different objectives and require different S&T efforts to achieve their specific objectives which are captured under the respective RCDs. Further information can be provided at a higher classification level. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY 2023 to FY 2024 is due to ramp of technology development, maturation, and integration activities, as well as related efforts to support commencement of initial ground testing in FY 2024.					
Title: Reentry Capability Demonstration 2	0.000	11.033	17.680	0.000	17.680
Articles:	-	-	-	-	-
FY 2023 Plans: Reentry Capability Demonstration 2 - Begin development of Aeroshell technologies to support future threats and flexibility. - Begin development of Fuzing technologies to support future threats and flexibility. - Begin design and conduct assessments to Trident flight test and strategic warhead/Reentry Body (RB) design concepts. - Initiate development of system architecture models of the capability demonstration effort. - Develop program execution plan for the experiment. - Models to describe the system architecture of proposed experiment effort. - Begin design and development of flight demonstration reentry body concept including system architecture, power, radio frequency sub-system, telemetry transmitter, and inertial measurement unit. Further information can be provided at a higher classification level. ***FY 2024 Base Plans:*** Reentry Capability Demonstration 2 - Continue development of Aeroshell technologies to support future threats and flexibility.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603273N / *Science & Technology for Nuclear Re-entry Systems*	**Project (Number/Name)** 3095 / *Nuclear Delivery Systems*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue development and integration concepts of Fuzing technologies to support future threats and flexibility. - Continue design and conduct assessments to Trident flight test and strategic warhead/Reentry Body (RB) design concepts. - Continue development of system architecture models of the capability demonstration effort. - Maintain program execution plan for the experiment. - Begin Long lead procurement of hardware to support flight testing - Begin development of detailed technical design of experiment and preparation for preliminary design review (PDR) RCD 1 and RCD 2 have different objectives and require different S&T efforts to achieve their specific objectives which are captured under the respective RCDs. Further information can be provided at a higher classification level. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY 2023 to FY 2024 is due to ramp of technology development, maturation, and integration activities; as well as related efforts to support commencement of initial ground testing in FY 2024.					
Title: Advanced Technology Demonstration	0.000	4.889	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2023 Plans: Advanced Technology Demonstration - Establish baseline infrastructure for evaluating and integrating technologies for a reentry capability demonstration. - Initiate the NDS Strategic Guidance Hardware independent validation & verification capability in various environments. - Develop NDS performance measures for the modeling and simulation activities to assess capability and performance effectiveness. Further information can be provided at a higher classification level. ***FY 2024 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603273N / *Science & Technology for Nuclear Re-entry Systems*	**Project (Number/Name)** 3095 / *Nuclear Delivery Systems*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue evaluation of effectiveness and implementation strategies, to include design architecture studies. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease from FY 2023 to FY 2024 is due to extending system architecture studies into FY 2024 to accommodate the extension of concept studies through FY 2023, with additional technology development activities beginning in FY 2025.					
Accomplishments/Planned Programs Subtotals	0.000	65.735	112.329	0.000	112.329

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Contracts will be awarded to those sources who were engaged in program and are currently engaged in the production and/or operational support on the basis of Other Than Full and Open Competition pursuant to the authority of 10 U.S.C. 2304 (c) (1) and (3) implemented by FAR 6.302.-1, 3, 4

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603640M *I MC Advanced Technology Demo*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	283.332	412.747	308.217	-	308.217	272.084	273.012	270.551	272.671	Continuing	Continuing
2223: *Marine Corps ATD*	0.000	106.408	118.183	126.171	-	126.171	127.120	131.202	133.826	136.503	Continuing	Continuing
2297: *Futures Directorate*	0.000	101.747	157.064	177.046	-	177.046	139.865	136.609	131.420	130.757	Continuing	Continuing
2958: *Cyberspace Activities*	0.000	4.609	4.800	5.000	-	5.000	5.099	5.201	5.305	5.411	Continuing	Continuing
9999: *Congressional Adds*	0.000	70.568	132.700	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	203.268

A. Mission Description and Budget Item Justification

The United States Navy/Marine Corps team is the most potent naval fighting force in the world. Fundamental to their success are the technologies necessary for effective Distributed Maritime Operations (DMO), Expeditionary Advanced Base Operations (EABO), Littoral Operations in Contested Environments (LOCE), Joint Warfighting Concepts, Stand-In Forces, and Reconnaissance / Counter-Reconnaissance. The Office of Naval Research (ONR) combines knowledge of the naval mission with researchers to select and explore solutions critical to expeditionary warfighting needs. It has become clear the joint force needs a capability that operates persistently and with maximum organic mobility and dispersion to compete and deter in the contact and blunt layers. This Program Element (PE) supports investments in critically needed capabilities as outlined in Force Design 2030, to operate below the threshold of armed conflict by winning the reconnaissance and counter-reconnaissance competition in facilitating deterrence by detection.

These future challenges and portents demand robust technologies for the Marine Corps, but the technology options are constrained. They must have a lightweight deployable character, and the ability to operate in austere conditions with little fixed infrastructure or support while retaining the agility and lethality of an integrated maneuver force. Technology must provide full spectrum capability against robust and complex peer and near-peer adversaries while meeting Size, Weight, Power, Cost limitations, and information availability within Distributed, Intermittent and Limited environments.

The approach within this Program Element (PE) encompasses ideas that support both revolutionary and evolutionary capabilities, and in this way considers and balances both "push" and "pull" aspects of technology projects. This PE matures technologies emerging from PE 0602131M-Marine Corps Landing Force Technology to develop concept prototypes and initial experimentation to confirm feasibility in an environment relevant to operations.

This PE funds Advanced Technology Development (ATD) that includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment. Efforts in this PE generally have Technology Readiness Levels (TRLs) of 4 (component and/or breadboard validation in laboratory environment), 5 (component and/or breadboard validation in relevant environment), or 6 (system/subsystem model or prototype demonstration in a relevant environment).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603640M *I MC Advanced Technology Demo*

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	291.183	280.285	254.337	-	254.337
Current President's Budget	283.332	412.747	308.217	-	308.217
Total Adjustments	-7.851	132.462	53.880	-	53.880
• Congressional General Reductions	-	-0.238			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	132.700			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.800	0.000			
• SBIR/STTR Transfer	-8.651	0.000			
• Program Adjustments	0.000	0.000	53.880	-	53.880
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 9999: *Congressional Adds*		
Congressional Add: *Adaptive threat force*	0.000	7.000
Congressional Add: *Expeditionary Process, Exploitation, and Dissemination*	3.861	4.000
Congressional Add: *Advanced mission planning system SBIR technology insertion*	4.827	5.000
Congressional Add: *Data analysis and sharing augmentation*	1.931	0.000
Congressional Add: *Low-cost atrittable aircraft technology*	24.134	25.000
Congressional Add: *Adaptive future force*	7.723	0.000
Congressional Add: *AI-powered tactical ISR*	4.923	0.000
Congressional Add: *Expeditionary mission support*	9.654	8.000
Congressional Add: *Platform agnostic weapons system*	4.827	0.000
Congressional Add: *Stand-off security inspection and surveillance system*	8.688	10.000
Congressional Add: *Mutli-function array for C-UAS*	0.000	18.000
Congressional Add: *C5ISR and EW modular open suite of standards*	0.000	10.000
Congressional Add: *ACV EW/comms/ISR technology*	0.000	10.000
Congressional Add: *AI-powered tactical ISR for battlespace awareness*	0.000	7.200
Congressional Add: *K-MAX next generation autonomouse logistics UAS*	0.000	7.000

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603640M *I MC Advanced Technology Demo*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Congressional Add: *Wireless tecnologies for sensing and surveillance at the tactical edge*	0.000	6.500
Congressional Add: *Hydrofoil wing in ground effect vehicle*	0.000	5.000
Congressional Add: *ENDOR spectrum superiority technology*	0.000	10.000
Congressional Add Subtotals for Project: 9999	70.568	132.700
Congressional Add Totals for all Projects	70.568	132.700

Change Summary Explanation

Funding: All funding increases support Marine Corps Warfighting Laboratory (MCWL) / Futures Directorate (FD) experimentation efforts:

- Increase of $30M to provide a third hull for use in Stern Landing Vessel (SLV) program; improving resilience, dispersion, and the ability to operate in complex archipelagoes and contested littorals.

- Increase of $21M to investigate the use of Ancillary Surface Connectors (ASC) to improve the sustainment of the future naval expeditionary force.

- Increase of $2.88M to establish the MCWL Information Fusion Center (IFC); providing a consolidated and collaborative environment, at all classification levels, to augment overall Marine Corps effectiveness as well as MCWL's experimentation objectives.

Technical: No significant change.

Schedule: No significant change.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603640M / *MC Advanced Technology Demo*	Project (Number/Name) 2223 / *Marine Corps ATD*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
2223: *Marine Corps ATD*	0.000	106.408	118.183	126.171	-	126.171	127.120	131.202	133.826	136.503	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project funds technology demonstration, experimentation, and prototyping; and more technologically mature projects within the Future Naval Capability (FNC) process as means to inform, enhance, enable, and invent future concepts and capabilities with new Science and Technology (S&T). This project is organized into ten activities, the core of which is represented by the eight Expeditionary Warfighting Capability Areas.

Emphasized within this project are increased efforts to actively demonstrate advanced technologies and system concepts. These demonstrations and experiments focus on the specific technologies, not necessarily their operational application, and vary based on the technical maturity of the project. This early technology exposure gives Marines a view into the future and enables them to use their imagination and innovation to envision novel employment of the technology and inform the acquisition process.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Command, Control, Communications, Computers (C4)	23.494	26.519	14.000	0.000	14.000
Articles:	-	-	-	-	-
Description: This activity investigates robust, resilient, and secure networked communications pathways and capability that support an expeditionary force's distributed and disaggregated operations. Research supports both networked and local computation for communications that exploits the expeditionary forces close physical proximity to threats while mitigating shortfalls commensurate within Distributed, Intermittent, and Limited environments. Expeditionary forces must operate in the cyber domain and in addition to defending communications networks, vehicles, and weapons systems, are reliant on electronic controllers for basic operations and as such are susceptible to cyberattacks. Technologies addressed within this activity include secure, robust, self-forming, mobile communications networks; distributed computing to support information dissemination to all echelons; improved capabilities in over-the-horizon, beyond line-of-sight, and restricted environment communications and sensors; and software and data processing to support formation of an appropriate common picture. Other efforts include power management, low detectability, conforming to Size, Weight, Power, Cost constraints, and interoperability within the joint environment.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2223 / *Marine Corps ATD*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Further, this activity integrates and demonstrates enhanced communications and situational awareness capabilities in experimental and warfighting environments reflecting USMC operations. Advanced technology resources will be developed and applied to complement commercial, other service, and defense agency investments to produce a technology base addressing identified Marine Corps technology gaps. Focus will be on developing component level prototypes and experimentation in relevant environments. ***FY 2023 Plans:*** Complete: The following efforts are in collaboration with the Cognitive Radio Frequency Inference Technology (CRIT) and Multi Domain Radar for the Contested Environment (MuDRaCE) FNC activities in this PE/project and leverage experimental discoveries under the MAGTF C4 project to accelerate development of high priority capabilities. - Complete the development and demonstrate technologies that include advanced signature management, machine learning, interoperability, spectrum maneuver, damage assessment monitoring, and information dominance for tactical edge systems. - Complete the development and demonstrate portable distributed multi-domain sensor and surveillance technologies in portable expeditionary warfare form factor to protect forces in denied and contested EM environments. Continue: The following efforts are in collaboration with the Cognitive Radio Frequency Inference Technology (CRIT) and Multi Domain Radar for the Contested Environment (MuDRaCE) FNC activities in this PE/project and leverage experimental discoveries under the MAGTF C4 project to accelerate development of high priority capabilities. - Continue the development of and demonstrate technologies that include advanced signature management, machine learning, interoperability, spectrum maneuver, damage assessment monitoring, and information dominance for tactical edge systems. - Continue the development of and demonstrate distributed multi-domain sensor and surveillance technologies in portable expeditionary warfare form factor to protect forces in denied and contested EM environments. Initiate: -Initiate research effort to extend demonstrated analysis capability to classified signal sets and reduce machine learning training time. ***FY 2024 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2223 / *Marine Corps ATD*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue the development of and demonstrate distributed multi-domain sensor and surveillance technologies in portable expeditionary warfare form factor to protect forces in denied and contested EM environments. - Continue research effort to extend demonstrated analysis capability to classified signal sets and reduce machine learning training time. - Complete the development of and demonstrate technologies that include advanced signature management, machine learning, interoperability, spectrum maneuver, damage assessment monitoring, and information dominance for tactical edge systems. - Initiate research to develop deep learning based natural language processing algorithms to extract operational defined events from unstructured, not grammatically correct Secure Internet Protocol Router Network (SIPRNet) Marine Corps chat rooms. - Initiate development of a prototype to deploy rulesets on US Marine Corps' Tactical Service Oriented Architecture program of record to fuse chat data into meaningful relationships displayed on the watch standers' common operating picture. - Initiate the integration of advanced prototype technologies that can enable electromagnetic signature control through the use of advanced material systems and test those on specific expeditionary platforms. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease in funding from FY 2023 to FY 2024 is due to the maturation of the Future Naval Capabilities (FNC) Cognitive of Radio Frequency Inference Technology (CRIT) the maturation and transition of the program out of S&T.					
Title: Firepower	6.616	7.485	8.500	0.000	8.500
Articles:	-	-	-	-	-
Description: The activity investigates a large variety of weapons technologies to enhance fires capabilities of Fleet Marine Forces as part of joint maritime campaigns to counter emerging threats and create new opportunities for the joint force to secure operational advantage. Research efforts increase range, lethality, and capacity, while maintaining mobility and tempo to operate inside actively contested maritime domains, to achieve overmatch fires capabilities when operating within the landward portions of the littorals, and to provide weapons system capabilities able to persist when operating within the adversary's intelligence, surveillance, collection, and weapons ranges. Focus on low size, weight, power, and cost of weapons components and weapon systems, having low manpower and cognitive burdens to operate, with low logistics burdens, stresses					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2223 / *Marine Corps ATD*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
technical solutions. This activity furthers the maturity of researched technology solutions by also developing the integration required to effectively demonstrate and test emergent capabilities. Weapons system technologies being developed include fire control, launch and propulsion, precision guidance, navigation, and control, seekers, fuzing, and lethality. ***FY 2023 Plans:*** Continue: - Development of integrated technologies for low-cost, extended range, precision guided munitions, having improved lethality and special effects payloads for use against various types of stationary and moving targets on land and water, and in satellite and network denied environments. ***FY 2024 Base Plans:*** - Continue development of integrated technologies for low-cost, extended range, precision guided munitions, having improved lethality and special effects payloads for use against various types of stationary and moving targets on land and water, and in satellite and network denied environments. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 is due to increased investments in research efforts to increase range, lethality, and capacity, while maintaining mobility and tempo to operate inside actively contested maritime domains, to achieve overmatch fires capabilities when operating within the landward portions of the littorals, and to provide weapons system capabilities able to persist when operating within the adversary's intelligence, surveillance, collection, and weapons ranges.					
Title: Force Protection	11.226	13.872	18.300	0.000	18.300
Articles:	-	-	-	-	-
Description: This activity investigates new ways and means to protect forces and materiel across all operational settings from contested sea-land surface interfaces to complex urban environments. The portfolio protects against adversaries' challenges such as guided-rockets and missiles, mobile coastal artillery, threat Electronic Warfare and Counter Intelligence, and Surveillance and Reconnaissance. Mines and obstacles both in the water and ashore also complicate amphibious landings. The activity invests in vehicle survivability aspects that are exacerbated due to Size, Weight, and Power Cost constraints inherent to Marine Corps operation and the harsh nature of the amphibious environment.					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Technologies addressed include lightweight armor for ballistic and underbody blast protection, advanced sensors for counter tactical surveillance, active protection, and signature management. This activity also considers technology for payloads, packages and sensors that are needed by amphibious vehicles (both manned and unmanned) including mine counter measures; explosive hazard defeat systems; and obstacle and threat detection systems as well as technologies for improved protection for individuals against blast, ballistic and blunt impact threats. Technologies in this activity enable Marine Corps forces to maintain operational tempo through a range of environments by avoiding or detecting surveillance and targeting capabilities before engagement; counter detection and targeting (e.g. long range sniper, urban shooter, rocket propelled grenades) and delay vehicle detection and identification through signature management/control. ***FY 2023 Plans:*** Continue: - Continue efforts looking at counters to autonomy and sensors/perception. - Continue to examine technologies for the utility of High Energy Laser (HEL) in Expeditionary operations, including robust, compact, lightweight lasers, with tracking, and optical components to enable Low Altitude Air Defense (LAAD) with non-kinetic weapon hard kill. - Continue development of low-cost robotic autonomy systems in support of amphibious operations (e.g., ISR, mine-counter-measure, breaching, fire support, and logistics). - Continue development and demonstrate human-machine teaming techniques and procedures appropriate to military tactics. The end state will demonstrate swarming multi-domain platforms capable of delivering military capabilities over land and sea. - Continue efforts that emphasize sensors and systems to enable autonomous amphibious assault under mined and obstacle environments will continue. The efforts will focus on multi-domain operations and extending the range at which these unmanned systems are able to perform and execute the assault mission. - Develop disposable heterogeneous "least-capable" multi-domain unmanned vehicles (UxVs), that can be rapidly manufactured at scale. The UxVs will operate as swarms, utilizing the organizational principles found in social insects/birds/fishes to overwhelm an adversary's kill chain. Initiate:					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate force-on-force experimentation for countering heterogeneous multi-domain autonomous swarm attacks in Expeditionary Advanced Basing Operations (EABO) scenarios. - Initiate a follow-on and focused research effort to develop compact rapid analysis and sensing systems to assess expeditionary operational site by detecting battle damages, surface and sub-surface explosive hazards detection and classification.					
FY 2024 Base Plans: - Continue efforts looking at counters to autonomy and sensors/perception. - Continue to examine technologies for the utility of High Energy Laser (HEL) in Expeditionary operations, including robust, compact, lightweight lasers, with tracking, and optical components to enable Low Altitude Air Defense (LAAD) with non-kinetic weapon hard kill. - Continue development of low-cost robotic autonomy systems in support of amphibious operations (e.g., ISR, mine-counter-measure, breaching, fire support, and logistics). - Continue development and demonstrate human-machine teaming techniques and procedures appropriate to military tactics. The end state will demonstrate swarming multi-domain platforms capable of delivering military capabilities over land and sea. - Continue efforts that integrate and demonstrate sensors and systems that enable autonomous amphibious assault in mined and obstacle environments. The efforts will focus on multi-domain operations and extending the range at which these unmanned systems are able to perform and execute the assault mission. - Continue development of disposable heterogeneous "least-capable" multi-domain unmanned vehicles (UxVs), that can be rapidly manufactured at scale. The UxVs will operate as swarms, utilizing the organizational principles found in social insects/birds/fishes to overwhelm an adversary's kill chain. - Continue force-on-force experimentation for countering heterogeneous multi-domain autonomous swarm attacks in Expeditionary Advanced Basing Operations (EABO) scenarios. - Continue a follow-on and focused research effort to develop compact rapid analysis and sensing systems to assess expeditionary operational site by detecting battle damages, surface and sub-surface explosive hazards detection and classification. -Initiate research to provide a solid-state High-Power Microwave prototype in a form factor that upon transition will enable the USMC to conduct advanced expeditionary base operations (EABO) while being capable of defeating sUAS swarms and other unmanned systems in littoral regions. -Initiate efforts to integrate and field test systems for the precision neutralization of threat explosive hazards, mines, and kill chain components with lethal or non-lethal force from standoff distances to enable in-stride littoral					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
movement and maneuver, designated ground corridors, at forward aviation points, littoral transition points, and in designated areas of interest. -Initiate efforts to rapidly assess and report the condition of expeditionary sites using the same or similar sensors suites used in the detection of explosive hazards. The efforts will also include development of a common messaging protocol to a control center for assessment sites for both explosive and other related damage. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 is due to the initiation of efforts to 1) provide a solid-state High-Power Microwave prototype in a form factor that upon transition will enable the USMC to conduct advanced expeditionary base operations (EABO) while being capable of defeating sUAS swarms and other unmanned systems in littoral regions, 2) integrate and field test systems for the precision neutralization of threat explosive hazards, mines, and kill chain components with lethal or non-lethal force from standoff distances to enable in-stride littoral movement and maneuver, designated ground corridors, at forward aviation points, littoral transition points, and in designated areas of interest and 3) rapidly assess and report the condition of expeditionary sites using the same or similar sensors suites used in the detection of explosive hazards. The efforts will also include development of a common messaging protocol to a control center for assessment sites for both explosive and other related damage.					
Title: Human Performance, Training and Education ***Articles:*** ***Description:*** This activity investigates several technology investment areas; warrior resilience, and decision-making and expertise development. Warrior resilience is focused on advanced training technologies and methodologies that enhance neural, cognitive, and physical readiness. Decision making and expertise development accelerates development and improves the retention of skills in decision making, situation awareness, and individual and team adaptability and coordination on decentralized, dynamic and dispersed battlefields. Focus will be on developing component level prototypes for Marine for evaluation and experimentation. ***FY 2023 Plans:*** Continue:	5.322 -	6.316 -	7.600 -	0.000 -	7.600 -

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Assess marksmanship lethality via automated capture of shot timing, accuracy, and physical performance; develop and assess new marksmanship training approaches, analysis, and visualizations to improve marksmanship and increase lethality. - Improve small unit decision-making capabilities through the use of human-machine teaming and multi-modal interactions - Demonstrate ability to increase physical readiness and reduce potential injuries by using wearable physiological monitoring devices, predictive algorithms, health tracking capability, and related technologies that support Marine Corps' Human Performance and Training programs. - Develop augmented reality technologies focused on fires applications that improve target identification, classification, and situational awareness. - Develop assessment tools and experiential training solutions to train and educate Marines for the right military occupation, and expand research to include adaptive training technologies. Complete: - Complete and transition 3-D terrain visualization, battlefield control measures and effects to Marine Corps and other DoD service related activities.					
FY 2024 Base Plans: - Continue to assess marksmanship lethality via automated capture of shot timing, accuracy, and physical performance; develop and assess new marksmanship training approaches, analysis, and visualizations to improve marksmanship and increase lethality; extend the lethality measurement approach to include other fires activities - Continue to improve small unit decision-making capabilities through the use of human-machine teaming and multi-modal interactions - Continue to demonstrate ability to increase physical readiness and reduce potential injuries by building infrastructure to incorporate wearable physiological monitoring devices, predictive algorithms, health tracking capability, and related technologies that can be operated by and support Marine Corps' Human Performance and Training programs. - Continue to develop mixed reality technologies focused on fires applications that improve target identification, classification, and situational awareness. - Continue to develop assessment tools and experiential training solutions to train and educate Marines for the right military occupation, and expand research to include adaptive training technologies.					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate to develop a tool that automatically imports shot timer data into a software application portal that provides analysis and actionable feedback based on USMC established parameters and doctrine. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 is due to the initiation of efforts to develop a tool that automatically imports shot timer data into a software application portal that provides analysis and actionable feedback based on USMC established parameters and doctrine.					
Title: Intelligence, Surveillance, and Reconnaissance (ISR) ***Articles:***	8.823 -	9.532 -	11.433 -	0.000 -	11.433 -
Description: This activity investigates enhanced situational awareness, persistent surveillance, and tactical decision making through automated analysis of data and rapid integration of information and acquired knowledge. Specific technologies in this activity effectively present actionable information to decision-makers, especially those at the lower command levels. This includes biometric monitoring for expeditionary operations, operational Course of Action development, and autonomous surveillance in support of distributed operations. Conduct advanced development research on the impact of machine learning on mission outcomes. Will investigate the operational relevance of enhanced situational understanding and machine-aided tactical decision-making. This includes presenting actionable information (e.g. support to planning, mission monitoring, and re-planning) to decision makers. Further, this activity supports the demonstration of technologies to enhance situational awareness and tactical decision making through automated analysis, fusion of data, rapid integration of information, and acquired knowledge resulting in actionable intelligence at the lower command levels. The activity includes the demonstration of ISR efforts involving enhanced reconnaissance and persistent surveillance, and sensors for unmanned ground and aerial vehicles. Advanced technology demonstrations also include the collection of information (monitoring, sensing, and locating) in the 3-Dimensional urban battlespace as well as exploiting information (identifying and classifying data) as part of the intelligence preparation of the battlespace in order to facilitate operational maneuver and distributed operations. ***FY 2023 Plans:*** Continue:					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Develop and demonstrate new artificial intelligence (AI) systems to automate monitoring and alerting. Research will integrate video analytics with edge processing to create high-throughput detection, classification, and tracking across multiple operational domains. - Develop a prototype using recommendation engines to adapt strategies based on adversary actions. - Advanced technology development on the operational utility of Artificial Intelligence and Machine Learning algorithms; develop, demonstrate, and experiment with these techniques during Marine Corps operations exercises and events. - Development to generate synthetic data useful for machine learning while learning how to combine real data from training or operations. - Demonstrations and experimentation with training and operational forces to understand the utility and impact of decision aids on improving and accelerating understanding and information-based decision-making, as well as reductions in operator workload. Initiate: - Develop fused common tactical picture, and tools to support planning, execution, and assessment that will allow commanders the all-domain situation awareness required to make informed and timely decisions.					
FY 2024 Base Plans: - Continue to develop and demonstrate new artificial intelligence (AI) systems to automate monitoring and alerting. Research will integrate video analytics with edge processing to create high-throughput detection, classification, and tracking across multiple operational domains. - Continue to develop a recommendation engine prototype to adapt strategies based on adversary actions. - Continue advanced technology development to evaluate operational utility of Artificial Intelligence and Machine Learning algorithms to improve decision making; and develop, demonstrate, and experiment with these techniques during Marine Corps operations exercises and events. - Continue development to generate synthetic data useful for machine learning while learning how to combine real data from training or operations. - Continue demonstrations and experimentation with training and operational forces to understand the utility and impact of planning and decision aids on improving and accelerating understanding and information-based decision-making, as well as reductions in operator workload.					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue development of fused common tactical picture, and tools to support planning, execution, and assessment that will allow commanders the all-domain situation awareness required to make informed and timely decisions. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 is due to increased investments in enhanced situational awareness, persistent surveillance, and tactical decision making through automated analysis of data and rapid integration of information and acquired knowledge.					
Title: USMC Future Naval Capabilities	26.165	27.813	28.426	0.000	28.426
Articles:	-	-	-	-	-
Description: This R-2 Activity addresses the advanced technology development associated with the Marine Corps' participation in the Department of the Navy's (DoN) Future Naval Capabilities (FNC) Program. The objective of the work in this Program Element (PE) is to develop promising technologies emerging from the FNC technology candidates funded in PE 0602131M that have been matured to higher Technology Readiness Levels (TRLs). Investments in this activity are coordinated with similar and non-duplicative efforts in PE 0603673N. The FNC Program is structured to accelerate the transition of new technologies to the Fleet and Force. Each effort is assessed for its technology maturity and transition commitment. Funding for FNCs, which have Technology Readiness Levels (TRLs) of 4/5 to 6 and also have transition funding commitments from acquisition Programs of Record, are resourced in this PE 0603640M MC Advanced Technology Demo. Funding for FNC technology candidates at lower TRLs (3 to 4) is resourced in PE 0602131M Marine Corps Landing Force Tech. ONR is working closely with the Resource Sponsors and acquisition stakeholders to develop high priority technological capabilities needed by the operational forces. FNC budget activity (BA) 2 investments develop candidate FNC technologies in an agile fashion by exploiting technology advances that respond rapidly to naval needs. This approach facilitates an optimum response when developing and maturing the technology options that can be developed further in this PE 0603640M MC Advanced Technology Demo. The FNC Program favors a high level of collaboration. Collaboration with the acquisition stakeholders and their resource sponsors is required. A complete accounting of the technology candidates being developed and a full					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
disposition of each technology development effort funded in this PE is provided annually to the Congressional oversight committees. ***FY 2023 Plans:*** Continue: Maintenance Tools for Operations and Training (MTOT) - Continue to develop software applications (e.g. augmented reality) and content to improve training availability and accessibility, as well as analytics and algorithms to support student assessment and tailor training to address training gaps within the Marine Corps Deliberate Universal Needs Statement (D-UNS) on Enterprise Level Maintenance Simulation Training Solution. Streamlined Marine After-Action Review Tool- Visualization (SMART-Viz): - Complete development, exit criteria testing, and transition of Streamlined Marine After-Action Review (AAR) Tools for Visualization to Marine Corps Program Manager for Training Systems to support force-on-force and simulation-based training to improve lethality. All Signal Tactical Real-Time Analyzer (ASTRAL): - Continue development of the sensor receiver module to provide full spectral awareness in a contiguous RF range, unifying recent advances in spectral and correlative analysis, signal processing, and monolithic photonics-electronics integration. Cognitive Radio Frequency Inference Technology (CRIT): - Complete development of small form factor technologies that provide organic, easy to understand and use signature management of the Marine Air-Ground Task Force (MAGTF) in electromagnetic and information environments. Multi Domain Radar for the Contested Environment (MuDRaCE): - Complete development of portable, distributed multi-domain sensor and surveillance technologies in portable expeditionary warfare form factor to improve effectiveness and survivability in denied and contested electromagnetic environments. Poison Apple (PA)					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate the Poison Apple FNC with two awards to commercial and government performers and begin S&T development by initiating research into establishing a prototype solution that builds upon prior investments that matured earlier versions of the technological capability. - Initiate technology develop planning and documentation leading to a preliminary design review of the proposed prototype solution, and commence development of an initial operational prototype for first year demonstration in a field like setting to receive warfighter feedback of the maturing capability. Ubiquitous Edge (UbE) - Initiate the UbE FNC with five performer awards to begin development by conducting research into a cloud capability orchestration of networked devices to include command and control of networked components. - Initiate technology develop planning to establish a preliminary design for an initial operational prototype, conduct a stakeholder review of the system approach, and commence development of the initial prototype, to include an initial demonstration of the system that obtains warfighter feedback of the maturing capability.					
FY 2024 Base Plans: All Signal Tactical Real-Time Analyzer (ASTRAL): - Complete development of the sensor receiver module to provide full spectral awareness in a contiguous RF range, unifying recent advances in spectral and correlative analysis, signal processing, and monolithic photonics-electronics integration. Poison Apple (PA) - Continue the Poison Apple FNC S&T development by establishing a functional prototype solution that can be evaluated in simulated relevant environment designed to provide insight into software architectural and transition hardware solutions targeted at achieving Technology Readiness Level 6 by FY26. - Finish technology development planning and establish a model based systems engineering approach to documentation and requirements verification based on the preliminary design review outcomes. Finalize design solution supporting prototype development that was evaluated in the first year demonstration. Ubiquitous Edge (UbE) - Continue the Ubiquitous Edge FNC development through prototyping a software baseline targeted on networked devices that can provide an initial demonstration of transition program capability needs. - Continue technology definition through preliminary design review supporting an initial operational prototype based on the results of the first year demonstration feedback from warfighter feedback. Capture design					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
documentation into a model based systems engineering process to provide architecture analysis, requirements verification and measurement of prototype operational performance. Maintenance Tools for Operations and Training (MTOT) - Complete the MTOT FNC by providing immersive technologies to support just-in-time, just-in-place training in the field and the schoolhouse, and analytics to track student progress and provide intelligent paths to improve maintenance performance. The final year will continue development of the MTOT FNC via iterative testing of automated processes to generate real-world models of maintenance system for use in immersive technologies (e.g., augmented reality) and tailored training to support the identified Marine Corps use cases and programs of instruction. Collect metrics on student performance to provide objective feedback to students and instructors in realistic classroom settings. Conduct system demonstrations in support of verifying compliance with exit criteria. Training Environment for Advanced Marine Skills (TEAMS) - Initiate advanced prototype development to better integrate operational systems with training systems to support more realistic training with the Marine Corps Project Tripoli / Live Virtual Constructive-Training Environment. - Conduct stakeholder engagements with Training and Education Command and Program Manager of Training System on plans and development and begin development of operational prototypes. Stand-off Radar Imaging Detection System (SoRIDS) - Initiate development of a system for on-the-move standoff detection, virtual marking, and reporting of buried and surface laid explosive hazards using multi-static Ground Penetrating Synthetic Aperture Radar (GP-SAR) systems for Unmanned Aerial Vehicles (UAVs) and Unmanned Ground Vehicles (UGVs). - Initiate high sampling rate transceiver performance analysis and integration to improve the overall operational speed and fidelity. - Initiate software development and integration of a low-cost universally adaptable robotic UGV operator for operations of the unmanned ground vehicle. Dreamcatcher - Initiate the combining of an asset-target assignment mixed integer programming model with contested logistics models. - Initiate the development of an adversarial reinforcement learning to modify Navy and Marine Corps shooters behavior based on Red's behavior.					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate the development of modifying software to be compatible within a multi-level security environment. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant change from FY 2023 to FY 2024.					
Title: Logistics	9.804	10.778	18.200	0.000	18.200
Articles:	-	-	-	-	-
Description: This activity investigates the practical discipline and real world application of the deployment, sustainment, reconstitution, and re-deployment of forces engaged in expeditionary operations. Logistics replaces mass with assured knowledge and speed, is equally capable ashore or afloat in austere environments, and is fully scalable to meet uncertain requirements. This includes efficient and responsive force sustainment, planning and directing logistics operations, logistics demand reduction, fleet maintenance, and expeditionary energy. Expeditionary Energy enhances combat capability of expeditionary warfighters by increasing the efficiency and effectiveness of energy production, storage, distribution and use. Beyond traditional energy efforts, this portfolio also looks at other issues, including energy-efficient behaviors and hybridization of energy sources. These pillars are thoroughly integrated and perpetually related in execution. ***FY 2023 Plans:*** Continue: - Advance the broad range of technologies to demonstrate the military utility of enhancing combat capability by increasing energy production, storage, distribution, and curbing energy consumption of the individual Marine and other tactical assets with a particular emphasis on supporting distributed operations. - Progress efforts towards energy-aware aerial logistics, modular and reconfigurable tactical microgrids, aluminum-powered expeditionary energy sources and energy-intensive distributed operations. Complete: - Complete advanced system research into the scaled use of high specific power solar cell for Marine Corps applications ranging from the individual warfighter to augmenting the power and combat endurance unmanned robotic vehicles. Initiate:					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate a follow-on and focused research effort developing mission risk-based predictive maintenance technology. Demonstrate in laboratory and progress to field implementation of mission risk-based predictive maintenance technology to allow pre-planning of maintenance and repair requirements sufficiently far in advance to minimize mission interruption and facilitate longer horizon, more energy efficient distribution of Class IX materiel.					
FY 2024 Base Plans: - Continue to advance the broad range of technologies to demonstrate the military utility of enhancing combat capability by increasing energy production, storage, distribution, and curbing energy consumption of the individual Marine and other tactical assets with a particular emphasis on supporting distributed operations. - Continue progress efforts towards energy-aware aerial logistics, modular and reconfigurable tactical microgrids, aluminum-powered expeditionary energy sources and energy-intensive distributed operations. - Continue a focused research effort developing mission risk-based predictive maintenance technology. Demonstrate in laboratory and progress to field implementation of mission risk-based predictive maintenance technology to allow pre-planning of maintenance and repair requirements sufficiently far in advance to minimize mission interruption and facilitate longer horizon, more energy efficient distribution of Class IX materiel. - Initiate a research effort to research and develop solutions for safe and effective integration of Lithium-ion 6T batteries into soon-to-field energy storage platforms. - Initiate an effort to develop and ultimately demonstrate a modular hydrogen fuel cell Auxiliary Power Unit (APU) that can be mounted to light tactical vehicles to increase silent watch endurance without the addition of large amounts of batteries. - Initiate the development and demonstration of a long shelf-life, non-rechargeable electrical energy source that is affordable, safe, and transportable, that is a plug-and-play replacement for present Li-ion batteries about Loitering Munitions. - Initiate research effort to develop and deliver a power conversion efficiency solar cell mini-module that is based on next-generation perovskite photovoltaics. - Initiate research effort that will establish the development of transfer learning from sensor-informed additive manufacturing for F357 cast aluminum alloys to address critical casting and logistics shortages. - Initiate development and testing of computational tools for understanding flux-metal interaction during additive manufacturing. - Initiate development of specialized torches to adapt existing additive manufacturing system to reduce/eliminate shielding gas consumption in expeditionary manufacturing.					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate the integration of full-scale USV tug with inflatable vessel and close-coupling system. Demonstrate integrated system at-sea in required sea-state conditions. - Initiate creation and live fire testing of tiered (layered) body armor prototype to enhance warfighter protection from ballistic injury. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 is due to the initiation of efforts to 1) provide a roadmap and executed plan to yield a standardized Li6T that can fulfil the requirements for the four most pressing USMC programs using Li6T, 2) develop a small expeditionary Auxiliary Power Unit (APU) that can be mounted to light tactical vehicles to increase silent watch endurance without the addition of large amounts of batteries, 3) develop a long shelf-life, non-rechargeable electrical energy source which is affordable, safe to store, and readily transportable, that is a beyond-lithium-ion alternative the requirement of without supply chain logistics hurdles, 4)to develop and deliver a power conversion efficiency solar cell mini-module that is based on next-generation perovskite photovoltaics and 5) establish transfer learning algorithms and a material based equivalency approach to broaden material data sets leveraging Quality Made Additive Manufacturing (AM) capabilities to allow for AM replacement of hard-to-source conventional castings.					
Title: Maneuver	14.958	15.868	19.712	0.000	19.712
Articles:	-	-	-	-	-
Description: This activity investigates new ways and means to land forces and material through contested sea-land surface interfaces and then conduct maneuver warfare. In order to enable future Amphibious Operations, research efforts will support autonomous operations across the sea-surf-ground environment, improved fuel efficiency and speed of amphibious vehicles, amphibious vehicle technologies, water performance, and amphibious payloads to change the dynamics of a surface amphibious assault. This includes the emergence of manned-unmanned teaming and autonomous vehicle collaboration. The technologies included in this work address areas of mobility, materials, propulsion, signature reduction, modularity, and unmanned systems. This also encompasses navigating the surf zone by a small autonomous vehicle, navigating negative obstacles on land at speed, overcoming adversarial intent, and developing low-cost robotic autonomy kits to support of expeditionary amphibious operations (e.g., ISR, mine-counter-measures, breaching, fire support, and logistics).					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2223 / *Marine Corps ATD*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
FY 2023 Plans: Continue: - Researching advanced intelligent mobility technologies for ground and amphibious platforms to improve mobility and maneuverability across littoral and inland terrain. Demonstration platforms will continue to be utilized to assess potential future capabilities. - Expand efforts related to the low-cost, unmanned swarming amphibious assault capable platforms to include addition of enhanced autonomy capabilities and utilization and demonstration of advanced payloads for future operations. Conduct experimentation to understand feasibility and utility for military applications. Initiate: - Research advanced drivetrain technologies, system designs, and platforms to assess capability of future military tactical truck systems to improve fuel efficiency, extend range, reduce greenhouse gases, and provide on-board auxiliary power and energy.					
FY 2024 Base Plans: - Continue research to advance intelligent mobility technologies for ground and amphibious platforms to improve mobility and maneuverability across littoral and inland terrain. Demonstration platforms will continue to be utilized to assess potential future capabilities. - Continue to expand on efforts related to the low-cost, unmanned swarming amphibious assault capable platforms to include addition of enhanced autonomy capabilities and utilization and demonstration of advanced payloads for future operations. Conduct experimentation to understand feasibility and utility for military applications. - Continue research to advance drivetrain technologies, system designs, and platforms to assess capability of future military tactical truck systems to improve fuel efficiency, extend range, reduce greenhouse gases, and provide on-board auxiliary power and energy. - Initiate research effort to conduct a series of operational analysis and experiments to rapidly advance technologies in select focus areas related to littoral maneuver into the hands of Marines to evaluate military utility. - Initiate integration and field testing of AI-enabled autonomy Command and Control (C2) into Unmanned Swarming Amphibious Assault Craft (USAAC).					
FY 2024 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 is due to the initiation of efforts to 1) conduct a series of operational analysis and experiments to rapidly advance technologies in select focus areas related to littoral maneuver into the hands of Marines to evaluate military utility and 2) conduct integration and field testing of AI-enabled autonomy Command and Control (C2) into Unmanned Swarming Amphibious Assault Craft (USAAC).					
Accomplishments/Planned Programs Subtotals	106.408	118.183	126.171	0.000	126.171

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603640M / *MC Advanced Technology Demo*	Project (Number/Name) 2297 / *Futures Directorate*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
2297: *Futures Directorate*	0.000	101.747	157.064	177.046	-	177.046	139.865	136.609	131.420	130.757	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The mission of the Marine Corps Warfighting Laboratory / Futures Directorate (MCWL/FD) is to generate and examine threat-informed operating concepts and capabilities and provide analytically-supported recommendations to inform subsequent force design and development activities. The Deputy Commandant, Combat Development and Integration (DC, CD&I) is the United States Marine Corps (USMC) advocate for Science and Technology (S&T). MCWL's Commanding General (CG) is the proponent of USMC S&T and serves as the USMC Executive Agent for Marine Corps S&T. The MCWL/FD also serves as the Marine Corps' liaison to the Joint Staff for Joint Concept Development and Experimentation; thereby, facilitating service-specific experiments as well as participation in joint service experimentation.

As reflected in strategic guidance, expeditionary forces will provide an ever-ready quick strike force to protect United States (US) interests. MCWL/FD pursues concepts, capabilities, and solutions to ensure that Marines of the future force will be effectively organized, trained, and equipped to win across the range of military operations in an uncertain and complex environment. Prioritized investments in S&T are necessary to enable the future Marine Corps and maintain a technological advantage over our adversaries.

This project is organized into 6 activities, the core of which are represented by the Warfighting Capability Areas of the Marine Air-Ground Task Force (MAGTF). The project emphasizes development and demonstration of advanced technology capability concepts, and the examination of their operational application and military utility in the context of formal wargames, Modeling, Simulation, and Analysis (MS&A), and live-force field experimentation with Marines. This operational experimentation directly supports Marine Corps combat development to inform future capability requirements and optimize the acquisition process.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Combat Service Support (CSS) and Force Protection	31.734	73.324	87.232	0.000	87.232
Articles:	-	-	-	-	-
Description: This activity includes Marine Corps Warfighting Laboratory / Futures Directorate (MCWL/FD) Combat Service Support and Force Protection experimentation efforts, to include overarching experimentation planning/execution, management, technical, and engineering support, assessment of equipment, new Tactics, Techniques, and Procedures (TTPs), training opportunities, and proposed organizational changes associated with enhanced capabilities. This activity develops technology in support of a more distributed technologically advanced force, increasing range, effectiveness, sustainability, and survivability of the Marine Corps Air-Ground Task Force (MAGTF). Most programs listed below are considered major (valued at $500K or more) or have near					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2297 / *Futures Directorate*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
real-time operational impact. Investments in this activity are conducted under the Thrust Areas of Expeditionary Logistics, Expeditionary Medical, Force Protection, or Autonomy and Robotics. ***FY 2023 Plans:*** Unmanned Logistics and Defense: - Continue development and experimentation with highly autonomous and synchronous logistics capabilities in support of expeditionary Marine Air-Ground Task Force (MAGTF) operations. - Continue to assess execution of high tempo unmanned sustainment to dispersed and disaggregated forces during joint combined air-ground operations in contested environments including transiting over water from surface vessels to shore and other surface vessels. - Complete development efforts in support of littoral staging and autonomous resupply, which provides a landing craft, utility (LCU) with hardened autonomy system that can deploy with Marine Expeditionary Units as part of extended user evaluations (EUEs) to inform requirements for autonomous and unmanned crafts in the littorals. Sustainment: - Continue to sustain and investigate multiple technologies integrated within the MAGTF to experiment with alternate vehicle power, extended mobility, hybrid energy, expeditionary fuel distribution, and small unit water purification to enable logistics demand reduction and provide alternate sustainment to the MAGTF at all levels. - Complete experimentation with hybrid power systems. - Complete design, development, manufacturing, and testing of an amphibious towable fuel container (unit/system). - Complete evaluating Limited Technical Assessment (LTA) results on the ability to organically construct expeditionary air fields, roadways, and hardened structures. - Initiate demonstrations with naval logistics information technology integration with low earth orbit and military satellite networks; ultimately reducing reliance on continuous emission systems and levering low probability of detection waveforms. - Initiate the research, design, and build of a littoral maneuver enabler prototype. Counter Unmanned Aerial System (CUAS): - Complete efforts to develop an enhanced capability to locate, identify, access, and neutralize small UAS threats.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2297 / *Futures Directorate*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Complete development efforts for automatic target recognition algorithms for radar optics as well as a library of 3-dimensional imagery to enhance current technology, reduce false positives, and shorten the systematic kill-chain for targeting. Explosive Detection/Defeat: - Continue to develop an autonomous explosive detection and defeat capability; integrating specialized sensors for enhanced neutralization. - Initiate spiral technology development to produce a mobile explosive hazard in-depth defense. Medical: - Continue to experiment with systems to support a smaller, modular, multifunctional medical concept that can support medical care ashore and Marine Littoral Regiments (MLR) by performing studies, integration with unmanned systems, demonstrations, and experimentation. - Continue to integrate, test, and demonstrate wearable bio-sensors and their applicability to a multifunctional medical team supporting the MLR. - Complete integration of automated casualty care, providing therapeutic care during movement. - Initiate research regarding the constraints of performing medical interventions aboard shallow draft vessels. Warfighter Performance: - Continue to provide increased lethality and mobility to the warfighter through the integration of technology directly attributable to individual combat equipment. - Continue to develop, test, and assess a Radio Agile Integrated Device (RAID) Plate. - Initiate development of common user interface and fully integrate Primary, Alternate, Contingency, Emergency (PACE) plan for dismounted troops. Littoral Connectors: - Continue development and enhancement of capabilities for diversified distribution, providing risk worthy, inexpensive platforms for maneuver and sustainment distribution. Utilize current commercial technology to enhance maneuver to and from seabases and expeditionary advanced bases in the littorals with the ability to deliver directly to the users at shore. Efforts will advance anti-access and area denial capabilities to forward deployed forces. Robotic Modernization:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2297 / *Futures Directorate*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue to provide ground combat element robotic asset maintenance, repair, and upgrades; ultimately ensuring systems viability for experimentation and user evaluation. Camouflage, Concealment, and Detection (CC&D): - Initiate the development of CC&D capabilities, enabling persistence within enemy's Weapons Engagement Zone (WEZ). ***FY 2024 Base Plans:*** Unmanned Logistics and Defense: - Continue development and experimentation with highly autonomous and synchronous logistics capabilities in support of expeditionary Marine Air-Ground Task Force (MAGTF) operations. - Continue to assess execution of high tempo unmanned sustainment to dispersed and disaggregated forces during joint combined air-ground operations in contested environments including transiting over water from surface vessels to shore and other surface vessels. Sustainment: - Continue to sustain and investigate multiple technologies integrated within the MAGTF to experiment with alternate vehicle power, extended mobility, hybrid energy, expeditionary fuel distribution, and small unit water purification to enable logistics demand reduction and provide alternate sustainment to the MAGTF at all levels. - Continue demonstrations with naval logistics information technology integration with low earth orbit and military satellite networks; ultimately reducing reliance on continuous emission systems and levering low probability of detection waveforms. - Continue the research, design, and build of a littoral maneuver enabler prototype. Counter Unmanned Aerial System (CUAS): - Initiate a comprehensive experimentation plan to successfully execute an end-to-end kill chain for developed CUAS capabilities. Specifically, demonstrating the ability to employ CUAS from the sea bases to support Marine forces in austere locations. Explosive Detection/Defeat: - Continue to develop an autonomous explosive detection and defeat capability; integrating specialized sensors for enhanced neutralization. - Continue spiral technology development to produce a mobile explosive hazard in-depth defense.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2297 / *Futures Directorate*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Medical: - Continue to experiment with systems to support a smaller, modular, multifunctional medical concept that can support medical care ashore and Marine Littoral Regiments (MLR) by performing studies, integration with unmanned systems, demonstrations, and experimentation. - Continue research regarding the constraints of performing medical interventions aboard shallow draft vessels. - Complete the integration, testing, and demonstration of wearable bio-sensors and their applicability to a multifunctional medical team supporting the MLR. Warfighter Performance: - Continue to provide increased lethality and mobility to the warfighter through the integration of technology directly attributable to individual combat equipment. - Continue to develop, test, assess, and experiment with a Radio Agile Integrated Device (RAID) Plate. - Continue the development of common user interface and fully integrate Primary, Alternate, Contingency, Emergency (PACE) plan for dismounted troops. Littoral Connectors: - Continue development and enhancement of capabilities for diversified distribution, providing risk worthy, inexpensive platforms for maneuver and sustainment distribution. Utilize current commercial technology to enhance maneuver to and from seabases and expeditionary advanced bases in the littorals with the ability to deliver directly to the users at shore. Efforts will advance anti-access and area denial capabilities to forward deployed forces. - Initiate assessments, evaluations, and experimentation with the Navy and Fleet Marine Forces to inform future naval surface vessel requirements, develop TTPs, and refine Distributed Maritime Operations (DMO)/ Expeditionary Advanced Base Operations (EABO) concept of operations (CONOPS), pertaining to Force Design 2030 and the activation of the MLR. Efforts will provide enhanced maneuver to and from expeditionary advance bases in the littorals with the ability to deliver personnel, equipment, and all classes of supply, directly to the shore. Because the Marine Corps requires intermodal maneuver and sustainment assets, these assets will compliment larger naval vessels supporting operational requirements. - Initiate assessments, evaluations, and experimentation with small boats to augment littoral maneuver capability in support of Force Design 2030. Provide detailed analysis to support capability development and future					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Program Objective Memoranda (POM) decisions. Combine efforts from wargames, studies, modeling and simulation, live force experimentation, and analysis to refine concept of operations (CONOPS) for sustainment as well as littoral maneuver capability. Robotic Modernization: - Continue to provide ground combat element robotic asset maintenance, repair, and upgrades; ultimately ensuring systems viability for experimentation and user evaluation. Camouflage, Concealment, and Detection (CC&D): - Continue the development of CC&D capabilities, enabling persistence within enemy's Weapons Engagement Zone (WEZ). ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The funding increase from FY 2023 to FY 2024 is directly attributable to advancements in the Littoral Connectors arena. Specifically, a third hull is added within the Stern Landing Vessel (SLV) program to improve resilience, dispersion, and the ability to operate in complex archipelagoes and contested littorals without incurring unacceptable risk. In addition, Ancillary Surface Connector (ASC) efforts are initiated to improve the sustainment of the future naval expeditionary force, through its tailored ability to support expeditionary forces operating in contested and austere environments, complicating enemy decision and targeting calculus, and freeing Navy operational availability that would have to originally be focused on sustainment to the Marine Corps. All efforts directly support Force Design 2030.					
Title: Marine Air-Ground Task Force (MAGTF) Command, Control, Communications, and Computers (C4) ***Articles:*** ***Description:*** This activity encompasses all Marine Corps Warfighting Laboratory/Futures Directorate (MCWL/FD) Command, Control, Communications, and Computers (C4) experimentation efforts, to include overarching experimentation planning/execution, management, technical, and engineering support, assessment of equipment, new Tactics, Techniques, and Procedures (TTPs), training programs, and proposed organizational changes associated with enhanced C4 capabilities. The area provides cutting edge/enhanced Over-The-Horizon (OTH), Beyond Line of Sight (BLOS), satellite and non-satellite based C4 capabilities to support experimentation. Programs listed below are considered major (valued at $500K or more) or have near real-time	8.650 -	15.144 -	9.733 -	0.000 -	9.733 -

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
operational impact. Investments in this activity are conducted under the Thrust Areas of Command, Control, Communications, and Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) and Cyber/Electronic Warfare (Cyber/EW). ***FY 2023 Plans:*** Asymmetric Command and Control (C2): - Continue to provide secure "one-to-many" (netted) push-to-talk (PTT) voice and command, control, communications, and computers (C4) data services to disadvantaged users in an easy to use, hand-held radio for both mounted and dismounted operations with no reliance on local ground infrastructure. - Continue mini-crypto development. - Initiate mission play-back capabilities for enhanced analysis and training and continue development and limited technical assessments with an expeditionary transportable communications platform. - Initiate a series of limited technical assessments to provide secure "one-to-many" (netted) push-to-talk (PTT) voice and command, control, communications, and computers (C4) data services to disadvantaged users in an easy to use, hand-held radio for both mounted and dismounted operations with no reliance on local ground infrastructure. Integrated C2: - Continue experimentation with an expeditionary transportable communications platform. - Continue the development of persistent satellite communications (SATCOM) point-of-presence to enable Expeditionary Advanced Base (EAB), Distributed Maritime Operations (DMO), and Joint All-Domain C2 (JADC2) experimentation. - Initiate the integration of a proliferated-Low Earth Orbit (pLEO) satellite constellation capability which will facilitate connectivity to elements of the Family of Integrated Targeting Cells (FITC) and other pLEO enabled platforms and agencies. Electronic Warfare (EW) / Information Environment Operations: - Continue to pursue multiple electronic and cyber-secure warfare efforts. - Complete efforts to test and assess, which provide a ruggedized case for sensing WiFi, Bluetooth, and other electro-magnetic transmissions. - Initiate the development and integration of an airborne EW/Signals Intelligence (SIGINT) radio frequency sensor that is optimized for Group I - III unmanned aerial system (UAS) deployment.					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate the integration of a full-spectrum SIGINT and EW capability onto Group V UAS. Effort will provide a modular system architecture with the ability to integrate into multiple platforms. - Initiate experimentation with a cyber application of swarmable, autonomous UASs used to accomplish intelligence, surveillance, and reconnaissance (ISR) and EW operations in a contested environment. - Initiate the development of a resilient, cyber-secure high-performance network within the littorals. Naval Force Tactical Communications: - Initiate experimentation opportunities for high frequency silent transmission over a resilient meshed network. Developed technology will support C2 in heavily contested electro-magnetic environments (EME).					
FY 2024 Base Plans: Asymmetric Command and Control (C2): - Continue to provide secure "one-to-many" (netted) push-to-talk (PTT) voice and command, control, communications, and computers (C4) data services to disadvantaged users in an easy to use, hand-held radio for both mounted and dismounted operations with no reliance on local ground infrastructure. - Continue mini-crypto development. - Continue mission play-back capabilities for enhanced analysis and training and continue development and limited technical assessments with an expeditionary transportable communications platform. - Continue a series of limited technical assessments to provide secure "one-to-many" (netted) push-to-talk (PTT) voice and command, control, communications, and computers (C4) data services to disadvantaged users in an easy to use, hand-held radio for both mounted and dismounted operations with no reliance on local ground infrastructure. Integrated C2: - Continue experimentation with an expeditionary transportable communications platform. - Continue the development of persistent satellite communications (SATCOM) point-of-presence to enable Expeditionary Advanced Base (EAB), Distributed Maritime Operations (DMO), and Joint All-Domain C2 (JADC2) experimentation. - Continue the integration of a proliferated-Low Earth Orbit (pLEO) satellite constellation capability which will facilitate connectivity to elements of the Family of Integrated Targeting Cells (FITC) and other pLEO enabled platforms and agencies. Electronic Warfare (EW) / Information Environment Operations:					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue to pursue multiple electronic and cyber-secure warfare efforts. - Continue the development and integration of an airborne EW/Signals Intelligence (SIGINT) radio frequency sensor that is optimized for Group I - III unmanned aerial system (UAS) deployment. - Continue the integration of a full-spectrum SIGINT and EW capability onto Group V UAS. Effort will provide a modular system architecture with the ability to integrate into multiple platforms. - Continue experimentation with a cyber application of swarmable, autonomous UASs used to accomplish intelligence, surveillance, and reconnaissance (ISR) and EW operations in a contested environment. - Continue the development of a resilient, cyber-secure high-performance network within the littorals. - Initiate a Size, Weight, and Power (SWAP) analysis on an advanced High Frequency (HF) Radio Frequency (RF) signal processing and emitter exploitation. Naval Force Tactical Communications: - Complete experimentation with high frequency silent transmission over a resilient meshed network. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease from FY 2023 to FY 2024 is attributable to the following areas: Electronic Warfare (EW) / Information Environment Operations: - Reduction in overall EW related investment areas. Naval Force Tactical Communications: - Completion of experimentation opportunities with high frequency silent transmission over a resilient meshed network.					
Title: Fires, Targeting, and Maneuver	6.297	11.744	7.433	0.000	7.433
Articles:	-	-	-	-	-
Description: This activity includes Marine Corps Warfighting Laboratory / Futures Directorate (MCWL/FD) experimentation efforts in the areas of fires, targeting, and maneuver, to include overarching experimentation planning/execution, management, technical, and engineering support, assessment of equipment, new Tactics, Techniques, and Procedures (TTPs), training programs, and proposed organizational changes associated with enhanced capabilities. This area increases fires, targeting, and maneuver related troop environmental					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
awareness, lethality, and mobility using fused sensors as well as unmanned weaponized and reconnaissance air and ground vehicle platforms to support experimentation. Most programs listed below are considered major (valued at $500K or more) or have near real-time operational impact. Investments in this activity are conducted under the Thrust Areas of Marine Air-Ground Task Force (MAGTF) Fires, Maneuver, and Autonomy and Robotics. ***FY 2023 Plans:*** Unmanned Ground Vehicle (UGV): - Continue to provide a multi-purposed UGV, with modular payload architecture, with specific focus on vehicle sustainment as well as command and control structure. - Continue to integrate program of record (POR) and non-POR payloads for the UGV platform that enhance dismounted units across the warfighting functions. - Continue to perform tests, demonstrations, and assessments prior to dedicated live-force experimentation. Aerial Munitions: - Continue to pursue company level precision guided munitions to increase responsiveness, survivability, and lethality to the ground combat element. - Continue experimentation with fully autonomous, remotely operated unmanned aerial systems (UASs) that serves as a dual electro-optical (day) and infra-red (IR) (night), precision-guided, loitering munition designed to seek, locate, and engage selected targets. - Initiate development of a common launcher system that can be integrated onto ultra-light and autonomous vehicles; capable of firing light and medium or medium and heavy precision fires assets. - Initiate tasks to integrate existing weapons technology into a single killer munition. Multi-Domain Fires: - Continue the examination and testing of precision guided munitions. Efforts promote artillery force protection. - Complete investigations into low cost hypersonic technologies as well as multi-domain over-the-horizon (OTH) targeting. - Initiate the incorporation of POR command and control (C2) infrastructure with modified long-range aerial munitions to identify feasibility or recoverable, canister launched, platforms. - Initiate fire coordination cognizance investigations to reduce the cognitive load on fire support officers and commanders as they seek to understand events, make decisions, and take actions during high-stakes operations.					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate small unmanned close air support efforts to determine most capable product (platform + weapon + C2); leading to subsequent development and experimentation. - Initiate organic sensor-to-shooter data that expedites the targeting process at the tactical level by integrating national technical means and is interoperable with Joint fires. Funding will be used to conduct a series of Developmental Tests and Limited Technical Assessments that matures the technology and validates USMC service level requirements. - Initiate preliminary design for a hypersonic capability in the 227mm (~9 inch variant) form factor to fit into a M142 High Mobility Artillery Rocket System (HIMARS) Launcher and support an expeditionary concept of operation. Pursuing this size will enable the Marine Corps to leverage existing legacy program of record technologies for both the launcher system (HIMARS) and the command and control software Advanced Field Artillery Tactical Data System (AFATDS). ***FY 2024 Base Plans:*** Unmanned Ground Vehicle (UGV): - Continue to provide a multi-purposed UGV, with modular payload architecture, with specific focus on vehicle sustainment as well as command and control structure. - Continue to integrate program of record (POR) and non-POR payloads for the UGV platform that enhance dismounted units across the warfighting functions. - Continue to perform tests, demonstrations, and assessments prior to dedicated live-force experimentation. Aerial Munitions: - Continue to pursue company level precision guided munitions to increase responsiveness, survivability, and lethality to the ground combat element. - Continue experimentation with fully autonomous, remotely operated unmanned aerial systems (UASs) that serves as a dual electro-optical (day) and infra-red (IR) (night), precision-guided, loitering munition designed to seek, locate, and engage selected targets. - Continue development of a common launcher system that can be integrated onto ultra-light and autonomous vehicles; capable of firing light and medium or medium and heavy precision fires assets. - Continue tasks to integrate existing weapons technology into a single killer munition. Multi-Domain Fires: - Continue the examination and testing of precision guided munitions. Efforts promote artillery force protection.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue the incorporation of POR command and control (C2) infrastructure with modified long-range aerial munitions to identify feasibility or recoverable, canister launched, platforms. - Continue small unmanned close air support efforts to determine most capable product (platform + weapon + C2); leading to subsequent development and experimentation. - Continue organic sensor-to-shooter data that expedites the targeting process at the tactical level by integrating national technical means and is interoperable with Joint fires. Funding will be used to conduct a series of Developmental Tests and Limited Technical Assessments that matures the technology and validates USMC service level requirements. - Complete fire coordination cognizance investigations to reduce the cognitive load on fire support officers and commanders as they seek to understand events, make decisions, and take actions during high-stakes operations. - Complete preliminary design for a hypersonic capability in the 227mm (~9 inch variant) form factor to fit into a M142 High Mobility Artillery Rocket System (HIMARS) Launcher and support an expeditionary concept of operation. Pursuing this size will enable the Marine Corps to leverage existing legacy program of record technologies for both the launcher system (HIMARS) and the command and control software Advanced Field Artillery Tactical Data System (AFATDS). - Initiate the demonstration and experimentation of a small form factor hypersonic capability in the 227mm (~9 inch variant) form factor to fit into a M142 High Mobility Artillery Rocket System (HIMARS) Launcher and support an expeditionary concept of operation. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The funding decrease from FY 2023 to FY 2024 is due to the following Multi-Domain Fires efforts: - Completion of fire coordination cognizance investigations. - Completion of preliminary design for a hypersonic capability in the 227mm form factor to fit into a M142 High Mobility Artillery Rocket System (HIMARS) Launcher.					
Title: Marine Air-Ground Task Force (MAGTF) Intelligence, Surveillance, and Reconnaissance (ISR)	25.441	25.884	37.740	0.000	37.740
Articles:	-	-	-	-	-
Description: This activity includes Marine Corps Warfighting Laboratory / Futures Directorate (MCWL/FD) Intelligence, Surveillance and Reconnaissance (ISR) related experimentation efforts, to include overarching experimentation planning/execution, management, technical, and engineering support, assessment of					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2297 / *Futures Directorate*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
equipment, new Tactics, Techniques, and Procedures (TTPs), training programs, and proposed organizational changes associated with enhanced ISR capabilities. Using a variety of fused sensors to mesh data, video, and images and incorporating a common tactical controller to operate multiple air and ground ISR platforms, this area enhances small unit situational awareness as well as exploitation and forward engagement ability via experimentation. Programs listed below are considered major (valued at $500K or more) or have near real-time operational impact. Investments in this activity are conducted under the Thrust Areas of Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) and Autonomy and Robotics. ***FY 2023 Plans:*** Unmanned Aerial Systems (UASs): - Continue to explore, expand mission sets, and exploit the tactical potential of small UASs across multiple Marine Corps domains, focusing on autonomy, innovative applications, and the most advanced small UAS technology. - Continue development of Group I long endurance (24+ hour) small UAS. - Continue to investigate and assess vertical take-off and landing (VTOL) Group II UAS capabilities. Objectives still include integrating, testing, and demonstrating a heavy fuel engine to expand Department of the Navy (DoN) organic ship-board operations. - Continue to explore Group II fixed wing and VTOL payload development. - Continue efforts to provide a highly automated/autonomously operated cargo drone that supports organic resupply via an aerial cargo vehicle; supporting a squad sized element. - Complete efforts using larger UASs to develop shipboard operations using an electric VTOL (EVTOL) asset. - Initiate specialized payload development for Group 2 and 3 UAS organic to tactical units for extended endurance, increased lethality, and developmental testing. Robotic Autonomous Command and Control (C2): - Continue to investigate and experiment with enabling technologies combining sensor and telemetry data from multiple unmanned platforms (ground, surface (water), and air). Fused Integrated Networking: - Continue development and experimentation using an aerial communications gateway platform. Objectives include developing a podded C4 gateway prototype optimized to be hosted on a Group V Mid-Altitude Long Endurance (MALE) UAS as well as optimizing multi-domain (air, land, and sea) system-to-system					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2297 / *Futures Directorate*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
interoperability; enabling joint targeting (planned and/or dynamic); and providing a robust capacity to locally hosted applications and services. Information Operations: - Continue to develop and enhance capabilities to increase situational awareness and influence decision making. - Continue to investigate technologies and experimentation opportunities to support the operational utility of artificial intelligence/machine learning algorithms, developing Marine Corps intelligence and logistics applications. - Complete the integration of capabilities in the information operation environment, to include monitoring, engaging, and producing effects. Space: - Continue to develop capabilities to conduct electronic warfare in support of Marine Air-Ground Task Force (MAGTF) operations. - Continue to investigate experimentation opportunities for inexpensive commercial based satellites, leveraging existing high volume design/manufacturing/test infrastructures. - Complete low probability of intercept/low probability of detection (LPI/LPD) C2 link for autonomous surface vessels and demonstrate a communication pathway in a C2 degraded environment. - Complete experimentation efforts to reduce overall cost of distributed, space-based observations. - Initiate the construct and experimentation of integrated targeting cells. - Initiate investigations to search and receive messages transmitted outside standard frequency assignments and forward to deployed forces within the Expeditionary Advanced Base Operations (EABO) construct. - Initiate Family of Integrated Targeting Cells (FITC) development in order to enhance the tactical-national interfaces that can support the over-the-horizon awareness, identification, and targeting in stressing environments. Prototypes will demonstrate tactical and resilient networking and processing capabilities that can work with national, commercial, and in-theater tactical feeds to increase capabilities operating at the tactical edge. ***FY 2024 Base Plans:*** Unmanned Aerial Systems (UASs): - Continue to explore, expand mission sets, and exploit the tactical potential of small UASs across multiple Marine Corps domains, focusing on autonomy, innovative applications, and the most advanced small UAS technology.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2297 / *Futures Directorate*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
testing, and demonstrating a heavy fuel engine to expand Department of the Navy (DoN) organic ship-board operations. - Continue to explore Group II fixed wing and VTOL payload development. - Continue efforts to provide a highly automated/autonomously operated cargo drone that supports organic resupply via an aerial cargo vehicle; supporting a squad sized element. - Continue specialized payload development for Group 2 and 3 UAS organic to tactical units for extended endurance, increased lethality, and developmental testing. - Complete development efforts of Group I long endurance (24+ hour) small UAS. - Complete assessment of vertical take-off and landing (VTOL) Group II UAS capabilities. Objectives include integrating, Robotic Autonomous Command and Control (C2): - Continue to investigate and experiment with enabling technologies combining sensor and telemetry data from multiple unmanned platforms (ground, surface (water), and air). Fused Integrated Networking: - Continue development and experimentation using an aerial communications gateway platform. Objectives include developing a podded C4 gateway prototype optimized to be hosted on a Group V Mid-Altitude Long Endurance (MALE) UAS as well as optimizing multi-domain (air, land, and sea) system-to-system interoperability; enabling joint targeting (planned and/or dynamic); and providing a robust capacity to locally hosted applications and services. Information Operations: - Continue to develop and enhance capabilities to increase situational awareness and influence decision making. - Continue to investigate technologies and experimentation opportunities to support the operational utility of artificial intelligence/machine learning algorithms, developing Marine Corps intelligence and logistics applications. Space: - Continue to develop capabilities to conduct electronic warfare in support of Marine Air-Ground Task Force (MAGTF) operations. - Continue the construct and experimentation of integrated targeting cells.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2297 / *Futures Directorate*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue investigations to search and receive messages transmitted outside standard frequency assignments and forward to deployed forces within the Expeditionary Advanced Base Operations (EABO) construct. - Continue Family of Integrated Targeting Cells (FITC) development in order to enhance the tactical-national interfaces that can support the over-the-horizon awareness, identification, and targeting in stressing environments. Prototypes will demonstrate tactical and resilient networking and processing capabilities that can work with national, commercial, and in-theater tactical feeds to increase capabilities operating at the tactical edge. - Complete assessment of experimentation opportunities for inexpensive commercial based satellites, leveraging existing high volume design/manufacturing/test infrastructures. - Initiate developmental efforts to support redundant command and control in contested and degraded environments. - Initiate investigations, demonstrations, and experimentation of proliferated Low Earth Orbit (LEO) communications as well as support the integration of C2 architectures onto multiple expeditionary platforms. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY 2023 to FY 2024 supports Space investments via an increase in experimentation of MCWL's Family of Integrated Targeting Cells (FITC). Technology will be demonstrated across the globe in support of Joint All Domain Command and Control JADC2. Increase is also attributed to an increase in funding towards developing redundant space layer communication nodes.					
Title: Marine Corps Warfighting Laboratory / Futures Directorate (MCWL/FD) Technical, Engineering, and Management Support	8.155	8.671	7.316	0.000	7.316
Articles:	-	-	-	-	-
Description: Marine Corps Warfighting Laboratory / Futures Directorate (MCWL/FD) Technical, Engineering, and Management Support efforts include lab-wide, non-program specific experimentation doctrine, planning, management, and technical/engineering support, as well as technology transition tracking efforts. Tasks listed below are considered major (valued at $500K or more) or have near real-time operational impact. ***FY 2023 Plans:*** Commercial Forecasting:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2297 / *Futures Directorate*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue to identify long-range commercially available technologies and innovations that may influence future Marine Corps investments. Efforts provide a means to ensure proactive awareness and leveraging of foreseeable developments in commercial cutting-edge technologies. Technical Support: - Continue to provide a full range of overarching, lab-wide, engineering, analytical, technical, management, and business services; directly related to live-force experimentation. Portfolio Analytics: - Continue to build a comprehensive visualization tool for the Marine Corps Warfighting Laboratory (MCWL) portfolio and integrate it with Science and Technology (S&T) efforts across the Department of Defense's (DoD's) S&T community. Since these efforts are tightly coupled with both Technical Support as well as Collaboration requirements, future discussions will be captured within the Technical Support arena. Collaboration: - Continue to provide critical infrastructure to support the execution of S&T projects. The provided laboratory facility co-locates experimentation designers/implementers with project teams and technologists to enhance effectiveness of experimentation design, development, implementation, reporting, prototyping, and outreach of results.					
FY 2024 Base Plans: Commercial Forecasting: - Continue by exploring new mechanisms to identify long-range commercially available technologies and innovations that may influence future Marine Corps investments. Program goals include leveraging commercial dual use investments to preserve military S&T resources. Efforts center on military focused technologies available in 10 to 20 years. Technical Support: - Continue to provide a full range of overarching, lab-wide, engineering, analytical, technical, management, and business services; directly related to live-force experimentation. Tasks include Portfolio Analytics; a continued exploration of Artificial Intelligence (AI) capabilities to streamline data collection and program presentation, facilitating informed rapid decision-making and strategic planning.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2297 / *Futures Directorate*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Collaboration: - Continue to provide a laboratory facility to co-locate experimentation designers/implementers with project teams and technologists to enhance effectiveness of experimentation design, development, implementation, reporting, prototyping, and outreach of results. Effort seeks to facilitate communication, problem solving, risk mitigation, and status reporting in the execution of S&T projects at all classification levels. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The funding decrease from FY 2023 to FY 2024 is attributable to the following areas: - Commercial Forecasting: Alternative methods of identifying long-range commercially available technologies and innovations have resulting in cost savings. - Technical Support: As part of a continuing effort to make re-alignments to better identify command-level support versus specific project level function, overall costs were redistributed. This category did not experience significant growth or decline from FY 2023 to FY 2024; however, the requested budget as shown is now better representative of overarching, lab-wide, non-program specific support.					
Title: Warfighting Excellence	21.470	22.297	27.592	0.000	27.592
Articles:	-	-	-	-	-
Description: This activity includes Marine Corps Warfighting Laboratory / Futures Directorate (MCWL/FD) efforts in the development and assessment of joint and service warfighting concepts, joint and service missions, analysis of emerging threats and opportunities, and joint capability experimentation. It also includes MCWL/FD service experimentation (to include planning and analysis) in areas that impact multiple warfighting functions. Programs listed below are considered major (valued at $500K or more) or have near- real-time operational impact. ***FY 2023 Plans:*** Wargaming: - Continue to plan and execute executive agent responsibilities for the Marine Corps Title Ten Wargame, Expeditionary Warrior, as well as other wargames to examine Marine Corps capstone, operating, and functional concepts and explore assigned topics. Efforts provide high-level, diverse wargaming support that embrace both					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2297 / *Futures Directorate*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
the scope of joint wargaming and experimentation. Tasks support the combat development process by helping to develop and refine emerging concepts, conceptualize force design, and identify capabilities and deficiencies within future operating environments. - Continue to enhance on-demand, qualitative, and quantitative modeling capability that executes in a collaborative environment. This is provided by state-of-the-art equipment to improve visualization and allow for seamless collaboration output during wargaming scenarios. Emerging Threats and Opportunities: - Continue to assess and analyze the future security environment; identify and analyze emerging threats; and develop and appraise promising concepts, opportunities and technologies. Efforts include performing as an internal Marine Corps think tank dedicated to developing new ideas and concepts. - Continue to support the full spectrum of combat development-related missions and tasks, to include the assessment of future threats and adversaries and associated geographic, environmental, economic, and demographic conditions that may influence the development of future warfighting concepts, experimentation, and required capabilities in the areas of Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, and Facilities (DOTMLEPF). Joint Concept Technology Demonstrations (JCTDs): - Continue to monitor and contribute to approved efforts that address joint and combatant command warfighting needs through the execution and demonstration of prototypes within two to four years. - Complete efforts to provide kitted solutions to increase the survivability of expeditionary and permanent logistical support networks in an Anti-Access/Area Denial (A2/AD) environment. - Initiate experimentation and complete efforts to enable barges/vessels to serve as distributed resupply nodes in support of littoral operations. - Initiate explorations into joint efforts that supplement force design initiatives. Exercise Support: - Continue multi-year effort to enhance the ability of the Marine Air-Ground Task Force (MAGTF). Focus areas include demonstrations of an unmanned kill-chain utilizing Group I and II unmanned aerial vehicles (UASs) with Electro-Optic Infrared (EO/IR) payloads and laser target designators, aerial loitering munitions, and unmanned ground vehicles. Innovation:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2297 / *Futures Directorate*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue to develop/conduct/refine warfighter driven challenges to develop/identify prototypes and foster innovation within the Marine Corps. During this series of exercises industry, academia, and the Naval Research and Development Establishment (NR&NE) are invited to demonstrate emerging technology/engineering innovations that address priority Navy and Marine Corps missions. - Continue to reach out to the fleet and conduct capability wheel workshops in order to identify vital requirements for future development of the Expeditionary Advanced Base Operations (EABO) construct. Where applicable, integrate emergent technologies into experimental venues to access feasibility. Modeling, Simulation, and Analysis: - Continue to investigate/use emerging modeling and simulation (M&S) tools and techniques to provide analysis to support capability development activities. Provide M&S of naval operations with a focus on the Pacific Theater. Efforts include conducting comprehensive kill-chain assessment processes to evaluate current and future offensive capabilities against defensive counter-capabilities between the United States and a range of potential adversaries. - Continue to provide a broad range of independent, unique, and comprehensive analytical expertise to facilitate and evaluate experiments in various warfighting areas. This includes the planning, development, and execution of M&S as well as experimentation events. Experimentation Opposition Force: - Continue to demonstrate/hone the abilities of a live adversary force. Force provides a realistic, adaptive, and cohesive adversary as well as civilian environmental characteristics; thus strengthening experiment hypotheses and objectives. Artificial Intelligence (AI): - Continue to leverage joint Component investments to investigate concepts, methods, toolkits, software applications, and ideologies to provide/promote AI support/use for MCWL concept based experimentation. - Initiate investigations into changing service culture, making it more receptive of AI capabilities, and demonstrating how AI can make missions more effective and efficient. The aim is to reduce human processes and decrease resources and time for administrative tasks as well as demonstrating AI capabilities to garner service-wide acceptance. ***FY 2024 Base Plans:*** Wargaming:					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue to plan, coordinate, execute, and access all aspects of specified wargames. This includes examining Marine Corps capstone, operating, and functional concepts via wargaming platforms. At a minimum, games will include Marine Corps Title Ten Wargame Expeditionary Warrior, Naval Services Game, and Force Design. - Continue to sustain the Warfighting Network (WarNet), a stand-alone network that provides improved visualization, collaboration, quantitative, and qualitative output during wargames. Emerging Threats and Opportunities: - Continue to assess and analyze the future security environment; identify and analyze emerging threats; and develop and appraise promising concepts, opportunities and technologies. Serve as a catalyst to stimulate thought and debate on issues of importance to the Marine Corps. - Continue to provide a full spectrum of broad-based technological and analytical support for the Marine Corps combat development and experimentation programs at the component, Service, and Joint levels. Joint Concept Technology Demonstrations (JCTDs): - Continue to monitor and contribute to approved efforts that address joint and combatant command warfighting needs through the execution and demonstration of near-term prototypes. - Re-initiate Resilient Logistics efforts to provide kitted solutions to increase the survivability of expeditionary and permanent logistical support networks in an Anti-Access/Area Denial (A2/AD) environment. - Initiate explorations into joint efforts that supplement force design initiatives. Exercise Support: - Continue multi-year effort to enhance the ability of the MAGTF. Focus areas continue to include experimentation / demonstrations of a battalion-level organic unmanned kill-chain ecosystem. - Initiate Marine Littoral Regiment (MLR) experimentation efforts. A MLR is a self-deployable, multi-domain force optimized for engaging the contact and blunt layers of warfare. It is designed to operate across the competition continuum to support the Joint Force's role in assuring allies and partners, deterring adversaries, conducting and enabling Joint Force's contact, blunt, and surge capabilities. Innovation: - Continue to develop/conduct/refine warfighter driven challenges to develop/identify prototypes and foster innovation within the Marine Corps. Efforts will enable distributed experimentation, wargaming, and analysis while providing a real-time feedback and human-in-the-loop interaction with Program of Record (POR) systems.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue to reach out to the fleet and host, coordinate, and facilitate a collaborative effort to analyze future capabilities and provide data to aid decision-makers in funding and capability development decisions. Integrate emergent technologies into experimental venues to access feasibility. Modeling, Simulation, and Analysis: - Continue to investigate/use emerging modeling and simulation (M&S) tools and techniques to provide detailed, threat-informed, multi-level security analysis to support capability development and future Program Objective Memoranda (POM) decisions. Provide analytical modeling and data-driven, evidence-based assessment. Develop Marine Corps operating concepts, lead Marine Corps participation in the development of naval, joint, multi-service, and multi-national concepts/CONOPS, and deliver Strategic Analysis products in order to guide force development activities. - Continue to provide M&S of naval operations, focusing on the Pacific Theater. - Continue to provide independent, unique, and comprehensive analytical expertise to facilitate and evaluate experiments in various warfighting areas. Building upon lessons learned in previous experimentation, this includes experimentation design as well as data collection. Analysts take active roles in supporting experimentation concept refinement, capability development, and identification of tactics, techniques and procedures; organizational changes; technologies; and training that the experiments are designed to test. Experimentation Opposition Force: - Continue to demonstrate the abilities of a live adversary force; providing a realistic, adaptive, and cohesive adversary as well as civilian environmental characteristics. Artificial Intelligence (AI): - Continue to leverage joint Component investments to investigate concepts, methods, toolkits, software applications, and ideologies to provide/promote AI support/use for MCWL concept based experimentation. Since these efforts are tightly coupled with those listed elsewhere within this exhibit, future discussions will be captured within the MAGTF Intelligence, Surveillance, and Reconnaissance (ISR) Support arena under Information Operations. - Complete investigations into changing service culture, making it more receptive of AI capabilities, and demonstrating how AI can make missions more effective and efficient. Information Fusion Center (IFC):					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2297 / *Futures Directorate*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate efforts to provide a consolidated and collaborative environment, allowing the Marine Corps to successfully initiate, inform, and develop key capabilities at all classification levels. This environment will augment overall Marine Corps effectiveness as well as MCWL's experimentation objectives. The IFC is a collaborative effort between multiple Marine Corps organizations and supporting program offices to provide expertise and information with the goal of maximizing ability to support the Commandant's Force Design efforts. Efforts will allow an effective and efficient mechanism to exchange information and intelligence (at higher classification levels); and improve MCWL's ability to support the Marine Expeditionary Forces (MEFs). The IFC will act as the Marine Corps' backbone/strategic node for Fleet Marine Forces (FMFs); complementing the tactical nodes deployed across the globe.					
FY 2024 OCO Plans: N/A					
FY 2023 to FY 2024 Increase/Decrease Statement: The funding increase from FY 2023 to FY 2024 is directly attributable to the following areas: Exercise Support: - Within the multi-year effort to enhance the ability of the MAGTF; expand kill-chain ecosystem experimentation efforts. - Initiation of Marine Littoral Regiment (MLR) experimentation efforts. Experimentation within the MLR realm is a requirement to conduct Force Design 2030 analysis and is based around the MLR operating environment and conduct of operations. Modeling, Simulation, and Analysis: - Within continuing to investigate/use emerging modeling and simulation (M&S) tools and techniques; incorporate analytical modeling and data-driven, evidence-based assessment as well as development of Marine Corps operating concepts. Information Fusion Center (IFC): - Initiation of efforts to provide a consolidated intelligence facility to augment overall Marine Corps effectiveness as well as MCWL's experimentation objectives. Technical Support (incorporated into program areas):					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- As part of a continuing effort to make re-alignments to better identify command-level support versus specific project level function, overall costs were redistributed. This category showed commensurate growth from FY 2023 to FY 2024 and the requested budget as shown is now better representative of program specific support.					
Accomplishments/Planned Programs Subtotals	101.747	157.064	177.046	0.000	177.046

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603640M / *MC Advanced Technology Demo*	Project (Number/Name) 2958 / *Cyberspace Activities*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
2958: *Cyberspace Activities*	0.000	4.609	4.800	5.000	-	5.000	5.099	5.201	5.305	5.411	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project activity provides freedom of maneuver and influence in the cyber-electronic warfare domain while simultaneously denying the same to the adversary and protecting critical command systems. Technologies are being developed using a multi-disciplinary approach that combines Radio Frequency electronics, digital signal processing, computer engineering, software engineering, machine learning and data science to support Naval Expeditionary warfighters operating with size, weight and power constrained equipment in Disrupted, Intermittent, Limited environments. Areas of applied research include distributed precision time, predictive software defined radio architectures, coordinated Cyber and Spectrum maneuver to mitigate detection and exploitation, tactical Cyber visualization, discovering and mapping networks in dense urban environments, contextual awareness and blind channel characterization.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Expeditionary Cyber	4.609	4.800	5.000	0.000	5.000
Articles:	-	-	-	-	-
FY 2023 Plans: Continue: - Continue cyber related research into mitigation techniques related to USMC systems - Continue research to better identify key cyber terrain at the physical, logical, and cyber persona layers that can be visualized at small unit level - Continue research to develop of RF enabled EW/cyber networking that will deliver actions at scale through the integration of secure orchestration, cyber secure sensors, and resilient networking technologies - Continue research into automating cyber analysis and testing tools to enable software developers and reverse engineers to reduce the time required to conduct vulnerability analysis and software testing tasks.					
FY 2024 Base Plans: - Complete research into automating cyber analysis and testing tools to enable software developers and reverse engineers to reduce the time required to conduct vulnerability analysis and software testing tasks - Continue cyber related research into mitigation techniques related to United States Marine Corps (USMC) systems. - Continue research to better identify key cyber terrain at the physical, logical, and cyber persona layers that can be visualized at small unit level.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research to develop of RF enabled EW/cyber networking that will deliver actions at scale through the integration of secure orchestration, cyber secure sensors, and resilient networking technologies. - Initiate field experimentation on attended ground systems with Cyber survey and exploitation tools. - Initiate the development of non-traditional platform integration of Cyber-EW capabilities. - Initiate effort to develop a modular defensive cyber kit that can be plugged into an existing vehicle without requiring cutting or irreversible mods and that provides proactive protections against whole classes of cyber-EW attacks against vehicles. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024.					
Accomplishments/Planned Programs Subtotals	4.609	4.800	5.000	0.000	5.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603640M / *MC Advanced Technology Demo*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	70.568	132.700	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	203.268
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Congressional Add: Adaptive threat force	0.000	7.000
FY 2022 Accomplishments: N/A		
FY 2023 Plans: Sustained by the FY 2021 Congressional Enhancement, the Adaptive Threat Force (ATF) has become an accepted and critical component of live-force experiments conducted by the Marine Corps Warfighting Laboratory (MCWL). The ATF serve as experts on the employment of adversary capabilities. They train and equip adversary force units participating in experiments in order to emulate enemy tactics and operational style. This greatly enhances the relevance and accuracy of data gathered during the experiments and this data then informs capability investment decisions. The necessity of conducting not only concept-based, but threat-informed experiments is clear and the products of MCWL experiments are more relevant and applicable to potential real-world scenarios than ever before. As MCWL continues to advance Marine Corps warfighting capabilities to enable Force Design 2030, the ATF will continue to play an essential role. Due to their extensive military experience, ATF personnel will provide mentorship and operational expertise used in planning experiments. Operating within the concepts of Expeditionary Advanced Base Operations (EABO), Littoral Operations in a Contested Environment (LOCE), and Stand-in Forces (SIF), MCWL is conducting experiments with the newly designed infantry battalion, the recently established Marine Littoral Regiment (MLR), and with small boats and littoral connectors for reconnaissance/ counter-reconnaissance and littoral maneuver. The ATF supports each of these ongoing efforts and ensures that enemy capabilities and equipment are considered and included within experiment planning and execution. The ATF will be utilized within experiments that will span the globe; in particular within the Indo-Pacific Command (INDOPACOM) Area of Responsibility (AOR). Their involvement in the maritime component of a key		

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
exercises will allow them to assist in the planning and execution of the Littoral Maneuver line of effort, including attending planning sessions relating to small boat operations and maritime competition.		
Congressional Add: Expeditionary Process, Exploitation, and Dissemination ***FY 2022 Accomplishments:*** Conduct advanced technology development in expeditionary process, exploitation, and dissemination. ***FY 2023 Plans:*** Conduct advanced technology development in support of expeditionary process, exploitation, and dissemination.	3.861	4.000
Congressional Add: Advanced mission planning system SBIR technology insertion ***FY 2022 Accomplishments:*** Conduct technology development supporting advanced mission planning system SBIR technology insertion ***FY 2023 Plans:*** Conduct advanced technology development in support of advanced mission planning system SBIR technology insertion.	4.827	5.000
Congressional Add: Data analysis and sharing augmentation ***FY 2022 Accomplishments:*** Conduct data analysis and sharing augmentation technology development ***FY 2023 Plans:*** N/A	1.931	0.000
Congressional Add: Low-cost atrittable aircraft technology ***FY 2022 Accomplishments:*** Pursue demonstration and experimentation with the tactical and operational alternative uses of highly autonomous, low-cost unmanned aircraft in an operationally representative environment while simultaneously developing the requisite: concepts of employment (CONEMPS), concepts of operation (CONOPS), Tactics, Techniques, Procedures (TTP), and logistics requirements. Pursuits will utilize an unmanned aerial vehicle (UAV) that is runway independent and designed for operations from both austere and improved operations. Efforts are follow-on to an Air Force developmental program. ***FY 2023 Plans:*** In concert with the FY 2022 Congressional Enhancement, the Marine Corps Warfighting Laboratory (MCWL) will continue to pursue demonstration and experimentation with the tactical and operational alternative uses of highly autonomous, low-cost unmanned aircraft in an operational environment. Continue to demonstrate an experimental, yet operational Unmanned Aerial System (UAS) prototype capability that will inform acquisition requirements, as well as provide Tactics, Techniques, and Procedure (TTP) development to provide mission flexibility and accelerate the kill chain while imposing a positive "cost" trade-off with adversaries.	24.134	25.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Demonstration will inform Concepts of Employment (COEs) for Manned/Unmanned Teaming (MUM-T) and the development of technology that supports desired COEs.		
Congressional Add: Adaptive future force ***FY 2022 Accomplishments:*** Conduct advance technology development supporting adaptive future force ***FY 2023 Plans:*** N/A	7.723	0.000
Congressional Add: AI-powered tactical ISR ***FY 2022 Accomplishments:*** In response to small drones proliferating on the battlefield, pursue the generation of real-time two-dimensional (2D) maps, near-real-time three-dimensional (3D) models, and analytical layers on handheld devices with no network connectivity required. Software development investigations (interoperable with existing Group 1 - 5 unmanned aerial systems (UASs) imaging payloads) are anticipated to drastically improve individual soldier's capabilities without the need to test and field new drone or mobile device hardware. Efforts are in concert with a similar FY 2022 Army Congressional enhancement. ***FY 2023 Plans:*** N/A	4.923	0.000
Congressional Add: Expeditionary mission support ***FY 2022 Accomplishments:*** Conduct advanced technology development supporting expeditionary mission support objectives ***FY 2023 Plans:*** Conduct advanced technology development in support of expeditionary mission support objectives.	9.654	8.000
Congressional Add: Platform agnostic weapons system ***FY 2022 Accomplishments:*** Platform agnostic weapons system technology development ***FY 2023 Plans:*** N/A	4.827	0.000
Congressional Add: Stand-off security inspection and surveillance system ***FY 2022 Accomplishments:*** Conduct stand-off security inspection and surveillance system technology development ***FY 2023 Plans:*** Conduct advanced technology development in support of stand-off security inspection and surveillance system.	8.688	10.000
Congressional Add: Mutli-function array for C-UAS	0.000	18.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
FY 2022 Accomplishments: N/A ***FY 2023 Plans:*** Conduct advanced technology development in support of mutli-function array for C-UAS.		
Congressional Add: C5ISR and EW modular open suite of standards ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct advanced technology development in support of C5ISR and EW modular open suite of standards.	0.000	10.000
Congressional Add: ACV EW/comms/ISR technology ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct advanced technology development in support of ACV EW/comms/ISR technology.	0.000	10.000
Congressional Add: AI-powered tactical ISR for battlespace awareness ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** In concert with a similar FY 2022 Congressional Enhancement, continue to support Marine Corps Warfighting Laboratory's Unmanned Aircraft Systems (UAS) development of Tactical Intelligence, Surveillance, and Reconnaissance (ISR) Artificial Intelligence (AI) Software. Provides continuous research, conceptual/first article design, test, evaluation, prototyping, experimentation, and demonstration. Provides research, design, analysis, documentation, fabrication, assembly, delivery, installation, integration, testing, and support of Government prototyping, experimentation, demonstration, and initial fielding activities for prototype aircraft systems and/or modifications, ground-based mission systems, support and test equipment, and associated developmental equipment and systems integrations to promote battlespace awareness.	0.000	7.200
Congressional Add: K-MAX next generation autonomouse logistics UAS ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** The Marine Corps Warfighting Laboratory (MCWL) will pursue investigations into helicopter-based next generation autonomous unmanned aerial vehicles (UAVs). Logistics-based concept design, demonstrations, and experimentation will be examined.	0.000	7.000
Congressional Add: Wireless tecnologies for sensing and surveillance at the tactical edge	0.000	6.500

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
FY 2022 Accomplishments: N/A ***FY 2023 Plans:*** Conduct advanced technology development in support of wireless technologies for sensing and surveillance at the tactical edge.		
Congressional Add: Hydrofoil wing in ground effect vehicle ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** The Marine Corps Warfighting Laboratory (MCWL) will pursue investigations into vehicles that are able to move over the surface by gaining support from the reactions of the air against the surface of the earth or water. Logistics-based concept design, demonstrations, and experimentation will be examined.	0.000	5.000
Congressional Add: ENDOR spectrum superiority technology ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct advanced technology development in support of ENDOR spectrum superiority technology.	0.000	10.000
Congressional Adds Subtotals	70.568	132.700

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603651M *I JT Non-Lethal Wpns Tech Dev*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	13.026	14.048	15.556	-	15.556	16.967	17.504	17.855	18.212	Continuing	Continuing
3022: *Joint Non Lethal Weapons*	0.000	13.026	14.048	15.556	-	15.556	16.967	17.504	17.855	18.212	Continuing	Continuing

A. Mission Description and Budget Item Justification

The DoD Non-Lethal Weapons Program was established by the FY96 National Defense Authorization Act. The Office of the Secretary of Defense designated the Commandant of the Marine Corps (CMC) as the DoD NLW Executive Agent (EA). The EA exercises centralized responsibility for joint research and development of non-lethal weapons and technology through the Joint Non-Lethal Weapons Program (JNLWP). The Office of the Under Secretary of Defense for Acquisition and Sustainment (A&S) serves as the OSD Principal Staff Assistant and oversees, in consultation with the Under Secretary of Defense for Policy, the DoD NLW Executive Agent.

The efforts described in this Program Element (PE) reflect science and technology (S&T) investment decisions by the Joint Non Lethal Weapons (NLW) Integrated Product Team, a multi-service flag level corporate board that provides executive oversight and management for the JNLWP for the CMC. This direction is based on the requirements and capabilities sought by the Services and the Coast Guard, as identified in the DoD's Non-Lethal Weapons Joint Capabilities Based Assessment Document. This coordinated joint S&T development approach addresses mutual capability gaps and assures the most relevant non-lethal technologies, capabilities and equipment are provided to the operating forces while eliminating duplicative service S&T investment. These advanced technology development initiatives feed non-lethal capabilities which directly support the National Defense Strategy (NDS) objective of strategic competition by providing options to the Joint Force in pursuit of national objectives in legal or policy constrained scenarios, as well as complementing the use of lethal effects in complex combat scenarios, for example, in urban environments with large civilian populations. Ongoing NLW studies, analyses and exercise efforts with North Atlantic Treaty Organization (NATO) and Allies also support NDS objectives to strengthen alliances and partnerships. Resulting capabilities will facilitate a fully integrated non-lethal competency as a complement to lethal firepower, providing force application options for below lethal threshold engagements.

This program funds Advanced Technology Development of next-generation non-lethal capabilities and includes performing analysis, technology development efforts, and modeling and simulation necessary to ensure optimum weaponization and use of these capabilities. Investment areas include research and development of next-generation NLWs and Intermediate Force Capabilities (IFCs) such as: non-lethal directed energy weapons (lasers, millimeter wave and high power microwave) for counter-personnel and counter-materiel missions; non lethal counter-personnel technologies (acoustic, optical, and human electro-muscular disruption technologies), and advanced non-lethal materials (including materials for vehicle/vessel stopping and counter-facility applications). Next generation non lethal systems focus on long-range localized non-lethal effects to identified threat individuals (or groups of individuals) and/or their threat weapons systems operating in complicated environments such as urban areas, crowds, buildings, vehicles, vessels, and also in close proximity to high-value civilian facilities.

This Program Element (PE) funds Advanced Technology Development (ATD) that includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment. Efforts in this PE generally have Technology Readiness Levels TRL) of 4 (component and/or breadboard validation in laboratory environment.), 5 (component and/or breadboard validation in relevant environment.), or 6 (system/subsystem model or prototype demonstration in a relevant environment).

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603651M *I JT Non-Lethal Wpns Tech Dev*

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	13.429	14.048	15.556	-	15.556
Current President's Budget	13.026	14.048	15.556	-	15.556
Total Adjustments	-0.403	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.403	0.000			

Change Summary Explanation

Funding: No significant change.

Technical: No significant change.

Schedule: No significant change

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603651M / *JT Non-Lethal Wpns Tech Dev*	Project (Number/Name) 3022 / *Joint Non Lethal Weapons*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3022: *Joint Non Lethal Weapons*	0.000	13.026	14.048	15.556	-	15.556	16.967	17.504	17.855	18.212	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project funds the research and development of next-generation Non-Lethal Weapons and includes performing analysis, technical development efforts, and modeling and simulation necessary to ensure optimum weaponization and use of these NLWs. Investment areas include research and development of next-generation Non-Lethal Weapons (NLW) such as: non-lethal directed energy weapons (lasers, millimeter wave and high power microwave) for counter-personnel and counter-materiel missions; non-lethal counter-personnel technologies (acoustic, optical, and human electro-muscular disruption technologies), and advanced non-lethal materiels (including materiels for vehicle/vessel stopping and counter-facility applications). Next-generation Non-Lethal Weapon systems focus on long-range localized Non-Lethal effects to identified threat individuals (or groups of individuals) and/or their threat weapons systems operating in complicated environments such as urban areas, crowds, buildings, vehicles, vessels, and also in close proximity to high-value civilian facilities.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Joint Non-Lethal Weapons	13.026	14.048	15.556	0.000	15.556
Articles:	-	-	-	-	-
FY 2023 Plans: Continue: - Research and investigation of Non-Lethal Weapons (NLWs) and Intermediate Force Capability (IFC) effects and emergent technologies with the potential to further address the Joint Requirements Oversight Council (JROC) approved non-lethal counter-personnel and counter-materiel capability gaps. Specifically, explore new non-lethal effects and evaluate alternative innovative applications of existing technologies to address future non-lethal capability needs as escalation of force platforms. Examples of counter personnel research include further optimization of non-lethal human effects, and enhanced understanding of human target behavioral effects. - Characterize non-lethal phenomena and to assess target human effects and weapon effectiveness, including the development of dose response and injury correlates for new Non-Lethal Weapons technologies. - Assess and study of new technologies to NLW effectiveness and behavioral response, such as advancing the understanding of Flash Bang effects on humans to support novel non-explosive alternatives to pyrotechnic non-lethal IFC devices. - Counter-materiel research to include the investigation of novel intermediate force capabilities for increased delivery and employment options; for applications such as vehicle and vessel stopping and the further optimization of intermediate force materials for integration into future escalation of force platforms.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603651M / *JT Non-Lethal Wpns Tech Dev*	**Project (Number/Name)** 3022 / *Joint Non Lethal Weapons*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Perform feasibility and design studies for high peak power radio frequency directed energy sources and other high power microwave directed energy technologies (e.g., lasers, millimeter-waves) with extended range applications and longer duration of effect. - Investigation and conceptual design of high power microwave technologies to enable improved performance and reduce overall size, weight, power consumption, thermal cooling requirements, and overall system costs (SWaP-C). Results will support the transition of viable technologies to higher levels of development and demonstration. Complete: - Operational tests and support of electric "direct-injection" vehicle stopping prototypes over an extended duration of time in an operationally relevant environment to assess its effectiveness, suitability, maintainability, availability, and other performance indicators. Results from these extended operational tests now prescribe operationally suitable design and performance parameters for future directed energy (DE) vehicle stopping technologies. Initiate: - Integrate various human effects(HE) dose response studies into a generalized repel and thermodynamic model of relevant human effects that are safe for operational engagements with Non-lethal Weapon (NLWs) and Intermediate Force Capabilities (IFCs). - Prototype multiple long-range adaptive hardware and software systems; to validate Non-lethal Weapon (NLW) and Intermediate Force Capability (IFC) Directed Energy (DE) emissions are safely aimed on human targets. - Subsystem and component design and development of high peak-power, both for wide-band and for narrow-band Radio Frequencies (RFs), in support of longer range and more compact Non-Lethal Weapon (NLW) and Intermediate Force Capability (IFC) DE effects.					
FY 2024 Base Plans: Continue: - Research and investigation of Non-Lethal Weapons (NLWs) and Intermediate Force Capability (IFC) effects and emergent technologies with the potential to further address the Joint Requirements Oversight Council (JROC) approved nonlethal counter-personnel and counter-materiel capability gaps. Specifically, explore new non-lethal effects and evaluate alternative innovative applications of existing technologies to address future non-lethal capability needs as escalation of force platforms. Examples of counter personnel research include further optimization of non-lethal human effects, and enhanced understanding of human target behavioral effects.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603651M / *JT Non-Lethal Wpns Tech Dev*	**Project (Number/Name)** 3022 / *Joint Non Lethal Weapons*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Characterize non-lethal phenomena and to assess target human effects and weapon effectiveness, including the development of dose response and injury correlates for new Non-Lethal Weapons technologies. - Assess and study of new technologies to NLW effectiveness and behavioral response, such as advancing the understanding of Flash Bang effects on humans to support novel non-explosive alternatives to pyrotechnic non-lethal IFC devices. - Counter-materiel research to include the investigation of novel intermediate force capabilities for increased delivery and employment options; for applications such as vehicle and vessel stopping and the further optimization of intermediate force materials for integration into future escalation of force platforms. - Perform feasibility and design studies for high peak power radio frequency directed energy sources and other high power microwave directed energy technologies (e.g., lasers, millimeter-waves) with extended range applications and longer duration of effect. - Investigation and conceptual design of high power microwave technologies to enable improved performance and reduce overall size, weight, power consumption, thermal cooling requirements, and overall system costs (SWaP-C). Results will support the transition of viable technologies to higher levels of development and demonstration. - Integrate various human effects(HE) dose response studies into a generalized repel and thermodynamic model of relevant human effects that are safe for operational engagements with Non-lethal Weapon (NLWs) and Intermediate Force Capabilities (IFCs). - Prototype multiple long-range adaptive hardware and software systems; to validate Non-lethal Weapon (NLW) and Intermediate Force Capability (IFC) Directed Energy (DE) emissions are safely aimed on human targets. - Subsystem and component design and development of high peak-power, both for wide-band and for narrow-band Radio Frequencies (RFs), in support of longer range and more compact Non-Lethal Weapon (NLW) and Intermediate Force Capability (IFC) DE effects. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase funding from FY2023 to FY2024 will be used to: 1) begin operational testing of synthetic materials to verify the ability to occlude a propeller in an operationally equivalent environment and begin development of deployment method(s) for synthetic materials and to conduct research and test industrial scaling of					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603651M / *JT Non-Lethal Wpns Tech Dev*	**Project (Number/Name)** 3022 / *Joint Non Lethal Weapons*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
synthetic materials in support of Maritime Vessel Stopping Occlusion Technologies; and 2) design a prototype "No Contact" Pre-Emplaced Vehicle Stopper (NC PEVS). This prototype would be able to sustain prolonged operational testing in Pilot Programs to ensure robust design, complete vulnerability assessment, system development and refine requirements.					
Accomplishments/Planned Programs Subtotals	13.026	14.048	15.556	0.000	15.556

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603673N *I Future Naval Capabilities Advanced Tech Dev*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	275.441	268.993	264.700	-	264.700	272.130	277.739	269.493	275.934	Continuing	Continuing
3346: *Future Naval Capabilities Adv Tech Dev*	0.000	248.411	250.993	264.700	-	264.700	272.130	277.739	269.493	275.934	Continuing	Continuing
9999: *Congressional Adds*	0.000	27.030	18.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	45.030

A. Mission Description and Budget Item Justification

The Office of Naval Research (ONR) was established to ensure the technological advantage of U.S. Naval forces. ONR manages the Department of the Navy's science and technology (S&T) research portfolio (Basic, Applied and Advanced Technology Development investments). This work includes the Future Naval Capabilities (FNC) program, which delivers technology solutions to known requirements and accelerates innovative technology insertion into Programs of Record (PORs). In close and structured coordination with POR Stakeholders (Combat Capability Development organizations, Operating Forces, and acquisition organizations), FNC efforts create revolutionary technology for PORs. ONR's S&T competencies create substantially higher levels of technology, trade space, and capability gain than acquisition can create within POR programmatic risk constraints. FNC projects create exponential technology improvement substantially cheaper than POR vendors do. The structured FNC process and its specific transition mechanisms manage technical risk and increase the likelihood that technologies systematically deploy to warfighters.

The efforts described in this Program Element (PE) 0603673N for FNC Advanced Technology Development use earlier research conducted in PE 0602750N for FNC Applied Research., and have follow-on transition funding commitments in the receiving acquisition Program of Record PEs. Using a competitive selection process, ONR and POR Stakeholders assess and select each effort in this PE based on its revolutionary technology payoff to the naval warfighter and prioritized operating force requirements. FNC requests from POR Stakeholders exceed funding available in the FNC Program and drive the competitive selection.

Due to the classified efforts in this PE, some have incomplete descriptions. ONR can provide additional information in classified documents.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603673N *I Future Naval Capabilities Advanced Tech Dev*

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	282.020	251.267	264.700	-	264.700
Current President's Budget	275.441	268.993	264.700	-	264.700
Total Adjustments	-6.579	17.726	0.000	-	0.000
• Congressional General Reductions	-	-0.274			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	18.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-6.579	0.000			
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 9999: *Congressional Adds*		
Congressional Add: *Advanced Energetics Research*	2.896	5.000
Congressional Add: *Development of Submersible Air Revitalization*	0.000	8.000
Congressional Add: *Advanced lidar sensor and data processing*	1.931	0.000
Congressional Add: *Electronic maneuver warfare unmanned sensors*	13.515	0.000
Congressional Add: *Advance machine learning and artificial intelligence*	8.688	0.000
Congressional Add: *Advanced carbon nanotube conductors for naval power systems*	0.000	5.000
Congressional Add Subtotals for Project: 9999	27.030	18.000
Congressional Add Totals for all Projects	27.030	18.000

Change Summary Explanation

Funding: No significant change.

Technical: No significant change.

Schedule: No significant change

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603673N / *Future Naval Capabilities Advanced Tech Dev*	Project (Number/Name) 3346 / *Future Naval Capabilities Adv Tech Dev*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3346: *Future Naval Capabilities Adv Tech Dev*	0.000	248.411	250.993	264.700	-	264.700	272.130	277.739	269.493	275.934	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Future Naval Capabilities (FNC) Program exploits technology advances and responds quickly to Naval needs. As a result, future Budget Activity (BA) 3 investments supporting the FNC Program are made less than one year before commencing execution. Because FNCs start at higher Technology Readiness Levels (TRL), the typical duration of an FNC is 3-years. The FNC Program favors a high level of collaboration. Program Element R-2 Activities align to warfare areas where the FNC technologies will be integrated into acquisition programs of record.

A complete accounting of FNC technologies and a full disposition of each technology development effort is provided annually to the Congressional oversight committees.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Capable Manpower (CMP)	0.000	2.997	5.165	0.000	5.165
Articles:	-	-	-	-	-
Description: The Capable Manpower R-2 Activity focuses on the advanced technology development of new capabilities that leverage the underlying applied research investments in Program Element (PE) 0602750N Future Naval Capabilities (FNC) Applied Research. These advanced technology investments align to acquisition programs of record. Efforts focus on all aspects of training, including accelerated learning, training environments, ready relevant training, and Live-Virtual-Constructive (LVC) training.					
FY 2023 Plans: My Navy Foresight (MNF) - Initiate development of a web-based model that describes how changes in manpower, personnel, or training influence quantitative (e.g., retention targets) and qualitative (e.g., process improvements) outcomes. These will result in courses of action to make decision support faster and more precise than current processes. - Survey existing models for common and unique data and metadata, link to OPNAV N1's authoritative data environment and user interface, and develop modelling solutions.					
FY 2024 Base Plans: My Navy Foresight (MNF)					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603673N / *Future Naval Capabilities Advanced Tech Dev*	**Project (Number/Name)** 3346 / *Future Naval Capabilities Adv Tech Dev*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue the My Navy Foresight (MNF) FNC by continuing development of the platform decision support system with different Manpower, Personnel, Training and Education (MPTE) data sources. The system will include software that supports Government users' activities. - Continue development of the system models and associated documentation. The models will provide realistic quantitative simulation of MPTE behavior. - Continue identifying and documenting requirements for the development of the software for MNF. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY 2023 to FY 2024 is due to the planned ramp-up of the My Navy Foresight (MNF) FNC, which was initiated in FY 2023.					
Title: Expeditionary Maneuver Warfare (EMW)	37.773	27.185	25.842	0.000	25.842
Articles:	-	-	-	-	-
Description: The Expeditionary Maneuver Warfare R-2 Activity focuses on the advanced technology development of new capabilities that leverage the underlying applied research investments in PE 0602750N, Future Naval Capabilities (FNC) Applied Research. These advanced technology investments align to acquisition programs of record. The advanced technologies being developed under this R-2 Activity include innovative naval mine, mine counter measures (MCM), mine delivery methods, low observable mine neutralization technologies, and other technologies supporting expeditionary maneuver warfare overall. ***FY 2023 Plans:*** Magnetic & Acoustic Generation Next Unmanned Superconducting Sweep (MAGNUSS): - Continue progress on the MAGNUSS advanced development model with: fabrication of the superconducting magnet and cryogenic cooling system, sub-scale Seneca Lake testing of the acoustic generator, and integration of the magnetic and acoustic payloads with a single command and control system interface to the MCM-USV or any craft of opportunity. Low Observable No Collateral Damage - Neutralization (LONCD-N) System: - Complete final demonstrations and sea testing for this FNC, which experienced execution delays in FY22 and needed to be extended into FY23 to finish.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603673N / *Future Naval Capabilities Advanced Tech Dev*	**Project (Number/Name)** 3346 / *Future Naval Capabilities Adv Tech Dev*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Compact Encapsulated Mine (C-ENCAP): - Compete design and prototype development for modular payload subcomponent integration, to include energetics characterization. Compete optimized deployment for minefield planning capability. Cognitive Router (CR): - Initiate development of the Cognitive Router, which is a clandestine AI-enabled, autonomous, undersea, low-latency cross-domain network. - Initiate development of an Artificial Intelligence / Machine Learning (AI/ML)-based cognitive engine for autonomous in-situ decision making for network discovery, link parameters optimization, link path optimization and supporting Autonomous behaviors for cooperative Unmanned Undersea Vehicle (UUV) autonomy (data exfiltration, path planning, obstacle and threat avoidance, and networking). ***FY 2024 Base Plans:*** Cognitive Router (CR) - Continue the Cognitive Router FNC by continuing development of an Artificial Intelligence / Machine Learning (AI/ML based cognitive engine for autonomous in-situ decision making for network discovery, link parameters optimization, and link path optimization. Demonstrate an increment of autonomous behaviors for cooperative Unmanned Undersea Vehicle (UUV) autonomy with focus on objective arbitration and threat avoidance. - Continue development of data exfiltration, path planning, additional obstacle and threat avoidance, and networking. - Continue development of the Cognitive Router, which is a clandestine AI-enabled, autonomous, undersea, low-latency cross-domain network. Demonstrate Gen1 Cognitive Router AI control and link management in a water data collection event. Magnetic & Acoustic Generation Next Unmanned Superconducting Sweep (MAGNUSS) - Continue the MAGNUSS FNC by continuing the advanced development model with adjustments to the integrated magnetic/acoustic payload and any hardware/software mitigations necessary to operate craft in a magnetic field. Long-Range Over the Horizon (OTH) Communications at High Frequency (HF) Using a Nested, Electronically-Steered System (LOCH NESS) - Initiate HF multifunction architecture development for greater resiliency. Commence waveform design and beam forming/nulling with advanced algorithms and M&S validation.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Conduct design review with stakeholders and begin prototype development with pacing demonstration of capabilities. Next Generation High Frequency (NGHF) - Initiate award to industry to develop new signal processing algorithms for advanced long range radar waveforms for improved performance in complex, high-clutter environments. - Implement initial versions of radar signal processing algorithms in a modeling and simulation environment to characterize search, track, and identification capabilities against representative targets. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease from FY 2023 to FY 2024 is predominantly due to the completion in FY23 of two FNCs: Low Observable No Collateral Damage - Neutralization (LONCD-N) System and Compact-Encapsulated Mine (C-ENCAP).					
Title: Air Warfare (AW)	52.282	44.021	47.440	0.000	47.440
Articles:	-	-	-	-	-
Description: The Air Warfare R-2 Activity focuses on the advanced technology development of new capabilities that leverage the underlying applied research investments in Program Element (PE) 0602750N, Future Naval Capabilities (FNC) Applied Research. These advanced technology investments align to acquisition programs of record. Efforts include human machine interfaces for unmanned platforms and payloads that will assist with delegation of resources from one operator to another, airframe corrosion protection, and a Carrier Air Wing performance assessment tool that uses live, virtual, and constructive data to improve pilot and aircrew performance in near real-time. Different software efforts address unique and specific requirements. ***FY 2023 Plans:*** Incapacitation Prediction in Readiness Domains: an Integrated Computational Tool (I-PREDICT): - Continue integration of I-PREDICT human digital twin into digital engineering efforts for design of platforms (e.g., future vertical lift helicopter, F-18 and F-35) and equipment (e.g., ejection and crew seats, casualty litter support systems, helmets and body armor). - Continue development of a multi-physics computational model that combines a structural human body model with a dynamic musculoskeletal model that enables prediction of injury risk for both acute traumatic and chronic					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
repetitive operational exposures. The human digital twin will represent both males and females across a range of body sizes and postures. Fleet Adaptive Multilevel Measurement for Operations & Unit Systems (FAM2OUS): - Complete final testing of the FAM2OUS deliverables, which experienced execution delays in FY22, delaying its completion into FY23. Enhanced Lethality for Maritime Operations (ELMO): - Complete development of ELMO Counter Electronic Attack (CEA) builds 1 through 3. Complete laboratory and flight demonstration and analysis of Advanced CEA modes, builds 2 and 3. Landing Autonomous Navigation Technology for Enhanced Recovery to Navy Ships (LANTERNS): - Complete development of enhanced, Precise Ship-Relative Navigation (PS-RN) for reliable autonomous ship recovery of Unmanned Aerial Systems (UAS) in all weather, high deck motion environments with single vendor selected in FY22. Develop prototype to be used in the Joint Precision Approach & Landing System (JPALS) shore based test site with a surrogate aircraft refined by lessons learned from FY22 prototype laboratory bench test results. Execute shore based prototype test with surrogate aircraft and use results to prepare for CVN test as graduation exercise. Digital Expanded Ultra-High Frequency (UHF) Multiple Input, Multiple Output (MIMO) Optimized Radar (DEUMOR): - Initiate development of high-value signal processing, MIMO, Cognitive & Advanced Space-Time-Adaptive Processing (STAP) algorithms, and advanced antenna technologies for airborne surveillance platforms. - Initiate planning for flight-testing of prototype hardware & software. Prediction of Regional Operational Propagation of HF for EMSO Tactics (PROPHET): - Initiate the development of a high frequency communications planning tool to optimize maritime and shore-based distributed communications that accounts for variability and impact of ionospheric conditions. TEDSat:					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate development of a low size, weight, power, and cost electronic warfare payload with required on-board processing to provide a persistent capability not currently available to DoD users.					
FY 2024 Base Plans: Digital Expanded Ultra-High Frequency (UHF) Multiple Input, Multiple Output (MIMO) Optimized Radar (DEUMOR) - Continue the DEUMOR FNC by continuing development of high-value signal processing, MIMO, Cognitive and Advanced Space-Time-Adaptive Processing (STAP) algorithms, and advanced antenna technologies for airborne surveillance platforms. Perform initial flight testing of prototype hardware and software. Prediction of Regional Operational Propagation of HF for EMSO Tactics (PROPHET) - Continue the PROPHET FNC by continuing development based on the initial prototype and validation and verification studies completed in FY23. Refine the model logic and optimize the processing of ionospheric and high frequency propagation models to provide timely and accurate answers to the warfighter. TEDSat - Continue the TEDSat FNC by continuing development and beginning integration of a low size, weight, power and cost electronic warfare payload with required on-board processing to provide a persistent capability not currently available to DoD users. Incapacitation Prediction in Readiness Domains: an Integrated Computational Tool (I-PREDICT) - Complete the I-PREDICT FNC by transitioning integration of the I-PREDICT human digital twin into digital engineering efforts for design of platforms (e.g., future vertical lift helicopter, F-18 and F-35) and equipment (e.g., ejection and crew seats, casualty litter support systems, helmets and body armor). - Use the most up to date human digital models (male/female, large/small) to develop analyses accounting for variability between people for relevant long (e.g., exposure to high accelerations during vehicle motion) and short duration (e.g., high impacts resulting from blast effects) loading scenarios. - Develop end-user graphical interface tool. - Identify improvements that could be made on future I-PREDICT human body modeling versions. Advanced Autonomous Air-to-Air Refueling System (A4RS)					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate design activities, based on an Autonomous Aerial Refueling Modular Open System Architecture study, in support of a tanking MQ-25 with a podded aerial refueling store subsystem and a receiving MQ-25 with a computer vision-based navigation subsystem. Coordinated Advanced Distributed Radio Frequency (RF) Effects (CADRE) - Initiate development of novel technology capabilities to enable advanced distributed and coordinated airborne electronic attack techniques to defeat advanced threats. Modified Aircraft Gamma Inceptor Control Platform Recovery Optimization Program (MAGIC PROP) - Initiate development of baseline system architecture for a preliminary design of the prototype system for E-2D CVN recovery improvements. - Develop new model-based engineering and analytics capabilities required for flight control software simulation. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY 2023 to FY 2024 is predominantly due to the initiation in FY 2024 of three FNCs: Advanced Autonomous Air-to-Air Refueling System (A4RS), Coordinated Advanced Distributed Radio Frequency (RF) Effects (CADRE), and Modified Aircraft Gamma Inceptor Control Platform Recovery Optimization Program (MAGIC PROP).					
Title: Information Warfare (IW)	54.149	58.338	61.912	0.000	61.912
Articles:	-	-	-	-	-
Description: The Information Warfare R-2 Activity focuses on the advanced technology development of new capabilities that leverage the underlying applied research investments in Program Element (PE) 0602750N, Future Naval Capabilities (FNC) Applied Research. These advanced technology investments align to acquisition programs of record. Efforts provide Information Warfare capabilities across several disparate uses and environments. ***FY 2023 Plans:*** DECAF:					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue DECAF development based on underlying analysis done in FY22 to determine effectiveness of a new information warfare capability with test and demonstration events. Initiate transition process into a Program of Record. Additional details are classified. Data Framework for Maritime Operations Center of the Future (DF-MOTF): - Continue to transform Command and Control Decision Making by setting the foundation for artificial intelligence and machine learning big data analytics by consuming data from a single repository with multiple classifications. Continue to develop a multi-level security middleware software tier for Battle Management Aids, Tactical Decision Aids, and Planner applications. Continue to develop middleware containerization software novel solutions to more efficiently use central processing unit and memory resources than typical virtual machine or bare metal deployments that unnecessarily add operating system overhead. Multi-Beam Array for Cooperative Engagement (MACE): - Continue development of a new fully digital, multichannel, multi-beam, communications capability for the Navy's Cooperative Engagement Capability (CEC) to enable significantly more targets to be tracked and engaged. SLQ 32 Signal Identification Improvements (SI^2): - Continue SI2 development and evaluation of new technology to extend machine learning based electronic warfare classification systems in order to improve their capabilities to detect and more accurately characterize modern emitters that are not accurately captured with existing systems. Water-space Planning and Execution for Theater Undersea Warfare (WasP-ET): - Complete development of a new capability for Theater Undersea Warfare Commanders to plan and execute theater Anti-Submarine Warfare operations that eliminates all risk of fratricide and collision with known submerged bodies. Complete development of analytic tools to shorten Commander's decision cycle by automatically gathering, synthesizing, and analyzing data; making recommendations for platform and sensor movement and placement to either avoid or locate adversary submarines. Transitioned to Undersea Warfare-Decision Support System program of record. Long Endurance Airborne Platform (LEAP) Decoy: - Complete development of the LEAP prototype countermeasure vehicle and payload to demonstrate a low size, weight and power (SWaP), long endurance, unmanned, expendable EW decoy capability. Finalize integration efforts started in FY22 and conduct tethered and untethered flight tests of the integrated system. Measure					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
detailed antenna and payload performance in a chamber test to verify that the measured technical performance parameters meet system requirements. Data on the Move (DotM): - Initiate the Data on the Move FNC with three awards to commercial and government performers by conducting applied research to efficiently exchange information and integrate large amounts of data in real time among distributed commands. - Initiate technology development planning to establish a preliminary design for an initial operational prototype, conduct a stakeholder review of the system approach, and commence development of the initial prototype to support multiple warfighting domains. MAGICO: - Initiate development of an innovative orchestration application based on modeling and simulation for coordinated employment of information warfare capabilities. Identify technical performance parameters and system requirements through planning and stakeholder engagements to establish a preliminary design of a prototype that provides outputs to shorten decision cycles while meeting operational intent.					
FY 2024 Base Plans: Data Framework for Maritime Operations Center of the Future (DF-MOTF) - Continue the DF-MOTF FNC by developing and testing a multi-level security architecture that hosts different artificial intelligence and machine learning big data analytic applications. - Continue to develop and test SELinux policies to demonstrate the ability to run data analytics in multi-level security SELinux enforcing mode. - Continue to test and modify middleware containerization software novel solutions to use central processing unit and memory resources more efficiently than typical virtual machine or bare metal deployments that unnecessarily add operating system overhead. Multi-Beam Array for Cooperative Engagement (MACE) - Continue the MACE FNC by continuing integration and testing of completed critical subassemblies, leading up to a final integrated prototype planar-array system. - Initiate final TRL 6 test planning and demonstration of the MACE prototype planar-array system. Data on the Move (DotM)					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue the DotM FNC by developing methods for dynamic container deployment and routing at different security level contexts. - Continue to develop container solutions to integrate SE Linux policies with structured and unstructured objects, messaging, and security authorization. - Continue technology development and testing of different hardware and software design prototypes that will meet key performance parameters. MAGICO - Continue MAGICO FNC development through modeling and simulation, which are subject to identified technical performance parameters and system requirements. Begin interfacing with the Program of Record (POR) to initiate the transition process and optimize outputs to shorten decision cycles while meeting operational intent. Additional details are classified. DECAF - Complete DECAF FNC development and demonstrate the capability in support of transition to the Program of Record. Additional details are classified. SLQ 32 Signal Identification Improvements (SI^2) - Complete the SI^2 FNC, evaluating the technology against its exit criteria in a representative environment by testing machine learning based electronic warfare classification systems and their improvements in detection and characterization of modern emitters. Deliver final reports and technology for incorporation into Program of Record (POR) systems. 4 Leaf Clovers - Initiate data collections and analysis to identify system requirements, conduct stakeholder reviews of the system approach, and initiate development of capabilities. - Initiate simulation model development for distributed signal processing techniques. - Initiate cybersecurity analysis to discover and characterize system vulnerabilities. Federated Learning and Optimization for Wireless networks (FLOW) - Initiate system engineering, Modeling and Simulation (M&S) for wireless network optimization with enhanced mission performance. - Conduct design review with stakeholders and commence software prototype development.					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Measurement-Based Adaptive Response (M-BAR) - Initiate development of technologies needed to enable real-time adaptive electronic attack techniques to defeat modern anti-ship missile threats. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY 2023 to FY 2024 is predominantly due to the initiation in FY 2024 of three FNCS: 4 Leaf Clovers, Federated Learning and Optimization for Wireless networks (FLOW), and Measurement-Based Adaptive Response (M-BAR).					
Title: Surface Warfare (SW)	48.775	55.274	60.112	0.000	60.112
Articles:	-	-	-	-	-
Description: The Surface Warfare R-2 Activity focuses on the advanced technology development of new capabilities that leverage the underlying applied research investments in Program Element (PE) 0602750N, Future Naval Capabilities (FNC) Applied Research. These advanced technology investments align to acquisition programs of record. Efforts include technologies that will provide mission visualization, network analysis, and training for operators in denied and degraded environments. ***FY 2023 Plans:*** Empire - Continue development of Empire, finalizing and demonstrating a software build leveraging SPY-6 backend signal processing in a simulated environment, which will show distributed functions against simulated targets. - Initiate development of a software build for over-the-air testing with surrogate SPY-6 aperture hardware, which will demonstrate distributed capabilities against surrogate targets. Agnostic Signal Processing for Increased Radar Efficiency (ASPIRE): - Continue Iteration 1 hardware design, fabrication and demonstration of next generation SPY-6 digital receiver exciter (DREX) electronics with improved waveform generation capabilities. - Initiate Iteration 2 DREX hardware design, fabrication and demonstration. - Continue fabricating heterogeneous computing (HC) hardware and software design for next generation SPY-6 digital beamformer (DBF).					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate DBF subsystem integration and demonstration. - Continue to develop representative functions for HC-based SPY-6 signal processor and adaptive digital beamforming (ADBF) electronics. - Document new DREX and HC design performance and space, weight, and power-cooling (SWaP-C) benefits. Amon Hen: - Continue Amon Hen development, holding a critical design review of prototype radar illuminator and initiating fabrication of the illuminator aperture and supporting equipment. - Complete the initial build of government-owned backend scheduler software for the illuminator design. - Integrate multi-INT apertures and X-band surface search radar into a modular payload with data fusion processor, then conduct afloat testing on an available surface platform. Conventional Ammunition High Density Reactive Material Augmented Ordnance Systems (CHAOS): - Continue development of HDRM into Navy Conventional Ammunition. Further develop the Damaged State Modeling capability for representative targets engaged by Navy Conventional Ammunition. Include comparative analyses of baseline (kinetic energy only) and HDRM (kinetic & reactive energy) ammunition behavior in the Damaged State Models. Receive-Only Cooperative Radar (ROCR): - Complete development of this FNC, which experienced execution delays in FY22 and needed to be extended into FY23 to complete S&T development and deliver its technology to acquisition. - Complete over-the-air testing of ROCR software build on SPY-6 surrogate apertures. - Demonstrate receive-only functions and radar communication functions against surrogate targets. Hypersonic-threat Dynamic Reassessment and Adaptation (HyDRA): - Complete development of HyDRA, which experienced schedule delays in FY22 and needed to be extended into FY23 to complete S&T development and deliver its technology to the AEGIS Weapon System. Robust Combat Power Control (RCPC): - Complete this FNC with development and implementation of the control layers of the shipboard Tactical Energy Management as described in the 2019 Electric Ships Technology Development Roadmap. The FY23 focus will transition the developmental controls implementation from a notional ship reference system instantiated using a Power Hardware In-the-Loop (PHIL) onto an Integrated Power and Energy System Test Facility (ITF) under					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
development at NSWC PD in support of DDG(X) electrical machinery system testing. The goal would be to confirm FNC exit criteria were met using results of testing conducted. Multi-Spectral High Resolution Targeting Sensor (MUST HITS) - Initiate development of a Digital Read Out Integrated Circuit (DROIC) mated with a high-resolution infrared sensor for detection and tracking of difficult targets. Rough Patch III - Initiate development of a counter Intelligence, Surveillance and Reconnaissance (ISR) prototype.					
FY 2024 Base Plans: Amon Hen - Continue the Amon Hen FNC by initiating factory testing of the prototype radar illuminator. - Complete design and documentation for interfaces between the illuminator backend scheduler, illuminator hardware, payload assembly, and the test platform. - Complete at-sea testing with multi-INT apertures and other surveillance radars using a modular payload installed on an available surface platform. Multi-Spectral High Resolution Targeting Sensor (MUST HITS) - Continue the MUST HITS FNC by continue development of a Digital Read Out Integrated Circuit (DROIC) mated with a high-resolution infrared sensor for detection and tracking of difficult targets. Begin integration of the camera and processing suite. Rough Patch III - Continue the Rough Patch III FNC by establishing a functional prototype solution that can be evaluated in a simulated relevant environment designed to provide insight into software architectural and transition hardware solutions targeted at achieving Technology Readiness Level 6 by FY26. - Initiate prototype packaging efforts and continue getting operator/fleet input for the mission planning effort. Empire - Complete the Empire FNC by completing development of Empire software and algorithms. - Complete demonstration of distributed radar functions with real SPY-6 signal processing hardware in a simulated environment for comparison with over-the-air testing.					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Complete integrating the developmental software build of Empire algorithms into surrogate SPY-6 hardware and conduct over-the-air testing. Resolve potential software defects from developmental builds and summarize performance improvements delivered by the Empire algorithms. Agnostic Signal Processing for Increased Radar Efficiency (ASPIRE) - Complete the ASPIRE FNC by completing testing of the first iteration of a next generation SPY-6 digital receiver exciter (DREX). - Complete fabrication and testing of the second iteration DREX design for SPY-6. - Complete testing of a new Heterogeneous Computing (HC) Digital BeamFormer (DBF) and signal processing backend for the SPY-6. - Characterize the improved waveform generation flexibility provided by the new DREX design and demonstrate representative radar functions provided by the new HC and DBF architectures. Conventional Ammunition High Density Reactive Material Augmented Ordnance Systems (CHAOS) - Complete the CHAOS FNC by completing the integration of off-design, Damaged State, flight performance for representative target models engaged by Navy Conventional Ammunition. The ability of the Damaged State models to discriminate between classes of damage will be evaluated in comparative encounters using baseline (kinetic energy only) and High Density Reactive Material (HDRM) (kinetic and reactive energy) ammunition. Counter-Intelligence, Surveillance and Reconnaissance (C-ISR) - Initiate the integration of the components developed during the tech candidate effort, which will include the design, development, packaging and test for an initial prototype that meets the specified requirements that can be integrated into a designated host system. Crossbow - Initiate development of Decision Aids that enhance the synchronization of Maritime Dynamic Targeting resources for Course of Action options and the monitoring/re-planning and execution of kill-chain timelines for Anti-Surface Warfare Long Range Fires. Radar Advanced Signal Processing (RASP) - Initiate modeling and simulation to characterize long range performance of waveforms transmitted from and received by surface platforms. - Initiate efforts to characterize HF antennas through simulation and field testing.					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Implement initial algorithms for improving HF signal reception in a simulated environment. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY 2023 to FY 2024 is predominantly due to the initiation in FY 2024 of three FNCs: Counter-Intelligence, Surveillance and Reconnaissance (C-ISR), Crossbow, and Radar Advanced Signal Processing (RASP).					
Title: Undersea Warfare (UW)	55.432	63.178	64.229	0.000	64.229
Articles:	-	-	-	-	-
Description: The Undersea Warfare R-2 Activity focuses on the advanced technology development of new capabilities that leverage the underlying applied research investments in Program Element (PE) 0602750N, Future Naval Capabilities (FNC) Applied Research. These advanced technology investments align to acquisition programs of record. Efforts include improvements to a broad range of undersea warfare capabilities, including undersea weapons, submarine acoustic sensing and signal processing systems, communications, electro-optics systems, signature management, training, and decision aids.					
FY 2023 Plans: VIRGINIA Improved Propulsion Bearing (VIPB): - Continue bearing development. Complete bearing detailed design and critical design review. Complete manufacturing and testing of bearing subcomponents. Continue preparation of manufacturing drawings and purchase of long-lead materials. Conduct test planning for land-based test of the full-scale bearing concept (test scheduled 1QFY26). Multi-Material Propeller Prototype (M2P2) - Continue material coupon and building block testing. - Initiate and complete full scale 688 prototype mechanical concept design. - Initiate full scale 688 prototype mechanical detailed design. - Conduct 1/10th scale testing of full scale 688 prototype hydrodynamic design. - Conduct preliminary design review for full scale 688 prototype design. MK-48 Acoustic Modifications (M&M)					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603673N / *Future Naval Capabilities Advanced Tech Dev*	**Project (Number/Name)** 3346 / *Future Naval Capabilities Adv Tech Dev*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue development of acoustic modification component designs. Down-select components to prototype manufacture. Validate improvements via physics based models and experimental in water measurements. Stern Area System (SAS): - Complete this FNC with analysis of at-sea trial data, and update systems models and software for second at-sea trial. Prepare and execute full function SAS second at-sea trial events to verify system performance. Conduct and document analysis of full function SAS performance. Compact Rapid Attack Weapon (CRAW) Upgrade: - Complete this FNC with a final in-water demonstration of a CRAW launch from a submarine. Complete modifications to submarine fire control that are needed for the CRAW launch demonstration. Complete demonstration of CRAW Anti-Submarine Warfare (ASW) capability. Submarine Tethered Expendable Buoy: - Complete this FNC by completing development of the buoy prototype and conducting final testing of the sensor payload, fiber deployment, and launcher under operational conditions. Own Ship Acoustic Monitoring (OSAM) - Initiate efforts to execute an FY23 at-sea demo to collect data for software development. - Begin development of prototype vulnerability decision aid and monitoring system. Untethered Goat (U GOAT) - Initiate development of a multifunction Intelligence, Surveillance and Reconnaissance (ISR) payload for Unmanned Underwater Vehicles to support distributed maritime operations.					
FY 2024 Base Plans: VIRGINIA Improved Propulsion Bearing (VIPB) - Continue the VIPB FNC by continuing full scale VIRGINIA Class bearing development, completing preparation of manufacturing drawings and the purchase of bearing long lead materials, conducting a bearing manufacturing readiness review, initiating bearing fabrication, continuing land-based test planning, conducting a land-based test readiness review, conducting a Shaft Line Test Capability (SLTC) critical design review, and initiating SLTC development.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603673N / *Future Naval Capabilities Advanced Tech Dev*	**Project (Number/Name)** 3346 / *Future Naval Capabilities Adv Tech Dev*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Multi-Material Propeller Prototype (M2P2) - Continue the M2P2 FNC by establishing the qualification approach for multi-material structural design (full scale 3-blade/hub prototype), including mechanical requirements for the Design Validation Rotor (DVR). - Conduct Resistance & Powering (R&P) testing in the NSWC tow tank. - Complete the designs for large (1/3) scale rotors to test on the Large-Scale Vehicle (LSV) model at the Acoustic Research Detachment (ARD). Own Ship Acoustic Monitoring (OSAM) - Continue the OSAM FNC by conducting an FY24 at-sea demo to collect data for software development and the confirmation of hardware connectivity to ship systems (the FY23 demo was deferred due to ship availability), continuing development of a prototype vulnerability decision aid and monitoring system, continuing software development and the assessment of software performance using FY24 at-sea demo data, and initiating efforts to execute a FY25 at-sea demo to test an initial vulnerability decision aid and a monitoring system prototype hardware/software suite. Untethered Goat (U-GOAT) - Continue the U-GOAT FNC by continuing development of a multifunction Intelligence, Surveillance, and Reconnaissance (ISR) payload for Unmanned Underwater Vehicles (UUVs) to support distributed maritime operations. - Continue hardware/software development, fabrication, integration, and demonstration efforts. CRAW Upgrade - Complete this FNC by finishing the final demonstration. This demonstration was originally scheduled for FY23, but a delay in submarine availability required it to be rescheduled into FY24. MK-48 Acoustic Modifications (M&M) - Complete the M&M FNC by delivering the new component prototype(s) design to NAVSEA PMS404 and providing inputs to NAVSEA's Engineering Change Proposal paperwork. Gravity-Aided Inertial Navigation system (GAINS) - Initiate system software and software in the loop simulation for gravity algorithms integrated in the navigation subsystem. - Initiate field testing of existing gravimeter system on test ship.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603673N / *Future Naval Capabilities Advanced Tech Dev*	**Project (Number/Name)** 3346 / *Future Naval Capabilities Adv Tech Dev*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate Concept of Operation and implementation studies for new mission profiles. Physical and Networking Layer Prototype (PNLP) - Initiate PNLP FNC with award selection for a multidisciplinary team of industry and government performers to integrate algorithms, hardware, and system test frames for in-water data collection - Initiate hardware and software bench testing in tank environments - Conduct comparative algorithm characterization in a virtual live reconstruction environment, leveraged from the ASTRAnet 6.2 program ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY 2023 to FY 2024 is predominantly due to the initiation in FY 2024 of two FNCs: Gravity-Aided Inertial Navigation system (GAINS) and Physical and Networking Layer Prototype (PNLP).					
Accomplishments/Planned Programs Subtotals	248.411	250.993	264.700	0.000	264.700

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603673N / *Future Naval Capabilities Advanced Tech Dev*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	27.030	18.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	45.030
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other projects

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Congressional Add: Advanced Energetics Research	2.896	5.000
FY 2022 Accomplishments: Conduct advanced energetics technology development		
FY 2023 Plans: Conduct advanced energetics technology development		
Congressional Add: Development of Submersible Air Revitalization	0.000	8.000
FY 2022 Accomplishments: N/A		
FY 2023 Plans: Conduct Development of Submersible Air Revitalization research		
Congressional Add: Advanced lidar sensor and data processing	1.931	0.000
FY 2022 Accomplishments: Conduct advanced lidar sensor and data processing advanced technology development		
FY 2023 Plans: N/A		
Congressional Add: Electronic maneuver warfare unmanned sensors	13.515	0.000
FY 2022 Accomplishments: Conduct electronic maneuver warfare unmanned sensors advanced technology development		
FY 2023 Plans: N/A		
Congressional Add: Advance machine learning and artificial intelligence	8.688	0.000
FY 2022 Accomplishments: Conduct advance machine learning and artificial intelligence advanced technology development		
FY 2023 Plans: N/A		
Congressional Add: Advanced carbon nanotube conductors for naval power systems	0.000	5.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603673N / *Future Naval Capabilities Advanced Tech Dev*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
FY 2022 Accomplishments: N/A		
FY 2023 Plans: Conduct research supporting Advanced carbon nanotube conductors for naval power systems		
Congressional Adds Subtotals	27.030	18.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603680N *I Manufacturing Technology Program*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	74.826	61.704	61.843	-	61.843	63.115	64.403	65.691	67.005	Continuing	Continuing
1050: *Manufacturing Tech*	0.000	55.519	60.704	61.843	-	61.843	63.115	64.403	65.691	67.005	Continuing	Continuing
9999: *Congressional Adds*	0.000	19.307	1.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	20.307

A. Mission Description and Budget Item Justification

The Office of Naval Research's (ONR) mission is to foster scientific research for the advancement of naval power. This work does not stop at the laboratory. Delivery of breakthrough capability often requires new technologies in manufacturing and supply chains of national security. The Manufacturing Technology (ManTech) Program is intended to improve the productivity and responsiveness of the U.S. defense industrial base by funding the development, optimization, and transition of enabling manufacturing technologies to key naval suppliers. In general, investments transition emerging Science and Technology (S&T) results to acquisition programs; improve industrial capabilities in production, maintenance, repair and industrial base responsiveness; and advance manufacturing technology to reduce cost, improve performance, and responsiveness. Currently, the ManTech Program is focused on affordability improvements for specific key acquisition platforms as defined in the Navy ManTech Investment Strategy. Key platforms currently targeted include: VIRGINIA Class Submarine (VCS)/COLUMBIA Class submarine (CLB); DDG 51 Class destroyer; CVN 78 Class carrier; FFG 62 Class frigate, and F-35 Lightning II aircraft. Office of Naval Research (ONR) ManTech helps these Navy programs achieve their respective affordability goals by transitioning developed manufacturing technology which, when implemented, results in needed cost reduction or cost avoidance. In addition to addressing affordability for key naval platforms, ManTech also addresses manufacturing technology to aid in capability acceleration to the fleet.

Today's Sailors and Marines are enabled by naval Science and Technology (S&T). Since 1946, the Office of Naval Research (ONR) has fostered scientific research related to the maintenance of maritime superiority and national defense. ONR manages the Department of the Navy's (DON) portfolio of naval Basic and Applied research, and Advanced Technology Development investments to ensure naval forces can effectively deter conflict, but when called upon, fight, win and come home safe. Current investments hedge against uncertainty, providing solutions to commanders today, and options for the future. The Naval S&T budget supports higher guidance defined by the National Defense Strategy, and responds to requirements identified by the Secretary of the Navy through research priorities set by the Chief of Naval Research, coordinated across the Naval Research Enterprise (NRE), and outlined in the Naval R&D Framework.

This Program Element (PE) funds Advanced Technology Development (ATD) that includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment. Efforts in this PE generally have Technology Readiness Levels TRL) of 4 (component and/or breadboard validation in laboratory environment.), 5 (component and/or breadboard validation in relevant environment.), or 6 (system/subsystem model or prototype demonstration in a relevant environment).

Due to the number of efforts in this Program Element (PE), the programs described herein are representative of the work included in this PE.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603680N *I Manufacturing Technology Program*

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	77.236	60.704	61.843	-	61.843
Current President's Budget	74.826	61.704	61.843	-	61.843
Total Adjustments	-2.410	1.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	1.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.410	0.000			
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 9999: *Congressional Adds*		
Congressional Add: *Energetics processing*	4.827	0.000
Congressional Add: *Chemical reactor and crystallizer technology*	14.480	0.000
Congressional Add: *Machine learning for in-water hull inspection*	0.000	1.000
Congressional Add Subtotals for Project: 9999	19.307	1.000
Congressional Add Totals for all Projects	19.307	1.000

Change Summary Explanation

Funding: no significant change

Technical: Not applicable

Schedule: Not applicable

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603680N / *Manufacturing Technology Program*	Project (Number/Name) 1050 / *Manufacturing Tech*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
1050: *Manufacturing Tech*	0.000	55.519	60.704	61.843	-	61.843	63.115	64.403	65.691	67.005	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Office of Naval Research's (ONR) mission is to foster scientific research for the advancement of naval power. This work does not stop at the laboratory. Delivery of breakthrough capability often requires new technologies in manufacturing and supply chains of national security. The Manufacturing Technology (ManTech) Program is intended to improve the productivity and responsiveness of the U.S. defense industrial base by funding the development, optimization, and transition of enabling manufacturing technologies to key naval suppliers. In general, investments transition emerging Science and Technology (S&T) results to acquisition programs; improve industrial capabilities in production, maintenance, repair and industrial base responsiveness; and advance manufacturing technology to reduce cost, improve performance, and responsiveness. Currently, the ManTech Program is focused on affordability improvements for specific key acquisition platforms as defined in the Navy ManTech Investment Strategy. Key platforms currently targeted include: VIRGINIA Class submarine (VCS)/COLUMBIA Class submarine (CLB), DDG 51 Class destroyer, CVN 78 Class carrier, FFG 62 Class frigate, and F-35 Lightning II aircraft. Through its affordability efforts, ManTech helps these Navy programs achieve their respective affordability goals by transitioning developed manufacturing technology which, when implemented, results in needed cost reduction or cost avoidance. In addition to addressing affordability for key naval platforms, ManTech also addresses manufacturing technology to aid in capability acceleration to the fleet.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Composites Processing and Fabrication	7.694	7.877	8.000	0.000	8.000
Articles:	-	-	-	-	-
Description: The primary technical goal of the Composites Processing and Fabrication activity is improving weapon systems affordability, enhancing weapon system effectiveness and improving reliability/warfighter readiness through the increased utilization of composite materials and structures. This is being achieved through the development, maturation, and transition of affordable and robust manufacturing, assembly, and repair processes that fully exploit the benefits of composite materials. Concentration is on affordability for the following platforms: VIRGINIA Class submarine (VCS)/COLUMBIA Class submarine (CLB), DDG 51 Class destroyer, CVN 78 Class carrier, FFG 62 Class frigate, and F-35 Lightning II aircraft. In addition to addressing affordability for key naval platforms, ManTech also addresses manufacturing technology to aid in capability acceleration to the fleet. Composites processing and fabrication technology areas include but are not limited to fiber-reinforced polymeric (organic) resin composites; ceramic-matrix, metal-matrix, and carbon-carbon composites; composite internal stiffening core materials such as foam, ceramic, balsa wood, polymeric or metallic honeycomb, or other					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603680N / *Manufacturing Technology Program*	**Project (Number/Name)** 1050 / *Manufacturing Tech*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
materials; composite external stiffening concepts such as hat and blade stiffeners and methodologies to manufacture them; materials for radomes and other electrical applications; composite manufacturing and similar processes and related equipment technology; and adhesives, adhesive bonding, and related technologies (i.e., surface preparation techniques), as well as mechanical fastening, and other methodologies for joining composites to other composites or metals, and similar assembly technologies. ***FY 2023 Plans:*** - Continue to develop and transition composites manufacturing technology improvements that result in cost reduction for key affordability platforms: VCS/CLB, DDG 51, CVN 78, FFG 62 (formerly FFG(X)), and F-35. - Continue to develop and transition composites manufacturing technology improvements that accelerate capability to the fleet. Areas of FY23 concentration include (1) SWARM/unmanned/autonomous vehicle production, (2) advanced submarine fabrication technology, (3) fleet sustainment technology (ships/aircraft), (4) hypersonics production, and (5) other ONR manufacturing acceleration efforts. ***FY 2024 Base Plans:*** - Continue to develop and transition composites manufacturing technology improvements that result in cost reduction for key affordability platforms: VCS/CLB, DDG 51, CVN 78, FFG 62 (formerly FFG(X)) and F-35. - Continue to develop and transition composites manufacturing technology improvements that accelerate capability to the fleet based on DoD Critical Technology areas. Areas of concentration include (1) SWARM/ unmanned/autonomous vehicle production, (2) advanced submarine fabrication technology, (3) fleet sustainment technology (ships/aircraft), (4) hypersonics production, and (5) other ONR manufacturing acceleration efforts. - Initiate/complete efforts for composites manufacturing technology improvements for CH-53K ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024					
Title: Electronics Processing and Fabrication	11.541	11.816	12.000	0.000	12.000
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603680N / *Manufacturing Technology Program*	**Project (Number/Name)** 1050 / *Manufacturing Tech*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Description: The primary technical goal of the Electronics Processing and Fabrication activity is improving electronic weapon systems affordability by developing and transitioning affordable, robust manufacturing processes and capabilities for electronics critical to defense applications over their full life-cycle. Efforts create new and improved electronics/electro-optics manufacturing processes for transition to the production floor. Emphasis is on affordability for the following platforms: VIRGINIA Class submarine (VCS)/COLUMBIA Class submarine (CLB), DDG 51 Class destroyer, CVN 78 Class carrier, FFG 62 Class frigate, and F-35 Lightning II aircraft. In addition to addressing affordability for key naval platforms, ManTech also addresses manufacturing technology to aid in capability acceleration to the fleet. Electronics processing and fabrication technology areas include but are not limited to Electronics manufacturing technology (materials, devices, circuits, modules, subsystems); semiconductor devices/vacuum electronics/ passive components; compound semiconductors/wide bandgap semiconductors; low-cost, high-throughput manufacturing and assembly techniques; nanoelectronics; electronics packaging technologies (including tamper proof and non-hermetic approaches); optics manufacturing technology (materials devices, circuits, modules, subsystems); optical interconnects; fiber optics and photonics; technologies for electronics and electro-optics testing and evaluation; optical imaging for manufacturing operations; and High Energy Laser (HEL)/directed energy weapons. ***FY 2023 Plans:*** - Continue to develop and transition electronics and electro-optics manufacturing technology improvements that result in cost reduction for key affordability platforms: VCS/CLB, DDG 51, CVN 78, FFG 62 (formerly FFG(X)), and F-35. - Continue to develop and transition electronics and electro-optics manufacturing technology improvements that accelerate capability to the fleet. Areas of concentration include (1) SWARM/unmanned/autonomous vehicle production, (2) High Energy Laser (HEL) weapon systems/directed energy, (3) fleet sustainment technology (ships/aircraft), and (4) other ONR manufacturing acceleration efforts. ***FY 2024 Base Plans:*** - Continue to develop and transition electronics and electro-optics manufacturing technology improvements that result in cost reduction for key affordability platforms: VCS/CLB, DDG 51, CVN 78, FFG 62 (formerly FFG(X)) and F-35.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603680N / *Manufacturing Technology Program*	**Project (Number/Name)** 1050 / *Manufacturing Tech*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue to develop and transition electronics and electro-optics manufacturing technology improvements that accelerate capability to the fleet based on DoD Critical Technology areas. Areas of concentration include (1) SWARM/unmanned/autonomous vehicle production, (2) High Energy Laser (HEL) weapon systems/directed energy, (3) fleet sustainment technology (ships/aircraft), and (4) other ONR manufacturing acceleration efforts. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024					
Title: Metals Processing and Fabrication	11.541	11.816	12.000	0.000	12.000
Articles:	-	-	-	-	-
Description: The primary technical goal of the Metals Processing and Fabrication activity is to develop affordable, robust manufacturing and repair processes/capabilities for metals and special materials critical to Navy weapon system applications. Emphasis is on affordability for the following platforms: VIRGINIA Class submarine (VCS)/COLUMBIA Class submarine (CLB), DDG 51 Class destroyer, CVN 78 Class carrier, FFG 62 Class frigate, and F-35 Lightning II aircraft. In addition to addressing affordability for key naval platforms, ManTech also addresses manufacturing technology to aid in capability acceleration to the fleet. This activity also includes the development, optimization, and transition of repair technology for the repair, overhaul, and sustainment of key navy systems. Metals processing and fabrication technology areas include but are not limited to: processing methods; metals additive manufacturing; metallic materials-based systems; casting; joining techniques; machining; surface and heat treatments; coating/cladding; assembly; metal/non-metals interfaces issues; and inspection and compliance verification. ***FY 2023 Plans:*** - Continue to develop and transition metals manufacturing technology improvements that result in cost reduction for key affordability platforms: VCS/CLB, DDG 51, CVN 78, FFG 62 (formerly FFG(X)), and F-35. - Continue to develop and transition metals manufacturing technology improvements that accelerate capability to the fleet. Areas of concentration include (1) SWARM/unmanned/autonomous vehicle production, (2) advanced submarine fabrication technology, (3) fleet sustainment technology (ships/aircraft), and (4) other ONR manufacturing acceleration efforts.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603680N / *Manufacturing Technology Program*	**Project (Number/Name)** 1050 / *Manufacturing Tech*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue Repair Technology (RepTech) Thrust to develop, optimize, and transition repair technology for key naval platforms at depots and logistics centers. ***FY 2024 Base Plans:*** - Continue to develop and transition metals manufacturing technology improvements that result in cost reduction for key affordability platforms: VCS/CLB, DDG 51, CVN 78, FFG 62 (formerly FFG(X)) and F-35. - Continue to develop and transition metals manufacturing technology improvements that accelerate capability to the fleet based on DoD Critical Technology areas. Areas of concentration include (1) SWARM/unmanned/ autonomous vehicle production, (2) advanced submarine fabrication technology, (3) fleet sustainment technology (ships/aircraft), and (4) other ONR manufacturing acceleration efforts. - Continue Repair Technology (RepTech) Thrust to develop, optimize, and transition repair technology for key naval platforms at depots and logistics centers. - Initiate/Complete efforts for metals manufacturing technology improvements for CH-53K ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024					
Title: Manufacturing Enterprise/Other	24.743	29.195	29.843	0.000	29.843
Articles:	-	-	-	-	-
Description: The Manufacturing Enterprise/Other activity includes: (1) efforts targeted towards improving, in general, the manufacturing enterprise for the production of key naval platforms (both shipbuilding and aircraft); (2) energetics efforts; (3) naval research enterprise and laboratory support for key projects; and (4) technical program support. Manufacturing Enterprise addresses the development, optimization, and transition of manufacturing enterprise technology to key naval platform suppliers. Emphasis is on affordability for the following shipbuilding platforms: VIRGINIA Class submarine (VCS)/COLUMBIA Class submarine (CLB), DDG 51 Class destroyer, CVN 78 Class carrier, FFG 62 Class frigate, and F-35 Lightening II aircraft. In addition to addressing affordability for key naval platforms, ManTech also addresses manufacturing technology to aid in capability acceleration to the fleet.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603680N / *Manufacturing Technology Program*	**Project (Number/Name)** 1050 / *Manufacturing Tech*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Manufacturing enterprise technology areas include, but are not limited to design for easier production/design for manufacturability; development of build/assembly strategies; modeling and simulation technologies; model-based tools and approaches to optimize ease of production; intelligent manufacturing planning and factory execution; elimination of inefficiencies in design optimization, material usage, labor utilization, work flow, etc.; supply chain procedures and improvements (such as network centric manufacturing capabilities to facilitate resilient and adaptable supply chains); development of more efficient structural fabrication product lines; streamlining of outfitting operations; prediction and reduction of welding distortion; advanced automation and robotics for manufacturing; advanced data analytics, artificial intelligence and machine learning for production environments; and inspection technologies such as digital radiography and ultrasonic technologies. Energetics efforts concentrate on developing energetics solutions to ensure the availability of safe, affordable, and quality energetics products largely in support of Program Executive Office (PEO) Integrated Warfare Systems (IWS). ***FY 2023 Plans:*** - Continue, at an increased level, to develop and transition advanced manufacturing enterprise technology improvements that result in cost reduction for key affordability platforms: VCS/CLB, DDG 51, CVN 78, FFG 62 (formerly FFG(X)), and F-35. - Continue to develop and transition advanced manufacturing enterprise technology improvements that accelerate capability to the fleet. Areas of concentration include (1) SWARM/unmanned/autonomous vehicle production, and (2) fleet sustainment technology (ships/aircraft). - Continue to develop and transition energetics manufacturing technology improvements that result in cost reduction for Naval Systems. - Continue to develop and transition energetics manufacturing technology improvements that accelerate capability to the fleet. An area of concentration includes energetics production improvement. ***FY 2024 Base Plans:*** - Continue to develop and transition advanced manufacturing enterprise technology improvements that result in cost reduction for key affordability platforms: VCS/CLB, DDG 51, CVN 78, FFG 62 (formerly FFG(X)) and F-35.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603680N / *Manufacturing Technology Program*	**Project (Number/Name)** 1050 / *Manufacturing Tech*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue to develop and transition advanced manufacturing enterprise technology improvements that accelerate capability to the fleet. Areas of concentration include (1) SWARM/unmanned/autonomous vehicle production, and (2) fleet sustainment technology (ships/aircraft) and (3) other ONR manufacturing acceleration efforts. - Continue to develop and transition energetics manufacturing technology improvements that result in cost reduction for Naval Systems. - Continue to develop and transition energetics manufacturing technology improvements that accelerate capability to the fleet. An area of concentration for capability acceleration is energetics production improvement. - Initiate/complete efforts for advanced manufacturing enterprise technology improvements CH-53K ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024					
Accomplishments/Planned Programs Subtotals	55.519	60.704	61.843	0.000	61.843

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Efforts are focused on affordability improvements (both acquisition and life-cycle) for specific key acquisition platforms as defined in the Navy ManTech Investment Strategy. Currently, the majority of Navy ManTech efforts are focused on affordability improvements for: VIRGINIA Class submarine (VCS)/COLUMBIA Class submarine (CLB), DDG 51 Class destroyer, CVN 78 Class carrier, FFG 62 Class frigate, and F-35 Lightning II aircraft. A smaller portion of ManTech's budget (approximately 20%) is directed towards capability acceleration -- manufacturing acceleration of key technologies to enable transition of these technologies to the fleet more quickly.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603680N / *Manufacturing Technology Program*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	19.307	1.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	20.307
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Congressional Add: Energetics processing ***FY 2022 Accomplishments:*** Conduct energetics processing advanced technology development ***FY 2023 Plans:*** N/A	4.827	0.000
Congressional Add: Chemical reactor and crystallizer technology ***FY 2022 Accomplishments:*** Conduct chemical reactor and crystallizer technology advanced technology development ***FY 2023 Plans:*** N/A	14.480	0.000
Congressional Add: Machine learning for in-water hull inspection ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct machine learning for in-water hull inspection research.	0.000	1.000
Congressional Adds Subtotals	19.307	1.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603729N *I Warfighter Protection Adv Tech*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	39.057	46.999	5.100	-	5.100	5.105	5.209	5.314	5.397	Continuing	Continuing
2914: *Warfighter Protection Adv Tech*	0.000	4.787	4.999	5.100	-	5.100	5.105	5.209	5.314	5.397	Continuing	Continuing
9999: *Congressional Adds*	0.000	34.270	42.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	76.270

A. Mission Description and Budget Item Justification

This PE supports the advanced development and demonstration of technologies to improve warfighter performance, safety and survivability. Naval investment in these areas is essential in order to improve the ability to enhance, maintain, and sustain Warfighter effectiveness.

Today's Sailors and Marines are enabled by Naval Science and Technology (S&T). Since 1946, the Office of Naval Research (ONR) has fostered scientific research related to the maintenance of maritime superiority and national defense. ONR manages the Department of the Navy's (DON) portfolio of Naval basic and applied research, and advanced technology development investments to ensure Naval forces can effectively deter conflict, but when called upon, fight, win and come home safe. Current investments hedge against uncertainty, providing solutions to commanders today, and options for the future. The Naval S&T budget supports higher guidance defined by the National Defense Strategy, and responds to requirements identified by the Secretary of the Navy through research priorities set by the Chief of Naval Research, coordinated across the Naval Research Enterprise (NRE), and outlined in the Naval R&D Framework.

This Program Element (PE) funds Advanced Technology Development (ATD) that includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment. Efforts in this PE generally have Technology Readiness Levels (TRL) of 4 (component and/or breadboard validation in laboratory environment.), 5 (component and/or breadboard validation in relevant environment.), or 6 (system/subsystem model or prototype demonstration in a relevant environment).

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	40.435	4.999	5.100	-	5.100
Current President's Budget	39.057	46.999	5.100	-	5.100
Total Adjustments	-1.378	42.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	42.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.378	0.000			
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603729N *I Warfighter Protection Adv Tech*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 9999: *Congressional Adds*		
Congressional Add: *Bone Marrow Registry Program*	25.582	32.000
Congressional Add: *Warfighter resilience and readiness*	3.861	0.000
Congressional Add: *Dynamic modular manufacturing*	4.827	0.000
Congressional Add: *Laser protective eyewear research*	0.000	5.000
Congressional Add: *Closed-loop sedation and anesthesia system*	0.000	5.000
Congressional Add Subtotals for Project: 9999	34.270	42.000
Congressional Add Totals for all Projects	34.270	42.000

Change Summary Explanation

Funding: No significant change.

Technical: Not applicable.

Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603729N / *Warfighter Protection Adv Tech*	Project (Number/Name) 2914 / *Warfighter Protection Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
2914: *Warfighter Protection Adv Tech*	0.000	4.787	4.999	5.100	-	5.100	5.105	5.209	5.314	5.397	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Program Element supports the advanced development and demonstration of technologies to improve warfighter performance, safety and survivability. Naval investment in these areas is essential in order to improve the ability to enhance, maintain, and sustain Warfighter effectiveness.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Naval Noise-Induced Hearing Loss (NIHL) and Warfighter Performance	4.787	4.999	5.100	0.000	5.100
Articles:	-	-	-	-	-
Description: Improve technologies aimed at enhancing warfighter effectiveness and efficiency, including efforts in: biocentric technologies, medical concepts, intelligent and autonomous systems, decision sciences, information warfare and future conflict, manpower, personnel, training, and education, human performance. These efforts will mature technologies in order to better ensure transition into acquisition and procurement programs.					
FY 2023 Plans: Shaping the Maritime Acoustic Environment (This thrust was previously part of the Auditory Neuroscience and Performance FY22 plan. The name was changed to more accurately describe the research.) Continue: - Advanced development and assessment of mitigation strategies to protect Warfighters with enhanced communication systems (communications interfaces with advanced functionalities, speech to text capabilities) and situational awareness (auditory cuing and alerting for spatial audio, auditory sensor network for decision-aiding), for mission effectiveness. Complete: - Advanced development and assessment of mitigation strategies to protect Warfighters with: (i.) an improved communication systems for divers to dampen equipment noise and minimize hearing loss, (ii.) an impulse noise calculator for assessing exposure from small caliber firearms, and (iii.) a hearing protection device training protocol to mitigate hazardous noise exposures in weapons training environments.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603729N / *Warfighter Protection Adv Tech*	**Project (Number/Name)** 2914 / *Warfighter Protection Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Initiate: - Development of acoustic camouflage and decoy technologies to identify and exploit acoustic signatures of Naval platforms and systems. Warfighter Performance and Protection: Continue: - Advanced technology development and assessment of materials and protective gear to reduce exposures of Warfighters to directed energy systems. - Development of advanced physiological and cognitive monitoring technologies that incorporate real-time sensing and observation of individual and team responses to environmental and operational stressors (e.g., hyperbaric, hypobaric, cold, hot, humid). - Advanced development of artificial intelligence-driven physiological and biological monitoring devices that will provide real-time prediction of performance to command and leadership in training and operational scenarios. Complete: N/A Initiate: - Enhance and fuse multiple streams of data from aerial, ground, and physiological on-body sensor sources for asymmetric advantage in operational environments.					
FY 2024 Base Plans: Shaping the Maritime Auditory/Acoustic Environment Continue: - Advanced technology development and assessment of enhanced communication systems (communications interfaces with advanced functionalities) and situational awareness (auditory cuing and alerting for spatial audio, auditory sensor network for decision-aiding) for mission effectiveness and mitigate noise to protect Warfighters. - Advanced development and assessment of mitigation strategies to protect Warfighters with: (i.) an improved communication systems for divers to dampen equipment noise and minimize hearing loss, (ii.) an impulse noise calculator for assessing exposure from small caliber firearms, and (iii.) a hearing protection device training protocol to mitigate hazardous noise exposures in weapons training environments. - Development of acoustic camouflage and decoy technologies to identify and exploit acoustic signatures of Naval platforms and systems. Warfighter Performance and Protection					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603729N / *Warfighter Protection Adv Tech*	**Project (Number/Name)** 2914 / *Warfighter Protection Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Continue: - Advanced technology development and assessment of materials and protective gear to reduce exposures of Warfighters to directed energy systems. - Development of advanced physiological/cognitive monitoring technologies that incorporate real-time sensing, observation, and location of individual and team responses to environmental and operational stressors (e.g., smoke, cold, heat, immersion). - Advanced development of artificial intelligence-driven physiological and environmental monitoring devices that will provide real-time prediction of personnel status to command and leadership in operational scenarios. Complete: - Development of a prototype platform that will enhance and fuse multiple streams of data from environmental and physiological on-body sensor sources for personnel tracking and health status monitoring in emergency scenarios. Initiate: - Advanced development of countermeasures against extreme environmental exposures (i.e. extreme heat, cold, smoke) to enhance warfighter survivability in operational or emergency scenarios. - Advanced technology development efforts in areas including: expeditionary medicine, diver performance, and information warfare. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY2024.					
Accomplishments/Planned Programs Subtotals	4.787	4.999	5.100	0.000	5.100

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603729N / *Warfighter Protection Adv Tech*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	34.270	42.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	76.270
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Congressional Add: Bone Marrow Registry Program	25.582	32.000
FY 2022 Accomplishments: Develop the scientific, medical and technological advances required to support military contingencies caused by injury to the blood-forming system from toxic substances. Continue to develop, test and mature the ability to address contingency events wherein civilian or military personnel are exposed to marrow toxic agents, primarily ionizing radiation or chemical weapons containing nitrogen mustard in four focus areas: Contingency Preparedness, Development of Science and Technology for Rapid Identification of Matched Donors, Immunogenetic Studies in Transplantation and Clinical Research in Transplantation. Develop an ecosystem around concurrent physiologic and environmental monitoring wearable devices to include new environmental sensors.		
FY 2023 Plans: The first objective is to develop the scientific, medical and technological advances required to support military contingencies caused by injury to the blood-forming system from toxic substances. The aim is to provide HLA matched hematopoietic progenitor cells for casualties from donors during a contingency response and support for hematopoietic progenitor cell donors from the Department of Defense. The second objective is to develop, test, and mature the ability of the NMDP Coordinating Center and NMDP contracted network sites (network sites to address contingency events wherein civilian or military personnel are exposed to marrow toxic agents, primarily ionizing radiation or chemical weapons containing nitrogen mustard gas) for contingency preparedness activities, and to integrate NMDP's role with federal, state and local agencies. Additional work includes immunobiologic and clinical research activities that promote studies to advance the science and technology of HCT transplantation to improve outcome and quality of life for military patients. An additional aim is to develop technology for rapid identification of donors to provide the best matched donor for hematopoietic cell transplantation as quickly as possible for service members in need. To this end, the goal is to		

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603729N / *Warfighter Protection Adv Tech*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
test various HLA strategies and protocols to determine which approach matches a recipient to donor in shortest 'diagnosis-to-match' time interval.		
Congressional Add: Warfighter resilience and readiness ***FY 2022 Accomplishments:*** Conduct warfighter resilience and readiness advanced technology development ***FY 2023 Plans:*** N/A	3.861	0.000
Congressional Add: Dynamic modular manufacturing ***FY 2022 Accomplishments:*** Conduct dynamic modular manufacturing advanced technology development ***FY 2023 Plans:*** N/A	4.827	0.000
Congressional Add: Laser protective eyewear research ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Leveraging bio-derived compounds, which exhibit heat-resistance, for the manufacture of protective structures for hypersonic projectiles.	0.000	5.000
Congressional Add: Closed-loop sedation and anesthesia system ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Acquire in-silico and animal-based data, as well as compliance test reports supporting the safety of the overall system in order to support the FDA Investigational Device Exemption (IDE) application. The IDE application will be the main deliverable under this program.	0.000	5.000
Congressional Adds Subtotals	34.270	42.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603758N *I Navy Warfighting Exp & Demo*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	60.878	99.020	75.898	-	75.898	78.446	84.460	84.084	85.916	Continuing	Continuing
2918: *Navy Warfighting Experiments and Demo*	0.000	48.328	76.020	75.898	-	75.898	78.446	84.460	84.084	85.916	Continuing	Continuing
9999: *Congressional Adds*	0.000	12.550	23.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	35.550

A. Mission Description and Budget Item Justification

The Office of Naval Research (ONR) and NavalX guides ongoing research and innovation operations in the pursuit of novel and decisive capabilities for our Sailors and Marines. ONR manages a broad, but priority-driven investment portfolio of near to long-term basic and applied research. This Program Element (PE) develops Science and Technology (S&T) breakthroughs to meet current operational needs, from prototyping solutions for warfighters, to Fleet experimentation and operational demonstrations including Fleet Battle Problems
(FBP), Limited Objective Experiments
(LOEs) and Fleet/Force exercises. The key aspects of this PE are divided into five areas supporting the continuum of S&T and innovation operations from discovery to delivery: (1) Naval Warfare Experimentation develops rapid prototypes and through innovation operations, provides them to the warfighter for experimentation during operational demonstrations and exercises; (2) Operations Analysis provides the Navy and Marine Corps the means to identify capability needs that can be addressed with science and technology solutions and inform future investment; (3) NavalX Swamp Works applies innovation operations to develop, demonstrate, and transition newly invented or recently discovered technologies that address emergent and enduring operational problems in an accelerated timeframe; (4) TechSolutions to include Tech Bridge industry scanning allows the ability to rapidly prototype science and technology solutions that address Fleet/Force needs submitted by Sailors and Marines within the development environment and at the deck plate level: and (5) support for the Naval Precision Strike Operations, providing the Navy capability to quickly locate, target, and strike critical targets.

Today's Sailors and Marines are enabled by naval Science and Technology (S&T). Since 1946, the Office of Naval Research (ONR) has fostered scientific research related to the maintenance of maritime superiority and national defense. ONR manages the Department of the Navy's (DON) portfolio of naval Basic and Applied research, and Advanced Technology Development investments to ensure naval forces can effectively deter conflict, but when called upon, fight, win and come home safe. Current investments hedge against uncertainty, providing solutions to commanders today, and options for the future. The Naval S&T budget supports higher guidance defined by the National Defense Strategy, and responds to requirements identified by the Secretary of the Navy through research priorities set by the Chief of Naval Research, coordinated across the Naval Research Enterprise (NRE), and outlined in the Naval R&D Framework.

This Program Element (PE) funds Advanced Technology Development (ATD) that includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment. Efforts in this PE generally have Technology Readiness Levels TRL) of 4 (component and/or breadboard validation in laboratory environment.), 5 (component and/or breadboard validation in relevant environment.), or 6 (system/subsystem model or prototype demonstration in a relevant environment).

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603758N *I Navy Warfighting Exp & Demo*

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	60.167	83.137	83.398	-	83.398
Current President's Budget	60.878	99.020	75.898	-	75.898
Total Adjustments	0.711	15.883	-7.500	-	-7.500
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-7.117			
• Congressional Rescissions	-	-			
• Congressional Adds	-	23.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.289	0.000			
• Program Adjustments	2.000	0.000	-7.500	-	-7.500
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 9999: *Congressional Adds*		
Congressional Add: *Naval tech bridges*	4.827	5.000
Congressional Add: *ONR Scout*	7.723	0.000
Congressional Add: *Small unmanned surface vessels for expeditionary forces*	0.000	5.000
Congressional Add: *Swampworks*	0.000	5.000
Congressional Add: *SCOUT experimentation campaign*	0.000	8.000
Congressional Add Subtotals for Project: 9999	12.550	23.000
Congressional Add Totals for all Projects	12.550	23.000

Change Summary Explanation

Funding: 7.500M decrease in planned program growth in favor of other priority research objectives.

Technical: No significant change.

Schedule: No significant change.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603758N / *Navy Warfighting Exp & D emo*	Project (Number/Name) 2918 / *Navy Warfighting Experiments and Demo*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
2918: *Navy Warfighting Experiments and Demo*	0.000	48.328	76.020	75.898	-	75.898	78.446	84.460	84.084	85.916	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project focuses on the application of recent technology breakthroughs to meet current operational needs from a subscale proof-of-principle into a full-scale prototypes for warfighter experimentation during laboratory and operational demonstrations, Fleet Battle Problems (FBPs), Limited Objective Experiments (LOEs) and Fleet/Force exercises.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Naval Warfare Experimentation	9.665	31.711	32.681	0.000	32.681
Articles:	-	-	-	-	-
Description: The objective of this activity is to capitalize technology breakthroughs of Government and Industry to develop and integrate components including subsystems into prototypes quickly, mature into products, and provide to the warfighter for experimentation, field experiments and/or tests in simulated or actual environments. NavalX, through the use of Navy Warfare Development Command (NWDC) Fleet Experimentation (FLEX) events, iterates throughout the innovation process to achieve optimal warfighter results. The net results are early warfighter feedback to refine and transition innovative capabilities. An example of Naval Warfare Experimentation that NavalX will execute is the Integrated Battle Problem 24 operational experiment in which ONR/NavalX partnered with Pacific Fleet to insert approximately 29 unmanned systems into a large scale fleet environment and determine their ability to address key operational problems.					
FY 2023 Plans: Conduct international experimentation in support of COMPACFLT PACIFIC DRAGON and COMSIXTHFLT, FORMIDABLE SHIELD exercises. Continue to maintain and leverage a Naval Research Enterprise (NRE) experimentation opportunities to guide prioritized concept investigations in support of fleet/force needs and strategic S&T initiatives. Investing in operational experimentation such as tests, demonstrations, and large and small scale experimentation that will address emerging operational needs. Managing a NRE experimentation plan which will guide multi-year S&T experimentation efforts in response to emerging concepts and doctrine. Conduct early Technology Readiness Level concept investigations with Fleet and Force input to establish					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603758N / *Navy Warfighting Exp & D emo*	**Project (Number/Name)** 2918 / *Navy Warfighting Experiments and Demo*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
concept potential, and inform NRE investment decisions. Leverage experimentation as an excursion to traditional programs to address additional warfighter needs and/or mitigate capability delivery risk. ***FY 2024 Base Plans:*** Manage an NRE experimentation plan which will guide multi-year S&T experimentation efforts in response to emerging concepts and doctrine. Leverage experimentation as an excursion to traditional programs to address additional warfighter needs and/or mitigate capability delivery risk. Continue to maintain and leverage Naval Research Enterprise (NRE) experimentation opportunities to guide prioritized concept investigations in support of fleet/force needs and strategic S&T initiatives. Conduct an unmanned campaign experimentation plan in support of the Unmanned Task Force. Conduct international experimentation in support of COMPACFLT PACIFIC DRAGON and COMSIXTHFLT FORMIDABLE SHIELD exercises. Invest in operational experimentation such as technology operational experimentation events that will address operational problems identified by fleet/force inputs. Conduct experimentation events such as limited technology assessments, limited objective experiments, and advance capability experiments to inform S&T investments. Conduct large scale service-level experimentation and international experimentation to assess early Technology Readiness Level concept investigations with Fleet and Force input to establish concept potential and to inform NRE investment decisions. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding changes from FY 2023 to FY 2024.					
Title: Operations Analysis	3.595	4.114	3.884	0.000	3.884
Articles:	-	-	-	-	-
Description: The objective of this project is for NavalX to provide operational analysis through studies, analyses, gaming, modeling and simulation (M&S), and experimentation to identify Navy and Marine Corps capability needs that can be addressed with S&T solutions. The effort includes core analysis of Science and					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603758N / *Navy Warfighting Exp & D emo*	**Project (Number/Name)** 2918 / *Navy Warfighting Experiments and Demo*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Technology (S&T) programs, military utility/capability gaps analyses, war gaming, structured experimentation events, the articulation of the results of that analysis and war gaming, and the development of innovation strategies and messages resulting from these analyses. An example of an Operations Analysis effort would be conducting the Fast Agile Naval Technology Munitions (FANTOM) Technology Innovation Game (TIG) with the Naval Warfare Development Command and representatives from the fleet, force, and NRE to determine where application of super-cavitating torpedo technology can have the most significant, near term impact on warfighting capability which allows the NRE to more accurately focus its S&T investments. Tactical Advancement for Next Generation (TANG) solves mission focused, human-centered challenges using innovation and design thinking methods. TANG initiatives tailor the research and solution generation methods to the respective topic and scope. ***FY 2023 Plans:*** Continue to conduct new workshops, commission studies, and conduct Concept of Employment and Concept of Operations investigations. Continue TANG projects that solve mission focused, human-centered challenges using innovation and systems engineering methods for the Navy and United States Marine Corps (USMC). TANG will support discovery of trends, sharing lessons learned, and empowering the workforce to solve problems and build their agility skills by providing high-quality, low-friction training and support to equip commands with warfighter-centered fundamentals. ***FY 2024 Base Plans:*** Continue to conduct warfighter workshops to include Technology Innovation Games (TIGs), commission operations research studies, and conduct operational analysis and modeling and simulation studies related to military utility of emerging technologies. Continue TANG projects that solve mission focused, human-centered challenges using innovation and systems engineering methods for the Navy and United States Marine Corps (USMC). TANG will support discovery of trends, sharing lessons learned, and empowering the workforce to solve problems and build their agility					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603758N / *Navy Warfighting Exp & D emo*	**Project (Number/Name)** 2918 / *Navy Warfighting Experiments and Demo*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
skills by providing high-quality, low-friction training and support to equip commands with warfighter centered fundamentals. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024.					
Title: Swampworks	17.698	22.182	22.555	0.000	22.555
Articles:	-	-	-	-	-
Description: Description: The SwampWorks portfolio responds to opportunities for rapid and disruptive technologies to meet urgent warfighter needs, and addresses technology and sailor performance issues identified during experiments, exercises, and demonstrations. SwampWorks explores high-risk, disruptive, and innovative technologies and concepts that advance naval warfighter's capabilities. The program has substantial programmatic flexibility and is not limited to any set of technology areas. Ultimately, the goal is to provide a dramatic improvement for the warfighter at a rapid pace. Some of these technologies may become part of a follow-on technology development, may end up in the hands of the warfighter for Fleet/ Force experimentation, or may culminate in a significant Fleet/Force exercise that demonstrates capability that transitions into the Acquisition Program of Record (POR). The Naval Agility Cell (NavalX) group assist in TECHDEV selection within Swampworks. NavalX builds an agile, collaborative, and connected Naval network via regional Technology Bridges (Tech Bridges) to pursue high-risk, disruptive, and innovative technologies and concepts that advance naval warfighter's capabilities. Also funded in this activity is the Next System Technology Evaluation Program (NextSTEP), which promotes innovation and entrepreneurial opportunities for naval personnel and student veterans through advanced technology development and demonstration projects at naval facilities and laboratories. ***FY 2023 Plans:*** Complete development of the Quantum Gravimeter Navigation System. The remaining Science and Technology (S&T) projects that start in FY22 will be identified during FY22 as emerging warfighters needs are realized. SwampWorks projects will continue to be aligned with National Defense Strategy, OSD Modernization Priorities					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603758N / *Navy Warfighting Exp & D emo*	**Project (Number/Name)** 2918 / *Navy Warfighting Experiments and Demo*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
and CNO / CMC Guidance. Apply the NavalX Innovation pipeline concept to source, curate, scan, incubate, prototype, validate, field and sustain new technologies to accelerate the discovery, development of new technologies and capabilities for naval warfighters. NavalX will continue to support discovery of trends, sharing lessons learned, and empowering the workforce to solve problems and build their agility skills by providing high-quality, low-friction training and support to equip commands with warfighter-centered fundamentals. Tech Bridge will support regional technology innovation challenges addressing critical Naval mission problems; increase participation of small- and medium-sized business in the defense industrial base; produce and deliver dual-use prototypes in partnership with the local/regional commercial sector, and support regional operational experimentation events. Tech Bridges are an ASN(RDA) initiative under NavalX and sponsored by ONR. Currently, fourteen Tech Bridges have been established across the U.S. plus one in London with the mission to promote regional/local collaborations in support of DON and national security missions. While each Tech Bridge may focus on their specific local/regional challenges and opportunities, they all work together as a Tech Bridge network to share best practices and support each other's mission. Next Strategic Technology Evaluation Program (NextSTEP) projects will focus on assessing advanced energy technologies, developing cyber-physical security for energy networks, and utilizing autonomous systems, artificial intelligence and advanced manufacturing to address operational and installation challenges in logistics, readiness, and resilience. NextSTEP (previously Energy Systems Technology Evaluation Program (ESTEP)) is a prototype viability assessment program at naval facilities that promotes adoption, scaling and deployment to the warfighter of defense and dual-use technologies with the following goals: conduct advanced technology demonstrations to evaluate emerging technologies using Navy and Marine Corps operations as test beds; evaluate and de-risk new prototype technologies to help enable their acquisition and adoption; and provide opportunities for professional development for DON personnel and student veteran interns through project participation. ***FY 2024 Base Plans:*** SwampWorks projects will continue to be aligned with National Defense Strategy, OSD Modernization Priorities and CNO / CMC Guidance. Apply the NavalX Innovation pipeline concept to source, curate, scan, incubate, prototype, validate, field and sustain new technologies to accelerate the discovery, development of new technologies and capabilities for naval warfighters.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603758N / *Navy Warfighting Exp & D emo*	**Project (Number/Name)** 2918 / *Navy Warfighting Experiments and Demo*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
NavalX will continue to support discovery of trends, sharing lessons learned, and empowering the workforce to solve problems and build their agility skills by providing high-quality, low-friction training and support to equip commands with warfighter-centered fundamentals. Tech Bridge will support regional technology innovation challenges addressing critical Naval mission problems; increase participation of small- and medium-sized business in the defense industrial base; produce and deliver dual-use prototypes in partnership with the local/regional commercial sector, and support regional operational experimentation events. Tech Bridges are an ASN(RDA) initiative under NavalX and sponsored by ONR. Currently, fourteen Tech Bridges have been established across the U.S. plus one in London with the mission to promote regional/local collaborations in support of DON and national security missions. While each Tech Bridge may focus on their specific local/regional challenges and opportunities, they all work together as a Tech Bridge network to share best practices and support each other's mission. Next Strategic Technology Evaluation Program (NextSTEP) projects will focus on assessing advanced energy technologies, developing cyber-physical security for energy networks, and utilizing autonomous systems, artificial intelligence and advanced manufacturing to address operational and installation challenges in logistics, readiness, and resilience. NextSTEP (previously Energy Systems Technology Evaluation Program (ESTEP)) is a prototype viability assessment program at naval facilities that promotes adoption, scaling and deployment to the warfighter of defense and dual-use technologies with the following goals: conduct advanced technology demonstrations to evaluate emerging technologies using Navy and Marine Corps operations as test beds; evaluate and de-risk new prototype technologies to help enable their acquisition and adoption; and provide opportunities for professional development for DON personnel and student veteran interns through project participation. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024.					
Title: Tech Solutions	4.783	5.263	4.941	0.000	4.941
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603758N / *Navy Warfighting Exp & D emo*	**Project (Number/Name)** 2918 / *Navy Warfighting Experiments and Demo*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Description: TechSolutions rapidly prototypes science and technology solutions that address Fleet/Force needs submitted directly by individual Sailors at the deckplate level and individual Marines at the operational level. TechSolutions engages warfighters online and in person to learn of their technology needs then links them with science and technology experts to develop prototype solutions as quickly as possible. Sailors and Marines submit their ideas anytime/anywhere via the TechSolutions web portal. New projects are initiated annually directly from such requests and prototype technology is developed collaboratively with the warfighter for delivery to them within 12 months. Examples of technology solutions delivered this year include a novel individual light therapy device, designed by spectral engineering of LED's, to increase alertness without causing sleep or circadian disruption. The light boxes help Sailors and Marines optimize their sleep schedules in the absence of natural light, adjust to work-related sleep changes, and increase their alertness after wake-up. TechSolutions delivered to MCAS Cherry Point a government-owned game-engine-based virtual environment training solution that realistically replicates the operations, duties, and tasks of Air Traffic Control Radar Operators, alleviating on-the-job-training bottlenecks in the tower. Additionally, TechSolutions delivered multispectral concealment solutions requested by warfighters. ***FY 2023 Plans:*** TechSolutions will continue to conduct new Science and Technology (S&T) developments based on Fleet/ Force interactions and expressed warfighter needs. Developments will be undertaken to deliver rapid response solutions so warfighters can achieve mission success and perform their duties more effectively and more efficiently by leveraging new or emergent technology. ***FY 2024 Base Plans:*** TechSolutions will deliver new Science and Technology (S&T) solutions based on expressed warfighter needs received during Fleet/Force interactions. Developments will be initiated to deliver rapid response solutions so Warfighters can achieve mission success and perform their duties more effectively and more efficiently by leveraging new or emergent technology. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603758N / *Navy Warfighting Exp & D emo*	**Project (Number/Name)** 2918 / *Navy Warfighting Experiments and Demo*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
There is no significant funding changes from FY 2023 to FY 2024.					
Title: Precision Strike Technology	12.587	12.750	11.837	0.000	11.837
Articles:	-	-	-	-	-
Description: Efforts in this area support Naval Precision Strike Operations, providing the Navy capability to quickly locate, target, and strike critical targets. Ongoing efforts include conducting kill-chain studies to identify and recommend engineering trades to enable weapon system interoperability and data fusion alternatives. These studies assess engineering feasibility of various kill-chain options and assess the capability provided. Classified addendum includes further program details. ***FY 2023 Plans:*** - Continue efforts in the area supporting Naval Precision Strike Operations, providing the Navy capability to quickly locate, target, and strike critical targets. Ongoing efforts include conducting kill-chain studies to identify and recommend engineering trades to enable weapon system interoperability and data fusion alternatives. These studies assess engineering feasibility of various kill-chain options and assess advanced weapon system capabilities. ***FY 2024 Base Plans:*** - Continue efforts in the area supporting Naval Precision Strike Operations, providing the Navy capability to quickly locate, target, and strike critical targets. Ongoing efforts include conducting kill-chain studies to identify and recommend engineering trades to enable weapon system interoperability and data fusion alternatives. These studies assess engineering feasibility of various kill-chain options and test and assess advanced weapon system capabilities. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** No significant changes from FY 2023 to FY 2024.					
Accomplishments/Planned Programs Subtotals	48.328	76.020	75.898	0.000	75.898

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603758N / *Navy Warfighting Exp & Demo*	**Project (Number/Name)** 2918 / *Navy Warfighting Experiments and Demo*

D. Acquisition Strategy

Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603758N / *Navy Warfighting Exp & D emo*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	12.550	23.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	35.550
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Congressional Add: Naval tech bridges ***FY 2022 Accomplishments:*** Conduct experiments and demonstrations supporting Naval technology bridges efforts ***FY 2023 Plans:*** Conduct experiments and demonstrations supporting Naval technology bridges efforts	4.827	5.000
Congressional Add: ONR Scout ***FY 2022 Accomplishments:*** Conduct ONR Scout experiments and demonstrations ***FY 2023 Plans:*** N/A	7.723	0.000
Congressional Add: Small unmanned surface vessels for expeditionary forces ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct research supporting small unmanned surface vessels for expeditionary forces	0.000	5.000
Congressional Add: Swampworks ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct Swampworks related research	0.000	5.000
Congressional Add: SCOUT experimentation campaign ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct research supporting SCOUT experimentation campaign	0.000	8.000
Congressional Adds Subtotals	12.550	23.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603758N / *Navy Warfighting Exp & D emo*	**Project (Number/Name)** 9999 / *Congressional Adds*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603782N *I Mine and Expeditionary Warfare Advanced Technology*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	1.922	2.007	2.048	-	2.048	2.050	2.090	2.133	2.166	Continuing	Continuing
2917: *Shallow Water MCM Demos*	0.000	1.922	2.007	2.048	-	2.048	2.050	2.090	2.133	2.166	Continuing	Continuing

A. Mission Description and Budget Item Justification

Explosive ordnance disposal is a critical naval mission vital to the safety of service members and civilians. Highly trained Sailors and Marines utilize their knowhow and courage combined with state-of-the-art technology to remove unexploded ordnance, land/sea mines and even chemical, biological and nuclear weapons. The Department of Defense (DoD) Directive 5160.62 "DoD Executive Agent for Military Explosive Ordnance Disposal Technology & Training" guides research in this Program Element (PE). Unique needs and capabilities identified by the Joint Requirements Oversight Council (JROC) and the DoD EOD Program Board are also addressed by this PE, and provide the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval and Joint EOD forces in the 21st century. The strategy focuses and aligns Naval S&T with Naval missions, DoD EOD S&T with Joint EOD missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

This PE primarily develops and demonstrates prototype Mine Countermeasures (MCM), Expeditionary Warfare and Joint EOD system components that support capabilities enabling Naval and Joint EOD Forces to influence operations ashore. Adversarial nations have the capability to procure, stockpile and rapidly deploy all types of naval mines, including new generation mines having sophisticated performance characteristics, throughout the littorals. They also have the capability to develop or modify explosive devices such as mines and unexploded ordnance to construct Improvised Explosive Devices (IEDs) for the purpose of targeting Joint Forces. Real world operations have demonstrated the requirement to quickly counter the mine threat. Current operations have also demonstrated the requirement to quickly counter the threat from explosive hazards and IEDs during DoD operations. Advanced technologies must rapidly detect and neutralize all mine types, from deep water to the inland objective. Advanced technologies must enable Joint EOD forces to detect/locate, gain access, diagnose, render safe, neutralize, recover, exploit and dispose of a broad spectrum of explosive hazards including unexploded ordnance and IEDs. This program supports the advanced development and integration of sensors, processing, warheads, and delivery vehicles to demonstrate improved Naval Warfare capabilities. It supports the advanced development and integration of sensors and tools for standoff capabilities such as detection and location of IEDs (particularly in dismounted operations), dismounted diagnosis of buried munitions and other explosive hazards, precision render safe and neutralization of surface munitions and other explosive hazards, and enhanced access to IEDs. It supports the MCM-related FNC Enabling Capabilities (ECs).

Today's Sailors and Marines are enabled by naval Science and Technology (S&T). Since 1946, the Office of Naval Research (ONR) has fostered scientific research related to the maintenance of maritime superiority and national defense. ONR manages the Department of the Navy's (DON) portfolio of naval Basic and Applied research, and Advanced Technology Development investments to ensure naval forces can effectively deter conflict, but when called upon, fight, win and come home safe. Current investments hedge against uncertainty, providing solutions to commanders today, and options for the future. The Naval S&T budget supports higher guidance defined by the National Defense Strategy, and responds to requirements identified by the Secretary of the Navy through research priorities set by the Chief of Naval Research, coordinated across the Naval Research Enterprise (NRE), and outlined in the Naval R&D Framework.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603782N *I Mine and Expeditionary Warfare Advanced Technology*

This Program Element (PE) funds Advanced Technology Development (ATD) that includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment. Efforts in this PE generally have Technology Readiness Levels TRL) of 4 (component and/or breadboard validation in laboratory environment.), 5 (component and/or breadboard validation in relevant environment.), or 6 (system/subsystem model or prototype demonstration in a relevant environment).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	1.981	2.007	2.048	-	2.048
Current President's Budget	1.922	2.007	2.048	-	2.048
Total Adjustments	-0.059	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.059	0.000			

Change Summary Explanation

Funding: No significant change.

Technical: No significant change.

Schedule: No significant change

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603782N / *Mine and Expeditionary Warfare Advanced Technology*	Project (Number/Name) 2917 / *Shallow Water MCM Demos*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
2917: *Shallow Water MCM Demos*	0.000	1.922	2.007	2.048	-	2.048	2.050	2.090	2.133	2.166	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project develops and demonstrates prototype technology for Mine Countermeasures (MCM), US Naval sea mining, and Expeditionary Warfare and Joint EOD system components that support capabilities enabling Naval and Joint EOD Forces to influence operations ashore. Adversarial nations have the capability to procure, stockpile and rapidly deploy all types of naval mines, throughout the littorals including new generation mines having sophisticated performance characteristics. They also have the capability to develop or modify explosive devices such as mines and unexploded ordnance to construct Improvised Explosive Devices (IEDs) for the purpose of targeting Joint Forces. Real world operations have demonstrated the requirement to quickly counter the mine threat. Current operations have also demonstrated the requirement to quickly counter the threat from explosive hazards and IEDs during DoD operations. Advanced technologies must rapidly detect and neutralize all mine types, from deep water to the inland objective. Advanced technologies must enable Joint EOD forces to detect/locate, gain access, diagnose, render safe, neutralize, recover, exploit and dispose of a broad spectrum of explosive hazards including unexploded ordnance and IEDs. This program supports the advanced development and integration of sensors, processing, warheads, and delivery vehicles to demonstrate improved Naval Warfare capabilities.

This Project supports the advanced development and integration of sensors and tools for standoff capabilities such as detection and location of IEDs (particularly in dismounted operations), dismounted diagnosis of buried munitions and other explosive hazards, precision render safe and neutralization of surface munitions and other explosive hazards, and enhanced access to IEDs. It supports advanced development for battlespace shaping weapons including advanced undersea weapons. It supports the MCM related FNC Enabling Capabilities (ECs).

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Joint EOD Demos	1.922	2.007	2.048	0.000	2.048
Articles:	-	-	-	-	-
Description: This activity focuses on developing and demonstrating technologies to support a standoff or remote capability for detection and location, diagnosis, render safe, neutralization and enhanced access. Efforts include: electromagnetic, electro-optical, radiographic and advanced sensors and systems for detection of explosive threat components including explosives, device housings/containers, and triggering mechanisms, standoff identification and confirmation of trace explosives, fusion of multi-sensor input for high confidence detection and diagnosis of buried and surface threats, highly dexterous manipulators and imitative controllers for lightweight, efficient (strength/weight ratio) dual manipulator systems integrated onto EOD robots for enhanced access, enhanced robotic autonomy to support EOD missions, data compression and visualization					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603782N / *Mine and Expeditionary War fare Advanced Technology*	**Project (Number/Name)** 2917 / *Shallow Water MCM Demos*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
techniques to support precise render safe and neutralization, and neutralization devices containing reactive materials to neutralize devices with low collateral damage and rapid clearance of operational areas. This S&T investment supports the Joint Requirements Oversight Council (JROC) and DoD EOD Program Board validated requirements for Joint EOD missions. This S&T investment provides critical S&T transitions to acquisition programs. This investment in Joint EOD S&T is reported annually to the DoD EOD Program Board. This S&T investment is documented in the DoD EOD Technology and Training Plan which is reviewed as a decision brief annually by the DoD EOD Program Board. ***FY 2023 Plans:*** - Continue Joint Explosive Ordnance Disposal (JEOD), Advanced Technology: continue development and demonstration for JEOD functional areas including detect, access, diagnose, and render safe/neutralize. - Continue Joint Explosive Ordnance Disposal (JEOD), Detection: continue efforts in the detection functional area. Specific efforts will include development and demonstration of advanced electro-optical and spectroscopic sensors for detection of explosives. The objective is to remotely detect bulk and trace explosives. - Continue Joint Explosive Ordnance Disposal (JEOD), Remote Access: continue efforts the access functional area. Specific efforts will include robotic manipulators, end effectors and haptics. The objective is to enable remote access to explosive threats and unexploded ordnance. - Continue Joint Explosive Ordnance Disposal (JEOD), Acoustic Sensor: continue detection of buried explosive threats with seismic- acoustic sensor. Specific effort includes demonstration of a robot mounted seismic acoustic sensor. The objective is to enable standoff detection of buried explosive threats with improved detection and classification statistics. - Continue Joint Explosive Ordnance Disposal (JEOD), Man-Portable Prototypes: continue efforts in diagnose and render safe/ neutralize functional areas. Specific efforts will include the development and demonstration of man-portable prototypes. The objective is to assess the status of explosive threats and ordnance and render safe/neutralize at standoff. - Continue Joint Explosive Ordnance Disposal (JEOD), Rapid Large Area Clearance advanced technology development for rapid large area clearance of explosive threats. Specific effort includes collective demonstration of multiple prototypes for experimentation. The objective is to enable rapid large area clearance operations					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603782N / *Mine and Expeditionary Warfare Advanced Technology*	**Project (Number/Name)** 2917 / *Shallow Water MCM Demos*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
including detection of explosive threats, classification statistics and clearance of munitions from the operational area and render safe/neutralize at standoff.					
FY 2024 Base Plans: - Continue Joint Explosive Ordnance Disposal (JEOD), Advanced Technology: continue development and demonstration for JEOD functional areas including detect, access, diagnose, render safe/neutralize and disposal. - Continue Joint Explosive Ordnance Disposal (JEOD), Detection: continue efforts in the detection functional area. Specific efforts will include development and demonstration of advanced sensors, sensor fusion and signal processing (optical, electro-magnetic induction, ground penetrating radar, advanced magnetometers, acoustic and spectroscopic) for detection of explosives. The objective is to remotely detect surface and buried targets as well as bulk and trace explosives. - Continue Joint Explosive Ordnance Disposal (JEOD), Remote Access: continue efforts the access functional area. Specific efforts will include robotic manipulators, end effectors, haptics and robotic digging capabilities. The objective is to enable remote access to explosive threats and unexploded ordnance. - Continue Joint Explosive Ordnance Disposal (JEOD), Acoustic Sensor: continue detection of buried explosive threats with seismic- acoustic sensor. Specific effort includes demonstration of a robot mounted seismic acoustic sensor. The objective is to enable standoff detection of buried explosive threats with improved detection and classification statistics. - Continue Joint Explosive Ordnance Disposal (JEOD), Man-Portable Prototypes: continue efforts in diagnose and render safe/ neutralize functional areas. Specific efforts will include the development and demonstration of man-portable prototypes. The objective is to assess the status of explosive threats and ordnance and render safe/neutralize at standoff. - Continue Joint Explosive Ordnance Disposal (JEOD), Rapid Large Area Clearance advanced technology development for rapid large area clearance of explosive threats. Specific effort includes collective demonstration of multiple prototypes for experimentation. The objective is to enable rapid large area clearance operations including detection of explosive threats, classification statistics and clearance of munitions from the operational area and render safe/neutralize/disposal at standoff.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603782N / *Mine and Expeditionary Warfare Advanced Technology*	**Project (Number/Name)** 2917 / *Shallow Water MCM Demos*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate development of Silent Saber, Compact Laser for EOD Neutralization, a tripod mounted directed energy capability that provides for low & high order surface target neutralization. Specific efforts include development and demonstration of a dismounted Silent Saber capability that can be vehicle mounted for rapid large area clearance. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** There is no significant funding change from FY 2023 to FY 2024					
Accomplishments/Planned Programs Subtotals	1.922	2.007	2.048	0.000	2.048

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy												Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603801N *I Innovative Naval Prototypes (INP) Adv Tec Dev*							
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	165.136	261.903	132.931	-	132.931	127.939	130.496	126.646	129.674	Continuing	Continuing
2731: *High Energy Laser Counter ASCM Project (HELCAP)*	0.000	13.541	22.460	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	36.001
2958: *Cyberspace Activities*	0.000	15.416	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	15.416
3400: *Innovative Naval Prototypes (INP) Adv Tech Dev*	0.000	0.000	9.000	4.268	-	4.268	8.290	22.381	31.398	62.370	Continuing	Continuing
3416: *HIJENKS*	0.000	7.392	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	7.392
3423: *LOCUST*	0.000	12.271	67.300	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	79.571
3450: *AMOS*	0.000	3.268	4.478	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	7.746
3451: *CLAWS*	0.000	13.467	7.810	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	21.277
3452: *ELEKTRA*	0.000	12.345	9.845	4.924	-	4.924	6.022	0.000	0.000	0.000	0.000	33.136
3455: *MINERVA*	0.000	12.489	11.814	6.894	-	6.894	7.031	0.000	0.000	0.000	0.000	38.228
3456: *Full Spectrum Undersea Warfare*	0.000	0.000	8.910	9.900	-	9.900	9.900	9.900	9.608	0.000	0.000	48.218
3457: *Long Range Targeting*	0.000	15.027	24.748	44.400	-	44.400	29.300	22.500	0.000	0.000	0.000	135.975
3458: *Undersea Warfare Efforts*	0.000	6.575	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	6.575
3459: *Super Swarm (SS)*	0.000	9.392	14.848	19.800	-	19.800	19.800	0.000	0.000	0.000	0.000	63.840
3461: *MASS*	0.000	0.883	3.957	4.950	-	4.950	4.950	0.000	0.000	0.000	0.000	14.740
3462: *DEALRS*	0.000	0.837	4.948	5.940	-	5.940	5.940	7.920	7.686	0.000	0.000	33.271
3463: *MATes*	0.000	0.768	3.958	4.950	-	4.950	4.950	13.860	13.451	0.000	0.000	41.937
3464: *REDCAT*	0.000	5.457	8.000	13.500	-	13.500	6.000	0.000	0.000	0.000	0.000	32.957
3507: *Chimera*	0.000	0.000	0.000	4.732	-	4.732	15.404	34.415	50.109	67.304	Continuing	Continuing
5899: *Precision Fire Control*	0.000	0.000	0.527	8.673	-	8.673	10.352	19.520	14.394	0.000	0.000	53.466
9999: *Congressional Adds*	0.000	36.008	59.300	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	95.308

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603801N *I Innovative Naval Prototypes (INP) Adv Tec Dev*

A. Mission Description and Budget Item Justification

The Office of Naval Research (ONR) portfolio includes efforts that solve problems and respond to mission requirements, as well as, exploratory research for new ideas and breakthrough capabilities. Larger in scope, scale and risk Innovative Naval Prototypes (INP) are selected for their high-payoff and potential to revolutionize operational concepts. The efforts described in this Program Element (PE) continue the Applied Research work in PE 0602792N for promising INPs with Advanced Technology Development activities. INP investments define the future of U.S. naval forces. Due to high technical risk, INPs often have long trial-and-error timeframes to work through challenges, but typically no more than three years between decision points. INP efforts mature technologies from a Technology Readiness Level (TRL) of 2 or 3 to a TRL of 6. As such, INPs require applied and advanced technology development funding to bridge from concept to working prototype. INPs prove technological and capability potential, validate production feasibility, and acquisition potential. ONR demonstrates INPs in relevant environments. Successful experimentation and demonstrations present the Department of the Navy with disruptive capabilities that may lead to a new acquisition programs. INPs are selected by senior leadership in the Department of the Navy.

This Program Element (PE) funds Advanced Technology Development (ATD) that includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment. Efforts in this PE generally have Technology Readiness Levels TRL) of 4 (component and/or breadboard validation in laboratory environment.), 5 (component and/or breadboard validation in relevant environment.), or 6 (system/subsystem model or prototype demonstration in a relevant environment).

INP investments represent game changing technologies with the potential to revolutionize operational concepts. They are disruptive in nature, as they would dramatically change the way naval forces fight. Due to high technical risk, INPs typically have long duration but have no more than three years between decision points. INPs do not develop hardware for service use, rather they prove technological and production feasibility, and show naval utility and acquisition potential. The Office of Naval Research (ONR) demonstrates INPs in relevant environments. Successful experimentation and demonstrations present the Department of the Navy with disruptive capabilities that may lead to the obsolescence of existing capabilities and acquisition programs. The Department of the Navy would have to make significant acquisition decisions to integrate the new technological capabilities into naval warfighting systems. INPs are selected by a process that involves senior leadership in the Department of the Navy.

Information security concerns preclude fully detailed descriptions of project efforts, research activities, and technology development plans. Specific information on each project and activity will be provided separately to the Congressional oversight committees.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy	Date: March 2023
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603801N *I Innovative Naval Prototypes (INP) Adv Tec Dev*

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	161.444	144.122	125.431	-	125.431
Current President's Budget	165.136	261.903	132.931	-	132.931
Total Adjustments	3.692	117.781	7.500	-	7.500
• Congressional General Reductions	-	-0.019			
• Congressional Directed Reductions	-	-2.800			
• Congressional Rescissions	-	-			
• Congressional Adds	-	120.600			
• Congressional Directed Transfers	-	-			
• Reprogrammings	9.000	0.000			
• SBIR/STTR Transfer	-5.308	0.000			
• Program Adjustments	0.000	0.000	7.500	-	7.500
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 9999: *Congressional Adds*		
Congressional Add: *High speed laser cooling systems*	5.792	0.000
Congressional Add: *Advanced ATRT SBIR enterprise capabilities*	15.735	25.300
Congressional Add: *Energetics renaissance*	9.654	0.000
Congressional Add: *Group 3 advanced autonomous*	4.827	5.000
Congressional Add: *Combinded fiber laser arrays without wavefront sensing*	0.000	24.000
Congressional Add: *HEL testing and risk reduction*	0.000	5.000
Congressional Add Subtotals for Project: 9999	36.008	59.300
Congressional Add Totals for all Projects	36.008	59.300

Change Summary Explanation

Funding: Funding increase of $7,500K supports Accelerating Microwave Effects Testbed for Exploring Operational Requirements (METEOR) effort in the REDCAT INP program.

Schedule: not applicable.

Technical: not applicable

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 2731 / *High Energy Laser Counter ASCM Project (HELCAP)*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
2731: *High Energy Laser Counter ASCM Project (HELCAP)*	0.000	13.541	22.460	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	36.001
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The High Energy Laser Counter ASCM Project (HELCAP) will expedite the development, experimentation, integration and demonstration of critical technologies to defeat crossing Anti-Ship Cruise Missiles (ASCM) by addressing the remaining technical challenges, e.g.: atmospheric turbulence, automatic target identification and aim point selection, precision target tracking with low jitter in high clutter conditions, advanced beam control, and higher power HEL development.
HELCAP will assess, develop, experiment, and demonstrate the various laser weapon system technologies and methods of implementation required to defeat ASCMs in a crossing engagement.

HELCAP activities in this project (0603801N) include technology assessments, laser lethality investigations, and advanced beam control. Component and Subsystem level operability is being conducted under this project specifically the Beam Control subsystem including active tracking and advanced atmospheric compensation using Adaptive Optics. The Beam Director subsystem testing will occur in a simulated environment (land based) against surrogate ASCM targets. Other subsystems being developed and tested under this project include the automated engagement sequencing, HEL targets and diagnostics subsystems, and an HEL interface compatible with a range of competing HEL source technologies. This project passes technology to follow on HELCAP activities under Program Element (PE) 0603925N Directed Energy and Electric Weapon Systems.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: HELCAP	13.541	22.460	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: The High Energy Laser Counter ASCM Project (HELCAP) expedites the development, experimentation, integration and demonstration of critical technologies to defeat crossing Anti-Ship Cruise Missiles (ASCM) by addressing the remaining technical challenges, e.g.: atmospheric turbulence, automatic target identification and aim point selection, precision target tracking with low jitter in high clutter conditions, advanced beam control, and higher power HEL development. HELCAP will assess, develop, experiment, and demonstrate various laser weapon system technologies and methods of implementation required to defeat ASCMs in a crossing engagement.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 2731 / *High Energy Laser Counter ASCM Project (HELCAP)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
HELCAP activities conducted in this project (0603801N) include technology assessments, laser lethality investigations, and advanced beam control. Component and Subsystem level operability is being conducted under this project specifically the Beam Control subsystem including active tracking and advanced atmospheric compensation using Adaptive Optics. The Beam Director subsystem tested will occur in a simulated environment (land based) against surrogate ASCM targets. Other subsystems being developed and tested under this project include the automated engagement sequencing, HEL targets and diagnostics subsystems, and an HEL interface compatible with a range of competing HEL source technologies. This project passes technology to follow on HELCAP activities conducted under Program Element (PE) 0603925N Directed Energy and Electric Weapon Systems. ***FY 2023 Plans:*** Continue: - Integration phase of an overall multi-year effort whose objective is to conduct development, experimentation, and demonstration of critical technologies to defeat crossing Anti-Ship Cruise Missiles (ASCM) including laser lethality, advanced beam control, and high energy laser sources. Continue: - Integration phase of an overall multi-year effort whose objective is to conduct development, experimentation, and demonstration of critical technologies to defeat crossing Anti-Ship Cruise Missiles (ASCM) including laser lethality, advanced beam control, and high energy laser sources. Complete: - Laser/materiel component interaction testing and support beam control tracker and adaptive optics verification experimentation. - ASCM defeat analysis and assessments including lethality, engagement modeling, atmospheric propagation characterization, and beam control. Continue: - High Power System Integration and Anti-Ship Cruise Missile Detect to Defeat Demonstration preparations - High power system integration demonstration (Demo 2) at White Sands Missile Range (WSMR). Demo 2 serves to prove the technological feasibility and assessments of subsystem and component operability in a simulated land-based environment.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 2731 / *High Energy Laser Counter ASCM Project (HELCAP)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Demo 2 will demonstrate subsystem operability to receive and process target tracking, adherence to range safety protocols and user control, and demonstrate laser deconfliction against space assets in user-defined regions. Testing planned includes static and dynamic ground and air-based targets. ***FY 2024 Base Plans:*** N/A ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease in funding from FY 2023 to FY 2024 in Proj: 2731 HELCAP is due to program completion.					
Accomplishments/Planned Programs Subtotals	13.541	22.460	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/ 0603925N/2731: *High Energy Laser Counter ASCM Project*	25.185	6.598	6.194	-	6.194	4.150	4.047	3.388	3.458	Continuing	Continuing

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 2958 / *Cyberspace Activities*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
2958: *Cyberspace Activities*	0.000	15.416	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	15.416
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project contains all Advanced Technology Development Innovative Naval Prototype (INP) investments that are developing new technologies for cyber warfare. Potential adversaries are investing in advanced technologies that will challenge our advantages in the critical information domain. Nation states and non-state actors seek to degrade our command and control capabilities, networks and computer systems. Cyber threats continue to grow and rapidly proliferate. Technologies developed in this Project will enable the warfighter to take immediate, appropriate action at any time against any desired adversary, target or network by assuring that autonomous, continuous analyses of intelligence, persistent surveillance and open information sources have, at all times, optimized the possible courses of action based on commander's guidance. Technologies within this activity will foster operational endurance and enable sustained operations and resiliency for warfighters and platforms through enhanced cyber security/protection.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Cyber	15.416	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: This R2 Activity contains all Advanced Technology Development Innovative Naval Prototype (INP) investments that are developing new technologies for cyber warfare. Potential adversaries are investing in advanced technologies that will challenge our advantages in the critical information domain. Nation states and non-state actors seek to degrade our command and control capabilities, networks and computer systems. Cyber threats continue to grow and rapidly proliferate. Technologies developed in this R2 Activity will enable the warfighter to take immediate, appropriate action at any time against any desired adversary, target or network by assuring that autonomous, continuous analyses of intelligence, persistent surveillance and open information sources have, at all times, optimized the possible courses of action based on commander's guidance. Technologies within this activity will foster operational endurance and enable sustained operations and resiliency for warfighters and platforms through enhanced cyber security/protection.					
FY 2023 Plans: N/A					
FY 2024 Base Plans: N/A					
FY 2024 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 2958 / *Cyberspace Activities*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
N/A					
Accomplishments/Planned Programs Subtotals	15.416	0.000	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0602792N/2958: *CYBERSPACE ACTIVITIES*	25.208	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	52.075

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3400 / *Innovative Naval Prototypes (INP) Adv Tech Dev*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3400: *Innovative Naval Prototypes (INP) Adv Tech Dev*	0.000	0.000	9.000	4.268	-	4.268	8.290	22.381	31.398	62.370	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The efforts described in this Project address the Advanced Technology Development associated with the Innovative Naval Prototypes (INP) Program. These investments represent game-changing technologies with the potential to revolutionize operational concepts. They are disruptive in nature, as they would dramatically change the way naval forces fight. Due to high technical risk, INPs typically have long duration but have no more than three years between decision points. They mature technologies from a Technology Readiness Level (TRL) of 2 or 3 to a TRL of 6. As such, INPs require both Budget Activity (BA) 2 and BA3 funding. The BA3 INP funds are specified in a separate Program Element (PE), 0603801N Innovative Naval Prototypes (INP) Adv Tec Dev. INPs do not develop hardware for service use; rather they provide feeder technology that can be demonstrated in prototypes in the 6.3 portion of the INP program. Developing INPs requires a systematic expansion and application of knowledge to develop useful materials, devices, and systems oriented toward the design and development of prototypes applicable to specific mission area requirements. The efforts funded within this PE is focuses on continuing the technology development from the BA2 efforts in order to develop full-scale technology/ operational demonstrations. The Department of the Navy would have to make significant acquisition decisions to integrate the new technological capabilities into naval warfighting systems. INPs are selected by a process that involves senior leadership in the Department of the Navy.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Innovative Naval Prototypes (INP) Adv Tech Dev	0.000	9.000	4.268	0.000	4.268
Articles:	-	-	-	-	-
Description: The efforts described in this Project address the Advanced Technology Development associated with the Innovative Naval Prototypes (INP) Program. These investments represent game-changing technologies with the potential to revolutionize operational concepts. They are disruptive in nature, as they would dramatically change the way naval forces fight. Due to high technical risk, INPs typically have long duration but have no more than three years between decision points. They mature technologies from a Technology Readiness Level (TRL) of 2 or 3 to a TRL of 6. As such, INPs require both Budget Activity (BA) 2 and BA3 funding. The BA3 INP funds are specified in a separate Program Element (PE), 0603801N Innovative Naval Prototypes (INP) Adv Tec Dev. INPs do not develop hardware for service use; rather they provide feeder technology that can be demonstrated in prototypes in the 6.3 portion of the INP program. Developing INPs requires a systematic expansion and application of knowledge to develop useful materials, devices, and systems oriented toward the design and development of prototypes applicable to specific mission area requirements. The efforts funded within this PE is focuses on continuing the technology development from the BA2 efforts in order to develop full-scale technology/					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3400 / *Innovative Naval Prototypes (INP) Adv Tech Dev*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
operational demonstrations. The Department of the Navy would have to make significant acquisition decisions to integrate the new technological capabilities into naval warfighting systems. INPs are selected by a process that involves senior leadership in the Department of the Navy. ***FY 2023 Plans:*** Initiate exploring promising advanced technology development efforts and identify the best candidates capable of resulting in full-scale technology/operational demonstrations which will inform future INP investment decisions in this activity. This includes identifying technologies that will provide scalable lethality through enabling multi-domain, integrated, scalable kinetic and non-kinetic systems for offensive of defensive purposes. ***FY 2024 Base Plans:*** Continue to explore promising advanced technology development efforts and identify the best candidates capable of resulting in full-scale technology/operational demonstrations which will inform future INP investment decisions in this activity. This includes identifying technologies that will provide scalable lethality through enabling multi-domain, integrated, scalable kinetic and non-kinetic systems for offensive of defensive purposes. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease in funding from FY 2023 to FY 2024 in Proj 3400 INP Advanced Technology Development is due to the success of advanced technology development efforts in FY 2023, which are resulting in future INP investments, and reducing the need for advanced technology development efforts in FY 2024.					
Accomplishments/Planned Programs Subtotals	0.000	9.000	4.268	0.000	4.268

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3416 / *HIJENKS*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3416: *HIJENKS*	0.000	7.392	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	7.392
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The HIgh-power Joint Electromagnetic Non-Kinetic Strike (HIJENKS) INP effort is a non-kinetic High Power Microwave (HPM) payload integrated on an airborne platform will enable the prosecution of multiple targets with area coverage across each target and open targets previously restricted due to collateral damage. HIJENKS increases operational access by disrupting land-based infrastructure facilities tied to adversary systems, decreases cost exchange ratios through non-kinetic engagement, and addresses targets previously restricted due to collateral damage concerns/moral hardening. It expands the competitive space in the electromagnetic spectrum to disrupt, degrade, and destroy critical electronic targets. The Activity identified in Project Unit 3416 specifically addresses Advanced Technology Development in support of the HIJENKS INP effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: HIJENKS	7.392	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: The High Power Joint Electromagnetic Non-Kinetic Strike (HIJENKS) program is a proof-of-concept demonstration of a multi-target, advanced airborne High Power Microwave (HPM) payload capable of disrupting electronic targets non-kinetically. HIJENKS is capable of disrupting land-based electronic system infrastructure and engaging multiple targets with a single airborne weapon, increasing operational access/ decreasing cost exchange ratios, providing area lethality with increased pulse rate, providing options to address limitations on collateral damage, increasing standoff range and expanding magazine depth. HIJENKS will advance the current state-of-the-art in HPM technology and demonstrate the near-term operational benefits of integrating HPM-based Electronic Warfare/Electronic Attack (EW/EA) into the current force structure.					
FY 2023 Plans: N/A					
FY 2024 Base Plans: N/A					
FY 2024 OCO Plans: N/A					
Accomplishments/Planned Programs Subtotals	7.392	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3416 / *HIJENKS*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0602792N/3416: *HIJENKS*	9.619	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	30.652

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3423 / *LOCUST*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3423: *LOCUST*	0.000	12.271	67.300	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	79.571
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Adversary military modernization and increasing contested domains require a shift in approach "...to strike diverse targets inside adversary air and missile defense networks to destroy mobile power-projection platforms. This will include capabilities to enhance close combat lethality in complex terrain." LOCUST will develop and deliver autonomy, C2 architecture, and a series of modular payloads on a robust, scalable, flexible, multifunctional UAV system; employable from surface, sub-surface, airborne, and ground manned and un-manned systems to provide a dispersed, resilient, and adaptive capability to gain a competitive military advantage. LOCUST will provide ISR and precision loitering munitions capable of being launched from air, surface, ground, and sub-surface platforms to conduct both singular and swarm operations across battlespace in conjunction with Joint and manned operations. It will demonstrate multi-domain launch and strike operations, heterogeneous air platform payloads, unmanned from unmanned operations, distributed control of the strike mission, and refined cost elements for critical technologies that have supply chain assurance addressed. The Activity identified in Project Unit 3423 specifically addresses Advanced Technology Development in support of the LOCUST INP effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: LOCUST	12.271	67.300	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: Adversary military modernization and increasing contested domains require a shift in approach "...to strike diverse targets inside adversary air and missile defense networks to destroy mobile power-projection platforms. This will include capabilities to enhance close combat lethality in complex terrain." LOCUST will develop and deliver autonomy, C2 architecture, and a series of modular payloads on a robust, scalable, flexible, multifunctional UAV system; employable from surface, sub-surface, airborne, and ground manned and un-manned systems to provide a dispersed, resilient, and adaptive capability to gain a competitive military advantage. LOCUST will provide ISR and precision loitering munitions capable of being launched from air, surface, ground, and sub-surface platforms to conduct both singular and swarm operations across battlespace in conjunction with Joint and manned operations. It will demonstrate multi-domain launch and strike operations, heterogeneous air platform payloads, unmanned from unmanned operations, distributed control of the strike mission, and refined cost elements for critical technologies that have supply chain assurance addressed.					
FY 2023 Plans: Continue advanced technology development in support of the LOCUST INP. Activities will further the development of key enabling technologies supporting the INDOPACOM requested operational need. These					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3423 / *LOCUST*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
developments maturation of strike weapon and production of quantities to conduct this as well as two major demonstration events. Warhead, lethality analysis, and launcher developments are also a significant advancement contained in the BA3 effort. FY 2023 funds added for Advanced Concept of Operations. Specific efforts include: - Continue Advanced Technology Development activities to support participation live-fire Fleet experimentation venues. - Initiate payload development that is specific to a Fleet requested operational scenario. This payload is being adapted from applied research conducted under a non-LOCUST activity. The utilization of this technology in the LOCUST concept introduces additional technical risk that will be addressed. - Initiate platform design modifications to increase payload capacity, integrate mission specific payload, and conduct live flight testing. ***FY 2024 Base Plans:*** N/A ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease in funding from FY 2023 to FY 2024 in Proj: 3423 LOCUST is due to program completion.					
Accomplishments/Planned Programs Subtotals	12.271	67.300	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0602792N/3423: *LOCUST*	19.934	25.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	65.710
• RDTEN/0603382N/3423: *LOCUST*	3.270	40.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	50.156

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3450 / *AMOS*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3450: *AMOS*	0.000	3.268	4.478	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	7.746
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Arctic Mobile Observing System (AMOS) INP effort will develop a prototype mobile sensing system that can be deployed anywhere in the Arctic via the development of a sea ice-based buoy node that will enable the critical infrastructure (power, communication, environmental intelligence) to provide the Navy with a persistent Arctic presence at lower cost than manned platforms. AMOS is a mobile observing system of systems node that enables 2-way communications, under-ice vehicle navigation, and extended-duration autonomy in the complex Arctic environment. AMOS will provide a persistent, mobile, autonomous capability to monitor the operational environment and maritime operations of potential adversaries in the Arctic Ocean. The Activity identified in Project Unit 3450 specifically addresses Advanced Technology Development in support of the AMOS INP effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: AMOS	3.268	4.478	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: The Arctic Mobile Observing System (AMOS) INP effort will develop a prototype mobile sensing system that can be deployed anywhere in the Arctic via the development of a sea ice-based buoy node that will enable the critical infrastructure (power, communication, environmental intelligence) to provide the Navy with a persistent Arctic presence at lower cost than manned platforms. AMOS is a mobile observing system of systems node that enables 2-way communications, under-ice vehicle navigation, and extended-duration autonomy in the complex Arctic environment. AMOS will provide a persistent, mobile, autonomous capability to monitor the operational environment and maritime operations of potential adversaries in the Arctic Ocean.					
FY 2023 Plans: Continue advanced technology development efforts: - Demonstration of navigation and 2-way communications of AMOS platforms and vehicles. Complete All AMOS prototype system and subsystem builds in preparation for end of FY23 deployment. This includes: - Complete construction of all ice tethered buoys, navigation buoys, floats, gliders and UUVs that meet the AMOS prototype requirements and operational concept. - Complete construction of prototype AMOS communication node with final meteorological sensors.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3450 / *AMOS*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Complete the situational awareness/command and control system to monitor prototype performance during final test and evaluation period. - Initiate final Arctic deployment of full AMOS prototype for test and evaluation ***FY 2024 Base Plans:*** N/A ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease in funding from FY 2023 to FY 2024 in Proj: 3450 is due to program completion.					
Accomplishments/Planned Programs Subtotals	3.268	4.478	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0602792N/3450: *AMOS*	6.253	8.320	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	22.491

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3451 / *CLAWS*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3451: *CLAWS*	0.000	13.467	7.810	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	21.277
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The CLAWS INP effort will develop an autonomous unmanned undersea weapon system capable of providing offensive effects to the Combatant Commanders beyond Phase 0 inside the first island chain. It will clandestinely extend the reach of large UUVs and increase the mission areas into kinetic effects. CLAWS will deliver algorithms to enable all families of UUVs to operate in complex, dynamic and degraded environments. CLAWS will demonstrate autonomous missions in denied waters, develop and demonstrate autonomous technologies for survivability of large UUVs, and develop autonomy and launch capabilities for special mission payloads. CLAWS will be able to complete missions 1&2 against near peer adversary defenses, maintain critical communication with Navy C2/Fires and provide critical ISR information. The Activity identified in Project Unit 3451 specifically addresses Advanced Technology Development in support of the CLAWS INP effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: CLAWS	13.467	7.810	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: The CLAWS INP effort will develop an autonomous unmanned undersea weapon system capable of providing offensive effects to the Combatant Commanders beyond Phase 0 inside the first island chain. It will clandestinely extend the reach of large UUVs and increase the mission areas into kinetic effects. CLAWS will deliver algorithms to enable all families of UUVs to operate in complex, dynamic and degraded environments. CLAWS will demonstrate autonomous missions in denied waters, develop and demonstrate autonomous technologies for survivability of large UUVs, and develop autonomy and launch capabilities for special mission payloads. CLAWS will be able to complete missions 1&2 against near peer adversary defenses, maintain critical communication with Navy C2/Fires and provide critical ISR information.					
FY 2023 Plans: Continue: Continue the advanced development of autonomy for classified payload 2. Develop adaptive mission planning for swarm of payload to create kinetic effects. In FY 23, technical demostrations for Payload 2 will be completed before final demonstration. Complete: Final report and knowedge transfer of technology to navy acquisition					
FY 2024 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3451 / *CLAWS*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
N/A ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease in funding from FY 2023 to FY 2024 in Proj: 3451 CLAWS is due to program completion.					
Accomplishments/Planned Programs Subtotals	13.467	7.810	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0602792N/3451: *CLAWS*	25.095	2.475	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	47.513

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3452 / *ELEKTRA*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3452: *ELEKTRA*	0.000	12.345	9.845	4.924	-	4.924	6.022	0.000	0.000	0.000	0.000	33.136
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Complex multi-domain threats can overwhelm the operator and individual platforms ability to defend the force. The ELEKTRA INP effort is developing "Human on the Loop" Artificial Intelligence (AI) enabled algorithms to perform force level kinetic/non-kinetic kill chain optimization and coordination across multiple domains at machine to machine speeds to increase the lethality and survivability of the Force. ELEKTRA will demonstrate AI/ML ability to coordinate kinetic/non kinetic effects autonomously with heterogeneous platforms, the ability to operate in degraded environments for hours and the ability to coordinate and execute domain kill chains simultaneously. It will deploy artificial intelligent (AI) and machine learning (ML) architecture, neural networked computing and large data handling to enable real time, force level effects assignment, coordination and resource management. The Activity identified in Project Unit 3452 specifically addresses Advanced Technology Development in support of the ELEKTRA INP effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: ELEKTRA	12.345	9.845	4.924	0.000	4.924
Articles:	-	-	-	-	-
Description: Complex multi-domain threats can overwhelm the operator and individual platforms ability to defend the force. The ELEKTRA INP effort is developing "Human on the Loop" Artificial Intelligence (AI) enabled algorithms to perform force level kinetic/non-kinetic kill chain optimization and coordination across multiple domains at machine to machine speeds to increase the lethality and survivability of the Force. ELEKTRA will demonstrate AI/ML ability to coordinate kinetic/non kinetic effects autonomously with heterogeneous platforms, the ability to operate in degraded environments for hours and the ability to coordinate and execute domain kill chains simultaneously. It will deploy artificial intelligent (AI) and machine learning (ML) architecture, neural networked computing and large data handling to enable real time, force level effects assignment, coordination and resource management.					
FY 2023 Plans: Continue: - Development and implementation of artificial intelligence/machine learning functionality for surface and air platforms to include commander's intent, threat evaluation, engage ability and effector management.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3452 / *ELEKTRA*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Implementation of distributed maritime operations warfare concepts, effects coordination techniques and human-machine teaming concepts. - Demonstrations of complex kinetic/non-kinetic kill chains and battle management functionality in a multi-platform live virtual construct/live experiment. Initiate: - Integration of feedback from FY22 experimentation and identify new analytics and decision support functionality based on results. - Development and demonstration of new human machine interface and effector coordination functionality into airborne platforms.					
FY 2024 Base Plans: Continue: - Development of artificial intelligence/machine learning functionality for surface and air platforms to include commander's intent, threat evaluation, engage ability and effector management. - Incorporate lessons learned from demonstrations of complex kinetic/non-kinetic kill chains and battle management functionality in a multi-platform live virtual construct/live experiment. - Demonstration of new human machine interface and effector coordination functionality into airborne Platforms in LVC - Demonstration of new human machine interface and effector coordination functionality during at sea experimentation and in LVC Initiate: - Evaluation of the functionality for complex kinetic/non-kinetic kill chains and battle management functionality in a multi-platform live virtual construct/live experiment. Complete: - Implementation and testing of artificial intelligence/machine learning functionality for surface and air platforms to include commander's intent, threat evaluation, engage ability and effector management.					
FY 2024 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3452 / *ELEKTRA*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease in funding from FY 2023 to FY 2024 in Proj: 3452 ELEKTRA is due to the completion of planned development, testing and validation of Elektra functionality prior to project completion.					
Accomplishments/Planned Programs Subtotals	12.345	9.845	4.924	0.000	4.924

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0602792N/3452: *ELEKTRA*	3.848	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.534

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3455 / *MINERVA*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3455: *MINERVA*	0.000	12.489	11.814	6.894	-	6.894	7.031	0.000	0.000	0.000	0.000	38.228
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The need to operate in a multiple domain environment against highly capable peers requires improved decision quality and reduced decision timelines. MINERVA will develop AI and Machine-Learning (ML) capabilities to improve mission planning, intelligence gathering, execution and assessment. Minerva will deliver next-generation decision aids by combining operations research with emerging AI capabilities to create learning, self-adaptive automation that supports Composite Warfare Commander's (CWC) and their staffs at the Fleet, Force and Group echelons. It will establish a DevOps environment that includes warfighter staffs in the development and integration of new capabilities. The Activity identified in Project Unit 3455 specifically addresses Advanced Technology Development in support of the MINERVA INP effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: MINERVA	12.489	11.814	6.894	0.000	6.894
Articles:	-	-	-	-	-
Description: The need to operate in a multiple domain environment against highly capable peers requires improved decision quality and reduced decision timelines. MINERVA will develop AI and Machine-Learning (ML) capabilities to improve mission planning, intelligence gathering, execution and assessment. Minerva will deliver next-generation decision aids by combining operations research with emerging AI capabilities to create learning, self-adaptive automation that supports Composite Warfare Commander's (CWC) and their staffs at the Fleet, Force and Group echelons. It will establish a DevOps environment that includes warfighter staffs in the development and integration of new capabilities.					
FY 2023 Plans: Continue: - to develop models that exploit intelligence information and tactical contact reporting to generate probabilistic estimates of target location, intended mission, and projected future location even in face of large time gaps between contacts reports and high degrees of uncertainty over intended target mission. - to develop a multi-objective planner (time scale of days, not hours) that optimizes the limited number of Navy and Marine Corps platforms/assets based on an adversary's order of battle.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3455 / *MINERVA*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- to develop a dynamic waterspace "area" planner that enables staff planners to evaluate developing plans across the seven joint operational functions (command and control, information, intelligence, fires, movement and maneuver, protection, and sustainment). - to develop advanced analytics and prototyping for operational level of war staff planners to optimize Navy and Marine - to develop mixed linear integer program model that assigns air, surface, and undersea effects to a grouping of moving defended targets that can shoot down incoming salvos that can't be targeted until, say, a sensor window on day three. - to develop reinforcement learning models that learn from in-situ and historical data in predicting the next location of the adversary platform location. - to develop a multi-objective multi-warfare domain planner for Future Operations (FOPS) planners to generate and share products used to convey operational and tactical plans. - to experiment and test in real world events and training exercises to improve Minerva's analytic tools. Measure effectiveness of mission planning services, mission execution and adjustment services; and human acceptance of artificial intelligence / machine learning decision aid services. Complete: - integration of unit readiness data into Minerva applications. Up-to-date readiness data combined with Minerva's planning analytic algorithms will help staff planners evaluate Risk to Force / Risk to Mission. - optimized negative search algorithm to aid Maritime Operations Center staff in understanding tradeoff between sensor placement and risk of missing threat. - automated analytics tool to monitor, ingest, parse, and exploit naval chat message traffic in real-time with little to no human intervention. The tool extracts and associates events with their arguments and locations from chat messages. The tool monitors chatrooms to answer questions of who/what/when/where from unstructured text (e.g., naval 9-line reports). Initiate: - mission planning tools for Maritime Operations Center (MOC) logistics planning. ***FY 2024 Base Plans:*** Continue: - Develop a multi-objective planner (time scale of days, not hours) that optimizes the limited number of Navy and Marine Corps platforms/assets based on an adversary's order of battle.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3455 / *MINERVA*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Develop operational level-of-war plan assignments of many kill-chains (sensors, weapons, contested logistics) to many targets over several days in a manner that balances Navy and USMC offensive coverage and defensive posture in accordance with commanders intent while preserving assets and resources. - Development of a multi-objective multi-warfare domain planner for Future Operations (FOPS) planners in the MOC to generate and share products used to convey operational and tactical plans. - Experiments to measure effectiveness of mission planning services, mission execution and adjustment services; and validate human acceptance of artificial intelligence / machine learning decision aid services. - Development of machine workflow learning algorithms for operational level of war staff planning enable Navy and Marine Corps planning efforts. Complete: - Development of models that exploit intelligence information and tactical contact reporting to generate probabilistic estimates of target location, intended mission, and projected future location even in face of large time gaps between contacts reports and high degrees of uncertainty over intended target mission. - Development a dynamic waterspace "area" planner that enables staff planners to evaluate developing plans across the seven joint operational functions (command and control, information, intelligence, fires, movement and maneuver, protection, and sustainment). - Development of reinforcement learning models that learn from in-situ and historical data in predicting the next location of the adversary platform location Initiate: - Develop mixed linear integer program model that assigns air, surface, and undersea effects to a grouping of moving defended targets that can shoot down incoming salvos that can't be targeted until, say, a sensor window on day three. - Develop Service concepts for resilient logistics webs in a contested environment with multiple options for support, to include distribution networks, and multi-domain delivery methods. - Develop and implement contested logistics/supply chain management models combined with operational Commanders intent. - Develop methodologies that automatically learn domain-specific reasoning in adversarial and deceptive operational level-of-war scenarios while also being computationally lightweight enough to scale to large problem instances.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3455 / *MINERVA*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Develop real-time, adaptive and robust decision-making systems for multi-agents in the blue team to adaptively combat against the red team and be robust even when the blue agents communication network is under attack. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease in funding from FY 2023 to FY 2024 in Proj: 3455 MINERVA is due to last year of project and focused on transitioning products to POR and Undersea Warfare Decision Support System in CD 23.1 where a new framework for visualization layer for GCCS-M and MTC2 will be delivered.					
Accomplishments/Planned Programs Subtotals	12.489	11.814	6.894	0.000	6.894

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0602792N/3455: *MINERVA*	3.847	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.557

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3456 / *Full Spectrum Undersea Warfare*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3456: *Full Spectrum Undersea Warfare*	0.000	0.000	8.910	9.900	-	9.900	9.900	9.900	9.608	0.000	0.000	48.218
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Full Spectrum Undersea Warfare (FSUW) Project will develop new technology for offensive and defensive warfare conducted on the seabed, in the sea (i.e. subsea), and from the sea. This INP focuses on Theatre Undersea Warfare (TUSW), Joint Targeting and Strike, and Subsea and Seabed Warfare (SSW). There are five thrust areas of the FSUW INP that are key to enabling Chief of Naval Operations Guidance (CNOG), Distributed Maritime Operations (DMO), and the Commandant's Stand in Force with manned and unmanned warfighting capability. These thrust areas were specifically chosen in direct collaboration with STRATCOM, INDO-PACOM, Fleet and Undersea Warfare Commanders and validated with regular Flag engagements. These advanced technology developments will enable future undersea weapon systems (e.g., Maritime Strike Tomahawk and ADCAP variants), COCOM campaign, and operational plans. FSUW thrust areas include 1) Undersea effectors, 2) Integrated expeditionary subsea system of systems, 3) Multi-Vehicle Torpedo Tube Development System (MVTTDS) for payload A, 4) Undersea UAV for Over-The-Horizon (OTH) effects and 5) Undersea Launched Devices to enable Commanding Officers and Regional Combatant Commander effects. The thrust areas are technically an operational interconnected. Selected concepts from advanced research will be integrated into viable representative prototypes for field experimentation in a relevant environment. Lessons learned from field experimentation will inform continued applied research spirals to remedy technical shortcomings, expand capability, or define an alternate approach. The Activity identified in Full Spectrum Undersea Warfare, Project 3458, specifically addresses Advanced Technology Development in support of the Full Spectrum Undersea Warfare INP effort. The Applied Research Budget Activity (BA) 2 funding is in a separate Program Element (PE) 0602792N FSUW INP, Project 3456.

Information security concerns preclude fully detailed descriptions of project efforts, research activities, and technology development plans. Specific information on each project and activity will be provided separately to the Congressional oversight committees.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Full Spectrum Undersea Warfare (FSUW)	0.000	8.910	9.900	0.000	9.900
Articles:	-	-	-	-	-
FY 2023 Plans: Continue: Advanced Technology Development associated with the Multi-Vehicle Torpedo Tube Deployment System prototype for Virginia Class submarines including - Prototype construction - Full scale prototype testing - Reload scaled testing					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3456 / *Full Spectrum Undersea Warfare*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Complete: Design Multi-Vehicle Torpedo Tube Deployment System (MVTTDS) prototype for Virginia Class submarines. Initiate: - Reload viability and features of the MVTTDS (Reloader) - Joint undersea surveillance and targeting UUV sensors for autonomously conducting specific undersea tasks - Small autonomous undersea launched devices. ***FY 2024 Base Plans:*** Continue: - Advanced Technology Development associated with the Multi-Vehicle Torpedo Tube Deployment System (MVTTDS) prototype for Virginia Class submarines including. FY24 tasks inlcude: - MVTTDS Revolver full scale prototype testing - MVTTDS Reloader testing Initiate: - Joint undersea surveillance and targeting (JUST) UUV sensors and sub-system integration for autonomously conducting specific undersea tasks Complete: - Spiral one Prototype construction for MVTTDS prototype for Virginia Class submarines Initiate: - MVTTDS objective payloads design spiral - Full scale operational prototype testing of JUST autonomy on large diameter UUV. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 in Proj: 3456 FSUSW is due to expand the sizes of devices developed and support spiral development and enable an additional spiral development cycle to commence for Multi Vehicle Torpedo Tube Deployment System to address objective device deployment.					
Accomplishments/Planned Programs Subtotals	0.000	8.910	9.900	0.000	9.900

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3456 / *Full Spectrum Undersea Warfare*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3457 / *Long Range Targeting*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3457: *Long Range Targeting*	0.000	15.027	24.748	44.400	-	44.400	29.300	22.500	0.000	0.000	0.000	135.975
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Long Range Targeting emphasizes the specific naval use of HF Over the Horizon Radar (OTHR) on maritime platforms and forward-based positive identification technologies to fill gaps in long-range fires kill chains. Technologies within this activity will enable integrated long range naval fires. Investments include technologies for OTH radar antennas, HF antenna arrays, signal processing, and electronic surveillance. Activity identified in Project Unit 3457 specifically addresses Advanced Technology Development in support of the LRT INP effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Long Range Targeting	15.027	24.748	44.400	0.000	44.400
Articles:	-	-	-	-	-
Description: Long Range Targeting emphasizes the specific naval use of HF Over the Horizon Radar (OTHR) on maritime platforms and forward-based positive identification technologies to fill gaps in long-range fires kill chains. Technologies within this activity will enable integrated long range naval fires. Investments include technologies for OTH radar antennas, HF antenna arrays, signal processing, and electronic surveillance. Activity identified in Project Unit 3457 specifically addresses Advanced Technology Development in support of the LRT INP effort.					
FY 2023 Plans: - Continue development efforts to incorporate methods and develop technology to exploit Over-the-Horizon (OTH) sensors, In-Scene aids, and sense making phenomenology to refine BLOS target detection, track and positive identification. - Continue planning for test, integration, demonstration and experiment activities for Long Range Targeting. - Continue development of technologies to integrate track data with other sources to feed Battle Management Command and Control (BMC2) kill chain algorithms with the objective of supporting live missions. Continue MOTHR software development; Analyze data from recent HF demonstrations. - Complete the refinement of LRT framework/architecture; Initial increment of MOTHR software; and Test planning for In-Scene Aids data collection #2.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3457 / *Long Range Targeting*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Initiate At-sea HF phenomenology data collection. ***FY 2024 Base Plans:*** - Continue development efforts to incorporate methods and develop technology to exploit Over-the-Horizon (OTH) sensors, In-Scene aids, and sense making phenomenology to refine BLOS target detection, track and positive identification. - Continue planning for test, integration, demonstration and experiment activities for Long Range Targeting. - Continue development of technologies to integrate track data with other sources to feed Battle Management Command and Control (BMC2) kill chain algorithms with the objective of supporting live missions. Continue MOTHR software development; Analyze data from recent HF demonstrations. - Complete an architecture for using In-scene aids for OTH sensors - Initiate development and testing of MOTHR hardware and software. - Initiate testing long range ES systems for afloat platforms and prepare for at-sea testing. - Initiate testing of sensors and integrating into a high altitude payload. - Initiate testing of land-based ES system for ground forces. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 in Proj: 3457 - LRT is due to procuring hardware components for the MOTHR transmitter and receiver, procuring antenna parts, and preparing platform for at-sea integration/ testing (shelter integration, RF and power cable installation).					
Accomplishments/Planned Programs Subtotals	15.027	24.748	44.400	0.000	44.400

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3458 / *Undersea Warfare Efforts*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3458: *Undersea Warfare Efforts*	0.000	6.575	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	6.575
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Undersea Warfare Efforts Project will develop new technology for offensive and defensive warfare conducted on the seabed, in the sea (i.e. subsea), and from the sea. Undersea Warfare Efforts as part of Full Spectrum Undersea Warfare (FSUSW) focuses on Theatre Undersea Warfare (TUSW), Joint Targeting and Strike, and Subsea and Seabed Warfare (SSW). There are five thrust areas of the Undersea Warfare Efforts that are key to enabling Chief of Naval Operations Guidance (CNOG), Distributed Maritime Operations (DMO), and the Commandant's Stand in Force with manned and unmanned warfighting capability. These thrust areas were specifically chosen in direct collaboration with STRATCOM, INDO-PACOM, Fleet and Undersea Warfare Commanders and validated with regular Flag engagements. These advanced technology developments will enable future undersea weapon systems (e.g., Maritime Strike Tomahawk and ADCAP variants), COCOM campaign, and operational plans. Undersea Warfare Efforts thrust areas include 1) Undersea effectors, 2) Integrated expeditionary subsea system of systems, 3) Multi-Vehicle Torpedo Tube Development System (MVTTDS) for payload A, 4) Undersea UAV for Over-The-Horizon (OTH) effects and 5) Undersea Launched Devices to enable Commanding Officers and Regional Combatant Commander effects. The thrust areas are technically an operational interconnected. Selected concepts from advanced research will be integrated into viable representative prototypes for field experimentation in a relevant environment. Lessons learned from field experimentation will inform continued applied research spirals to remedy technical shortcomings, expand capability, or define an alternate approach. The Activity identified in the Undersea Warfare Efforts, Project 3458, specifically addresses Advanced Technology Development in support of the Full Spectrum Undersea Warfare INP effort. The Applied Research Budget Activity (BA) 2 funding is in a separate Program Element (PE) 060279N FSUSW INP, Project 3456.

Information security concerns preclude fully detailed descriptions of project efforts, research activities, and technology development plans. Specific information on each project and activity will be provided separately to the Congressional oversight committees.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Undersea Warfare Efforts	6.575	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: The Undersea Warfare Efforts Project will develop new technology for offensive and defensive warfare conducted on the seabed, in the sea (i.e. subsea), and from the sea. Undersea Warfare Efforts as part of Full Spectrum Undersea Warfare (FSUSW) focuses on Theatre Undersea Warfare (TUSW), Joint Targeting and Strike, and Subsea and Seabed Warfare (SSW). There are five thrust areas of the Undersea Warfare Efforts that are key to enabling Chief of Naval Operations Guidance (CNOG), Distributed Maritime Operations (DMO), and the Commandant's Stand in Force with manned and unmanned warfighting capability. These thrust areas were specifically chosen in direct collaboration with STRATCOM, INDO-PACOM, Fleet and Undersea Warfare					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3458 / *Undersea Warfare Efforts*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Commanders and validated with regular Flag engagements. These advanced technology developments will enable future undersea weapon systems (e.g., Maritime Strike Tomahawk and ADCAP variants), COCOM campaign, and operational plans. Undersea Warfare Efforts thrust areas include 1) Undersea effectors, 2) Integrated expeditionary subsea system of systems, 3) Multi-Vehicle Torpedo Tube Development System (MVTTDS) for payload A, 4) Undersea UAV for Over-The-Horizon (OTH) effects and 5) Undersea Launched Devices to enable Commanding Officers and Regional Combatant Commander effects. The thrust areas are technically an operational interconnected. Selected concepts from advanced research will be integrated into viable representative prototypes for field experimentation in a relevant environment. Lessons learned from field experimentation will inform continued applied research spirals to remedy technical shortcomings, expand capability, or define an alternate approach. The Activity identified in the Undersea Warfare Efforts, Project 3458, specifically addresses Advanced Technology Development in support of the Full Spectrum Undersea Warfare INP effort. The Applied Research Budget Activity (BA) 2 funding is in a separate Program Element (PE) 060279N FSUSW INP, Project 3456. Information security concerns preclude fully detailed descriptions of project efforts, research activities, and technology development plans. Specific information on each project and activity will be provided separately to the Congressional oversight committees. ***FY 2023 Plans:*** N/A ***FY 2024 Base Plans:*** N/A ***FY 2024 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	6.575	0.000	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3459 / *Super Swarm (SS)*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3459: *Super Swarm (SS)*	0.000	9.392	14.848	19.800	-	19.800	19.800	0.000	0.000	0.000	0.000	63.840
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Swarming is a concept that allows for multi-domain, heterogeneous swarms of unmanned systems capable of rendering the counter's ability to scale either inadequate or irrelevant and includes offensive and defensive operations, own and adversarial employment, and a physical battlespace ranging from open ocean to ashore. The Super Swarm (SS) INP effort will develop an autonomous control system for multiple USV's consisting of cooperative task allocation, cooperative route planning/behaviors and shared situational awareness. The Swarm autonomy technology is leveraged by other programs including the Medium Displacement Unmanned Surface Vehicle (MDUSV) and the Autonomous USV FNC program. It will consist of the employment of sustainable large-scale robotic swarm warfare across all domains ahead of our adversaries to obviate costly and vulnerable legacy platforms and to gain a competitive advantage. The Activity identified in Project Unit 3459 specifically addresses Advanced Technology Development in support of the Super Swarm INP effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Super Swarm (SS)	9.392	14.848	19.800	0.000	19.800
Articles:	-	-	-	-	-
Description: Swarming is a concept that allows for multi-domain, heterogeneous swarms of unmanned systems capable of rendering the counter's ability to scale either inadequate or irrelevant and includes offensive and defensive operations, own and adversarial employment, and a physical battlespace ranging from open ocean to ashore. The Super Swarm (SS) INP effort will develop an autonomous control system for multiple USV's consisting of cooperative task allocation, cooperative route planning/behaviors and shared situational awareness. The Swarm autonomy technology is leveraged by other programs including the Medium Displacement Unmanned Surface Vehicle (MDUSV) and the Autonomous USV FNC program. It will consist of the employment of sustainable large-scale robotic swarm warfare across all domains ahead of our adversaries to obviate costly and vulnerable legacy platforms and to gain a competitive advantage.					
FY 2023 Plans: Continue efforts focused on interaction of multiple autonomy architectures across multiple domains and platforms to generate coordinated and optimized behaviors for the delivery of effects on target. Initiate efforts in dynamic and reactive swarm optimization for complex, highly defended target scenarios.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3459 / *Super Swarm (SS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Initiate efforts for heterogeneous platform launch integration onto objective Deployment and Employment of Autonomous Long Range Systems (DEALRS) (Project 3462) swarm delivery marsupial host platform. ***FY 2024 Base Plans:*** - Continue efforts focused on interaction of multiple autonomy architectures across multiple domains and platforms to generate coordinated and optimized behaviors for the delivery of effects on target. - Continue dynamic and reactive swarm optimization for complex, highly defended target scenarios. - Complete efforts for heterogeneous platform launch integration onto objective Deployment and Employment of Autonomous Long Range Systems (DEALRS) (PRJ 3642) platforms. - Initiate effort to conduct full-scale force-on-force experimentation for validation of platforms and techniques and defense against relevant target scenarios. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 in Proj: 3459 Super Swarm is due to increase in number of swarm agents utilized for live testing.					
Accomplishments/Planned Programs Subtotals	9.392	14.848	19.800	0.000	19.800

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3461 / *MASS*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3461: *MASS*	0.000	0.883	3.957	4.950	-	4.950	4.950	0.000	0.000	0.000	0.000	14.740
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

This activity is being broken out from Project Unit 3459 Super Swarm to provide increased visibility and focus on this technical challenge area at the BA3 level.

A. Mission Description and Budget Item Justification

The rising use of air, surface, and sub-surface unmanned and autonomous systems requires a paradigm shift in the development, production, and life-cycle management of these systems in order to gain a competitive advantage against adversarial capabilities as well as allow for fielding of significant numbers (1000's to 10,000's) in an increasingly budget-constrained acquisition environment. The growth in rapid prototyping and additive manufacturing technologies presents an opportunity to capitalize on these advances though technical development and demonstration efforts focused on scale-up both in terms of rapid production of relevant quantities as well as greatly increasing the physical size of platforms produced far beyond what is currently achievable. Manufacturing of Autonomous Systems at Scale (MASS) efforts will utilize wide range of advanced manufacturing methods combined with adaptive digital design processes with "Design for Low-Cost Platform Attriteability" as a major attribute to avoid the platform cost growths normally associated with exquisite systems development. This also represents the ability to rapidly modify platform attributes based on evolving operational needs and quickly insert into build process without costly retooling. Secondary goals focus on increasing commonality of critical components across platforms and design of these in modular fashion in order to manage supply chain vulnerability. Lastly, the project will look at ability to place manufacturing capability as far forward/afloat as possible to reduce the logistics tail and speed delivery of capability at-scale into the fleet. The activity identified in Project Unit 3461 MASS specifically addresses Advanced Technology Development in support of the MASS effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Manufacture of Autonomous Systems at Scale (MASS)	0.883	3.957	4.950	0.000	4.950
Articles:	-	-	-	-	-
FY 2023 Plans: Continue Manufacturing of Autonomous Systems at Scale (MASS) efforts to utilize wide range of advanced manufacturing methods based on design for affordable attritability. Continue MASS digital design efforts to couple rapid adaptive processes focused on large scale (both size and quantity) Super Swarm (Project 3459) and Deployment and Employment of Autonomous Long Range Systems (DEALRS) (Project 3462) platforms of interest. Complete MASS experimentation and demonstration efforts of sub/small scale platform concept demonstrators.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3461 / *MASS*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Initiate rapidly reconfigurable tooling for large scale structures to enable rapid design iteration / evolution in response to threats. Initiate low-rate batch manufacturing of small-scale platforms in field environments. Initiate initial exploration of application of methodologies to larger-scale structures, components, and platforms across all domains. ***FY 2024 Base Plans:*** - Continue utilizing advanced manufacturing methods (additive manufacturing, composite tooling, etc) based on design for affordable attritability. - Continue MASS digital design efforts to couple rapid adaptive processes focused on large scale (both size and quantity) Super Swarm (Project 3459) and Deployment and Employment of Autonomous Long Range Systems (DEALRS) (Project 3462) platforms of interest. - Continue Super Swarm (Project 3459) and Deployment and Employment of Autonomous Long Range Systems (DEALRS) (Project 3462) platforms of interest. BA3 efforts will focus on swarm agent size/capability enhancements beyond the BA2 level. - Complete low-rate batch manufacturing of small-scale (<5ft) platforms in field environments. - Complete application of rapid manufacturing methodologies to larger-scale structures/platforms for surface platforms. - Initiate low-rate batch manufacturing of large-scale platforms (>20ft) - Initiate experimentation of large scale platforms for validation of manufacturing repeatability and reliability ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 in Proj: MASS is due to manufacturing of full-scale platform concepts.					
Accomplishments/Planned Programs Subtotals	0.883	3.957	4.950	0.000	4.950

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3461 / *MASS*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0602792N/3461: *MASS*	4.352	4.950	7.920	-	7.920	0.000	0.000	0.000	0.000	0.000	17.222

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3462 / *DEALRS*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3462: *DEALRS*	0.000	0.837	4.948	5.940	-	5.940	5.940	7.920	7.686	0.000	0.000	33.271
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

This activity is being broken out from Project Unit 3459 Super Swarm to provide increased visibility and focus on this technical challenge area at the BA3 level.

A. Mission Description and Budget Item Justification

Adversary Anti-Access and Area Denial (A2/AD) capabilities continue to improve but remain focused on targeting specific US and joint force capabilities. The Deployment and Employment of Autonomous Long Range Systems (DEALRS) project will develop technologies that sidestep, operate below the threshold, or deplete adversary A2/AD capabilities. DEALRS will specifically develop technologies to enable low-cost unmanned systems that can maneuver across theater-level ranges to penetrate, operate within, and launch strikes from within adversary A2/AD system coverage. This project will develop technologies to increase the range and endurance of autonomous systems while maintaining tactically relevant speeds, loiter times, and signatures with low cost. It will also address technologies that enable the marsupial launch of terminal engagement autonomous unmanned systems across all domains from larger and/or longer-range host systems that bring them to the launch area and the associated technologies needed to ensure roboticized and autonomous startup and launch of the marsupial systems without human intervention. The Activity identified in Project Unit 3462 DEALRS specifically addresses Advanced Technology Development in support of the INP effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Deployment & Employment of Autonomous Long Range Systems (DEALRS)	0.837	4.948	5.940	0.000	5.940
Articles:	-	-	-	-	-
Description: Adversary Anti-Access and Area Denial (A2/AD) capabilities continue to improve but remain focused on targeting specific US and joint force capabilities. The Deployment and Employment of Autonomous Long Range Systems (DEALRS) project will develop technologies that sidestep, operate below the threshold, or deplete adversary A2/AD capabilities. DEALRS will specifically develop technologies to enable low-cost unmanned systems that can maneuver across theater-level ranges to penetrate, operate within, and launch strikes from within adversary A2/AD system coverage. This project will develop technologies to increase the range and endurance of autonomous systems while maintaining tactically relevant speeds, loiter times, and signatures with low cost. It will also address technologies that enable the marsupial launch of terminal engagement autonomous unmanned systems across all domains from larger and/or longer-range host systems that bring them to the launch area and the associated technologies needed to ensure roboticized and autonomous startup and launch of the marsupial systems without human intervention. The Activity identified in					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3462 / *DEALRS*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Project Unit 3462 DEALRS specifically addresses Advanced Technology Development in support of the INP effort. ***FY 2023 Plans:*** - Continue efforts to explore concepts for the Deployment and Employment of Autonomous Long Range Systems (DEALRS) across all domains. Efforts will focus on platforms enhancements as well as marsupial concepts to allow extremely large numbers of systems to traverse long distances with minimal human intervention to bring them into the operations area. - Continue efforts to demonstrate concepts for DEALRS across all domains. Efforts will focus on scaling up promising concepts to demonstrate trans-Oceanic deployment and employment of large numbers of unmanned systems to deliver desired effects in the areas of operation. - Initiate efforts on scaling up promising concepts to demonstrate trans-Oceanic deployment of low-cost attritable swarm agents and platforms. This will be informed by FY22 and early FY23 Super Swarm (Project 3459), Manufacture of Autonomous Systems at Scale (MASS) (Project 3461) and Manned / Autonomous Teams (MATes) (Project 3463) activities. BA3 efforts will focus on swarm agent range/ endurance enhancements and swarm delivery marsupial host platform development beyond the BA2 level. ***FY 2024 Base Plans:*** - Continue exploring concepts for the Deployment and Employment of Autonomous Long Range Systems (DEALRS) across all domains. Efforts will focus on platforms enhancements as well as marsupial concepts to allow extremely large numbers of systems to traverse long distances with minimal human intervention to bring them into the operations area. - Continue efforts to demonstrate concepts for DEALRS across all domains. Efforts will focus on scaling up promising concepts to demonstrate trans-Oceanic deployment and employment of large numbers of unmanned systems to deliver desired effects in the areas of operation. - Continue scaling up promising concepts to demonstrate trans-Oceanic deployment of low-cost attritable swarm agents and platforms. This will be informed by Super Swarm (Project 3459), Manufacture of Autonomous Systems at Scale (MASS) (Project 3461) and Manned / Autonomous Teams (MATes) (Project 3463) activities.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3462 / *DEALRS*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
BA3 efforts will focus on swarm agent range/ endurance enhancements and swarm delivery marsupial host platform development beyond the BA2 level. - Initiate experimentation with intermediate scale concepts for mission specific scenarios. Efforts include integration and at-sea testing of payloads developed under Super Swarm (PRJ 3459). ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 increase is due to increase in on-water testing of full-scale platform concepts.					
Accomplishments/Planned Programs Subtotals	0.837	4.948	5.940	0.000	5.940

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0602792N/3462: *DEALRS*	5.804	6.930	10.890	-	10.890	6.930	0.000	0.000	0.000	0.000	30.554

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3463 / *MATes*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3463: *MATes*	0.000	0.768	3.958	4.950	-	4.950	4.950	13.860	13.451	0.000	0.000	41.937
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

This activity is being broken out from Project Unit 3459 Super Swarm to provide increased visibility and focus on this technical challenge area at the BA3 level.

A. Mission Description and Budget Item Justification

Traditionally, the utilization of autonomous systems is either operationally segregated from manned operations or requires a significant amount of human oversight when operating in conjunction with manned assets, which mitigates some of the advantage from using them. The goal of the Manned and Autonomous Teams (MATes) project is to develop autonomic robotic technology and collaborative autonomous behaviors that seamlessly operate across all domains in conjunction with manned units, allowing for real-time adaptation and optimization in a manner that streamlines the element of human interaction needed to share mission goals. This technology will monitor human or manned system teammate state, behavior, mission, and adversary threat status to anticipate and act in a tactically appropriate manner that is predictable, communicable, and trusted by the human/manned teammates and which enables autonomous system optimization in coordination with the human/manned teammate and mission objectives. Intuitive human/autonomous system interfaces will be developed to allow focus on higher-order decision-making tasks by the operators allowing for large numbers of autonomous systems (100's or 1000's) to be managed in support of manned operations. The activity identified in Project Unit 3463 MAtes specifically addresses Advanced Technology Development in support of the MATes effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Manned and Autonomous Teams (MATes)	0.768	3.958	4.950	0.000	4.950
Articles:	-	-	-	-	-
FY 2023 Plans: Continue efforts to explore autonomy, perception, and command and control (C2) concepts for Manned and Autonomous Teams (MATES) conducting complex multi-domain operations in proximity to each other along a spectrum of missions. Missions range from fully autonomous to highly supervised requiring an agile optimization as real-world factors change. Continue efforts to explore autonomy, perception, and command and control (C2) concepts for MATES conducting complex multi-domain operations in proximity to each other along a spectrum of missions.					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3463 / *MATes*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Initiate demonstration of multiple autonomy architectures across multiple domains conducting re-optimizing behaviors based on changing mission parameters and perception data. Agents will be Super Swarm (Project 3459) agents, and efforts will mutually inform tactical behavior, perception, and autonomy schemas. Initiate experiments to validate command and control with different levels of human oversight and trust. ***FY 2024 Base Plans:*** - Continue exploring autonomy, perception, and command and control (C2) concepts for Manned and Autonomous Teams (MATES) conducting complex multi-domain operations in proximity to each other along a spectrum of missions. Missions range from fully autonomous to highly supervised requiring an agile optimization as real-world factors change. - Continue efforts to explore autonomy, perception, and command and control (C2) concepts for MATES conducting complex multi-domain operations in proximity to each other along a spectrum of missions. - Continue demonstration of multiple autonomy architectures across multiple domains conducting re-optimizing behaviors based on changing mission parameters and perception data. Agents will be Super Swarm (PRJ 3459) agents, and efforts will mutually inform tactical behavior, perception, and autonomy schemas. - Continue experiments to validate command and control with different levels of human oversight and trust. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 in Proj: 3463 MATes is due to rapid experimentation cycles (monthly) to demonstrate and validate behaviors.					
Accomplishments/Planned Programs Subtotals	0.768	3.958	4.950	0.000	4.950

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3463 / *MATes*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTEN/0602792N/3463: *MATes*	4.836	6.435	9.900	-	9.900	9.900	4.950	4.804	0.000	Continuing	Continuing

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3464 / *REDCAT*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3464: *REDCAT*	0.000	5.457	8.000	13.500	-	13.500	6.000	0.000	0.000	0.000	0.000	32.957
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Remote Electromagnetic Disruption of Critical Advanced Threats (REDCAT) will demonstrate High Power Microwave (HPM) integration onto Naval platforms for air defense missions. The objective of the REDCAT rapid prototyping effort is to demonstrate that the REDCAT system is able to detect, track, engage, defeat and assess advanced threats to the ship in a maritime environment. This HPM payload capability will supplement and conserve the ships kinetic defensive weapons. In addition to advancing the HPM source and antenna technologies, this program will also enhance sensor systems well as common weapon console with ongoing laser programs. REDCAT will also develop novel Radio Frequency (RF) waveforms to improve HPM effectiveness. When combined with other non-kinetic capabilities and integrated with the ship's command and control (C2), REDCAT will provide a low cost-per-shot, deep magazine capability for significantly expanding the self-defense capabilities of US Navy platforms. Rapid engagement of targets for large threat raid defeat is a major feature of the system. The system will demonstrate full kill chain integration from find to assess. The payoffs for the REDCAT program include integrated non-kinetic air defense systems to improve the layered defense, optimized use of defensive kinetic weapons and improved sensor and control systems.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: REDCAT HPM Test Bed	5.457	8.000	13.500	0.000	13.500
Articles:	-	-	-	-	-
Description: Remote Electromagnetic Disruption of Critical Advanced Threats (REDCAT) will demonstrate High Power Microwave (HPM) integration onto Naval platforms for air defense missions. The objective of the REDCAT rapid prototyping effort is to demonstrate that the REDCAT system is able to detect, track, engage, defeat and assess advanced threats to the ship in a maritime environment. This HPM payload capability will supplement and conserve the ships kinetic defensive weapons. In addition to advancing the HPM source and antenna technologies, this program will also enhance sensor systems well as common weapon console with ongoing laser programs. REDCAT will also develop novel Radio Frequency (RF) waveforms to improve HPM effectiveness. When combined with other non-kinetic capabilities and integrated with the ship's command and control (C2), REDCAT will provide a low cost-per-shot, deep magazine capability for significantly expanding the self-defense capabilities of US Navy platforms. Rapid engagement of targets for large threat raid defeat is a major feature of the system. The system will demonstrate full kill chain integration from find to assess. The payoffs for the REDCAT program include integrated non-kinetic air defense systems to improve the layered defense, optimized use of defensive kinetic weapons and improved sensor and control systems. This effort will also develop and HPM test bed and perform capability demonstrations to fill gaps in effects and mission					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3464 / *REDCAT*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
modeling of HPM weapons. This includes providing specific measurable data to inform the Terminal Defense NIF gap assessment & closure plans. The goal of the government-developed HPM test bed is to: - Evaluate existing REDCAT prototype hardware for performance and suitability evaluation - Develop detailed effects understanding of HPM lethality capability and thresholds - Inform HPM system requirements and a ship deployable HPM system design ***FY 2023 Plans:*** Continue advanced technology development in support of the REDCAT INP. Specific efforts include the following: - Complete the HPM test bed - Begin integration testing for HPM/EW effects based requirements development. - Contract for antenna completion. - Effects testing initiation and analysis across Navy labs, JHU-APL, and Raytheon. Key Deliverables: Test bed hardware and drawings, Pulsed power assessment test report, EW techniques test report, Mission modeling analysis report, Effects based modeling framework ***FY 2024 Base Plans:*** Continue advanced technology development in support of the REDCAT HPM Testbed effort referred to as Microwave Effects Testbed for Exploring Operational Requirements (METEOR). Specific efforts include the following: Continue -Mission modelling and effects refinement to inform conceptual system design -Electronics effects work with expanded parameters that feed into key Navy requirements definition -Low Power Testing with RF Components and BDA testing with existing sensor capabilities Initiate -Open air propagation - test antenna with test bed in a scaled outdoor environment -Hardware equipment development and testing for candidate alternative subsystems -EMI measurements and shipboard environmental design requirements analysis for integration ***FY 2024 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3464 / *REDCAT*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase in funding from FY 2023 to FY 2024 in Proj: 3464 REDCAT is due to a Navy Terminal Defense directed research focus on accelerated testing for electronic effects under the REDCAT effort that was originally limited to existing hardware only at laboratory level instead of scaled system level. This testing is linked to support data development and mission modelling in support of Navy Integrated Air and Missile Defense (IAMD) layered ship defense. Additional investment is planned for hardware development and evaluation in government and contracted industry efforts that will allow added assessment and understanding across candidate HPM system technologies in this new developmental regime. These systems will also include added focus on assessment towards Naval shipboard requirements in EMI and Environmental considerations beyond a lab only focused testing program to include testing in an operationally relevant environment.					
Accomplishments/Planned Programs Subtotals	5.457	8.000	13.500	0.000	13.500

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3507 / *Chimera*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3507: *Chimera*	0.000	0.000	0.000	4.732	-	4.732	15.404	34.415	50.109	67.304	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

Project 3507 is a new start in FY 2024 for the Chimera INP

A. Mission Description and Budget Item Justification

Details at a higher classification

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Chimera	0.000	0.000	4.732	0.000	4.732
Articles:	-	-	-	-	-
Description: Details at a higher classification					
FY 2023 Plans: N/A					
FY 2024 Base Plans: Details at a higher classification					
FY 2024 OCO Plans: N/A					
FY 2023 to FY 2024 Increase/Decrease Statement: The increase in funding from FY 2023 to FY 2024 in Proj: 3507 Chimera is due to the initiation of the program.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	4.732	0.000	4.732

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 5899 / *Precision Fire Control*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
5899: *Precision Fire Control*	0.000	0.000	0.527	8.673	-	8.673	10.352	19.520	14.394	0.000	0.000	53.466
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Precision Fire Control (PFC) effort will develop a fire control architecture that delivers high precision, high update rate guidance solutions to enable cruise missile defense with small, low-cost interceptors and dramatically increase number of interceptors per ship or Expeditionary Advanced Base. It will develop fire control capability for multiple interceptors (missiles and gun projectiles) that contribute to layered defense of surface combatants, expeditionary forces, and homeland protection. Develop PFC-enabled low-cost missile (LCM) based on existing 2.75" rocket components.

The Activity identified in Proj: 5899 Precision Fire Control (PFC) specifically addresses Advanced Technology Development in support of the PFC INP effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Precision Fire Control	0.000	0.527	8.673	0.000	8.673
Articles:	-	-	-	-	-
FY 2023 Plans: Initiate Advanced Technology Development in support of the Precision Fire Control (PFC)INP. Specific efforts include the following: - Begin prototyping of PFC fire control elements and Hyper Velocity Projectile (HPV) flight test units.					
FY 2024 Base Plans: - Continue prototyping of Precision Fire-Control (PFC) fire control elements and Hyper Velocity Projectile (HVP) flight test units. - Initiate interceptor guidance testing with HVP and Low Cost Terminal Defense Missile (LCTDM).					
FY 2024 OCO Plans: N/A					
FY 2023 to FY 2024 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 5899 / *Precision Fire Control*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
The increase in funding from FY 2023 to FY 2024 in Proj: 5899 Precision Fire Control (PFC) is due to the prototyping of PFC fire control elements, fabrication of test articles, and execution of interceptor guidance testing with Hyper Velocity Projectiles and Low Cost Terminal Defense Missiles.					
Accomplishments/Planned Programs Subtotals	0.000	0.527	8.673	0.000	8.673

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	36.008	59.300	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	95.308
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
Congressional Add: High speed laser cooling systems ***FY 2022 Accomplishments:*** Conduct high speed laser cooling systems advanced technology development ***FY 2023 Plans:*** N/A	5.792	0.000
Congressional Add: Advanced ATRT SBIR enterprise capabilities ***FY 2022 Accomplishments:*** Conduct advanced ATRT SBIR enterprise capabilities advanced technology development ***FY 2023 Plans:*** Conduct effort to advance prior SBIR Automated Test and Re-Test efforts to address enterprise level: multi-level of security, digital authentication, zero trust and other technologies to ensure supply chain reliability and cyber resiliency.	15.735	25.300
Congressional Add: Energetics renaissance ***FY 2022 Accomplishments:*** Conduct energetics renaissance advanced technology development ***FY 2023 Plans:*** N/A	9.654	0.000
Congressional Add: Group 3 advanced autonomous ***FY 2022 Accomplishments:*** Conduct advanced technology development supporting group 3 advanced autonomous efforts ***FY 2023 Plans:*** Conduct advanced technology development supporting group 3 advanced autonomous efforts.	4.827	5.000
Congressional Add: Combinded fiber laser arrays without wavefront sensing	0.000	24.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023
FY 2022 Accomplishments: N/A ***FY 2023 Plans:*** Conduct combined fiber laser arrays without wavefront sensing research.		
Congressional Add: HEL testing and risk reduction ***FY 2022 Accomplishments:*** N/A ***FY 2023 Plans:*** Conduct high-energy laser (HEL) testing/risk reduction effort.	0.000	5.000
Congressional Adds Subtotals	36.008	59.300

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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