United States Air Force
Life Cycle Management Center Armament Directorate
DoD Small Business Innovation Research (SBIR) 22.4 Annual BAA
Proposal Submission Instructions

INTRODUCTION

The Armament Directorate designs, develops, produces, fields and sustains a family of air-to-ground and air-to-air munitions for both U.S. and allied nations to defeat a spectrum of enemy targets. Led by the Air Force Program Executive Officer for Weapons, the directorate reports to both the Assistant Secretary of the Air Force for Acquisition, Washington, DC and the Air Force Life Cycle Management Center, Wright Patterson Air Force Base, Ohio. Primary operations locations for its $92B portfolio include Eglin AFB, Hill AFB and Robins AFB. More information about the directorate's mission may be found at https://www.aflcmc.af.mil/WELCOME/Organizations/Armament-Directorate/.

Proposers responding to a topic in this BAA must follow all general instructions provided in the Department of Defense (DoD) SBIR Program BAA. Air Force specific requirements in addition to or deviating from the DoD Program BAA are provided in the instructions below.

Specific questions pertaining to the administration of this BAA and these proposal preparation instructions should be directed to: AFLCMC.EBZ.PD@us.af.mil .

The following dates apply to this topic release:

April 26, 2022: Topics open; Air Force begins accepting proposals via DSIP
May 27, 2022: DSIP Topic Q&A closes to new questions at 12:00 p.m. ET
June 14, 2022: Deadline for Receipt of proposals no later than 12:00 pm ET

Proposers may submit technical questions through the DSIP Topic Q&A page at https://www.dodsbirsttr.mil/submissions/login. Topic Q&A will close to new questions on May 27, 2022 at 12:00 p.m. ET.

DIRECT TO PHASE II (DP2) PROPOSAL GUIDELINES

This effort will result in Direct to Phase II SBIR awards.

Complete proposals must include all of the following:

Volume 1: DoD Proposal Cover Sheet
Volume 2: Technical Proposal
Volume 3: Cost Proposal
Volume 4: Company Commercialization Report
Volume 5: Supporting Documents
Volume 6: Fraud, Waste, and Abuse Training Completion

ALL CONTRACTORS SHALL FOLLOW PROPOSAL GUIDELINES AS DETAILED IN THE DOD ANNUAL SBIR WITH THE FOLLOWING SUPPLEMENTATION:

Firms must follow a two-step process to be selected. Step A includes submitting a proposal as detailed below in order to participate in Step B, Weapons Pitch Day. Weapons Pitch Day will be held around or about the week of 18 July 2022 at the Doolittle Institute in Niceville, FL. The Step A proposal will be evaluated to determine which offerors will be requested to present their solutions and technologies to a panel of Air Force personnel. Prior to Step B, offerors selected will receive information for making a live

pitch to the Air Force team. Companies must be present at the event and complete their pitch to Air Force evaluators in order to be considered for award.

VOLUME 1: DoD Proposal Cover Sheet
Submit in accordance with DoD SBIR BAA Section 5.3.a.

VOLUME 2: TECHNICAL PROPOSAL

STEP A TECHNICAL PROPOSAL: The Step A technical proposal shall consist of a 10 page technical summary, a 15-page slide deck, and a one page "sales pitch" summary document, submitted in a single PDF file. Content that exceeds these limits will not be reviewed.

TECHNICAL SUMMARY. The following information shall be provided in a single PDF file not to exceed 10 pages. Number all pages consecutively. Text shall not be smaller than 10-point on standard 8-1/2" x 11 paper with one inch margins.

1. Technical Approach: Clearly describe what is being proposed and what difference it will make (qualitatively and quantitatively), including a brief discussion on how this directly relates to the topic. This approach must substantiate the scientific and technical merit and feasibility of the work including, but not limited to any relevant technical reports, test data, prototype designs/models, and performance goals/results. Feasibility documentation must have been substantially performed by the proposer. This documentation may be added to Volume 5, Supporting Documents.
2. Technical Objectives & Key Results: Provide an outline of work to be accomplished through the effort. Detail specific objectives to describe end state outcomes rather than processes or activities. Each objective shall be accompanied by three to five specific key results measurable throughout contract performance. These key results are anticipated to be quantitative in nature; non-quantitative key results shall be clearly measurable.
3. Work Plan: For this Phase II topic, a Work Plan, not a Statement of Work, is required. The intent is to award contracts for what will be done, rather than how the work will be done. As such, the Work Plan should be structured around the effort's purpose and requirements set forth in clear, specific, and objective terms with measurable outcomes. The work plan has two mandatory features: (1) Work stated in terms of outcomes or results, rather than performance methods; and (2) measurable performance standards, including assessment methods for these standards. The plan should include the planned location and mechanics for accomplishing the proposed approach.
    a. Scope: List the major requirements and specifications for the effort.
    b. Task Outline: Provide an outline of work to be accomplished throughout the effort.
    c. Milestone Schedule: Include a concise program schedule with all key milestones identified. Propose a suggested start date, usually ~2 months after Phase II submission deadline. Please note Milestone 01 shall be Deliver Pitch Presentation, at award+1 minute for $50,000 exactly. All other milestones are tailorable. With each milestone, include:
        i. An expected delivery date, represented in number of months after contract award, e.g., widget delivered at contract award (CA) + 6 months.
        ii. A specific deliverable of value to be provided to the AF End-User.
        iii. Clear acceptance criteria for all parties to determine milestone achievement.
        iv. Proposed milestones/deliverables shall not exceed ten (10) for fully SBIR-funded Phase IIs. Three shall be included in the base effort, including a refined Work Plan (15 days), a Final Technical Report (90 days), and an intervening

milestone/delivery at the offerors' discretion.

v. Any supporting rationale referencing payment amounts may be included in Volume 5, Additional Cost Information.

d. Deliverables: Clearly describe the specific sample/prototype hardware/software to be delivered, as well as data deliverables, schedules, and quantities with reference to any proposed milestones. Required reports are detailed in the DoD SBIR BAA. Additional reports may be required including software documentation or manuals, engineering drawings, operation and maintenance documentation, safety hard analysis for hardware, or updated commercialization results.

4. Key Personnel, Organizational Experience and Related Work: Provide a brief summary of expertise of the team, including any subcontractors, investors, partners, consultants and key personnel. Include information regarding education, experience and citizenship. A technical resume for the Principal Investigator, including publications, if any, shall be included. Describe the organizational experience in this technology area, previous work not directly related to the proposed effort but similar and existing intellectual property required to complete the project. Describe significant activities directly related to the proposed effort, including any conducted by the principal investigator, the proposing firm, consultants, or others. Describe how these activities interface with the proposed project and discuss any planned coordination with outside sources. For previous work not directly related to the proposed effort but similar, provide a short description, client for which work was performed (including individual to be contacted and phone number), and date of completion.
5. Facilities/Equipment: Describe any specialized instrumentation and/or physical and digital facilities necessary to carry out the effort. Justify equipment to be purchased and include documentation Volume 5, Additional Cost Information, as necessary. State whether proposed performance locations meet Federal, state, and local Governments environmental laws and regulations of for, but not limited to, airborne emissions, waterborne effluents, external radiation levels, outdoor noise, solid/bulk waste disposal practices, and toxic/hazardous material handling/storage.
6. Requested Resources. List Government-furnished materials or data assumed to be available. List anticipated interactions with Stakeholders necessary to accomplish the effort. Such Stakeholders may include lawyers, test range officials, information assurance officials, system program office engineers, etc. Clearly describe any completion requirements not within the offeror's immediate control and plans to work within those constraints.

SLIDE DECK. Include a 15-page slide deck concisely summarizing the proposal's main points. This slide deck should be clear and easy to understand, the intent being for use as a starting point to understanding the proposal. Other volumes will provide the bulk of information. Convert the completed deck to a pdf and attach it to the Technical Summary.

1. What are you trying to do and how does this directly relate to the topic?
2. Technology and commercial product: Specifically, what are you proposing to produce – software, system, application? Be specific on what your proposed technology development is targeting as an end state.
3. How is the technology approached today? Who is doing the research, development and delivering products/services? What are the current limitations in the technology and commercial marketplaces?
4. Technical and commercial value proposition: How have you substantiated the feasibility of your approach? What is innovative in your approach and how does it compare to the state-of-

the-art? Why do you think it will be successful both from a technical and commercial perspective? If you are successful what difference will it make? Discuss your proposed business model – how do you expect to generate revenue from your technology?

5. Technical and commercial risks: What are the key technical and commercial challenges and how do you plan to address/overcome these?
6. Technical and commercial market analysis: Who will care and what will the impact be if you are successful? What/who are the markets/industries/integrators/stakeholders that would/should care?
7. Cost, schedule and milestones: Provide a summary of your cost volume. Provide a summary of your schedule and milestones. How much will your proposed effort cost in total? How long will it take? What are your technical milestones for achieving the proposed efforts? What are your transition and commercialization plan milestones? Discuss how much funding will be required to bring your proposed technology to market and execute on your proposed transition and commercialization plan. Include any funding raised to date and expected plans for raising any additional required funding (government contracting revenue, product sales, internal R&D investment, loan, angel or Venture Capital investment, etc.). Describe timeline to maturity for operational use or commercial sales.
8. Management: Overview of team, facilities and qualifications.

SALES PITCH SUMMARY DOCUMENT: Include a visually appealing, 1-page company 'sales pitch' and proposed non-Defense commercial solution adaptation as intended to meet a US Government need. This portion of the document may be circulated publicly and should contain no confidential or Personally Identifiable Information, e.g., names, contact information, etc., for US Government employees. This should be attached to the technical summary and slide deck document.

STEP B: WEAPONS PITCH DAY

SOLUTION PITCH PRESENTATION: Only if selected to provide a live Pitch for further consideration for award, you will be required to give a short pitch comprised of a five minute presentation and five minute Q&A to be completed in person at the Doolittle Institute in Niceville, FL, during the week of 18 July 2022. If invited to present, the presentation will be between the evaluation team members and the offeror. It is likely not all offerors will be invited to present.

If the offeror's Phase II proposal identifies a motivated, empowered Defense End User and/or Defense Customer, the offeror is strongly encouraged to invite the relevant stakeholders to participate. If the Defense stakeholders participate, the offeror's five minute presentation will be first, followed by a five minute Q&A between the evaluation team and the offeror. During the five minute pitch, the Defense stakeholder will not be permitted to speak or ask questions. Following the five minute presentation and five minute Q&A, the offeror will be removed from the room and the evaluation team will speak directly with the Defense End-User and Stakeholder.

After the solicitation closes, the offeror's identified Principal Investigator may be invited via email to pitch and provided a list of available time slots. The offeror may pick only one time slot per proposal. The pitch time slots will be assigned on a first-come, first-served basis. Companies missing the selected pitch slot will be ineligible for award.

The anticipated pitch time-slots are 8:00 a.m. to 6:00 p.m. Central Time during the week of 18 July 2022.

Proposing firms will be notified of Step B selection status no later than 15 July 2022 via email to the Corporate Official listed on Volume I, Cover Sheet.

VOLUME 3: COST PROPOSAL

The total value of a fully SBIR-funded Phase II contract shall not exceed $1,838,436.00. Firm Fixed Price payments shall be tied to measurable milestones, as agreed to with the Government. The format provided in the Cost Breakdown Guidance for the DSIP online cost volume form is required. Some items may not apply to the specific project and, therefore, do not require input. The Government needs sufficient information to allow understanding of proposed funds expenditure, if selected for award. The Cost Volume must be adequate to enable AF personnel to determine the overall price's purpose, necessity, and reasonableness. The cost volume will cover up to 12 months. The itemized listing may be placed in the Explanatory Material section of the online Cost Volume or in Volume 5, Supporting Documents, under the "Other" drop-down options.

For known costs such as the price of the non-Defense, commercial solution, it may be possible to include them as 'Direct Costs' in the on-line Cost Volume. If included as direct costs, include substantiating evidence the price and costs are reasonable and realistic, e.g., invoices to non-Defense commercial customers. This same logic could apply to non-Defense commercial solution adaptations, warranties, training, reporting, or other when substantiating evidence price is reasonable and costs are realistic, e.g., invoices to non-Defense commercial customers for commercial solution adaptations, warranties, or training. Costs without substantiating justification, e.g., invoices from the commercial market, should be detailed through the cost estimating process. All substantiating evidence should be included in the 'Additional Cost Information' section of the Supporting Documents Volume 5.

Proposed costs must be provided by individual cost element and calendar year (FY) in sufficient detail to support estimates' bases, as well as the purpose, necessity, and reasonableness of each. This information will expedite contract award if selected for award.

Cost Breakdown Guidance:

- List all key personnel by name as well as by number of hours dedicated to the project as direct labor.
- Special tooling and test equipment and material cost may be included. The inclusion of equipment and material will be carefully reviewed relative to need and appropriateness for the work proposed. The purchase of special tooling and test equipment must, in the opinion of the Contracting Officer, be advantageous to the Government and should be related directly to the specific topic. These may include such items as innovative instrumentation and/or automatic test equipment. Title to property furnished by the Government or acquired with Government funds will be vested with the Air Force; unless it is determined that transfer of title to the contractor would be more cost effective than recovery of the equipment by the Air Force.
- Cost for travel funds must be justified and related to the needs of the project.
- Cost sharing is permitted for proposals under this announcement; however, cost sharing is not required, nor will it be an evaluation factor in the consideration of a proposal.
- All subcontractor costs and consultant costs must be detailed at the same level as prime contractor costs in regard to labor, travel, equipment, etc. Provide detailed substantiation of subcontractor costs in your cost proposal. Enter this information in the Explanatory Material section of the on-

line cost proposal form. The Supporting Documents Volume (Volume 5) may be used if additional space is needed.

- If a DCAA Audit has been conducted within the last five (5) years, include the audit compliance documentation in the cost proposal documents. The documentation should also include the offeror's DCAA Point of Contact (if applicable).
- If selected for award, failure to include the documentation with your proposal will delay contract negotiation, and the proposer will be asked to submit the necessary documentation to the Contracting Officer to substantiate costs (e.g., cost estimates for equipment, materials, and consultants or subcontractors). It is important to respond as quickly as possible to the Contracting Officer's request for documentation.
- For more information about cost proposals and accounting standards, see the DCAA publication titled "Audit Process Overview – Information for Contractors" available at: http://www.dcaa.mil.

VOLUME 4: COMPANY COMMERCIALIZATION REPORT (CCR)

Completion of the CCR as Volume 4 of the proposal submission in DSIP is required. Please refer to the DoD SBIR Program BAA for full details on this requirement. Information contained in the CCR will not be considered during proposal evaluations.

VOLUME 5: SUPPORTING DOCUMENTS

Volume 5 is provided for proposers to submit additional documentation to support the Proposal Coversheet (Volume 1), Technical Proposal (Volume 2), and the Cost Proposal (Volume 3). The content shall not exceed 20 pages.

All proposers are REQUIRED to submit the following documents to Volume 5:

1. Contractor Certification Regarding Provision of Prohibition on Contracting for Certain Telecommunications and Video Surveillance Services or Equipment (DOD SBIR BAA Attachment 1)
2. Foreign Ownership or Control Disclosure (DOD SBIR BAA Attachment 2): Proposers must review Attachment 2: Foreign Ownership or Control Disclosure to determine applicability.

Any of the following documents may be included in Volume 5 as applicable to the proposal.

1. Letters of Support
2. Feasibility Documentation
3. Additional Cost Information
4. Technical Data Rights (Assertions)
5. Allocation of Rights
6. Prior, Current or Pending Support of Similar Proposals or Awards: Identify proposals for essentially equivalent work submitted to other US Government agencies or DoD components by providing:
    i. Name(s)/address(es) of Federal agency(ies)/DoD Component(s) to which proposals were/will be submitted, or from which an award is expected or has been received;
    ii. The proposal or award date(s);
    iii. Proposal titles;
    iv. Principal Investigator name and title for each proposal submitted /award received; and
    v. Announcement title, number, and date under which the proposal was/will be submitted or award is expected/has been received.
    vi. Provide contract number(s) for awards received
    vii. Specify applicable topics for each proposal submitted/award received.

NOTE: If this does NOT apply, include a single-page document stating, “No prior, current, or pending US Government support for proposed work.”

DISCRETIONARY TECHNICAL AND BUSINESS ASSISTANCE (TABA)
No TABA funding is available.

EVALUATION AND SELECTION
All proposals will be evaluated in accordance with the evaluation criteria listed in the DoD SBIR 2022.4 BAA. The Air Force will conduct an evaluation of each conforming proposal. Proposals that do not comply with the requirements detailed in this BAA and the research objective(s) of the corresponding topic are considered non-conforming and therefore are not evaluated nor considered for award.

Using the evaluation criteria, the Government will evaluate each proposal in its entirety, documenting the strengths and weaknesses relative to each evaluation criterion, and, based on these identified strengths and weaknesses, determine the proposal's overall selectability. Proposals will not be evaluated against each other during the evaluation process, but rather evaluated on their own individual merit to determine how well the proposal meets the criteria stated in this BAA and the corresponding topic.

For the purposes of this proposal evaluation process, a selectable proposal is defined as follows: Selectable: A selectable proposal is a proposal that has been evaluated by the Government against the evaluation criteria listed in the DoD SBIR 2022.4 BAA and topic, and the strengths of the overall proposal outweighs its weaknesses. Additionally, there are no accumulated weaknesses that would require extensive negotiations and/or a resubmitted proposal.

For the purposes of this proposal evaluation process, a non-selectable proposal is defined as follows: Non-Selectable: A proposal is considered non-selectable when the proposal has been evaluated by the Government against the evaluation criteria listed in the DoD SBIR 2022.4 BAA and topic, and the strengths of the overall proposal do not outweigh its weaknesses.

AWARD AND CONTRACT INFORMATION
Awards will be made to proposers whose proposals are determined to be the most advantageous to the Government, consistent with instructions and evaluation criteria specified in the DoD SBIR 2022.4 BAA and availability of funding. Given the limited funding available for each topic released, not all proposals considered selectable will be selected for funding.

All offerors will be immediately notified after the Part B Pitch Presentation if selected for a Direct to Phase II award. Selectees should be ready to sign and receive a contract at the Weapons Pitch Day event. Immediately after award, companies will submit the first contract deliverable, i.e., the Pitch Day presentation, and receive a first payment of $50,000.

Proposed efforts may be awarded a FAR-based firm-fixed-price contract up to $1,838,436.00 with a 12-month maximum period of performance.

Multiple awards are anticipated. The Government reserves the right to select for negotiation all, some, one, or none of the proposals received in response to this announcement and to make awards with or without communications with proposers.

Refer to the DoD SBIR Program BAA for procedures to protest the Announcement. As further prescribed in FAR 33.106(b), FAR 52.233-3, Protests after Award should be submitted to Ms. Terri Brown at terri.brown@us.af.mil.

Air Force SBIR 22.4 Topic Index
Release 1

AF22Z-PDCSO1	Weapons Pitch Day - Digital Engineering
AF22Z-PDCSO2	Weapons Pitch Day - Commonality

AF NUMBER: AF22Z-PDCSO1

TITLE: Weapons Pitch Day - Digital Engineering

TECH FOCUS AREAS: Cybersecurity; Network Command, Control and Communications; Autonomy; Artificial Intelligence/Machine Learning

TECHNOLOGY AREAS: Ground Sea; Sensors; Electronics; Materials; Information Systems; Air Platform; Battlespace

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the proposed tasks intended for accomplishment by the FN(s) in accordance with section 5.4.c.(8) of the Announcement and within the AF Component-specific instructions. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws. Please direct questions to the Air Force SBIR/STTR Help Desk: usaf.team@afsbirsttr.us

OBJECTIVE: The Armament Directorate is investigating concepts to employ emerging technologies faster. Implementation of digital engineering across the weapons enterprise will grow and accelerate the transition of advanced technologies. We seek digital solutions to utilize Weapons Open System Architecture (WOSA) at its maximum extent. Use of the Systems Modeling Language (SysML) is a critical enabler of WOSA and the catalyst for modular weapons. Process and network modeling ensure an early understanding of tactical, operational and strategic weapons system implications. The Directorate seeks the use of the Advanced Framework for Simulation, Integration and Modeling (AFSIM) tool for all integrated flight simulations, lethality validity models, autonomy implementations and collaborative weapons system effects.

DESCRIPTION: The Armament Directorate is looking for the following technology concepts; -Network Collaborative Autonomous (NCA) UCI-based Cameo SysML Message Set Definition. Create standard SysML defined set of UCA messages. Coordinate with AFRL Golden Horde, Industry, tactical networking SMEs within AFLCMC/HN. -Long Range Kill Chain (LRKC) UCI-based Cameo SysML Message Set Definition. Create standard SysML defined set of LRKC messages. Coordinate with Industry, tactical networking SMEs within AFLCMC/HN, and SECAF OEI working group. -WOSA ICD Autonomy Domain Study. Assess and ascertain whether a new Autonomy Domain is needed within WOSA ICD. Create new WOSA ICD Autonomy Domain if needed and coordinate with key AFRL WOSA ICD SMEs, AFLCMC/EBZ WOSA ICD SMEs, and Industry as needed to define and evolve WOSA ICD standard. -NCA Networking Model. Create Cameo SysML defined model for use as a System of Systems (SoS) data network model, with associated NCA message sets, delivery latencies, error budget (e.g. bias and random jitter). Coordinate with AFRL WOSA ICD SMEs to ensure seamless integration with WOSA ICD and or to assess whether new WOSA ICD message sets are required for a new Autonomy Domain. Coordinate with AFLCMC/EBZ led working group of AFRL WOSA ICD SMEs, AFLCMC/EBZ WOSA ICD SMEs, and Industry partners on model definition. Execute a plan to produced multiple model iterations with review, discuss, coordinate, and improvement cycles within period of performance. The intent is a deliverable model with maturity that will serve as the foundational model for future AFRL, USAF weapons development, and USN weapons development programs. Will be provided to USAF M&S SMEs for their use. -LRKC Networking Model. Create Cameo SysML defined model for use as a System of Systems (SoS) data network model, with associated LRKC message sets,

delivery latencies, error budget (e.g. bias and random jitter). Coordinate with AFRL WOSA ICD SMEs to ensure seamless integration with WOSA ICD and/or to assess whether new WOSA ICD message sets are required for the LRKC. Coordinate with AFLCMC/EBZ led working group of AFRL WOSA ICD SMEs, AFLCMC/EBZ WOSA ICD SMEs, and Industry partners on model definition. Execute a plan to produced multiple model iterations with review, discuss, coordinate, and improvement cycles within period of performance. The intent is a deliverable model with maturity that will serve as the foundational model for future AFRL, USAF weapons development, and USN weapons development programs. Will be provided to USAF M&S SMEs for their use. -Secure Point to Point Wireless Toolset. Define and create wireless point to point high bandwidth communications toolset for use with flight line reprogramming of future Common Weapons Launcher and Common Reprogramming ICD. Architecture and design should support wireless transmission and reprogramming of SECRET-level data which conforms to cybersecurity and security standards and requirements. The intent is to make maximum use of existing portable computing devices with embedded or configurable hardware to wirelessly communicate with a device able to be integrated within launchers and storage containers. The device for use within launchers and storage containers should have a defined set of Application Programming Interface (API) standards with full Government Purpose Data Rights which can be made available to USG and Industry partners for further integration and use. -Secure Wireless Communications System on a Chip (SoC). Design and prototype a secure wireless SoC device for use with weapons reprogramming. System must be able to be use for flight line reprogramming operations, must be able to be integrated within the Common Weapons Launcher and weapons containers, and must be able to withstand repeated exposure to flight operations across the approved aircraft operating limits. Interfaces and Application Programming Interface (API) for system will be Government Purpose Data Rights for use with USG and Industry. Prototype system should be available for demonstration and presentation of use, benefits, and associated risks. -Non-Traditional Cybersecurity Data Protection. Explore and assess potential for non-traditional methods to encrypt and protect highly sensitive data within weapon systems. Present alternatives and designs to protect data with and without hardware involvement. Present potential approaches for definition of non-traditional hardware techniques (such as customized data protection ASICs) to protect data within weapons systems. Address scope of design, capabilities, integration, test, fielding, and support of potential alternatives and approaches, to include risk assessments of deployment. -Post Launch Use of Artificial Intelligence (AI) in Weapons. Assess use of Ai in non-traditional use within air-launched weapon systems. Design and present methodology for defining key variables needed for AI learning, the approach for using high-fidelity M&S simulations, the categorization and separation of dissimilar and similar target sets to be used for AI learning, the number of M&S runs needed for AI learning, and describe the general approach needed to invoke AI experiments within known weapon M&S and software architectures. The outcome should be a methodology to define the process to define and mature AI within post-launch weapon software. -Assessment of Aerial Targets WOSA ICD and OMS Requirements. Provide assessment of aerial targets unique system functionality and hardware, with contractual language to achieve WOSA ICD compliance within avionics systems, and OMS compliance within overall aircraft system. Define and present approach to USG for abstraction of internal avionics WOSA ICD communications, abstraction of software from hardware for internal avionics systems, and the standard for integration of avionics systems Line Replaceable Units (LRUs) within aircraft. -System on a Chip (SOC) with Secure Processor. Design a System on a Chip (SOC) with secure processor. SoC design must allow for commercial off the shelf quad ARM processor as well as a replaceable secure processor. Intent is a prototype system with 100% digital twin available for software development and system evaluation. -M&S Smart Input File Creation Tool. Create a Cameo SysML tool to create and manage M&S input files. Allow the user to create a master set of scenarios, filter scenarios by scenario conditions (e.g. launch range and altitude, target type, range to target, etc.) and save different sets of scenarios (e.g. all scenarios for a given specific target, all

scenarios with launch conditions above 20Kft, etc.). Allow the user to define first, second, and third order M&S variables to be used to create input files for sets of scenarios. Allow the user to define unique M&S session input files which define M&S variables and their distributions. During each session, allow user to select any combination of first, second, and third order variables to create input files. Allow the user to define default values for variables and vary key variables for a set of Monte Carlo runs (to prepare for sets of sensitivity analysis runs or a set of runs to support a launch readiness review for a specific scenario and launch conditions). Allow selectable user option to run a user-defined number of Monte Carlo runs for a single scenario or for a set of selectable scenarios from the master set of all scenarios; scenario selections should be able to be filtered by types of scenarios (e.g. target type, altitude, launch modes, aircraft, etc.). Allow user the option to create input files based on random draw for selected first, second, and third order variables, so that variables across the entire factor space are a random draw according to each variable's specified distribution (e.g. this will result in each scenario having a unique set of input variables according to the user's criteria). Allow user to define distributions and or default values for all M&S variables to be used during random draws, such as Gaussian and linear distributions, or custom distributions based on operational realism (e.g. 5% chance of launch from 1-20Kft, 90% change of launch from 20Kft to 40Kft evenly distributed, 5% chance of launch from 40-50Kft). Allow user to save different sets of scenarios and different sets of input variable conditions. Allow user the ability to run an automated verification of sets of input files per their specified generation criteria to confirm that the input files were generated correctly (in accordance with specified criteria). Allow user to link a set of user selected scenarios and their input conditions to their data sets, data analysis files, and summary reports for completeness, clarity, and reference.

PHASE I: This topic is intended for technology proven ready to move directly into a Phase II. Therefore, a Phase I award is not required. The offeror is required to provide detail and documentation in the Direct to Phase II proposal which demonstrates accomplishment of a "Phase I like" effort, including a feasibility study. This includes determining, insofar as possible, the scientific and technical merit and feasibility of ideas appearing to have commercial potential. It must have validated the product-market fit between the proposed solution and a potential AF stakeholder. The offeror should have defined a clear, immediately actionable plan with the proposed solution and the AF customer. The feasibility study should have Identified the prime potential AF end user(s) for the non-Defense commercial offering to solve the AF need, i.e., how it has been modified; -Described integration cost and feasibility with current mission-specific products; and -Described if/how the demonstration can be used by other DoDor Governmental customers.

PHASE II: Under the Phase II effort, the offeror shall sufficiently develop the technical approach, product, or process in order to conduct a small number of advanced manufacturing and/or sustainment relevant demonstrations. Identification of manufacturing/production issues and or business model modifications required to further improve product or process relevance to improved sustainment costs, availability, or safety, should be documented. Air Force sustainment stakeholder engagement is paramount to successful validation of the technical approach.

PHASE III DUAL USE APPLICATIONS: Phase III efforts will focus on transitioning the developed technology to a working commercial or warfighter solution.

REFERENCES:

1. www.airforceweapons.com

KEYWORDS: WOSA; Digital Engineering; SoS; WDL; NCA; LRKC; UCI; SysML; AI; network; model; ML

AF NUMBER: AF22Z-PDCSO2

TITLE: Weapons Pitch Day – Commonality

TECH FOCUS AREAS: Cybersecurity; Network Command, Control and Communications; Autonomy; Artificial Intelligence/Machine Learning; 5G; General Warfighting Requirements (GWR)

TECHNOLOGY AREAS: Ground Sea; Sensors; Electronics; Materials; Information Systems; Air Platform; Battlespace

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the proposed tasks intended for accomplishment by the FN(s) in accordance with section 5.4.c.(8) of the Announcement and within the AF Component-specific instructions. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws. Please direct questions to the Air Force SBIR/STTR Help Desk: usaf.team@afsbirsttr.us

OBJECTIVE: The Armament Directorate is searching for concepts to develop, share, and swap subsystems and microservices across the munitions portfolio. The increased rate of tactical change we anticipate in a high-end fight dictates an increased acquisition and fielding tempo. Air delivered armaments share similar “architectural domains” such as guidance, navigation, and control systems, warheads, propulsion systems, seekers, etc. We need highly modular and software defined capabilities, maximum reuse of software and hardware architectures across services and mission areas, and a challenge-based acquisitions approach to maximize competition for system subcomponents. Of interest are common, small form factor, hardware architectures that fit within a 5” tube, use of commercial heterogeneous System on Chip (SoC), System on Module (SoM) or System in Package (SiP) to reduce Size/Weight/Power/Cost and unclassified Weapons Open System Architecture (WOSA) implementation models leveraging the Systems Modeling Language (SysML). Modularity and commonality must also address efficient design by leveraging advanced artificial intelligence methods like generative design to eliminate parasitic weapon weight, increasing battery efficiency (Wh/kg) and solid rocket motor efficiency (Isp). Lastly, the Directorate seeks the ability to evolve toward a common software centric development organization. As our weapons become modular and software defined, it is critical that we begin adopting and developing methods for agile embedded software design and acquisition. The ultimate goal is to enable the adoption and establishment of modular software architectures, frameworks, and acquisition best practices to expedited system upgrades, leverage reuse and collaboration across Services and mission areas.

DESCRIPTION: Specific initiatives include: The Armament Directorate is searching for concepts with increased standoff range and reach outside of threat range. These concepts must allow Blue aircraft to effectively prosecute targets in the air and on the ground. Intended targets include fighters, soft stationary ground targets, hardened targets, moving ground targets, and maritime targets. Specific initiatives include: -Decreased parasitic weight through: --AI enabled generative design (strong back, lugs, etc.) --Novel high performance polymers & super alloys --Additive manufacturing methods (5-axis, selective laser melting (SLM), directed-energy deposition (DED), etc.) --Increased hypersonic and supersonic engine efficiency -

-Increased battery efficiency to maximize Watt-hour per kilogram (Wh/kg) --Reliable alternatives to thermal batteries to allow lighter transmission cables (high voltage, low current) --Increased solid rocket motor efficiency to maximize specific impulse (Isp) -Advanced survivability measures -System-Level Performance Considerations: --Upstream energy deposition (forward facing gas jet, converging radiation, etc.) to manipulate shock structures --Formation Flying to Reduce Drag --Off-Design Engine Performance Improvement -- Exergy-based Performance Analysis Tools (Energy Utilization vs. Entropy Generation) The Armament Directorate is probing concepts that permit Blue Forces to leverage large numbers of relatively low-cost weapons systems simultaneously. These innovative technologies could have low-cost materials and manufacturing processes, low-cost propulsion systems, modular open-system payload architectures, and disposable or re-usable dispenser vehicles. Specific initiatives include: -Expedited/affordable gas-turbine engine prototyping enabled by advanced manufacturing The Armament Directorate is pursuing ideas that permit Blue Forces to command various collaborative weapons to employ coordinated tactics to ensure success. A dynamic battlespace requires automated, adaptive weapons systems, and cooperative tactics. Specific technologies under analysis include: -Artificial intelligence algorithms with “dialable” human influence -Target identification schema -Target prioritization algorithms -Collaborative weapons playbook scripts -Datalink technologies and theories -Miniaturized, reliable electronics -Electronic warfare concepts and capabilities The Armament Directorate is pursuing concepts focused on enabling Blue Forces to utilize weapons as major contributors to multi-domain command and control (MDC2) space. Specific technologies of interest include: -Low-cost, multi spectral seekers -Data transmission and evaluation software/algorithms -Software defined radio antennas -Beyond-line-of-sight communications The Armament Directorate seeks concepts with non-kinetic effects that are either interchangeable with kinetic weapons of connected to them. These concepts should increase Blue Forces’ magazine depth and present new armament delivered capabilities to the battlefield. Many non-kinetic weapons are electric powered derived and afford the potential for multiple “shots” per weapon engagement versus a traditional kinetic weapon. Other non-kinetic effects provide different affects than kinetic weapons that may be as effective in the battle space as a kinetic weapon with lower cost and/or in a smaller package. The Armament Directorate is investigating applying the Weapon GRA to an inventory weapon as a surrogate implementation. This ensures the GRA is robust enough to model current weapons and allow changes/improvements to the GRA to assist in improving the GRA in an agile manner. Specific initiatives the Armament Directorate is interested in pursuing include: -Subsystem or Systems-of-Systems architectures based on commercial heterogeneous System on Chip (SoC), System on Module (SoM) or System in Package (SiP) approaches -Ruggedized commercial hardware small form factor implementations (fit in ≤ 5” tube) -Embedded and hardened containerization architectures for Real-Time Operating Systems -Industry or Government hardware/software standards mapped to the Weapons Open System Architecture (WOSA) logical domains -Scalable propulsion families -Common Flight Termination Systems.

PHASE I: This topic is intended for technology proven ready to move directly into a Phase II. Therefore, a Phase I award is not required. The offeror is required to provide detail and documentation in the Direct to Phase II proposal which demonstrates accomplishment of a “Phase I like” effort, including a feasibility study. This includes determining, insofar as possible, the scientific and technical merit and feasibility of ideas appearing to have commercial potential. It must have validated the product-market fit between the proposed solution and a potential AF stakeholder. The offeror should have defined a clear, immediately actionable plan with the proposed solution and the AF customer. The feasibility study should have:-Identified the prime potential AF end user(s) for the non-Defense commercial offering to solve the AF need, i.e., how it has been modified; -Described integration cost and feasibility with current mission-

specific products; and -Described if/how the demonstration can be used by other DoD or Governmental customers.

PHASE II: Under the Phase II effort, the offeror shall sufficiently develop the technical approach, product, or process in order to conduct a small number of advanced digital, manufacturing and/or sustainment relevant demonstrations. Identification of manufacturing/production issues and or business model modifications required to further improve product or process relevance to improved sustainment costs, availability, or safety, should be documented. Air Force sustainment stakeholder engagement is paramount to successful validation of the technical approach. These Phase II awards are intended to provide a path to commercialization, not the final step for the proposed solution.

PHASE III DUAL USE APPLICATIONS: Phase III efforts will focus on transitioning the developed technology to a working commercial or warfighter solution.

REFERENCES:

1. www.airforceweapons.com

KEYWORDS: Microelectronics; Cybersecurity; Network Command; Command and Control; General Warfighting Requirements;