



Research Announcement
Young Faculty Award (YFA)
Defense Sciences Office
DARPA-RA-21-03
September 30, 2021

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ATTACHMENT A: EXECUTIVE SUMMARY TEMPLATE

ATTACHMENT B: PROPOSAL SUMMARY SLIDE TEMPLATE

ATTACHMENT C: PROPOSAL TEMPLATE VOLUME 1: TECHNICAL & MANAGEMENT

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ATTACHMENT E: MS Excel™ DARPA COST PROPOSAL SPREADSHEET

ATTACHMENT F: PROPOSAL TEMPLATE VOLUME 3: ADMINISTRATIVE & NATIONAL POLICY REQUIREMENTS

PART I: OVERVIEW INFORMATION

- **Federal Agency Name:** Defense Advanced Research Projects Agency (DARPA), Defense Sciences Office (DSO)
- **Funding Opportunity Title:** Young Faculty Award (YFA)
- **Announcement Type:** Initial Announcement
- **Funding Opportunity Number:** DARPA-RA-21-03
- **Catalog of Federal Domestic Assistance (CFDA) Number(s):** 12.910 Research and Technology Development
- **Dates** (All times listed herein are Eastern Time.)
 - Posting Date: September 30, 2021
 - Proposers Day: August 30, 2021. See Section VIII.A.
 - Executive Summary Due Date: November 4, 2021, 4:00 p.m.
 - FAQ Submission Deadline: January 18, 2021, 4:00 p.m. See Section VIII.B.
 - Full Proposal Due Date: January 25, 2022, 4:00 p.m.
- **Anticipated Individual Awards:** DARPA anticipates multiple awards.
- **Anticipated Funding Available for Award:** Each award will include a 24-month base period (a maximum of \$500,000) and a 12-month option period (a maximum of \$500,000).
- **Types of Instruments that May be Awarded:** Grants
- **Agency Contacts**
 - **Technical POC:** Rohith Chandrasekar, Program Manager, DARPA/DSO
 - **RA Email:** YFA2022@darpa.mil
 - **RA Mailing Address:**

DARPA/DSO
ATTN: DARPA-RA-21-03
675 North Randolph Street
Arlington, VA 22203-2114
 - **DARPA/DSO Opportunities Website:** <http://www.darpa.mil/work-with-us/opportunities>
- **Teaming Information:** See Section VIII.C for information on teaming opportunities.
- **Frequently Asked Questions (FAQ):** FAQs for this solicitation may be viewed on the DARPA/DSO Opportunities Website. See Section VIII.B for further information.

PART II: FULL TEXT OF ANNOUNCEMENT

I. Funding Opportunity Description

This Research Announcement (RA) constitutes a public notice of a competitive funding opportunity as described in 2 CFR § 200.203. Any resultant negotiations and/or awards will follow all laws and regulations applicable to the specific award instrument(s) available under this RA.

A. Introduction

The Defense Advanced Research Projects Agency (DARPA) Young Faculty Award (YFA) program aims to identify and engage rising stars in junior research positions in academia and equivalent positions at non-profit research institutions, particularly those without prior DARPA funding, to expose them to Department of Defense (DoD) needs and DARPA's mission to create and prevent technological surprise. The YFA program will provide high-impact funding to elite researchers early in their careers to develop innovative new research that enables transformative DoD capabilities. Ultimately, the YFA program is developing the next generations of researchers focused on national security issues.

Before preparing an executive summary or proposal submission, proposers are encouraged to review the DARPA mission statement and current program descriptions at the DARPA website <https://www.darpa.mil> to familiarize themselves with examples of current DARPA investments. This is not meant as instruction to duplicate those efforts, but rather to illustrate that current programs are aimed at research that will substantially advance our capabilities in these areas. Once awards are made, each YFA program performer will be assigned a DARPA Program Manager with interests closely related to their research topic. The Program Manager will act as project manager and mentor to the YFA award recipients.

Proposers should also familiarize themselves with the "Heilmeier Catechism." Details about the catechism and questions it seeks to answer can be found at <https://www.darpa.mil/work-with-us/heilmeier-catechism>.

B. Program Description/Scope

DARPA is soliciting innovative research proposals in the areas of interest to DARPA's six technical offices: Biological Technologies Office (BTO), Defense Sciences Office (DSO), Information Innovation Office (I2O), Microsystems Technology Office (MTO), Strategic Technology Office (STO), and Tactical Technology Office (TTO). Further detail regarding the specific technical areas of interest can be found under Section I.D "Topic Areas (TAs)." Proposed research should investigate innovative approaches that enable revolutionary advances in science, devices, or systems. Specifically excluded is research that primarily results in evolutionary improvements to the existing state of practice.

Submissions responding to a TA under this RA should clearly describe the relevance and impact of the proposed concept(s) for addressing the national security challenges identified in the TA description (Section I.D); the current state-of-the-art technology; new insights to address the TA challenges; a credible research plan and schedule; and critical, quantitative milestones to be pursued over the research period.

This RA seeks grant proposals only. Submissions for any other award instrument type may be considered non-conforming with the RA and may not be reviewed.

C. Program Structure

This RA seeks grant proposals for a research activity consisting of a 24-month base period. No award type other than grants will be issued under this RA. Each 12-month interval of the base period shall not exceed \$250,000. Proposals should also include a 12-month option period with a maximum funding level of \$500,000. The 12-month option period, referred to as the “Director’s Fellowship,” will be reserved for a limited number of awardees who demonstrate exceptional YFA project performance over the 24-month base period.

A target start date of July 2022 may be assumed for planning purposes.

As part of the program, a number of visits/exercises at a variety of DoD sites and facilities will be scheduled. These briefings and visits will provide YFA recipients unique, first-hand exposure to DoD personnel and technologies in the field; issues faced by the Military Services in execution of their missions; and current National Security challenges. It is expected that YFA recipients will participate in a subset of the visits/exercises made available to them. Participation in all such opportunities is not a requirement; however, lack of participation may impact the award of the Director’s Fellowship. Proposers are expected to include the necessary travel funds within the total budget of their proposal. For budgeting purposes, please plan for a minimum of 6 two-day meetings (three meetings in the Washington, D.C. area and three meetings in the San Francisco, CA area). Of the six meetings, four should occur over the course of the 24-month base period and two over the course of the 12-month option period.

D. Topic Areas (TAs)

This RA solicits single principal investigator (PI) proposals for research and development in the specific TAs of interest articulated below. Prior to submitting a full proposal, proposers are *strongly encouraged* to first submit an executive summary as described in Section IV. At the executive summary phase, proposing PIs are limited to one executive summary per TA; at the full proposal phase, proposing PIs are limited to submitting only one full proposal to only one topic under this RA. Submitting more than one full proposal may result in all of the PI’s proposal submissions being determined non-conforming and being removed from award consideration.

Potential applicants are encouraged to carefully consider the descriptions of the TAs before submission. Each submission (executive summary or full proposal) must specify ONE and only one TA for the submission and identify this TA on the submission’s cover sheet. Executive Summaries and Full Proposals (limit of one proposal per proposer) that do not clearly address a specific topic may be deemed non-conforming and may not be reviewed. DARPA reserves the right to assign a proposal or an executive summary to a different topic area than indicated by the proposer.

Technical inquiries should be emailed to YFA2022@darpa.mil with the TA stated in the subject line. Your question will be distributed to the appropriate contact. Please see Section VIII.B for more details regarding the question and answer process.

1. Modulation of Brown Adipose Tissue for Arctic Resilience

The Arctic’s frigid temperatures place extreme challenges on service members’ health, readiness, and operational capacity. Regulated activation of brown adipose tissue (BAT) to induce thermogenesis is the primary driver of cold-adaptation in arctic animals, yet this feature is disadvantageous in warmer climates. Recent evidence points to multiple genes and pathways that could be targeted to toggle BAT production and activation on or off without genomic

modification. This research effort seeks to develop tools to understand and control the thermogenesis process and develop novel interventions to accelerate a stable adaptation to and from cold operational environments. Ideally this research will identify treatments (e.g., probiotic, mi-RNA, nutritional supplement) that could enable an individual to acclimate from a warm climate ($>30^{\circ}\text{C}$) to a cold climate ($<5^{\circ}\text{C}$) (or the reverse: cold-to-warm climates) within 24 hours. Proposers should justify the relevance of the animal models proposed, and modulatory approaches should be translatable as therapies.

2. Engineered Cellular Symbiosis (ECS)

Today, the vast majority of concrete-based infrastructure possesses neither self-healing nor defect-reporting capabilities. Novel technologies that can integrate with existing concrete materials to augment inspection and repair of legacy structures will provide both a strategic and economic advantage for the DoD. Engineered biological systems offer a novel sustainment strategy due to their environmental robustness and genetic programmability. In natural settings, there is growing appreciation for the role of cross-kingdom interactions (e.g., fungal-bacterial symbiosis) in boosting the environmental robustness of microorganisms. DARPA is seeking proposals to research and develop engineered prokaryotic-eukaryotic symbiotic systems that can thrive within a cementitious environment and that can sense and report environmental factors (e.g., hydration status, chloride, pH, etc.) and/or synthesize materials for in situ repair. Proposers should describe a research plan for engineering self-sustaining, biological systems composed of prokaryotic symbionts with eukaryotic cellular hosts that are interchangeable to support different functionalities (e.g., sensing different analytes or synthesis of different repair materials). Proposers should justify how the research could aid the inspection and/or repair of legacy concrete structures.

3. Hierarchical Control of Biomaterial Structure, Function, and Organization for Injury Repair

Regrowth, repair, or replacement of damaged or diseased tissues or organs with engineered biomaterials has long been a goal of the DoD to address neural regeneration, wound healing, and burn recovery. While progress has been made in advancing biomaterial science, significant functional gaps remain between engineered constructs and native tissues, in part, due to the inability to recapitulate the complex hierarchical organization of native tissue at multiple length scales. Exquisite hierarchical control could lead to breakthroughs in applications such as guiding neurite outgrowth or repair of critical size defects in volumetric muscle, a critical need for the DoD. New methodologies to impart multi-length scale control create opportunities to improve efficacy of artificial tissue constructs and scaffolds for regenerative medicine. DARPA seeks innovative proposals to elucidate design rules and develop novel platform strategies for control of soft biomaterial structure, function, and organization at the nanoscale, microscale, and macroscale levels. Proposals must include the following for DoD-relevant injury repair applications: (1) novel methodologies to elicit anisotropic responses in tissue culture, (2) characterization of the mechanism of control, (3) characterization of the durability of biological effect, and (4) demonstration of production of macroscale constructs ($\geq 1\text{ cm}^3$) suitable for advanced research and development of in vitro, ex vivo, or in vivo models.

4. Metabolic Engineering Enabling Rare Chemistries

Small molecule production platforms enabled by synthetic biology offer several strategic advantages over traditional synthetic chemistry-based manufacturing paradigms. These

advantages include access to expansive chemical diversity; common, inexpensive production infrastructure; reduced hazardous industrial waste; and domestic production of critical chemicals to ensure supply-chain resiliency for the DoD, among others. Despite these technological advances, many critical chemistries important for a wide range of applications are currently limited or inaccessible via known metabolic pathways. To address these capability gaps, this topic area seeks proposals focused on development of novel methods for the rapid, high throughput identification and functional evaluation of new enzymes capable of catalyzing rare and non-standard functional group chemistries in biological systems for small molecule applications. Examples include terminal alkenes and alkynes, fluoro, epoxide, nitro, nitroso, and hydrazine functional groups, among others. In addition, enzymes and pathways enabling unique/rare stereo-chemistries, conjugated systems, heteroatom incorporation, cycloadditions, and polycyclic compounds are also highly desired. Chemistries that can be exploited to produce novel materials are of particular interest.

5. Strongly Correlated Material Systems and Sensors

Van der Waals heterostructures have recently shown remarkable experimental properties that enable the realization of elusive states of matter in the laboratory. The rapid configurability and ease of prototyping inherent in these materials offer a robust platform to study strongly correlated physics and topology in quantum systems. Strongly correlated materials are profoundly affected by electron-electron repulsion and often have remarkable and distinct material properties, depending on how they are stacked, rotated or gated. Recent progress has demonstrated an ability to tune and modulate superconductivity, ferromagnetism, and metal-insulator transitions, for example. The strong interactions that enable these rich electronic properties also make them difficult to study and understand, however. This problem is exacerbated by the fact that existing theoretical frameworks (Hartree-Fock, Thomas-Fermi, etc.) are poorly suited to describe large-scale interactions such as d- and f- electron systems, which, unfortunately, describe most of the relevant materials in this space. This topic seeks to explore new methods to model strongly correlated materials and better understand the basis of these effects. DARPA is seeking proposals that promise theoretical insight into the fundamental nature of these materials, supported by experimental verification, and propose new sensors borne from this emerging field.

6. Benchmarking Power Requirements for Electromagnetic Non-reciprocity

Kirchhoff's Law of thermal radiation describes the fundamental electromagnetic property of reciprocity: that at a given wavelength and angle, absorption and emission are equivalent for an object at thermal equilibrium. It is well known that this fundamental "law" has specific caveats: the relation universally applies specifically to linear, time-invariant systems. Recent progress in electromagnetics has demonstrated the ability to break this reciprocity in a variety of ways. For example, exploiting approaches such as material nonlinearities, external magnetic fields, and carrier/current injection has led to violations of reciprocity in spectral regions ranging from the visible to RF. However, the definition of breaking reciprocity has several facets, or "degrees," i.e., it can be broken in wavelength, angle, amplitude, and so forth; typically, approaches will target just one of these. Additionally, it is clear that in the case of modulated or dynamic systems that violate these "degrees," a dissipation of energy injected into the system is required in order to observe non-reciprocal behavior.

This topic seeks to answer the following: Is there a fundamental limit to how little energy per “degree” is dissipated in order to demonstrate non-reciprocity in modulated systems? Furthermore, can we identify a trend as to how much additional energy is required to be dissipated in order to violate additional “degrees” of reciprocity? Performers are expected to develop theoretical analyses in Year 1 to answers to these questions, which will provide an avenue to experimentally demonstrate breaking reciprocity using a variety of power-efficient devices in Years 2 and 3.

7. Autonomous Manufacturing and Repair for Austere Environments

Even under ideal conditions, most on-demand manufacturing and repair techniques generally require significant human interaction with machines and multiple iterations to achieve successful high strength parts and repairs. The ability to produce strong replacement parts or structural repairs without human intervention and no build-test iterations could enable new capabilities and greater operational flexibility in austere or difficult-to-reach locations such as space, deep ocean, and the Arctic. To fundamentally improve the robustness of on-demand manufacturing modalities (including, but not limited to, additive manufacturing), it is necessary to extend the state of the art of manufacturing process control to directly measure the strength of a material, part, or repair without requiring considerable hands-on effort to correlate to final part performance.

This topic seeks to develop and demonstrate the foundational capability for autonomous real-time measurement and correction of intrinsic material or interface strength during free-form manufacturing of structural parts and structural repairs. Proposers should develop and demonstrate a real-time autonomous closed-loop method for measuring material, part, or repair interface strength in-situ during manufacturing or repair. New methods for non-destructively but directly measuring material, part, or repair interface strength are particularly encouraged, although inference through real-time measured material and process characteristics to project and optimize functionality and strength performance is acceptable. Methods that can be used with feedback control to optimize strength are highly encouraged. Proposers should choose a high-performance material system (aerospace grade aluminum alloys, carbon fiber reinforced polymers, or other materials with specific strength >70 MPa/g/cc), a specific free-form manufacturing or repair method, and an appropriate standard test methodology (dogbone, lap joint, slant shear, etc.) for determining part or repair strength. Proposers must demonstrate that material, part, or repair interface strength can be predicted within 10% for a statistically relevant sample set for their chosen materials system.

8. Neuromorphic Metamaterials

Metamaterials cover a vast design space for functional materials with unique optical, acoustic, and structural properties. Recent efforts to incorporate smart materials (piezoelectric, optical, magnetostrictive, magnetorheological, electroactive materials, etc.) have led to the creation of active metamaterials whose functional properties can be tailored in real-time. The distribution of smart materials and neuromorphic circuit elements (redox transistors, memristors etc.) within the metamaterial structure offers a unique opportunity to create spatially distributed sense, compute, and actuation loops within the structure. This paradigm, referred to as structural computing or reservoir computing, leads to neuromorphic metamaterials that can operate without an external electronic control unit. In spite of the increased number of degrees of freedom due to distributed actuation, parallelized structural control, multi-domain coupling, and non-linear

dynamics, programmable signal conditioning and non-von Neumann computational architecture embedded in the structure allow us to access a design space that was otherwise out of reach for controllability. These foundational, dynamic models to represent neuromorphic metamaterials are at a nascent stage and pose numerous challenges. DARPA seeks proposals that will form the foundational knowledge to model, fabricate, and test neuromorphic metamaterials that are broadly applicable in applications, such as morphing structures in flying wing; autonomous underwater vehicles; adaptive optics; and noise, vibration, and harshness isolation.

9. Computational Theory of Information Control

Recently, there has been a substantial increase in technologies that enable broad network surveillance, restricting the free flow of information, cutting access to the open Internet, and implementing censorship mechanisms. There is currently a lack of theory-based, rigorous frameworks to reason about theoretical and demonstrated adversarial capabilities in this space in a way that usefully enables researchers to understand ongoing information control phenomena. This topic is interested in formal frameworks that leverage empirical data (e.g., network measurements or other ground truth) in order to inform the creation of models and/or frameworks that assess the technical capacity to conduct internet surveillance and/or censorship. Such work may specifically consider the relationship between large-scale networking and computational capability versus the relative technological sophistication of an actor's network surveillance and/or censorship capabilities for network traffic. Proposers may use existing open source or other datasets as basis for this work; no new empirical measurements are required to be undertaken. Proposers should consider how their work could be evaluated by practitioners in the internet freedom space. Research primarily focused on censorship or blocking of social media posts are explicitly NOT in scope.

10. Threat Modeling of the Influence Platform Ecosystem

Adversarial influence operations have been successful against U.S. interests through relentless experimentation and adaptation. Popular, broad-reaching platforms such as Twitter have been exploited, despite those platforms' ongoing efforts to identify and mitigate malicious behavior. Increasingly, multiple types of media (images, video, audio-only) has been used on Twitter, Instagram, TikTok, gaming platforms (e.g., Among Us), and other platforms to engage and ultimately influence audiences. Less "traditional" online, participatory platforms such as Amazon.com and WebMD.com are increasingly being used for influence campaigns (via user reviews, ads, comments, etc.) for commercial gain, such as peddling unproven cures for cancer, COVID-19, and other maladies. Given that these platforms may be more narrowly "policed," they are potentially ripe for more nefarious exploitation by a variety of actors. DARPA is seeking ways to build threat models for an expanding ecosystem of evolving online platforms to understand who is using them for malicious purposes and how; how they are used (actually or potentially) in concert with one another and offline media platforms; and which types of user populations are especially vulnerable to this activity. Threat models should also consider platforms' (evolving) affordances and characterization of their relevant behavior (e.g., curation mechanisms). These platform changes are being driven not just in response to how malicious actors are exploiting them but also by significant commercial concerns and competition with one another. Ideally, these threat models would help anticipate new uses of online platforms for influence by adversaries in the future and suggest potential mitigations that consider the broader ecosystem. Such predictive analyses would help allocate resources for monitoring, defense, and policymaking. Proposed efforts should identify and demonstrate feasibility of techniques and

metrics for threat modeling that characterize general types of actual or expected malevolent uses of multiple, emerging platforms – individually and in concert – rather than identifying specific influence campaigns or instances of disinformation.

11. Patch Process Leapfrogging

With the majority of modern automated vulnerability assessment approaches being applications of fuzzing techniques, bugs in software often cannot be identified until they are able to be triggered. As a consequence, complex software contains many sections of code that are rarely or never triggered, either because they represent so-called "dead code" that is present but never executed, or because they are disabled under common configurations, or simply because they are unreachable due to other bugs in the code. Unfortunately, this code can become active and accessible as software evolves, through feature changes, configuration changes, or fixes to other bugs. When previously-inaccessible code becomes accessible, the bugs contained in that code become triggerable. The bugs comprising the Stagefright vulnerability in Android MMS libraries are good examples of this phenomenon. The critical bug was blocked by several levels of lower-impact bugs, and when the critical bug was eventually discovered, several successive patches were necessary to fix even deeper bugs that were exposed by earlier patches. DARPA is seeking proposals on work to explore code reachability requirements, centering on reasoning concepts about the behavior of "un-fuzzed" code, to include vulnerabilities in dead code, configuration-guarded vulnerabilities, and vulnerability-guarded vulnerabilities. The ultimate goal is development of an abstract model of vulnerability reachability that would allow for reasoning regarding the impact of changes to software on the criticality of otherwise-guarded vulnerabilities. Proposed efforts should target techniques to identify such vulnerabilities before they become runtime threats, in order to reduce potential vulnerability of critical software and greatly shorten turnaround for repair.

12. Computational Theory of Insecurity

Cybersecurity researchers demonstrated that common mechanisms and subsystems of computing environments can be exploited to program complex computations in ways entirely unintended by their designers. However, the root causes of exploitability and emergent computation remain unexamined by core computer science theories, such as theory of computation, complexity theory, theory of data types, information theory, etc. Although exploits are now understood as instances of programming, i.e., of building larger programs out of composable primitives, they still lack productive abstractions that support reasoning at a level beyond that of concrete representations. DARPA is seeking proposals to develop abstract theories of exploit programming, emergent behaviors of computing systems, and, in particular, composability of these behaviors. Successful proposals will describe emergent behaviors of systems in terms of core computer science theories and will demonstrate the capability to anticipate new classes of unintended behaviors. They will also reduce complexity of analyzing systems for these behaviors compared to methodologies that operate on concrete representations. Proposals must include a succinct review of state-of-the-art research in novel exploitation methods both within and outside of academia and include plans for collaborating with industry experts.

13. Effective Assurance for 5G Technologies

5G technologies are of rapidly increasing importance to the U.S. infrastructure and offer unprecedented connectivity benefits. However, these technologies also present an attack surface of unprecedented size, due to the complexity of both specifications and implementations of 5G

stacks. At the same time, large sizes and considerable investment into existing code bases preclude clean-slate redevelopment. Therefore, discovering and mitigating vulnerabilities and unintended emergent behaviors in 5G stacks requires novel combinations of automated formal reasoning techniques and automated discovery of relevant models and properties from extant code bases. DARPA is seeking innovative theories and technologies for analysis of 5G stack models and implementations for emergent behaviors to provide the strongest possible assurances and mitigations for extant stacks via minimal changes to these stacks. Desired technologies are expected to combine strong assurances of formal methods and models with the means for assuring the faithfulness of these models to the code of existing implementations. Further, these technologies are expected to offer sufficient automation, scalability, and usability to improve analysis of actual 5G code bases. Both previously known and yet unknown kinds of unintended emergent behaviors are in scope. Strong proposals will leverage open source technologies, but are expected to demonstrate viability for existing 5G implementations. Proposals should describe how they will use open source 5G software available from the Linux Foundation and/or others to demonstrate the techniques developed in the effort. Industry collaborations are encouraged.

14. Adaptive Conventions for Human-Machine Partnership

Humans collaborate seamlessly together in complex tasks by adapting to each other through repeated interactions. Achieving such collaboration in human-machine teams is quite challenging. One hypothesis is that human collaboration is easy and seamless because of convention formation among the humans through interaction. Conventions can encompass team member roles, specific expertise, nomenclature and communication, tacit knowledge, and other dimensions. This topic is focused on developing a theory of conventions in human-machine collaboration in a context of repeated interaction. In a multi-agent repeated game context, there can be a number of equilibria, with some more preferable than others. The conventions narrow this to a subset of these equilibria (or norms) to which the team might more naturally gravitate. Technical challenges include methods for learning, leveraging, and influencing conventions that evolve and emerge through repeated interactions. Research efforts should address (1) methods for extracting modular structure that separates partner-specific conventions from task-dependent representations; (2) characterizing the map from the space of conventions to outcomes in multi-agent and human-machine collaboration; and (3) techniques to influence and guide the agents (machine and humans) to reach a desirable equilibrium. Concepts such as dimensionality reduction may be approaches to capture the notion of convention. In addition, reinforcement learning methods can guide and influence the learned conventions. Plans to demonstrate methods in applications such as autonomous vehicle collectives or human-robot interaction should be identified along with Institutional Review Board (IRB) approvals and plans for any applicable Human Subject Research (HSR).

15. Embodied Physical Intelligence

Electronic computing subsystems are susceptible to a broad range of failures and cyber-attacks. When systems are augmented with physical actuation capabilities, such as cyber-physical systems, such failures lead to disastrous consequences. There have been numerous cases of supply chain issues, adversarial attacks, side-channel vulnerabilities, etc., bringing down supervisory control and data acquisition (SCADA) and other cyber-physical systems (CPS). As such systems become simultaneously more capable and prevalent, it becomes critical to proactively mitigate both the threat surface and the potential impact of such failures at design time. The physical embodiment of the systems for control architecture (e.g., universal and

programmable mechanical PID-controllers) provides an opportunity to quarantine the requisite control intelligence, neutralizing its attack surface and minimizing potential fallout. Such systems could also be of interest in specialized mission-specific systems (such as a robot re-configurable for many tasks). This topic is focused on developing such embodied physical intelligence for potential use in reducing cyber-attacks and other applications.

Research should investigate generalizable methods of realizing mechanical or physical intelligence in CPS designs and explore impacts to key performance metrics of the current electronic control architecture. Examples of mechanical realization include mechanisms for passive programmed behaviors or variable stiffness mechanisms for in-structure mechanical computation. Proposed methods should be configurable and broadly scoped to address varied CPS needs through the design and manufacturing process. It should also be programmable, enabling run-time specification of key parameters, as necessary, in the field. Efforts should present a plan to evaluate and demonstrate the benefits of the proposed methods, including tradeoffs in CPS design in enhancing security and minimizing impact and achieving intelligent performance as electronic subsystems are substituted in favor of mechanical embodiment of controls and securing critical controls within a physically realized enclave.

16. Physics of Charge Trapping in Bulk Dielectrics

High-altitude spacecrafts are exposed to high fluxes of energetic (>1 MeV) electrons. At these energies, electrons can readily penetrate spacecraft shielding and produce charge buildup in laminated and bulk dielectrics such as those used in coaxial cables and power supplies. Discharges can occur if the charge buildup reaches voltage breakdown thresholds, leading to electronic upset, system degradation, or catastrophic failures. To improve the performance and lifetime of in-flight dielectric materials, this topic seeks to develop a fundamental understanding of how charge is trapped within dielectrics, the physics of instabilities and discharge, and methods of mitigation. Research areas could include experimental characterization of high energy-implanted, trapped-charge lifetimes in bulk dielectrics relevant to spacecraft applications; measurement and simulation of discharge phenomena; temperature-dependent effects (including thermal cycling); modeling and simulation of the chemical and structural changes in the materials resulting from thermal effects and irradiation; and methods to mitigate charge buildup.

17. In-Situ Characterization of Additively Manufactured Materials in Complex Structures

The microstructures of objects fabricated via electron beam powder bed fusion (EB-PBF) additive manufacturing (AM) are fundamentally different from the same material compositions made via traditional cast or wrought processing routes. Rapid solidification and complex thermal cycling result in many non-equilibrium solidification conditions, which can be directly linked to porosity, defects, novel microstructures, and subsequent downstream solid-state phase transformations. To advance EB-PBF AM as a tool for materials discovery and facilitate timely quality assurance for large-scale AM of novel alloy material systems and their interfaces, this topic seeks to expand our fundamental understanding of microstructural development during solidification before, during, and after the EB-PBF AM process. Research areas could include new techniques to characterize in-situ electron beam energy, profile, and position; development of real-time monitoring of electron emission as a means to predict and avoid defect formation; development of new thermo-mechanical models capable of addressing widely disparate length

and time scales; and methods to provide real-time feedback to EB-PBF systems that provide high-precision control over liquid-solid phase transformation.

18. Self-Assembled Transistor Fabrication to Support Manufacturing as a Technology Differentiator

State-of-the-art transistor fabrication relies on planar fabrication techniques (top-down approaches with large-volume scale manufacturing) that use lithographic patterning and selective deposition or removal of layers to define the device. Device size scaling, based on the economics of Moore's Law, has posed several challenges including lithographic resolution and the layer-to-layer registration of each processing step. An additional challenge includes applying planar processing to device structures that are increasingly three-dimensional in nature such as FinFETs and emerging gate-all-around (GAA) devices. Furthermore, the cost and complexity of planar processing has continued to increase, which limits access to some technologies and potentially hinders transistor fabrication for prototyping specialized integrated circuits. It is expected that alternative approaches to traditional planar processing could lead to lower non-recurring engineering (NRE) fabrication and design costs to support low-volume manufacturing as a technology differentiator for the Department of Defense. DARPA is seeking innovative proposals in device fabrication that leverage techniques such as self-assembly, surface functionalization, area selective deposition, and lithography-free device definition. While highly-scaled transistor devices may eventually be achievable for this topic, any sub-micron channel length is acceptable. Devices may be fabricated on a substrate, released from a substrate, or fabricated with little or no substrate, potentially in-solution. Demonstration of devices may be n-type, p-type, enhancement-mode, depletion-mode, or bipolar devices. Integrating transistors into functional circuits should be considered in the suggested approaches. While the material system is left to the proposer, DARPA's primary interest is in silicon and conventional III-V semiconductor materials. It is expected that relevant material and device metrics be proposed and characterized during development and compared with traditionally fabricated material/device metrics from the literature.

19. Highly-reliable and Bandwidth-scalable Electrical Interconnects

The growing bandwidth and number of digital beamforming (DBF) arrays emphasizes the need for scalable interconnect solutions suitable for mission payload management. Current state-of-the-art practice includes using electrical interconnects such as mechanical connectors and coaxial cables. While these technologies are mature, their deployment often involves a large number of rugged connectors and 10s of meters-long cables to scale the interconnect bandwidth, which severely impacts the payload management. Recently, optical interconnects also have been used, which are lightweight and highly bandwidth-scalable, but their space-qualified assembly process is complicated, expensive, and sensitive to temperature variations, necessitating additional thermal management hardware. DARPA is interested in developing highly-reliable and bandwidth-scalable millimeter-wave wireless and dielectric fiber interconnects using fully-integrated transmitters (TX) and receivers (RX). DARPA is particularly interested in the development and demonstration of light-weight interconnect technologies that are capable of high data rates (> 20 Gb/s) with high energy efficiency (< 10 pJ/bit) over distances between 1 and 10 meters. The interconnect technology should also be compatible with operation in environments consistent with military and aerospace applications as defined in MIL-STD-883 "Test Method Standard, Microcircuits.

20. Intelligent Sensor Management for Undersea Environmental Characterization

In the last decade, significant advances have been made in the area of intelligent sensor management, particularly in the cases of terrestrial and aerial sensors, where communication between sensors is feasible and a fusion center can be used to guide sensor resource allocation. Such methods are adaptive in the sense that sensor configurations are guided by previous measurements, with the goal of maximizing the overall information gain of the system. Existing solutions typically formulate this problem as a partially-observable Markov decision process, which is then solved either by domain-specific approximation schemes or using reinforcement learning (RL). Optimizing sensor management in underwater environments poses a number of challenges, including limited communication ability between sensors and uncertainty in the location of sensors. Further, the majority of existing work focuses on detection, tracking, and classification of targets. This topic seeks to establish theory for underwater sensor management, with an emphasis on approaches for guiding multiple autonomous vehicles equipped with distributed acoustic and environmental sensors with limited ability to communicate. Of particular interest is fundamental research into the characterization and sampling of environmental parameters (e.g., sound speed profile of the water column and seabed, seabed density, seabed reflection loss) from indirect measurements of ambient noise. Proposals must include a theoretical effort to understand the fundamental limits of statistical estimators in this setting and characterize their performance.

21. Distributed Machine Learning over Non-Terrestrial Networks (NTNs)

Proliferated Low Earth Orbit (p-LEO) satellite constellations are a type of non-terrestrial network (NTN) that has grown rapidly in recent years due to numerous benefits, including increasingly lower cost, smaller size, increased resiliency, and lower latency communications. An increase in the number of satellites also enables an increase in distributed, on-board computing and processing capabilities. This comes with the challenge of determining how to best allocate computation and processing resources throughout the network. At the same time, significant advances have been made in the last decade in the area of machine learning (ML) such that ML has become ubiquitous across many domains. However, one open area of research with ML relates to figuring out how to train models at the edge, closer to the sources of data, in order to reduce traffic load on the network(s). Existing techniques that execute ML algorithms at a central location (cloud) and statically deploy learned models suffer from network delays and stale data. This topic seeks to investigate new distributed learning approaches, such as federated learning and fog learning, within non-terrestrial networking (NTN) environments. Research should explore the unique characteristics of NTN environments and investigate performance tradeoffs including approaches to leverage processing capabilities at the edge and in nodes distributed throughout both terrestrial and non-terrestrial networks. Approaches should identify and consider challenges related to running in multiple heterogeneous networks, including the commercial p-LEO environment, as well as on nodes with multiple, different types of processing capabilities. Possible applications of this research in the public health sector may include telemedicine and agricultural safety/security. Proposals should consider where and how to process data at the edge and how tasks would be distributed among available resources. Proposals should also include a detailed comparison of how the approach would improve upon the current state of the art and a discussion of possible applications. Consideration should also be given to how to incorporate data security and privacy in the approach.

22. Trust Architectures to Enable Space Infrastructure as a Service

Infrastructure as a Service (IaaS), where users can access resources they do not own to perform a variety of tasks, has enabled modern e-commerce and cloud capabilities to proliferate. To enable this IaaS paradigm, cyber-security and trust architectures must be in place to ensure reliability and protect against malicious users. As the space domain proliferates, we seek to extend this IaaS paradigm to utilize different resources that will exist on orbit; i.e., Space Infrastructure as a Service (SIaaS). Unfortunately, cyber-security and trust architectures developed for terrestrial applications do not immediately extend to the space domain. Particular challenges of space include low power, high latency, hard to physically access, and intermittent connectivity. DARPA is seeking proposals for research towards extending cyber-security and trust mechanisms developed for traditional IaaS to the space domain. An outcome of this research will be novel approaches, advances, or insights for developing trust architectures to enable SIaaS.

23. Scaling Challenges in Metal Additive Manufacturing

Emerging metal Additive Manufacturing (AM) machines for Laser Powder Bed Fusion (L-PBF) have larger build volumes and multiple lasers, and this enables production of taller complex parts at reduced costs and build times. However, thermal distortion currently limits the ability to meet geometric and dimensional tolerancing for critical applications, and this requires non-linear changes to current process-material models and laser scan path planning algorithms. DARPA is seeking proposals to create models, techniques, and procedures to take full advantage of emerging build volumes (at least 400x400x400mm) with multiple simultaneously-operating lasers (up to four). The investigators must include physics models, such as melt pool modeling (micro-scale and short duration) and thermal history modeling (larger scale, longer duration). Experimental validation approaches and AM machine availability should be included. The baseline material is Inconel 625, with Nb alloys (e.g., C-103, WC-3009) as a stretch goal. Exemplar AM machines are the EOS M400-4 and GE M Line. DARPA plans to provide access to representative part designs and tolerances upon award.

24. Platform Design Optimization Leveraging Power Beaming

DARPA is exploring wireless energy networks to enhance platform capabilities. Conventional systems typically carry all the energy required for a mission internally as liquid fuel or batteries. In a power beaming architecture, an air platform may carry only the energy needed to provide a safety margin to manage short disruptions in the energy web. Off-boarding primary energy storage and generation would allow for the unlocking of significant new air platform capabilities, such as unlimited endurance or high-power density payloads. Fully recognizing the benefits of off-boarding energy storage and generation requires a new design approach.

DARPA envisions providing platform power through either an optical or radio frequency (RF) beam. This research topic will address the fundamental question: What changes in design methods and analysis are required to optimize platform performance when offboarding some amount of energy storage and generation? There is little information in the design databases to address this question, and fundamental assumptions about fuel volume fraction, gross takeoff weight scaling with endurance and range that are taken from existing design databases may not apply.

New methods for platform optimization within an energy web framework should be developed and explored. Proposals should identify modifications to existing analysis or design tools or planned development of new tools required to evaluate air platforms using beamed power. Critical factors needed within this design optimization should be identified by looking at

structural, thermal, aerodynamic, energy storage, powerplant, and energy beaming integration requirements. The new design methods should then be evaluated through exemplar point designs for various classes of UAVs with mission payloads and parameters provided by DARPA. See FAQ for additional bounding assumptions and background information.

25. Integrated Perception Learning and Control for Autonomous Robots

Autonomous unmanned aerial and ground robots equipped with on-board sensors have the potential to help humans solve tasks and provide capabilities that are either too complex, dangerous, or expensive to be undertaken by humans alone. DARPA is particularly interested in developing perception and control algorithms for small unmanned robots that are robust, adaptive, and resilient to uncertain, complex, dynamic, and cluttered environments. These algorithms may be especially useful during agile navigation. Independent derivation of action and tasks within a team with limited or degraded communication is critical but not explored. When left to overly rely on communications or distributed processing, the coordination of the team is latent or inadequate. State-of-the-art perception and control algorithms for unmanned robots are becoming very mature. However, perception and action approaches are currently too brittle. These approaches also run sequentially without considering overall optimal system performance and the cross-coupling among these sequential processes. These considerations increase latency, and they require storing a substantial amount of redundant information at different levels of system abstractions. The algorithms delay each other, preventing fast decision-making. This is particularly critical on small scale robots where the size, power, computational, and sensing capabilities impose severe design constraints. DARPA desires efficient, bundled perception, localization, planning, and control algorithms for small robots to move rapidly and accomplish a multi-robot task that does not rely on high-bandwidth networked communications nor distributed processing between robots.

Approaches that demonstrate a path to completing collective tasks (with kilobits to zero exchanged communications), such as multiple robots mapping interior floors, rapid platooning/pursuit, coordinated movement through clutter/interiors, anti-collision, or precision positioning, are desired. Successful proposals will develop algorithms that integrate traditionally sequential tasks on individual robots and efficiently coordinate their tasks, movement, and perception capabilities using minimal communications with other collaborating robots. Algorithm characteristics are anticipated to demonstrate resilient, agile, and collaborative navigation and autonomy of small-scale autonomous robots (aerial and/or ground vehicles). Goals are to equal human-controlled performance of teamed robots in real world environments for tasks with greatly reduced reliance on external system inputs (e.g., GPS).

II. Award Information

A. General Award Information

DARPA anticipates multiple awards. The level of funding for individual awards made under this RA will depend on the quality of the proposals received and the availability of funds. Awards will be made to proposers¹ whose proposals are determined to be the most advantageous to the

¹ As used throughout this RA, “proposer” refers to the lead organization on a submission to this RA. The proposer is responsible for ensuring that all information required by a RA--from all team members--is submitted in accordance with the RA. “Awardee” refers to anyone who might receive a prime award from the Government. “Subawardee” refers to anyone who might receive a subaward from a prime awardee (e.g., subawardee, consultant, etc.).

Government, all evaluation factors considered. See Section V for further information.

The Government reserves the right to:

- select for negotiation all, some, one, or none of the proposals received in response to this solicitation;
- make awards without discussions with proposers;
- conduct discussions with proposers if it is later determined to be necessary;
- segregate portions of resulting awards into pre-priced options;
- accept proposals in their entirety or select only portions of proposals for award;
- fund awards in increments with options for continued work at the end of one or more phases and increase the cost ceiling of the award for additional work within scope;
- request additional documentation once the award instrument has been determined (e.g., representations and certifications); and
- remove proposers from award consideration should the parties fail to reach agreement on award terms within a reasonable time or the proposer fails to provide requested additional information in a timely manner.

All awards resulting from proposals identified for negotiation will be grants.

B. Fundamental Research

It is DoD policy that the publication of products of fundamental research will remain unrestricted to the maximum extent possible. National Security Decision Directive (NSDD) 189 defines fundamental research as follows:

‘Fundamental research’ means basic and applied research in science and engineering, the results of which ordinarily are published and shared broadly within the scientific community, as distinguished from proprietary research and from industrial development, design, production, and product utilization, the results of which ordinarily are restricted for proprietary or national security reasons.

As of the date of publication of this solicitation, the Government expects that program goals as described herein may be met by proposers intending to perform fundamental research and does not anticipate applying publication restrictions of any kind to individual awards for fundamental research that may result from this solicitation. DARPA will not select proposals for negotiation of an award if the proposal is deemed to be Applied Research, or otherwise requires Controlled Unclassified Information (CUI) restrictions.

- (a) The University or non-profit research institution performer or recipient must establish and maintain an internal process or procedure to address foreign talent programs, conflicts of commitment, conflicts of interest, and research integrity. The academic or non-profit research performer or recipient must also utilize due diligence to identify Foreign Components or participation by Senior/Key Personnel in Foreign Government Talent Recruitment Programs and

agree to share such information with the Government upon request.

- i. The above described information will be provided to the Government as part of the proposal response to the solicitation and will be reviewed and assessed prior to award. Generally, this information will be included in the Research and Related Senior/Key Personnel Profile (Expanded) form (SF-424) required as part the proposer’s submission through Grants.gov.
 1. Instructions regarding how to fill out the SF-424 and its biographical sketch can be found through Grants.gov.
- ii. In accordance with USD(R&E) direction to mitigate undue foreign influence in DoD-funded science and technology, DARPA will assess all Senior/Key Personnel proposed to support DARPA grants and cooperative agreements for potential undue foreign influence risk factors. This will be done by evaluating information provided via the SF-424, and any accompanying or referenced documents, in order to identify and assess any associations or affiliations the Senior/Key Personnel may have with foreign strategic competitors or countries that have a history of intellectual property theft, research misconduct, or history of targeting U.S. technology for unauthorized transfer. DARPA’s evaluation takes into consideration the entirety of the Senior/Key Personnel’s SF-424, current and pending support, and biographical sketch, placing the most weight on the Senior/Key Person’s activities over the last 4 years. The majority of foreign entities lists used to make these determinations are publicly available. The DARPA CFIP “Senior/Key Personnel Foreign Influence Risk Rubric” details the various risk ratings and factors. The rubric can be seen at the following link: https://www.darpa.mil/attachments/092021DARPA_CFIPRubric.pdf
- iii. Examples of lists that DARPA leverages to assess potential undue foreign influence factors include, but are not limited to:
 1. Executive Order 13959 “Addressing the Threat From Securities Investments That

- Finance Communist Chinese Military Companies”:
<https://www.govinfo.gov/content/pkg/FR-2020-11-17/pdf/2020-25459.pdf>
2. The U.S. Department of Education’s College Foreign Gift and Contract Report: [College Foreign Gift Reporting \(ed.gov\)](#)
 3. The U.S. Department of Commerce, Bureau of Industry and Security, List of Parties of Concern:
<https://www.bis.doc.gov/index.php/policy-guidance/lists-of-parties-of-concern>
 4. Georgetown University’s Center for Security and Emerging Technology (CSET) Chinese Talent Program Tracker:
<https://chinatalenttracker.cset.tech>
 5. Director of National Intelligence (DNI) “World Wide Threat Assessment of the US Intelligence Community”: [2021 Annual Threat Assessment of the U.S. Intelligence Community \(dni.gov\)](#)
 6. Various Defense Counterintelligence and Security Agency (DCSA) products regarding targeting of US technologies, adversary targeting of academia, and the exploitation of academic experts:
<https://www.dcsa.mil/>

DARPA’s analysis and assessment of Senior/Key Personnel is compliant with Title VI of the Civil Rights Act of 1964. Information regarding race, color, or national origin is not collected and does not have bearing in DARPA’s assessment.

University or non-profit research institutions with proposals selected for negotiation that have been assessed as having high or very high undue foreign influence risk, will be given an opportunity during the negotiation process to mitigate the risk. DARPA reserves the right to request any follow-up information needed to assess risk or mitigation strategies.

- iv. Upon conclusion of the negotiations, if DARPA determines, despite any proposed mitigation terms (e.g. mitigation plan, alternative research

personnel), the participation of any Senior/Key Research Personnel still represents high risk to the program, or proposed mitigation affects the Government's confidence in proposer's capability to successfully complete the research (e.g., less qualified Senior/Key Research Personnel) the Government may determine not to award the proposed effort. Any decision not to award will be predicated upon reasonable disclosure of the pertinent facts and reasonable discussion of any possible alternatives while balancing program award timeline requirements.

- (b) Failure of the academic or non-profit research performer or recipient to reasonably exercise due diligence to discover or ensure that neither it nor any of its Senior/Key Research Personnel involved in the subject award are participating in a Foreign Government Talent Program or have a Foreign Component with an a strategic competitor or country with a history of targeting U.S. technology for unauthorized transfer may result in the Government exercising remedies in accordance with federal law and regulation.
 - i. If, at any time, during performance of this research award, the academic or non-profit research performer or recipient should learn that it, its Senior/Key Research Personnel, or applicable team members or subtier performers on this award are or are believed to be participants in a Foreign Government Talent Program or have Foreign Components with a strategic competitor or country with a history of targeting U.S. technology for unauthorized transfer , the performer or recipient will notify the Government Contracting Officer or Agreements Officer within 5 business days.
 - 1. This disclosure must include specific information as to the personnel involved and the nature of the situation and relationship. The Government will have 30 business days to review this information and conduct any necessary fact-finding or discussion with the performer or recipient.
 - 2. The Government's timely determination and response to this disclosure may range anywhere from acceptance, to mitigation, to termination of this award at the Government's discretion.

3. If the University receives no response from the Government to its disclosure within 30 business days, it may presume that the Government has determined the disclosure does not represent a threat.
 - ii. The performer or recipient must flow down this provision to any subtier contracts or agreements involving direct participation in the performance of the research.
- (c) Definitions
- i. Senior/Key Research Personnel
 1. This definition would include the Principal Investigator or Program/Project Director and other individuals who contribute to the scientific development or execution of a project in a substantive, measurable way, whether or not they receive salaries or compensation under the award. These include individuals whose absence from the project would be expected to impact the approved scope of the project.
 2. Most often, these individuals will have a doctorate or other professional degrees, although other individuals may be included within this definition on occasion.
 - ii. Foreign Associations/Affiliations
 1. Association is defined as collaboration, coordination or interrelation, professionally or personally, with a foreign government-connected entity where no direct monetary or non-monetary reward is involved.
 2. Affiliation is defined as collaboration, coordination, or interrelation, professionally or personally, with a foreign government-connected entity where direct monetary or non-monetary reward is involved.
 - iii. Foreign Government Talent Recruitment Programs
 1. In general, these programs will include any foreign-state-sponsored attempt to acquire U.S. scientific-funded research or technology through foreign government-run or funded recruitment programs that target

scientists, engineers, academics, researchers, and entrepreneurs of all nationalities working and educated in the U.S.

2. Distinguishing features of a Foreign Government Talent Recruitment Program may include:
 - a. Compensation, either monetary or in-kind, provided by the foreign state to the targeted individual in exchange for the individual transferring their knowledge and expertise to the foreign country.
 - b. In-kind compensation may include honorific titles, career advancement opportunities, promised future compensation or other types of remuneration or compensation.
 - c. Recruitment, in this context, refers to the foreign-state-sponsor's active engagement in attracting the targeted individual to join the foreign-sponsored program and transfer their knowledge and expertise to the foreign state. The targeted individual may be employed and located in the U.S. or in the foreign state.
 - d. Contracts for participation in some programs that create conflicts of commitment and/or conflicts of interest for researchers. These contracts include, but are not limited to, requirements to attribute awards, patents, and projects to the foreign institution, even if conducted under U.S. funding, to recruit or train other talent recruitment plan members, circumventing merit-based processes, and to replicate or transfer U.S.-funded work in another country.
 - e. Many, but not all, of these programs aim to incentivize the targeted individual to physically relocate to the foreign state. Of particular

concern are those programs that allow for continued employment at U.S. research facilities or receipt of U.S. Government research funding while concurrently receiving compensation from the foreign state.

3. Foreign Government Talent Recruitment Programs DO NOT include:
 - a. Research agreements between the University and a foreign entity, unless that agreement include provisions that create situations of concern addressed elsewhere in this section,
 - b. Agreements for the provision of goods or services by commercial vendors, or
 - c. Invitations to attend or present at conferences.

iv. Conflict of Interest

1. A situation in which an individual, or the individual's spouse or dependent children, has a financial interest or financial relationship that could directly and significantly affect the design, conduct, reporting, or funding of research.

v. Conflict of Commitment

1. A situation in which an individual accepts or incurs conflicting obligations between or among multiple employers or other entities.
2. Common conflicts of commitment involve conflicting commitments of time and effort, including obligations to dedicate time in excess of institutional or funding agency policies or commitments. Other types of conflicting obligations, including obligations to improperly share information with, or withhold information from, an employer or funding agency, can also threaten research security and integrity and are an element of a broader concept of conflicts of commitment.

- vi. Foreign Component
 - 1. Performance of any significant scientific element or segment of a program or project outside of the U.S., either by the University or by a researcher employed by a foreign organization, whether or not U.S. government funds are expended.
 - 2. Activities that would meet this definition include, but are not limited to:
 - a. Involvement of human subjects or animals;
 - b. Extensive foreign travel by University research program or project staff for the purpose of data collection, surveying, sampling, and similar activities;
 - c. Collaborations with investigators at a foreign site anticipated to result in co-authorship;
 - d. Use of facilities or instrumentation at a foreign site;
 - e. Receipt of financial support or resources from a foreign entity; or
 - f. Any activity of the University that may have an impact on U.S. foreign policy through involvement in the affairs or environment of a foreign country.
 - 3. Foreign travel is not considered a Foreign Component.

- vii. Strategic Competitor

- 1. A nation, or nation-state, that engages in diplomatic, economic or technological rivalry with the United States where the fundamental strategic interests of the U.S are under threat.

III. Eligibility Information

A. Eligible Applicants

Participation is open to individuals who are U.S. Citizens, U.S. Permanent Residents, and Foreign Nationals who meet the eligibility criteria listed below:

- Proposers must be one of the following (excluding any personal leaves of absence) by the full proposal deadline listed in Part One: Overview Information:
 - current Tenure-Track Assistant/Associate Professors;
 - current Tenured faculty within 3 years of their Tenure date; or
 - an equivalent at a non-profit research institution within 12 years of the receipt of their Ph.D.
- All proposers must be employed at a U.S. institution, which includes those in U.S. states and territories. Proposals from outside these regions will not be accepted.
- Individuals who have previously received a YFA Award are not eligible for this or any future YFA program.
- Former DARPA Program Managers are not eligible to apply for funding under this program.
- Researchers working at Federally Funded Research and Development Centers and Government Entities are not eligible to apply as PIs for funding under this program; however, they may be proposed as subawardees provided they meet the requirements in Section III.A.1.a. Please see Section VIII.C for teaming.
- Non-U.S. individuals employed by U.S. institutions may participate to the extent that such participants comply with any necessary nondisclosure agreements, security regulations, export control laws, and other governing statutes applicable under the circumstances.
- At the executive summary phase, proposing PIs are limited to one executive summary per TA. At the full proposal phase, proposing PIs are limited to submitting only one full proposal to only one topic under this RA. Submitting more than one full proposal may result in all of the PI's proposal submissions being determined non-conforming and being removed from award consideration. A proposer is strongly encouraged to submit an executive summary in advance of a full proposal to determine DARPA's interest and minimize the effort and expense of preparing an out of scope proposal.
- Recipients of non-YFA DARPA awards are eligible to propose. Proposers must provide a listing of federal support (past, current, and pending). This list must include the sponsor, amount, and performance dates of all federally-funded research efforts and should be present on the submission cover sheet as indicated in Section IV.

There is no limit to the number of applications that can be submitted by an institution; however, each submission must have a single PI. Submissions to young investigator programs sponsored by other agencies are not restricted.

1. Federally Funded Research and Development Centers (FFRDCs) and Government Entities

a. FFRDCs

FFRDCs are subject to applicable direct competition limitations and cannot propose to this solicitation in any capacity unless they meet the following conditions: (1) FFRDCs must clearly demonstrate that the proposed work is not otherwise available from the private sector, and (2) FFRDCs must provide a letter, on official letterhead from their sponsoring organization, that (a) cites the specific authority establishing their eligibility to propose to Government solicitations and compete with industry and (b) certifies the FFRDC's compliance with the associated FFRDC sponsor agreement's terms and conditions. These conditions are a requirement for FFRDCs proposing to be subawardees.

b. Government Entities

Government Entities (e.g., Government/National laboratories, military educational institutions, etc.) proposing as subawardees are subject to applicable direct competition limitations. Government Entities must clearly demonstrate that the work is not otherwise available from the private sector and provide written documentation citing the specific statutory authority and contractual authority, if relevant, establishing their ability to propose to Government solicitations and compete with industry.

c. Authority and Eligibility

At the present time, DARPA does not consider 15 U.S.C. § 3710a to be sufficient legal authority to show eligibility. While 10 U.S.C. § 2539b may be the appropriate statutory starting point for some entities, specific supporting regulatory guidance, together with evidence of agency approval, will still be required to fully establish eligibility. DARPA will consider FFRDC and Government Entity eligibility submissions on a case-by-case basis; however, the burden to prove eligibility for all team members rests solely with the proposer.

2. Foreign Entity Participation

Non-U.S. organizations may not propose to this RA in any capacity.

B. Organizational Conflicts of Interest

§200.112 Conflict of Interest and §200.318 General procurement standards

In accordance with §200.112 and §200.318, proposers are required to identify and disclose all facts relevant to potential organizational conflicts of interest (OCI) involving the proposer's organization and *any* proposed team member (subawardee, consultant). Under this Section, the proposer is responsible for providing this disclosure with each proposal submitted to the solicitation. The disclosure must include the proposer's, and as applicable, proposed team member's OCI mitigation plan. The OCI mitigation plan must include a description of the actions the proposer has taken, or intends to take, to prevent the existence of conflicting roles that might bias the proposer's judgment and to prevent the proposer from having unfair competitive advantage. The OCI mitigation plan will specifically discuss the disclosed OCI in the context of each of the OCI limitations.

Agency Supplemental OCI Policy

In addition, DARPA has a supplemental OCI policy that prohibits contractors/performers from concurrently providing Scientific Engineering Technical Assistance (SETA), Advisory and Assistance Services (A&AS) or similar support services and being a technical performer. Therefore, as part of the disclosure requirement above, a proposer must affirm whether the

proposer or *any* proposed team member (subawardee, consultant) is providing SETA, A&AS, or similar support to any DARPA office(s) under (a) a current award or subaward or (b) a past award or subaward that ended within one calendar year prior to the proposal's submission date.

If SETA, A&AS, or similar support is being or was provided to any DARPA office(s), the proposal must include:

- The name of the DARPA office receiving the support;
- The prime contract number;
- Identification of proposed team member (subawardee, consultant) providing the support; and
- An OCI mitigation plan.

Government Procedures

In accordance with agency requirements, the Government will evaluate OCI mitigation plans to avoid, neutralize, or mitigate potential OCI issues before award and to determine whether it is in the Government's interest to grant a waiver. The Government will only evaluate OCI mitigation plans for proposals that are determined selectable under the solicitation evaluation criteria and funding availability.

The Government may require proposers to provide additional information to assist the Government in evaluating the proposer's OCI mitigation plan.

If the Government determines that a proposer failed to fully disclose an OCI, or failed to provide the affirmation of DARPA support as described above, or failed to reasonably provide additional information requested by the Government to assist in evaluating the proposer's OCI mitigation plan, the Government may reject the proposal and withdraw it from consideration for award.

Include any OCI affirmations and disclosures in Attachment F: PROPOSAL TEMPLATE VOLUME 3: ADMINISTRATIVE & NATIONAL POLICY REQUIREMENTS, Section 3.

C. Cost Sharing/Matching

Cost sharing is not required.

IV. Application and Submission Information

Prior to submitting a full proposal, proposers are *strongly encouraged* to first submit an executive summary as described below. This process allows a proposer to ascertain whether the proposed concept is (1) applicable to the YFA RA and (2) currently of interest. For the purposes of this RA, applicability is defined as follows:

- The proposed concept is applicable to the technical and topic areas described herein;
- The proposed concept is important to DARPA's current investment portfolio;
- The proposed concept investigates an innovative approach that enables revolutionary advances, i.e., will not primarily result in evolutionary improvements to the existing state of practice;
- The proposed work has not already been completed (i.e., the research element is complete but manufacturing/fabrication funds are required);
- The proposer has not already received funding or a positive funding decision for the

proposed concept (whether from DARPA or another Government agency);

- The proposer must meet the eligibility requirements outlined in Section III; and
- Only requests for grants may be considered.

Executive summaries and full proposals that are not found to be applicable to the YFA RA as defined above may be deemed non-conforming² and removed from consideration. All executive summaries and full proposals must provide sufficient information to assess the validity/feasibility of their claims as well as comply with the requirements outlined herein for submission formatting, content and transmission to DARPA. Executive summaries and full proposals that fail to do so may be deemed non-conforming and removed from consideration. Proposers will be notified of non-conforming determinations via letter.

A. Address to Request Application Package

This document contains all information required to submit a response to this solicitation. No additional forms, kits, or other materials are needed except as referenced herein. No request for proposal or additional solicitation regarding this opportunity will be issued, nor is additional information available except as provided at the SAM.gov website (<https://sam.gov/>), the Grants.gov website (<http://www.grants.gov/>), or referenced herein.

B. Content and Form of Application Submission

1. Executive Summary Information and Formatting

As stated above, proposers are strongly encouraged to submit an executive summary in advance of a full proposal to minimize effort and reduce the potential expense of preparing an out of scope proposal. DARPA intends to conduct a blind review of submitted executive summaries. Institution and Key Personnel identifying information must be present on only the Executive Summary Cover Sheet, which will be separated from the remaining text prior to DARPA conducting its review. If Institution or Key Personnel identifying information is found after the Executive Summary Cover Page, the executive summary may be deemed non-conforming, and may not be reviewed. DARPA will respond to executive summaries with a statement as to whether DARPA is interested in the idea. Regardless of DARPA's response to an executive summary, proposers may submit a full proposal. DARPA will review all conforming full proposals using the published evaluation criteria (See Section V.A) and without regard to any comments resulting from the review of an executive summary. Proposers should note that a favorable response to an executive summary is not a guarantee that a proposal based on the executive summary will ultimately be selected for award negotiation.

Executive summaries submitted in response to this solicitation may anticipate a response within approximately 30 calendar days. These notifications will be sent via email to the Technical POC and/or Administrative POC identified on the Executive Summary Cover Sheet.

Proposing PIs are limited to one executive summary per TA. Proposers are encouraged to carefully consider the descriptions of the TAs before submission. Each executive summary submission must specify *only one* of these TAs for their submission and identify this TA on the submission cover sheet. Executive summaries that do not clearly address a specific topic may be

² "Conforming" is defined as having been submitted in accordance with the requirements outlined herein.

deemed non-conforming and may not be reviewed. DARPA reserves the right to assign executive summaries to a different topic area than indicated by the proposer.

All proposers are required to use the template provided as Attachment A: EXECUTIVE SUMMARY TEMPLATE to this solicitation on <https://sam.gov/> and <http://www.grants.gov>. Executive summaries must not be submitted to DARPA via email. See Section IV.E.1.a for executive summary submission instructions.

2. Full Proposal Information and Formatting

Full proposals must consist of all 3 volumes described below in addition to the Grants.gov application package. To assist in proposal development, templates for these volumes are posted as attachments to this solicitation on <https://sam.gov/> and on <http://www.grants.gov>. The templates are specific to each volume, as outlined below.

- **Volume 1**
 - Attachment B: PROPOSAL SUMMARY SLIDE TEMPLATE
 - Attachment C: PROPOSAL TEMPLATE VOLUME 1: TECHNICAL & MANAGEMENT
- **Volume 2**
 - Attachment D: PROPOSAL TEMPLATE VOLUME 2: COST (Optional)
 - Attachment E: MS Excel™ DARPACOST PROPOSAL SPREADSHEET
- **Volume 3**
 - Attachment F: PROPOSAL TEMPLATE VOLUME 3: ADMINISTRATIVE & NATIONAL POLICY REQUIREMENTS

The Government requires that proposers use the provided MS Excel™ DARPA Standard Cost Proposal Spreadsheet in the development of their cost proposals. A customized cost proposal spreadsheet may be an attachment to this solicitation. If not, the spreadsheet can be found on the DARPA website at <http://www.darpa.mil/work-with-us/contract-management> (under “Resources” on the right-hand side of the webpage). All tabs and tables in the cost proposal spreadsheet should be developed in an editable format with calculation formulas intact to allow traceability of the cost proposal. This cost proposal spreadsheet should be used by the prime organization and all subcontractors. In addition to using the cost proposal spreadsheet, the cost proposal still must include all other items required in this announcement that are not covered by the editable spreadsheet. Subcontractor cost proposal spreadsheets may be submitted directly to the Government by the proposed subcontractor via e-mail to the address in Part I of this solicitation. **Using the provided cost proposal spreadsheet will assist the Government in a rapid analysis of your proposed costs and, if your proposal is selected for a potential award, speed up the negotiation and award execution process.**

Full Proposals that do not include the appropriate attachments as detailed here may be deemed non-conforming and may not be evaluated.

Budget Justification should be provided as Section L of the SF 424 Research & Related Budget form provided via <http://www.grants.gov>. The Budget Justification should include the following information for the recipient and all subawardees:

- **Direct Labor (sections A and B)** - Detail the total number of persons and their level of commitment for each position listed as well as which specific tasks (as described in the SOW) they will support.
- **Equipment (section C)** - Provide an explanation for listed requested equipment exceeding \$5,000, properly justifying why it is required to meet the objectives of the program.
- **Travel (section D)** - Provide the purpose of the trip, number of trips, number of days per trip, departure and arrival destinations, number of people, etc.
- **Other Direct Costs (section F)** - Provide a justification for the items requested and an explanation of how the estimates were obtained.
- **Participant/Trainee Support Costs (section E)** - Provide details on Tuition/Fees/Health Insurance, Stipends, Travel and Subsistence costs.

Proposing PIs are limited to one full proposal submission to only one TA under this RA. Submitting more than one full proposal may result in all of the PI's proposal submissions being determined non-conforming and being removed from award consideration.

Potential applicants are encouraged to carefully consider the descriptions of the TAs before submission. A full proposal must specify ONE and only one of these TAs for the submission and identify this TA on the submission cover sheet. Full proposals that do not clearly address a specific topic may be deemed non-conforming and may not be reviewed. DARPA reserves the right to assign proposals to a different TA than indicated by the proposer.

Full proposals must not be submitted to DARPA via email. See Section IV.E.1.b for proposal submission instructions.

3. Proprietary Information

Proposers are responsible for clearly identifying proprietary information. Submissions containing proprietary information must have the cover page and each page containing such information clearly marked with a label such as "Proprietary" or "Company Proprietary." NOTE: "Confidential" is a classification marking used to control the dissemination of U.S. Government National Security Information as dictated in Executive Order 13526 and should not be used to identify proprietary business information.

4. Security Information

All proposals and supporting documentation must be unclassified, and all awards made under this RA will be unclassified. Only proposals determined to be proposing Fundamental Research can be deemed selectable. DARPA will not select proposals for negotiation of an award if the proposal is deemed to be Applied Research, or otherwise requires Controlled Unclassified Information (CUI) restrictions.

C. Submission Dates and Times

Proposers are warned that submission deadlines as outlined herein are in Eastern Time and will be strictly enforced. When planning a response to this solicitation, proposers should take into account that some parts of the submission process may take from one business day to one month to complete (e.g., registering for a Data Universal Numbering System (DUNS) number or

Taxpayer Identification Number (TIN)).

DARPA will acknowledge receipt of *complete* submissions via email and assign identifying numbers that should be used in all further correspondence regarding those submissions. If no confirmation is received within two business days, please contact the RA Administrator at YFA2022@darpa.mil to verify receipt.

1. Executive Summaries

Executive summaries must be submitted per the instructions outlined herein *and received by DARPA* no later than the due date and time listed in Part One: Overview Information. Executive summaries received after this time and date may not be reviewed.

2. Full Proposals

Full proposal packages as detailed in Section IV.B.2 above, and, as applicable, proprietary subawardee cost proposals, must be submitted per the instructions outlined herein *and received by DARPA* no later than the due date and time listed in Part One: Overview Information. Proposals received after this time and date may not be reviewed.

D. Funding Restrictions

Not applicable.

E. Other Submission Requirements

1. Submission Instructions

Proposers must submit all parts of their submission package using the same method; submissions cannot be sent in part by one method and in part by another method nor should duplicate submissions be sent by multiple methods. Email submissions will not be accepted. Failure to comply with the submission procedures outlined herein may result in the submission being deemed non-conforming and withdrawn from consideration. All proposals and supporting documentation must be unclassified.

a. Executive Summaries

DARPA will employ an electronic upload submission system (<https://baa.darpa.mil/>) for all executive summaries sent in response to this solicitation. *Executive Summaries must not be submitted via Grants.gov, via hard copy, or via email.*

First time users of the DARPA Submission website must complete a two-step account creation process. The first step consists of registering for an extranet account by going to the URL listed above and selecting the “Account Request” link. Upon completion of the online form, proposers will receive two separate emails; one will contain a user name and the second will provide a temporary password. Once both emails have been received, the second step requires proposers to go back to the submission website and log in using that user name and password. After accessing the extranet, proposers may then create a user account for the DARPA Submission website by selecting the “Register your Organization” link at the top of the page. Once the user account is created, proposers will be able to see a list of solicitations open for submissions, view submission instructions, and upload/finalize their executive summary.

Proposers who already have an account on the DARPA Submission website may simply log in at <https://baa.darpa.mil/>, select this solicitation from the list of open DARPA solicitations and

proceed with their executive summary submission. Note: Proposers who have created a DARPA Submission website account to submit to another DARPA Technical Office's solicitations do not need to create a new account to submit to this solicitation.

All executive summaries submitted electronically through the DARPA Submission website must meet the following requirements: (1) uploaded as a zip file (.zip or .zipx extension), (2) only contain the document(s) requested herein, (3) only contain unclassified information, and (4) must not exceed 100 MB in size. Only one zip file will be accepted per executive summary and executive summaries not uploaded as zip files will be rejected by DARPA.

Technical support for the DARPA Submission website is available during regular business hours, Monday – Friday, 9:00 a.m. – 5:00 p.m. Requests for technical support must be emailed to BAAT_Support@darpa.mil with a copy to YFA2022@darpa.mil. Questions regarding submission contents, format, deadlines, etc. should be emailed to YFA2022@darpa.mil. Questions/requests for support sent to any other email address may result in delayed/no response.

Since proposers may encounter heavy traffic on the web server, DARPA discourages waiting until the day executive summaries are due to request an account and/or upload the submission.

Note: Proposers submitting an executive summary via the DARPA Submission website MUST (1) click the “Finalize” button in order for the submission to upload AND (2) do so with sufficient time for the upload to complete prior to the deadline. Failure to do so will result in a late submission.

b. Proposals

Proposers must submit proposals through one of the following methods: (1) electronic upload per the instructions at <https://www.grants.gov/applicants/apply-for-grants.html> (DARPA-preferred), or (2) hard-copy mailed directly to DARPA. If proposers intend to use Grants.gov as their means of submission, then they must submit their entire proposal through Grants.gov; applications cannot be submitted in part to Grants.gov and in part as a hard-copy. Proposers using Grants.gov do not submit hard-copy proposals in addition to the Grants.gov electronic submission.

Submissions: In addition to the volumes and corresponding attachments requested elsewhere in this solicitation, proposers must also submit the three forms listed below.

Form 1: SF 424 Research and Related (R&R) Application for Federal Assistance, available on the Grants.gov website at https://apply07.grants.gov/apply/forms/sample/RR_SF424_2_0-V2.0.pdf. *This form must be completed and submitted.*

To evaluate compliance with Title IX of the Education Amendments of 1972 (20 U.S.C. § 1681 et.seq.), the Department of Defense (DoD) is collecting certain demographic and career information to be able to assess the success rates of women who are proposed for key roles in applications in science, technology, engineering or mathematics disciplines. In addition, the National Defense Authorization Act (NDAA) for FY 2019, Section 1286, directs the Secretary of Defense to protect intellectual property, controlled information, key personnel, and information about critical technologies relevant to national security and limit undue influence, including foreign talent programs by countries that desire to exploit United States' technology within the DoD research, science and technology, and innovation enterprise. This requirement is necessary for all research and research-related educational activities. The DoD is using the two forms below to collect the necessary information to satisfy these requirements. Detailed instructions for each form are available on Grants.gov.

Form 2: The Research and Related Senior/Key Person Profile (Expanded) form, available on the Grants.gov website at https://apply07.grants.gov/apply/forms/sample/RR_KeyPersonExpanded_3_0-V3.0.pdf, will be used to collect the following information for all senior/key personnel, including Project Director/Principal Investigator and Co-Project Director/Co-Principal Investigator, whether or not the individuals' efforts under the project are funded by the DoD. The form includes 3 parts: the main form administrative information, including the Project Role, Degree Type and Degree Year; the biographical sketch; and the current and pending support. The biographical sketch and current and pending support are to be provided as attachments:

- Biographical Sketch: Mandatory for Project Directors (PD) and Principal Investigators (PI), optional, but desired, for all other Senior/Key Personnel. The biographical sketch should include information pertaining to the researchers:
 - Education and Training.
 - Research and Professional Experience.
 - Collaborations and Affiliations (for conflict of interest).
 - Publications and Synergistic Activities.
- Current and Pending Support: Mandatory for all Senior/Key Personnel including the PD/PI. This attachment should include the following information:
 - A list of all current projects the individual is working on, in addition to any future support the individual has applied to receive, regardless of the source.
 - Title and objectives of the other research projects.
 - The percentage per year to be devoted to the other projects.
 - The total amount of support the individual is receiving in connection to each of the other research projects or will receive if other proposals are awarded.
 - Name and address of the agencies and/or other parties supporting the other research projects
 - Period of performance for the other research projects.

Additional senior/key persons can be added by selecting the “Next Person” button at the bottom of the form. Note that, although applications without this information completed may pass Grants.gov edit checks, if DARPA receives an application without the required information, DARPA may determine that the application is incomplete and may cause your submission to be rejected and eliminated from further review and consideration under the solicitation. DARPA reserves the right to request further details from the applicant before making a final determination on funding the effort.

Form 3: Research and Related Personal Data, available on the Grants.gov website at https://apply07.grants.gov/apply/forms/sample/RR_PersonalData_1_2-V1.2.pdf. *Each applicant must complete the name field of this form, however, provision of the demographic information is voluntary. Regardless of whether the demographic fields are completed or not, this form must be submitted with at least the applicant’s name completed.*

i. Electronic Upload

DARPA encourages grant proposers to submit their proposals via electronic upload at <http://www.grants.gov/web/grants/applicants/apply-for-grants.html>. Proposers electing to use this method must complete a one-time registration process on Grants.gov before a proposal can be electronically submitted. *If proposers have not previously registered, this process can take up to four weeks so registration should be done in sufficient time to ensure it does not impact a proposer's ability to meet required submission deadlines.* Registration requirements and instructions are outlined at <http://www.grants.gov/web/grants/register.html>.

Carefully follow the DARPA submission instructions provided with the solicitation application package on Grants.gov. Only the required forms listed therein (e.g., SF-424 and Attachments form) should be included in the submission. *Note: Grants.gov does not accept zipped or encrypted proposals.*

Once Grants.gov has received an uploaded proposal submission, Grants.gov will send two email messages to notify proposers that: (1) the proposal has been received by Grants.gov; and (2) the proposal has been either validated or rejected by the system. *It may take up to two business days to receive these emails.* If the proposal is validated, then the proposer has successfully submitted their proposal. If the proposal is rejected, the submission must be corrected, resubmitted and revalidated before DARPA can retrieve it. If the solicitation is no longer open, the rejected proposal cannot be resubmitted. Once the proposal is retrieved by DARPA, Grants.gov will send a third email to notify the proposer. DARPA will send a final confirmation email as described in Section IV.C.

To avoid missing deadlines, Grants.gov recommends that proposers submit their proposals to Grants.gov 24-48 hours in advance of the proposal due date to provide sufficient time to complete the registration and submission process, receive email notifications and correct errors, as applicable.

Technical support for Grants.gov submissions may be reached at 1-800-518-4726 or support@grants.gov.

ii. Direct Mail/Hand-carry

Proposers electing to submit grant proposals via direct mail or hand-carried must provide one paper copy and one electronic copy on CD or DVD of the full proposal package. Proposers must complete the SF 424 R&R form (Application for Federal Assistance, Research and Related) provided at Grants.gov as part of the opportunity application package for this RA and include it in the proposal submission. All parts of the proposal package must be mailed or hand-carried to the address noted in Section VII below.

V. Application Review Information

A. Evaluation Criteria

Proposals will be evaluated using the following criteria listed in descending order of importance: Overall Scientific and Technical Merit, Potential Contribution and Relevance to the DARPA Mission, and Cost Realism.

- **Overall Scientific and Technical Merit**

The proposed technical approach is innovative, feasible, achievable, and complete.

The proposed technical team has the expertise and experience to accomplish the proposed tasks. Task descriptions and associated technical elements provided are complete and in a logical sequence with all proposed deliverables clearly defined such that a final outcome that achieves the goal can be expected as a result of award. The proposal identifies major technical risks, and planned mitigation efforts are clearly defined and feasible. The proposed schedule aggressively pursues performance metrics in an efficient time frame that accurately accounts for the anticipated workload.

- **Potential Contribution and Relevance to the DARPA Mission**

The potential contributions of the proposed effort bolster the national security technology base and support DARPA's mission to make pivotal early technology investments that create or prevent technological surprise. The proposed intellectual property restrictions (if any) will not significantly impact the Government's ability to transition the technology.

- **Cost Realism**

The proposed costs are realistic for the technical and management approach and accurately reflect the technical goals and objectives of the solicitation. The proposed costs are consistent with the proposer's Statement of Work and reflect a sufficient understanding of the costs and level of effort needed to successfully accomplish the proposed technical approach. The costs for the prime proposer and proposed subawardees are substantiated by the details provided in the proposal (e.g., the type and number of labor hours proposed per task, the types and quantities of materials, equipment and fabrication costs, travel and any other applicable costs and the basis for the estimates).

B. Review and Selection Process

DARPA will conduct a scientific/technical review of each conforming proposal. Conforming proposals comply with all requirements detailed in this solicitation; proposals that fail to do so may be deemed non-conforming and may be removed from consideration. Proposals will not be evaluated against each other since they are not submitted in accordance with a common work statement. DARPA's intent is to review proposals as soon as possible after they arrive; however, proposals may be reviewed periodically for administrative reasons.

The review process identifies proposals that meet the evaluation criteria described above and are, therefore, selectable for negotiation of awards by the Government. DARPA policy is to ensure impartial, equitable, comprehensive proposal evaluations and to select proposals that meet DARPA technical, policy, and programmatic goals. Proposals that are determined selectable will not necessarily receive awards (see Section II). Selections may be made at any time during the period of solicitation. For evaluation purposes, a proposal is defined to be the document and supporting materials as described in Section IV.

1. Handling of Source Selection Information

DARPA policy is to treat all submissions as source selection information and to only disclose their contents to authorized personnel. Restrictive notices notwithstanding, submissions may be handled by support contractors for administrative purposes and/or to assist with technical evaluation. All DARPA support contractors performing this role are expressly prohibited from performing DARPA-sponsored technical research and are bound by appropriate nondisclosure agreements. DARPA may also request input on technical aspects of the proposals from other non-Government consultants/experts who are strictly bound by the appropriate non-disclosure requirements.

Submissions will not be returned. The original of each submission received will be retained at DARPA and all other non-required copies destroyed. A certification of destruction may be requested via email to the RA mailbox, provided the formal request is received within 5 business days after being notified of submission status.

C. Countering Foreign Influence Program (CFIP)

DARPA's CFIP is an adaptive risk management security program designed to help protect the critical technology and performer intellectual property associated with DARPA's research projects by identifying the possible vectors of undue foreign influence. The CFIP team will create risk assessments of all proposed Senior/Key Personnel selected for negotiation of a fundamental research grant or cooperative agreement award. The CFIP risk assessment process will be conducted separately from the DARPA scientific review process and adjudicated prior to final award.

D. Federal Awardee Performance and Integrity Information (FAPIS)

Following the review and selection process described above, DARPA is required³ to review and consider any information available through the designated integrity and performance system (currently FAPIS). Selectees have the opportunity to comment on any information about themselves entered in the database. DARPA will consider any comments and other information in FAPIS or other systems prior to making an award.

VI. Award Administration Information

A. Selection Notices

After proposal evaluations are complete, proposers will be notified as to whether their proposal was selected for award negotiation as a result of the review process. Notification will be sent by email to the Technical and Administrative POCs identified on the proposal cover sheet. If a proposal has been selected for award negotiation, the Government will initiate those negotiations following the notification.

B. Administrative and National Policy Requirements

1. Solicitation Provisions and Award Clauses, Terms and Conditions

Solicitation provisions relevant to DARPA BAAs and RAs are listed on the Additional BAA Content page on DARPA's website at www.darpa.mil/work-with-us/additional-baa. This page also lists award clauses that, depending on their applicability, may be included in the terms and conditions of awards resultant from DARPA solicitations. This list is not exhaustive and the clauses, terms and conditions included in a resultant award will depend on the nature of the research effort, the specific award instrument, the type of awardee, and any applicable security or publication restrictions.

For terms and conditions specific to grants, see the DoD General Research Terms and Conditions (latest version) at <http://www.onr.navy.mil/Contracts-Grants/submit-proposal/grants-proposal/grants-terms-conditions> and the supplemental DARPA-specific terms and conditions at <http://www.darpa.mil/work-with-us/contract-management#GrantsCooperativeAgreements>.

The above information serves to put potential proposers and awardees on notice of proposal

³ Per 41 U.S.C. 2313, as implemented by 2 CFR § 200.205.

requirements and award terms and conditions to which they may have to adhere.

2. System for Award Management (SAM) and Universal Identifier Requirements

All proposers must be registered in SAM unless exempt per FAR 4.1102. FAR 52.204-7, “System for Award Management” and FAR 52.204-13, “System for Award Management Maintenance” are incorporated into this solicitation. See <http://www.darpa.mil/work-with-us/additional-baa> for further information.

International entities can register in SAM by following the instructions in this link:

https://www.fsd.gov/sys_attachment.do?sys_id=c08b64ab1b4434109ac5ddb6bc4bcbb8.

NOTE: New registrations can take an average of 7-10 business days to process in SAM. SAM registration requires the following information:

- DUNS number
- TIN
- Commercial and Government Entity (CAGE) Code. If a proposer does not already have a CAGE code, one will be assigned during SAM registration.
- Electronic Funds Transfer information (e.g., proposer’s bank account number, routing number, and bank phone or fax number).

3. Representations and Certifications

All proposers are required to submit supplementary DARPA-specific representations and certifications at the time of proposal submission. See <http://www.darpa.mil/work-with-us/rep-certs> for further information on required representation and certification.

4. Intellectual Property

Proposers should note that the Government does not own the intellectual property or technical data/computer software developed under Government contracts. The Government acquires the right to use the technical data/computer software. Regardless of the scope of the Government’s rights, awardees may freely use their same data/software for their own commercial purposes (unless restricted by U.S. export control laws or security classification). Therefore, technical data and computer software developed under this solicitation will remain the property of the awardees, though DARPA will have, at a minimum, Government Purpose Rights (GPR) to technical data and computer software developed through DARPA sponsorship.

If proposers desire to use proprietary computer software or technical data or both as the basis of their proposed approach, in whole or in part, they should: (1) clearly identify such software/data and its proposed particular use(s); (2) explain how the Government will be able to reach its program goals (including transition) within the proprietary model offered; and (3) provide possible nonproprietary alternatives in any area that might present transition difficulties or increased risk or cost to the Government under the proposed proprietary solution. Proposers expecting to use, but not to deliver, commercial open source tools or other materials in implementing their approach may be required to indemnify the Government against legal liability arising from such use.

a. Intellectual Property Representations

All proposers must provide a good faith representation of either ownership or possession of appropriate licensing rights to all other intellectual property to be used for the proposed project.

Proposers must provide a short summary for each item asserted with less than unlimited rights that describes the nature of the restriction and the intended use of the intellectual property in the conduct of the proposed research. See ATTACHMENT F: PROPOSAL TEMPLATE VOLUME 3: ADMINISTRATIVE & NATIONAL POLICY REQUIREMENTS, Section 4.

b. Patents

All proposers must include documentation proving ownership or possession of appropriate licensing rights to all patented inventions to be used for the proposed project. If a patent application has been filed for an invention, but it includes proprietary information and is not publicly available, a proposer must provide documentation that includes: the patent number, inventor name(s), assignee names (if any), filing date, filing date of any related provisional application, and summary of the patent title, with either: (1) a representation of invention ownership or (2) proof of possession of appropriate licensing rights in the invention (i.e., an agreement from the owner of the patent granting license to the proposer).

c. Grant Awards

Proposers shall follow the applicable rules and regulations governing grants and should appropriately identify any potential restrictions on the Government's use of any intellectual property contemplated under these awards. This includes both noncommercial items and commercial items. The Government may use the list as part of the evaluation process to assess the impact of any identified restrictions and may request additional information from the proposer to evaluate the proposer's assertions. Failure to provide full information may result in a determination that the proposal is non-conforming. A template for complying with this request is provided in ATTACHMENT F: PROPOSAL TEMPLATE VOLUME 3: ADMINISTRATIVE & NATIONAL POLICY REQUIREMENTS, Section 4.

5. Human Subjects Research (HSR)/Animal Use

Proposers that anticipate involving human subjects or animals in the proposed research must comply with the approval procedures detailed at <http://www.darpa.mil/work-with-us/additional-baa>, to include providing the information specified therein as required for proposal submission.

6. Electronic Invoicing and Payments

Awardees will be required to submit invoices for payment electronically via Wide Area Work Flow (WAWF), accessed through the Procurement Integrated Enterprise Environment at <https://piee.eb.mil/>, unless an exception applies. Registration in WAWF is required prior to any award under this RA.

7. Electronic and Information Technology

All electronic and information technology acquired or created through this RA must satisfy the accessibility requirements of Section 508 of the Rehabilitation Act (29 U.S.C. § 749d).

8. Publication of Grant Awards

Per Section 8123 of the Department of Defense Appropriations Act, 2015 (Pub. L. 113-235), all grant awards must be posted on a public website in a searchable format. To comply with this requirement, proposers requesting grant awards must submit a maximum one (1) page abstract that may be publicly posted and explains the program or project to the public. The proposer should sign the bottom of the abstract confirming the information in the abstract is approved for

public release. Proposers are advised to provide both a signed PDF copy, as well as an editable (e.g., Microsoft word) copy. Abstracts contained in grant proposals that are not selected for award will not be publicly posted.

C. Reporting

1. Technical and Financial Reports

The number and types of technical and financial reports required under the award will be specified in the award document and may include monthly financial reports, monthly technical reports, and/or a yearly status summary. A final report that summarizes the project and tasks will be required at the conclusion of the performance period for the award. The reports shall be prepared and submitted in accordance with the procedures contained in the award document.

2. Patent Reports and Notifications

All resultant awards will contain a mandatory requirement for patent reports and notifications to be submitted electronically through i-Edison (<https://public.era.nih.gov/iedison>).

VII. Agency Contacts

DARPA will use email for all technical and administrative correspondence regarding this solicitation.

- **Technical POC:** Rohith Chandrasekar, Program Manager, DARPA/DSO
- **RA Email:** YFA2022@darpa.mil
- **RA Mailing Address:**
DARPA/DSO
ATTN: DARPA-RA-21-03
675 North Randolph Street
Arlington, VA 22203-2114
- **DARPA/DSO Opportunities Website:** <http://www.darpa.mil/work-with-us/opportunities>

For information concerning agency level protests see <http://www.darpa.mil/work-with-us/additional-baa#NPRPAC>.

VIII. Other Information

A. Proposers Day

The YFA Proposers Day was held on August 30, 2021 via webcast. The presentation is posted at: <http://www.darpa.mil/work-with-us/opportunities>.

B. Frequently Asked Questions (FAQs)

Administrative, technical, and contractual questions should be emailed to YFA2022@darpa.mil. 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 10 days of the proposal due date may not be answered. DARPA will post an FAQ list at: <http://www.darpa.mil/work-with-us/opportunities>. The list will be updated on an ongoing basis

until the RA expiration date as stated in Part I.

C. Collaborative Efforts/Teaming

This RA solicits single Principal Investigator (PI) proposals; no co-PIs are allowed. However, investigators will be given the opportunity to propose teaming if the nature of the proposal requires it. The total, combined value of teaming and subcontract awards will be limited to no more than 30% of the total grant value. Non-U.S. organizations may not be proposed as subawardees. Please see guidance for FFRDCs and Government Entities in Section III.A.1.a, and III.A.1.b. Specific content, communications, networking, and team formation will be the sole responsibility of the participants.