Defense Advanced Research Projects Agency (DARPA)
DoD 22.4 Small Business Innovation Research (SBIR) Annual BAA
Topic Release 2
Proposal Submission Instructions

INTRODUCTION
DARPA's mission is to make strategic, early investments in science and technology that will have long-term positive impact on our national security. As part of this mission, DARPA makes high-risk, high-reward investments in science and technology that have the potential to disrupt current understanding and/or approaches. The pace of discovery in both science and technology is accelerating worldwide, resulting in new fields of study and the identification of scientific areas ripe for small business utilization through the SBIR and STTR programs. Small businesses are critical for developing technology to support national security. Proposers are encouraged to consider whether the R/R&D being proposed to DoD Components also has private sector potential, either for the proposed application or as a base for other applications. The topics below focus on technical domains important to DARPA's mission pursuing innovative research concepts that fall within one of its technology offices. More information about DARPA's technical domains and research topics of interest may be found at: http://www.darpa.mil/about-us/offices.

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

Specific questions pertaining to the administration of the DARPA Program and these proposal preparation instructions should be directed to: DARPA Small Business Programs Office at SBIR_BAA@darpa.mil. DSIP Topic Q&A will NOT be available for these DARPA topics. Technical questions related to improving the understanding of a topic's requirements must be submitted to SBIR_BAA@darpa.mil by the deadline listed below.

The following dates apply to this DARPA topic release:

February 17, 2022: Topics issued for pre-release
March 08, 2022: Topics open; DARPA begins accepting proposals via DSIP
March 31, 2022: Deadline for technical question submission
April 07, 2022: Deadline for receipt of proposals no later than **12:00 pm ET**

DIRECT TO PHASE II (DP2) PROPOSAL GUIDELINES

If a proposer can provide adequate documentation to substantiate that the scientific and technical merit and feasibility described in the Phase I section of the topic has been met and describes the potential commercial applications, the Direct to Phase II (DP2) authority allows the Department of Defense (DoD) to make an award to a small business concern under Phase II of the SBIR program without regard to whether the small business concern was provided an award under Phase I of an SBIR program. This topic is accepting DP2 proposal submissions ONLY.

DARPA will accept DP2 proposals with a total maximum cost/price of $4,000,000. This maximum cost/price includes a 24-month base period not to exceed $2,750,000 and a 12-month Option 1 minimum of $225,000. The base period and the minimum funding for Option 1 (if exercised) are funded entirely by DARPA. Additionally, in Option 1 (if exercised), DARPA is encouraging the performer to arrange additional program funding with a commercial or government (non-DARPA) partner of up to

$500,000. Any proposed non-DARPA funding agreement must be written, signed, and received by DARPA 60 calendar days before the last day of the period of performance of the base period to permit DARPA sufficient time to access as part of the determination to award the Option 1 effort. DARPA will match up to $500,000 of non-DARPA funds under a written, signed, and timely submitted agreement. Securing a non-DARPA funding agreement does not obligate DARPA to exercise the Option 1 effort, nor will the lack of a written funding agreement prevent the performer from receiving an Option 1 effort. DARPA will make option award decisions based on performance and funding availability.

DP2 proposals for this effort will consist of a 20-page white paper and a 15-page slide deck, and the following (Note the requested documents in A through C below are not included in previously stated page counts.):

A. Cost proposal (Required DP2 cost template is available at https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program. Upload complete cost proposal in Volume 3: Cost Volume on DSIP submission site.
B. Technical and Transition and commercialization milestone; utilize template at https://www.darpa.mil/work-with-us/for-small-businesses/commercialization-continued. Upload in Volume 5; Supporting Documents on DSIP submission site.
C. Detailed SOW; utilize template at https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program- citing specific tasks and their connection to the milestones and program metrics. (Upload in Volume 5: Supporting Documents.) For each task/subtask, provide:

    a. A detailed description of the approach to be taken to accomplish each defined task/subtask. Identification of the primary organization responsible for task execution (prime contractor, subcontractor(s), consultant(s), by name).
    b. A measurable milestone, i.e., a deliverable, demonstration, or other event/activity that marks task completion. Include completion dates and schedule for all milestones. Include quantitative metrics.
    c. A definition of all deliverables (e.g., data, reports, software) to be provided to the Government in support of the proposed tasks/subtasks. Include a table of deliverables and due dates.

Content of the Technical Volume

White Paper (20 pages). Provide the following information:
Goals and Impact: 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.

1. Phase I Feasibility: This topic is accepting Direct to Phase II proposals ONLY. To be eligible, proposers must demonstrate that the following has been achieved outside of the SBIR program: Initial software capable of automated allocation of domestic manufacturing assets for at least ten chemical products. The demonstrated capability must include: (1) a database of domestic chemical manufacturing assets; (2) an ontology to adequately describe and measure equivalency of chemical manufacturing equipment; (3) the ability to consider process features (e.g., volume, chemical compatibility, temperature ranges) and user requirements (e.g., throughput, purity, regulatory standards); and (4) capacity to consider equipment and/or processes across multiple manufacturing sites.

2. Technical Plan: Outline and address all technical areas and challenges inherent in the approach and possible solutions for overcoming potential problems. Provide specific objectives, metrics,

and milestones at intermediate stages to demonstrate a plan for accomplishment of the project objectives. Propose additional appropriate qualitative and quantitative metrics specific to the approach, as needed. Intermediary milestones should occur at no greater than 1-month increments.

3. Management and Capabilities: Designate key personnel who will be involved in the Phase II effort. Provide a brief summary of expertise of the team, including subcontractors and key personnel. Describe the organizational experience in this technology area, previous work not directly related to the proposed effort but similar, existing intellectual property required to complete the project, and any specialized facilities to be used as part of the project. List Government-furnished materials or data assumed to be available. Describe any specialized facilities to be used as part of the project, the extent of access to these facilities, and any biological containment, biosafety, and certification requirements.

4. Schedule and Milestones: Provide detailed schedule and associated milestones.

5. Transition and Commercialization Plan (this supersedes instructions provided in DoD Program BAA):
    a. Describe the commercial product or DoD system to be developed.
    b. Discuss the potential end users – DoD, Federal, and/or private sector customers. Discuss your business model for this technology (i.e., how to you anticipate generating revenue with this technology?). Who are you selling to directly or indirectly, a supplier, an integrator, or an end user?
    c. Describe your company's funding history. Discuss how much additional funding above this proposed effort (include additional required technology development, staffing requirements, infrastructure requirements, IP strategy costs, etc.) that will be required to bring this technology to market and how you anticipate going about getting that funding (e.g., Govt S&T contracts, investment).
    d. Describe the timeline to maturity for sales or transition to an end user. Describe your IP strategy.
    e. Describe the technology, market, team and business risks associated with this proposed effort and your plan to mitigate these risks.

6. Statement of Work (SOW): Provide a summary task breakdown as described in detailed SOW. Utilize the template available at https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program and upload to Volume 5: Supporting Documents on DSIP submission site. The template is not required, but serves as a useful guide for preparing the SOW details. Please note that the SOW does not count against the whitepaper 20-page limit.

Slide Deck (15 slides). Provide the following information (convert the completed deck to a pdf and attach it to the white paper):
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.

9. Technical summary quad chart: Use template provided at https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program.

10. Commercialization summary quad chart: Use the DARPA Transition and Commercialization Strategy Plan (TCSP) template, located at https://www.darpa.mil/work-with-us/for-small-businesses/commercialization-continued.

NOTE: All letters of recommendation and CVs can be loaded in Volume 5: Supporting Documents.

Company Commercialization Report (CCR) (Volume 4)
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 by DARPA during proposal evaluations.

DISCRETIONARY TECHNICAL AND BUSINESS ASSISTANCE (TABA)
DARPA does not offer TABA funding.

EVALUATION AND SELECTION
All proposals will be evaluated in accordance with the evaluation criteria listed in the DoD SBIR 2022.4 BAA. DARPA 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 DARPA topic.

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.

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 DARPA 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 DARPA topic, and the strengths of the overall proposal do not outweigh its weaknesses.

Proposing firms will be notified of selection or non-selection status for a Phase I award within 90 days of the closing date of the DoD SBIR 2022.4 BAA. It is the policy of DARPA to treat all proposals as source selection information and to disclose their contents only for the purpose of evaluation. Restrictive notices notwithstanding, during the evaluation process, submissions may be handled by support contractors for administrative purposes and/or to assist with technical evaluation. All DARPA support contractors are expressly prohibited from performing DARPA-sponsored technical research and are bound by appropriate nondisclosure agreements. Input on technical aspects of the proposals may be solicited by DARPA from other Government and/or non-Government consultants/experts who are strictly bound by the appropriate non-disclosure requirements. No submissions will be returned. Upon completion of the evaluation and selection process, an electronic copy of each proposal received will be retained at DARPA.

Proposal titles, abstracts, anticipated benefits, and keywords of proposals that are selected for contract award will undergo a DARPA Policy and Security Review. Proposal titles, abstracts, anticipated benefits, and keywords are subject to revision and/or redaction by DARPA. Final approved versions of proposal titles, abstracts, anticipated benefits, and keywords may appear on the DoD SBIR/STTR awards website and/or the SBA's SBIR/STTR award website (https://www.sbir.gov/sbirsearch/award/all).

Refer to the DoD SBIR 2022.4 Program BAA for procedures to protest the Announcement.
As further prescribed in FAR 33.106(b), FAR 52.233-3, Protests regarding the selection decision should be submitted to:

> DARPA
> Contracts Management Office (CMO)
> 675 N. Randolph Street
> Arlington, VA 22203
> E-mail: scott.ulrey@darpa.mil and sbir@darpa.mil

AWARD AND CONTRACT INFORMATION

    1. General Award Information

Multiple awards are anticipated. DARPA may award FAR-based government contracts (Firm- Fixed Price or Cost-Plus Reimbursement) or Other Transactions for Prototypes agreement (under the authority of 10 U.S.C. § 2371b) subject to approval of the Contracting Officer. The amount of resources made available for each topic issued under this BAA will depend on the quality of the proposals received and the availability of funds.

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. Additionally, the Government reserves the right to award all, some, one, or none of the options on the contract(s)/agreement(s) of the performers based on available funding and technical performance. If warranted, portions of resulting awards may be segregated into pre-priced options. Additionally, DARPA reserves the right to accept proposals in their entirety or to select only portions of proposals for award. In the event that DARPA desires to award only portions of a proposal, negotiations may be opened with that proposer. The Government reserves the right to fund proposals in phases with options for continued work, as applicable.

The Government reserves the right to request any additional, necessary documentation once it makes the award instrument determination. The Government reserves the right to remove a proposal from award consideration should the parties fail to reach agreement on award terms, conditions, and price within a reasonable time, and/or the proposer fails to provide requested additional information within three business days.

In all cases, the Government Contracting Officer reserves the right to select award instrument type, regardless of instrument type proposed, and to negotiate all instrument terms and conditions with selectees. DARPA will apply publication or other restrictions, as necessary, if it determines that the research resulting from the proposed effort will present a high likelihood of disclosing performance characteristics of military systems or manufacturing technologies that are unique and critical to defense. Any award resulting from such a determination will include a requirement for DARPA permission before publishing any information or results on the program. For more information on publication restrictions, see the DoD SBIR 2022.4 BAA.

Because of the desire to streamline the award negotiation and program execution process, proposals identified for negotiation will result in negotiating a type of instrument for award that is in the best interest of the Government. In the case of an OT for Prototype agreement under DARPA's authority to award OTs for prototype projects, 10 U.S.C. § 2371b, use of an OT provides significant opportunities for flexible execution to assist in meeting DARPA's aggressive SBIR/STTR program goals.

All proposers that wish to consider an OT award should carefully read the following:

The flexibility of the OT award instrument is beneficial to the program because the Performer will be able to apply its best practices as required to carry out the research project that may be outside of the Federal Acquisition Regulation (FAR) process-driven requirements. Streamlined practices will be used, such as milestone-driven performance, intended to reduce time and effort on award administration tasks and permit performers to focus on the research effort and rapid prototyping. Because of this ability, OTs provide the Agreements Officer the flexibility to create an award instrument that contains terms and conditions that promote commercial transition, reduce some administratively burdensome acquisition regulations, and meet SBIR/STTR program goals.

Proposers must only propose an OT agreement with fixed payable milestones. Fixed payable milestones are fixed payments based on successful completion of the milestone accomplishments agreed to in the milestone plan. Refer to the Other Transactions for Prototypes Fact Sheet and Other Transaction for Prototype Agreement, available at https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program. Specific milestones will be based upon the research objectives detailed in the topic.

Please see https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program for more information on OTs.

2. Transition and Commercialization Support Program (TCSP)

DARPA will provide services to Phase II or DP2 awardees upon contract execution through the Transition and Commercialization Support Program (TCSP) at no cost to awardees. The TCSP goal is to maximize the potential for SBIR/STTR companies to move their technology beyond Phase II, and into other research and development programs for further maturity, or into solutions or products for DoD acquisition programs, other Federal programs, and/or the commercial market. Please visit https://www.darpa.mil/work-with-us/for-small-businesses/commercialization-continued for more information on DARPA TCSP.

3. Embedded Entrepreneurship Initiative

Awardees of SBIR funding pursuant to this BAA may be eligible to participate in the DARPA Embedded Entrepreneurship Initiative (EEI) during the Period of Performance. Invitation to participate in EEI is at the sole discretion of the Government based on evaluation of technical and commercial factors and subject to program balance and the availability of funding. EEI is a limited scope program offered by DARPA, at DARPA's discretion, to a small subset of awardees. The goal of DARPA's EEI is to increase the likelihood that DARPA-funded technologies take root in the U.S. and provide new capabilities for national defense. EEI supports DARPA's mission "to make pivotal investments in breakthrough technologies and capabilities for national security" by accelerating the transition of innovations out of the lab and into new capabilities for the Department of Defense (DoD). EEI investment supports development of a robust and deliberate Go-to-Market strategy for selling technology product to the government and commercial markets and positions DARPA awardees to attract U.S. investment. The following is for informational and planning purposes only and does not constitute solicitation of proposals to the EEI.

There are three elements to DARPA's EEI: (1) A Senior Commercialization Advisor (SCA) from DARPA who works with the Program Manager (PM) to examine the business case for the awardee's technology and uses commercial methodologies to identify steps toward achieving a successful transition of technology to the government and commercial markets; (2) Connections to potential industry and investor partners via EEI's Investor Working Groups; and (3) Additional funding on an awardee's contract for the awardee to hire an embedded entrepreneur to achieve specific milestones in a Go-to-Market strategy for transitioning the technology to products that serve both defense and commercial markets. This embedded entrepreneur's qualifications should include business experience within the target industries of interest, experience in commercializing early stage technology, and the ability to communicate and interact with technical and non-technical stakeholders. Funding for EEI is typically no more than $250,000 per awardee over the duration of the award. An awardee may apportion EEI funding to hire more than one embedded entrepreneur, if achieving the milestones requires different expertise that can be obtained without exceeding the awardee's total EEI funding. The EEI effort is intended to be conducted concurrent with the research program without extending the period of performance.

EEI Application Process:
After receiving an award under the solicitation, awardees interested in being considered for EEI should notify their DARPA Program Manager (PM) during the period of performance. Timing of such notification should ideally allow sufficient time for DARPA and the awardee to review the awardee's

initial transition plan, identify milestones to achieve under EEI, modify the award, and conduct the work required to achieve such milestones within the original award period of performance. These steps may take 9-18 months to complete, depending on the technology. If the DARPA PM determines that EEI could be of benefit to transition the technology to product(s) the Government needs, the PM will refer the performer to DARPA Commercial Strategy.

DARPA Commercial Strategy will then contact the performer, assess fitness for EEI, and in consultation with the DARPA technical office, determine whether to invite the performer to participate in the EEI. Factors that are considered in determining fitness for EEI include DoD/Government need for the technology; competitive approaches to enable a similar capability or product; risks and impact of the Government's being unable to access the technology from a sustainable source; Government and commercial markets for the technology; cost and affordability; manufacturability and scalability; supply chain requirements and barriers; regulatory requirements and timelines; Intellectual Property and Government Use Rights, and available funding.

Invitation to participate in EEI is at the sole discretion of DARPA and subject to program balance and the availability of funding. EEI participants' awards may be subsequently modified bilaterally to amend the Statement of Work to add negotiated EEI tasks, provide funding, and specify a milestone schedule which will include measurable steps necessary to build, refine, and execute a Go-to-Market technology transition plan aimed at delivering new capabilities for national defense. Milestone examples are available at: https://www.darpa.mil/work-with-us/contract-management.

Awardees under this solicitation are eligible to be considered for participation in EEI, but selection for award under this solicitation does not imply or guarantee participation in EEI.

For more information please refer to the EEI website https://eei.darpa.mil/.

ADDITIONAL INFORMATION
DARPA intends to use electronic mail for all correspondence regarding these topics. Questions related to the technical aspect of the research objectives and awards specifically related to a topic should be emailed to SBIR_BAA@darpa.mil. Please reference the topic number in the subject line. All questions must be in English and must include the name, email address, and the telephone number of a point of contact.

DARPA will attempt to answer questions in a timely manner; however, questions submitted within seven (7) calendar days of the proposal due date listed herein may not be answered. DARPA will post a consolidated Frequently Asked Questions (FAQ) document. To access the posting please visit: http://www.darpa.mil/work-with-us/opportunities. Under the topic number summary, there will be a link to the FAQ. The FAQ will be updated on an ongoing basis until one week prior to the proposal due date.

Technical support for the Defense SBIR/STTR Innovation Portal (DSIP) is available Monday through Friday, 9:00 a.m. – 5:00 p.m. ET. Requests for technical support must be emailed to DoDSBIRSupport@reisystems.com with a copy to SBIR_BAA@darpa.mil.

HR0011SB20224-02   Resilient Chemical Manufacturing

HR0011SB20224-02   TITLE: Resilient Chemical Manufacturing

OUSD (R&E) MODERNIZATION PRIORITY: Artificial Intelligence (AI)/Machine Learning, Autonomy

TECHNOLOGY AREA(S): Biomedical, Chemical/Biological Defense, Information Systems, Materials/Processes

OBJECTIVE: Resilient Chemical Manufacturing (RCM) seeks to enable the rapid reallocation and optimization of existing domestic chemical manufacturing infrastructure to a new suite of products, allowing the U.S. to leverage existing onshore production equipment to respond to chemical supply chain disruptions.

DESCRIPTION: The United States relies on chemical manufacturing to provide products ranging from everyday consumer goods (plastics, fabrics, adhesives, paints) to cutting edge technologies (medicines, electronic materials), industrial goods (dyes, pesticides) and military supplies (fuels, explosives). While many high-volume, petroleum-derived chemical feedstocks are produced domestically, much of the fine chemical manufacturing necessary for complex chemical products (e.g., pharmaceuticals, electronics, energetics) has been outsourced. As a result, the U.S. is vulnerable to dynamic factors that are challenging to forecast, including issues as complex as political conflict, as unpredictable as natural disasters, and as simple as economies of scale. While the origin might vary, the impact is universal – such forces disrupt our supply of chemical feedstocks and products, affecting critical sectors of our nation including defense, healthcare, transportation, communications, and the economy.

While developing new manufacturing infrastructure and methods (e.g., automated, distributed, continuous) is one way to address these challenges, another approach of specific interest to DARPA is to build software planning capabilities that enable automated allocation and optimization of existing domestic chemical manufacturing infrastructure to a new set of products. Conventional plant-based chemical manufacturing consists of diverse sets of equipment (reactors, pumps, columns, separators, etc.) connected in a defined sequence to produce a single product. Allocation and reconfiguring of this equipment to produce a different product is a slow, manual operation, requiring detailed process knowledge and deep expertise on a given product. As a result, domestic manufacturing capacity for any new product is vastly underestimated, and diverse, secondary considerations related to critical manufacturing process attributes (e.g., scale, purity, and throughput; geographic location/distribution; and site-specific regulatory considerations) are challenging to consider and impossible to fully optimize. Developing the capacity to automatically identify, allocate, and optimize chemical manufacturing assets across multiple sites/vendors and understand dependencies of particular assets on user requirements for new chemical products would revolutionize our ability to address chemical supply chain challenges across multiple sectors.

RCM will enable rapid reallocation of existing domestic chemical manufacturing to produce chemicals that are subject to supply chain disruptions, allowing the U.S. to leverage on-shore, U.S.-owned production equipment to meet demand for chemicals due to supply chain disruptions or other dynamic demand swings. RCM will build robust production planning algorithms for a variety of domestic and foreign chemical products critical to the U.S. industrial and consumer base, develop precise ontologies for manufacturing equipment, establish a dynamic database of U.S.-owned manufacturing assets, and demonstrate a software tool that can pair production needs with latent (yet-to-be-configured) manufacturing capacity. Importantly, RCM will not develop new production infrastructure, but instead provide the capacity to model and forecast existing production equipment to meet a new production need.

PHASE I: This topic solicits Direct to Phase II proposals ONLY. Proposers must demonstrate that the following has been achieved outside of the SBIR program: Initial software tool/prototype that is capable of automated allocation of domestic manufacturing assets for at least ten chemical products. The demonstrated capability must include: (1) a database of domestic chemical manufacturing assets, (2) an ontology to adequately describe and measure equivalency of chemical manufacturing equipment, (3) the ability to consider process features (e.g., volume, chemical compatibility, temperature ranges) and user requirements (e.g., throughput, purity, regulatory standards), and (4) capacity to consider equipment and/or processes across multiple manufacturing sites.

PHASE II: RCM performers will build and validate software that enables automated allocation, management, and optimization of domestic chemical manufacturing assets. DARPA anticipates approaches that include (1) acquisition of domestic manufacturing asset information resulting in a dynamic asset database; (2) economic, security, and availability assessments of existing critical fine chemicals with approaches to computationally assess substitute chemicals; (3) fully operational, validated software with a user interface (UI) designed for non-experts that automatically allocates domestic chemical manufacturing assets across the U.S. to a particular chemical in shortage; and (4) a suite of tools that enables optimization across both chemical feedstock and/or supply chain availability and domestic manufacturing potential.

Base Period (24 Months):
Phase II fixed payable milestones for this program should include:
- Month 1: Report on current asset database and plans to incorporate additional elements, to include key details such as equipment, specifications, manufacturing locations, chemicals, suppliers, quantities, country of origin, etc., as required, to support technology/software development milestones and deliverables throughout the effort. The report should highlight current database knowledge gaps and a plan to acquire additional information to expand the breadth, scope, and utility of the database.
- Month 3: Report on selection of at least 10 chemicals that represent critical precursors, fine chemicals, and/or feedstocks to important chemical products, along with synthetic routes relevant to proposed efforts that will serve as a testbed for demonstration and validation of technology deliverables over the course of the award. Selected molecules should be directly applicable to at least one critical supply category (e.g., semiconductors and critical electronic components, energetic materials, active pharmaceutical ingredients (API)) as outlined in the 2021 House Armed Services Committee Report of the Defense Critical Supply Chain Task Force1. Selection of final testbed molecules will be approved after consultation with DARPA.
- Month 5: Report on initial algorithm development, software architecture, and modeling approaches, along with potential operational/user features of the software prototype to be employed for the Month 9 demonstration. The Month 5 report should also include details of security controls relative to database content and access that ensures vendor proprietary information is protected.
- Month 9: Report summarizing Month 9 software prototype demonstration. The report should provide details on approach, prototype architectures and algorithms, data sets, and results demonstrating initial proof-of-concept performance of software prototype (without experimental/manufacturing validation) to identify alternative/re-purposed manufacturing infrastructure or substitute chemical feedstocks/precursors. The Month 9 demonstration must utilize two of the 10 selected testbed molecules under three variable manufacturing/supply-chain scenarios selected by DARPA. The report should also detail software performance relative to database composition (e.g., number of vendors, types of equipment, etc.) with a plan to expand, augment, and refine database content and quality to enhance software/algorithm performance and capabilities.

- Month 12: Report on lessons learned, updated architectures, algorithms, and learning approaches based on results/analysis of software prototype performance during   Month 9 demonstration to include critical aspects of information contained in the database as well as a plan for experimental validation of asset allocation by Month 21.
- Month 15: Report describing expansion and optimization of technology platform integrating production capacity, logistics, costs, sustainability, and stakeholder constraints relevant to the proposed efforts.
- Month 18: Report describing the development of advanced tools and features that simplifies software operation (e.g., user interface and operability) and improves performance (e.g., time to provide a result, additional feature selection including process features and/or user requirements). The report should also include details related to development of the user interface, search, command, and control functions enabling use by non-experts.
- Month 21: Report on (1) initial software design and engineering for graphical user interface; visual analytics; and search, command, and control to include details/findings of beta-testing activities with non-experts and (2) details of experimental validation runs to include validation of user-defined requirements/inputs (e.g., throughput, purity, etc.) from the software realized in a chemical manufacturing facility.
- Month 24: Final demonstration and report documenting version 2.0 prototype architectures and algorithms, methods, results, and performance of software platform to identify alternative/re-purposed manufacturing infrastructure or substitute chemical feedstocks/precursors specific to three additional testbed molecules under five variable manufacturing/supply-chain scenarios selected by DARPA. The report should also detail software performance relative to usability by non-experts and to key data/metrics contained in the database with a plan to expand, augment, and refine database content and quality to enhance software/algorithm performance and capabilities if needed.

Option 1 (12 Months):
- Month 28: Report on development and performance of optimized user interface, cyber security features, cloud infrastructure, and/or software package intended for deployment and commercialization. Report should document subcontractors and vendors along with strategies for product launch, production, marketing, sales, and technical support, as appropriate.
- Month 34: Capstone demonstration to stakeholders as defined in consultation with DARPA.
- Month 36: Final report documenting software prototype architectures and algorithms, methods, results, and performance of software platform to identify alternative/re-purposed manufacturing infrastructure or substitute chemical feedstocks/precursors specific to the remaining five testbed molecules under seven variable manufacturing/supply-chain scenarios selected by DARPA. In addition, the final report should include quantitative metrics on decision making benefits, costs, risks, and schedule for implementation of a full prototype capability based on the pilot demonstrations. This report shall include an identification of estimated level of effort to integrate the pilot capability into an operational environment, addressing computing infrastructure and environment, decision making processes, real-time and archival data sources, and maintenance and updating needs; reliability, sensitivity, and uncertainty quantification; and transferability to other military users and problems. The report shall also document any scientific advances that have been achieved under the program. (A brief statement of claims supplemented by publication material will meet this requirement), and final PI meeting presentation material.

PHASE III DUAL USE APPLICATIONS: Fine chemical precursors are essential to a wide variety of applications critical to national security and defense such as plastics, adhesives, energetics, electronic materials, and pharmaceuticals. As such, RCM has broad applicability within the DoD, the broader U.S.

Government, and the commercial sector to include other manufacturing sectors as well as supply chain management.

REFERENCES:

1. U.S. House Armed Services Committee: Defense Critical Supply Chain Task Force Final Report (2021) https://armedservices.house.gov/_cache/files/e/5/e5b9a98f-9923-47f6-a5b5-ccf77ebbb441/7E26814EA08F7F701B16D4C5FA37F043.defense-critical-supply-chain-task-force-report.pdf coral Leptastrea purpurea. Scientific Reports, 2019. 9(1): p. 2291.