

Research Announcement

Young Faculty Award (YFA)

Defense Sciences Office

DARPA-RA-23-01

Amendment 1

January 20, 2023

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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:** Amendment
- **Funding Opportunity Number:** DARPA-RA-23-01
- **Catalog of Federal Domestic Assistance (CFDA) Number(s):** 12.910 Research and Technology Development
- **Dates** (All times listed herein are Eastern Time.)
  - Posting Dates
    - Initial Announcement: November 3, 2022
    - Amendment 1: January 20, 2023
  - Executive Summary Due Date: November 30, 2022, 4:00 p.m.
  - FAQ Submission Deadline: January 31, 2023, 4:00 p.m. See Section VIII.B.
  - Full Proposal Due Date: February 7, 2023, 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:** YFA2023@darpa.mil
  - **RA Mailing Address:**

    DARPA/DSO
    ATTN: DARPA-RA-23-01
    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 2023 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. Travel proposed for non-DoD sponsored activities and events is highly discouraged, please see FAQ for more information.

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 YFA2023@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. Models of Central Auditory Processing to Accelerate Therapeutic Advances

Auditory disorders affect millions of military service members and veterans and can degrade operational readiness and quality of life. Promising treatments are in development for conditions arising from disordered sensory processing in the peripheral auditory system (outer, middle, and

inner ear). However, the comparatively poor understanding of information processing in the central auditory system may diminish the potential of these approaches. Moreover, central auditory pathways may be damaged by trauma exposures in military settings. Disorders involving central auditory pathways, such as tinnitus and difficulty understanding speech in noisy environments despite normal processing at the periphery, are complex with limited treatment options. DARPA seeks innovative proposals to develop in silico auditory system models that will provide a foundation for breakthrough advances in treatment of complex auditory conditions. Models must include components of the central auditory system and emulate auditory system structure and function, including complex features that should be accounted for in development of treatment strategies (e.g., feedback mechanisms, plasticity). Detailed biological models and phenomenological models are within scope. There should be correspondence between model variables and biological phenomena such that the models can validated using data from in vivo or in vitro experiments. Performer should present clear experimental plans for validation; experiments in animal models or human subjects as applicable to the model may be proposed. Proposals must justify the modeling and validation approaches based on their potential to accelerate development of therapeutic strategies for conditions involving disordered central processing of auditory information.

2. Biocomposites for Thermal Management of Electronics

Emerging electronics generate increased quantities of waste heat that may hurt their performance and reliability. Thermally conductive (TC) but electronically insulative composites, which rely on inorganic nanoparticle fillers encased in polymer fiber matrices, are often used to passively dissipate heat. A challenge facing current TC composites is to maintain contact between heat-conducting nanoparticles to manage temperature of flexible electronics. Architectures found in natural composite materials such as nacre (which combines inorganic platelets interspersed with soft biopolymers) has inspired strategies to embed boron nitride (BN) inorganic nanoparticles in polymer matrices. Cellulose-BN composite films demonstrate high in-plane thermal conductivity, and some biopolymers (e.g. spider silk) are intrinsically thermally conductive. This research effort seeks to improve passive thermal management of electronics by developing novel materials that combine biopolymer fibers with inorganic fillers into biocomposites that: (1) efficiently conduct heat [>5 W/(m·K)]; (2) are electronically insulating; and, (3) maintain thermally conductive interfaces with surfaces of flexible electronics. Proposers should justify biological systems that will serve as sources of inspiration for their planned material design(s), including the anticipated benefits of biomaterial architectures, inorganic fillers, and biopolymers that they plan to incorporate into their designs.

3. Desorption and Capture of CO2 for Bioproducts

CO2 is an abundant, replenishing resource with applications in biomanufacturing, refrigeration, agriculture, carbonation, sterilization and more. Environmentally it is present at >400 ppm in the air and in higher local concentrations in exhaust gases or in contained spaces such as submarine environments. While it can be in short supply commercially due to demand from industry, its environmental overabundance is detrimental locally and globally. Sequestration for removal, directed use, or recycling can improve health and safety for individuals, populations, and environments. Existing chemical-based CO2 scrubbers capture the gas selectively and effectively, but it is energetically intensive to release the gas to recharge the scrubber and/or use

the gas for DoD and civilian uses. Biological systems offer a unique platform for CO2 capture and incorporation into DoD relevant products. DARPA is interested in developing novel bioinspired materials with advanced CO2 absorption and desorption properties. The material should absorb high quantities of CO2 passively or actively from an operationally relevant DoD environment, such as diesel tail pipe emissions or as a component of life support systems in contained environments, and be able to desorb the material at low energetic loads into an appropriate medium for facile downstream use. To accomplish these goals, proposals are expected to incorporate bioinspired molecules, materials, or enzymes into novel CO2 scrubbing materials.

4. Biocompatible Soft Batteries

The rapid development of flexible electronics for soft robotics, wearables and biomedical applications requires energy storage methods that are elastic, biocompatible, and operate utilizing ubiquitous chemicals—not being reliant on expensive metals. Electric eels generate electricity with high voltage but low amperage, and can be used as an inspiration for the development of novel energy storage technologies. For example, recent advances in stacked hydrogels have allowed for the creation of thin hydrogel film batteries. This research topic aims to build on this foundational knowledge to develop energy storage technologies that operate using environmental electrolytes found in seawater or in living organisms, and can recharge themselves over time. These developed technologies may utilize ionic gradients to generate scalable electrical power, and thus represent a truly soft, biocompatible power source that leverages the inherent chemistry of nature.

5. Dendritic Morphology and Physiology in Computation (DMPC)

Along with slowed information processing, damage to and remodeling of neuronal arbors, namely dendritic trees and axon terminal fields, is a common outcome of traumatic brain injury. Neurons are typically categorized based on their structure, including axons and dendrites, and neuronal morphology is a critical aspect of information processing within cells. Both dendrites and axon terminal fields exhibit a highly arborized and tortuous fractal (dendritic) geometry that impacts signal integration and propagation within neurons. The three-dimensional structure of both axons and dendrites includes the plasma membrane, a filamentous dielectric material that surrounds these structures, and embedded within this plasma membrane are ion channels that both respond to and modify the electric potential of their local environment. These active properties of the membrane add complexity to the information processing capabilities of neuronal arbors. Moreover, research has revealed that the expression and clustering of ion channels covaries with dendritic geometric motifs, and this nonuniform distribution of ion channels can lead to cooperative effects impacting intra-neuronal signals. Yet, it remains to be determined how differences in arbor morphology and associated patterns of ion channel distribution lead to differences in signal processing and conveyance in different cell types. DARPA is seeking innovative proposals to elucidate the design rules for dendritic and axonal morphology, paired with the nonuniform distribution of ion channels within these structures, and to generate new computational regimes that describe and predict the propagation of signals along the arborous structures as a function of these design rules. Proposals must include a plan to develop in silico algorithms capable of synthesizing realistic dendritic and/or axonal features, such as the distribution of branch lengths, branch angles, tortuosity, diameter, etc. and associated

ion channel distribution and colocalization (at minimum, sodium, potassium, and calcium channels) representative of at least three classes of neurons chosen from: striatal medium spiny, cortical pyramidal, monoaminergic projection, thalamocortical, and cerebellar Purkinje cells. Proposed approaches should include microanatomic and physiological measurements to inform and validate algorithms in terms of their neuromorphological outputs and their ability to predict how signals are processed along the arborous structures of the selected cell types.

6. Coolscaping

Large swaths of the US, including those that host DoD bases, experience increasing extreme heat events that cause severe stress to humans and supporting infrastructure. A combination of rising temperatures with aspects of the built environment create heat islands that exacerbate these effects, both in cities and at bases. DARPA is interested in creative and scalable approaches that rapidly (within one year) establish at least 3-5℃ local (acre-scale inclusive of existing structures) temperature reductions during peak daylight summer periods through innovative native landscaping and any associated soil modification, novel planting techniques, supporting architectural elements, and beneficial rhizospheric fungal and microbial community implementations that, upon completion, require a minimum of externally supplied water and maintenance. These approaches should forecast how such an installation would mature and show increased performance over time using modeling tools. The effort must include characterization of the surface and subsurface biological community, and a real-world demonstration with a testbed that shows efficacy compared against a control.

7. Biomimetic Prophylaxes for Sepsis

Nosocomial bloodstream infections (BSI) are a major source of morbidity in service members who have sustained combat-related injuries. Furthermore, polytrauma can cause dysregulation of the immune system leading to life-threating infections and septic shock. Cases of sepsis are currently identified by either monitoring symptoms (e.g., fever, sweating, tachycardia, and tachypnea) or using diagnostic platforms that provide results that may be inaccurate, untimely, or both. Patients with sepsis are then often treated with infusions of either therapeutics to destroy the pathogen or mitigants that attempt to rectify aberrant physiology. Recent progress in the field of biomimetics and cell engineering suggests that it is possible to create injectable particles, either living or abiotic, that exhibit long circulation times, contain drug depots, and display recognition molecules. In this research effort, DARPA seeks proposals that will design and test novel concepts for an injectable prophylactic for sepsis that can detect and resolve sepsis without additional intervention. Prospective technologies will be validated in vitro during the initial phases of the project before moving on to relevant in vivo models at later stages. The prophylactic would ideally ultimately confer protection against a sepsis challenge in relevant small animal models for up to 14 days. Proposals that describe redundant systems with multiple modes of action and/or built-in mechanisms for resiliency are of particular interest.

8. Materials Testing for Design

Commercial mechanical testing of structural materials relies on methods and sensors developed a century ago. Extensometers, strain gauges, and linear variable displacement transducers are still used extensively today to detect the shape change of simplified test specimens to extract property

curves for design. One test condition is typically probed per specimen such that 10's to 100's of individual tests must be conducted to generate sufficient statistical property data. Due to the time and expense associated with such tests the materials community has resorted to proxy tests (e.g., hardness) to drive research and development efforts. However, the data generated is often not sufficient to inform design and follow-on costly, time-consuming test campaigns are still required. This has limited the introduction of new materials in advanced engineered systems and is currently a bottleneck in the growing areas of high throughput and autonomous materials research. This topic aims to reimagine mechanical testing using state-of-the-art full field sensor technology coupled with computational methods to extract material properties efficiently and accurately. New approaches are encouraged where constitutive behavior is derived from a minimal number of simple specimen geometries. Approaches that are compatible with arbitrary, as-processed input geometries, or those built using additive manufacturing methods are also sought. Initial proof-of-concept testing should be done using an existing structural alloy with known properties (e.g., IN718, 316SS, Ti-6-4, 6061Al, etc.). Design relevant static properties (e.g., yield strength, tensile ductility, fracture toughness, etc.) must be extracted over a range of temperatures with quantified uncertainty; results should not vary from those extracted using conventional testing by more than 10%. Throughput of at least 10 tests/day in a single rig must be demonstrated where each test desirably captures more than one test condition.

9. Miniaturized Battery-free Wireless Force Sensing and Communication

Humans and machines interact with the physical environment using contact or force over a continuum or a surface. Force sensors are used to quantify ubiquitous contact phenomenon and bridge the gap between the digital world and the real environment. Such sensors traditionally transduce an applied force into an electrical change (like capacitance, resistance) at a low frequency, which is then digitized and transmitted at a high frequency for a wireless sensor. There is currently a lack of wireless force sensors that can directly transduce the applied force into an electromagnetic signal at frequencies above 400 MHz; such an approach would minimize the need for electronics (ADC, amplifiers) to digitize the force for every interaction.

This topic is interested in approaches to demonstrate battery-free flexible wireless force sensors that can be deployed in remote locations (e.g. robots, smart manufacturing, machines) and can wirelessly communicate force measurements. Such work may consider exploring materials and/or techniques that could directly transduce the applied force to change a high-frequency wireless signal and communicate the change in the high-frequency wireless signal without the need for battery power. Furthermore, proposers are encouraged to consider developing multiple point force measurements concurrently. Approaches to measuring pressure (average force over a large area) are out of scope, as are learning algorithms to predict point force by measuring pressure. Proposers should consider how their work could be used to deploy the wireless force sensor in remote locations in the field. Research primarily focused on solely designing new materials for force sensing, developing battery-free wireless communication technologies or focus on digitizing the sensor information and wireless communicating using a battery-free approach are out of scope.

10. Enabling Radical Scientific Advancements in Synthetic Biology/chemistry Manufacturing

The purpose of this topic is to create disruptive scientific advancements enabling new highly distributed, scalable and fieldable synthetic chemical and synthetic biomanufacturing technologies. Growth in the fields of synthetic chemistry and synthetic biomanufacturing is being bottlenecked by a fundamental inability to predict failure and port operations from one location to another. This characteristic of the field affects all synthetic chemical and synthetic biomanufacturing from the production of fine chemicals to the manufacturing of therapeutics. The current paradigm for distributing and parallelizing biomanufacturing is to recapitulate operations from the ground-up, which involves heavy intellectual, personnel, financial and facility overhead. The goal of this topic is to develop new methods for manufacturing therapeutics, specialty chemicals and remediating enzymes in diverse and forward deployed environments. Strong proposals to this program will be expected to offer competitive solutions for dramatically reducing failure modes in biomanufacturing and synthetic chemical manufacturing and novel demonstrated approaches to transferring complex biomanufacturing and synthetic chemical operations across locales. Strong proposals will be evaluated on their ability to characterize a maximum number of failure modalities using minimal measurements. Proposers will be expected to justify the industrial relevance of failure modalities and provide a strong statistical basis for measurement quantity versus failure detection sensitivity. Strong proposals will also need to be able to abstract arbitrarily complicated operations in an originating facility and demonstrate protocols and interfaces for production in a remote facility, without the transfer of personnel or equipment and with limited reachback. The ultimate criteria for evaluation in will be weighted between the generalizability of the methods. Failure rates and quality at the remote facilities are expected to be congruent with failure rates and quality at the originating facility. Proposers should propose solutions that minimize information transfer from the remote facility and provide an interface for communicating operations.

11. Cellular Agriculture

To address vulnerabilities in global supply chains, the Cellular Agriculture YFA Topic invites any approach to produce delicious, nutritious human foodstuffs from commercially available eukaryotic (animal, plant, fungal)-origin cells in systems that could allow production at point of consumption without going through a phase that involves the production and harvest of plant or animal bodies. In contrast to agriculture, literally “field” + “culture,” cells and tissues, theoretically from virtually any organism, can be cultivated for direct human consumption as foodstuffs containing at least one of the following human macronutrients, protein, lipids, carbohydrates, and dietary fiber. Initially these approaches focused primarily on protein from culture of cells from higher organisms and involved rich media, sterile conditions, intensive energy input and complex lab or manufacturing plant-based production systems. More recently, however, the use of extremophiles, opportunities afforded by advances synthetic biology, a wider range of chemical syntheses to create substrates for biology, and advances in engineering open the aperture of feasible approaches toward a field-deployable capabilities. Proposers must describe how their research could demonstrably contribute to a deployable food production capability delivering processed output suitable for human consumption (nutritious, palatable, safe) at scales relevant for both humanitarian and military applications within an energy budget demonstrably less than today’s approach, Meals Ready to Eat.

12. Harnessing the Power and Energy of Mini-magnetospheres

This topic investigates whether useful work or power can be extracted from the action of the solar wind against, or the charged particle environment present at mini-magnetospheres. Mini-magnetospheres are either naturally generated, such as above lunar magnetic anomalies, or may be artificially generated, such as proposed for mini-magnetospheric spacecraft propulsion [e.g. DOI 10.1029/1999ja0003341]. The solar wind and embedded magnetic field pile up against these coherent obstacles, causing compressional disturbances to magnetohydrodynamic waves, draping of magnetic field lines around the magnetic anomaly, and field line intensification. From a basic physics standpoint, compression of lunar magnetic fields by the solar wind will results in those fields storing electromagnetic potential energy. This topic seeks to theoretically develop and model new and foundational methods to harness mini-magnetospheres as a source of power by "useful" interactions with them. Examples of such useful interactions are (but not limited to), i.e., creating electromotive force to generate mechanical action, exploiting its mini-magnetosphere small-scale structure or low-altitude electric fields, interacting with force imparted to the source of the mini-magnetosphere along magnetic field lines, and/or storing and/or extracting electrical potential for later use from the charged particle environment using innovative methods not previously explored. Lunar mini-magnetospheres present a testbed anchored in instrumental magnetometer data to test theories and models, first applicable to lunar-based power generation, then to future artificially-generated mini-magnetospheres. Proposed methods may begin by actively supplying energy, but should end with a net-positive energy condition; the magnitude of extracted (useful) work or power is of direct interest. DARPA seeks proposals that will form the foundational knowledge to model scale-appropriate, useful interactions with a generalized mini-magnetosphere, while accounting for the impact of changing solar wind intensities, incident angles, electron behavior, charged particle magnetizations, and other relevant factors.

13. Fundamental Limits of Noise-Engineered Metrology

Recent developments in quantum sensing have led to the counter-intuitive notion that deliberately imposed dissipation or noise can lead to enhanced measurement strategies that can out-perform conventional classical or even quantum sensors. A variety of techniques including Exceptional-point (EP) sensing, non-Hermitian topological arrays and non-reciprocal sensors have been investigated in this context with often conflicting findings about the potential enhancements to sensor performance. For instance, experiments have shown that the increased responsivity of an EP sensor is often nullified by an increased susceptibility to multimode noise, leading to modest, if any, improvements to overall sensor performance. Similarly, theoretical studies have suggested dramatic, even exponential, enhancements to sensor performance in topological arrays of dissipation-engineered sensors. These studies seem to be in conflict with experiments that suggest that weak and often negligible nonlinear interactions between array elements can degrade the desired topological effects. Thus, it is as yet unclear whether techniques of noise-engineering can yield significant performance enhancements in realistic, experimentally feasible devices of metrological utility.

This research effort seeks to identify experimentally viable sensors wherein techniques of noise-engineering, non-reciprocity, topological design or some combination thereof, can lead to substantial improvements of sensitivity beyond standard limits. Proposers should justify the design of their proposed noise-engineered sensor and describe a research plan to clarify its fundamental limits; its resilience to realistic sources of noise, nonlinearities or other influences

that might ordinarily degrade sensor performance; and a route to experimental validation of their findings. The Year 3 option period may be used for the experimental realization of the proposed sensor and/or collaborative efforts with teams engaging in such experiments to develop and validate the proposed sensor.

14. Enhancement of Two-Phase Heat Transfer for Thermal Management of 3D Heterogeneous Microsystems

As the functional density of microelectronics increases, heat fluxes and volumetric heat density requirements are limiting the capabilities of 3D heterogeneous microsystems. When compared to single phase convection, liquid-vapor phase change heat transfer has long been known to provide significant enhancement in heat transfer capabilities. With shrinking space to accommodate heat removal technologies, the two-phase heat transfer occurs in micro or nano-sized passages, making these configurations increasingly important. An added complexity arises due to the need to maintain high dielectric strength of the coolant, since it can come in direct contact with electrically active components. Dielectric coolants are invariably associated with significantly poorer thermophysical and transport properties, such as thermal conductivity and latent heat of evaporation, as compared to water. Enhancement techniques are needed to improve the two-phase heat transfer performance of dielectric coolants in micro and nano-systems. Research on this topic will develop and demonstrate passive or active two-phase heat transfer enhancement approaches for dielectric coolants in micro/nano-passages that can provide overall heat transfer coefficient in excess of 50,000 W/m2K. The research also will develop a framework for fundamental understanding of the enhancement to guide optimization of such techniques.

15. Thermal Physics, Modeling, and Metrology of Wide Bandgap and Ultra-wide Bandgap Semiconductors

High-power RF devices fabricated from wide bandgap (WBG) and ultra-wide bandgap (UWBG) semiconductors are thermally limited, which degrades device performance and reliability. Improved thermal dissipation using new material integration techniques or device topologies can enable efficient operation at high current density. However, further understanding of the phonon physics of WBG and UWBG materials and interfaces is required before these thermally optimized device structures can be achieved. This topic seeks to develop new approaches for atomic-scale thermal modeling of WBG and UWBG materials and interfaces, electro-thermal co-design, and thermal metrology. Research areas could include using physics-informed neural networks to model these material systems, developing a multi-physics co-design platform, or using novel metrology methods to characterize materials and interfaces at nanometer length scales. Success of this effort would be the experimental verification of the thermal model, co-design platform and/or nanoscale thermal metrology methods for WBG/UWBG transistors.

16. Chip-Scale Ultrafast Photonics

Femtosecond lasers have become indispensable tools for ultrafast science and technology, where they play enabling roles in medicine, manufacturing, spectroscopy, and precision timing applications. Recent demonstrations have established that short pulse lasers could also transform mainstream applications such as optical communications, ultrafast electronics, and metrology by exploiting the broad bandwidth, short pulse duration, and high intensities they provide. However,

today's ultrafast systems typically employ exquisite, hand-built assemblies based on fiber and bulk optics, and their large size and high cost severely limit deployment opportunities outside the laboratory. Advances in nanofabrication, integrated photonics, and heterogeneous integration offer new pathways to ultrafast systems with disruptive improvements in size, weight, power, cost, and manufacturability. In this topic, DARPA seeks to mature the chip-scale technologies required to generate, amplify, and manipulate high-intensity optical pulses with sub-picosecond duration. Realizing on-chip femtosecond sources will require innovation in on-chip gain, mode-locking elements, supercontinuum generation, ultrafast detectors, dispersion control, low-loss waveguides, stretchers, compressors, and other ancillary components compatible with short, high-intensity optical pulses.

Additionally, DARPA seeks to advance novel application concepts enabled by chip-scale nanofabrication, including efficient high-harmonic generation in solids, terahertz and petahertz electronics, and precision metrology. Strong proposals will present key concepts clearly, provide theory and experimental evidence to support their effort, outline their planned fabrication and characterization activities, establish quantitative performance metrics, and describe how their project could impact a compelling DoD application.

17. Materials Research for Printed Dielectrics

Advancements in the field of printed electronics over the past several years have ushered in a wave of new applications in packaging, optical signal routing, and novel responses generated by meta-surfaces. Much of the associated materials development has focused on printable conductors, leading to reliable yields for lower resistivity materials printed under relatively benign processing conditions. As these conductors have entered the commercial market, a gap has emerged in the quality of printable dielectrics. In contrast to conductors, printable dielectrics have large loss tangents, precluding their application to radio frequency electronics, antennas, etc. Furthermore, due to the mismatch between the coefficient of thermal expansion (CTE) of printable conductors and dielectrics, significant processing challenges arise in the creation of complex, multi-layer printed systems. This topic seeks research leading to the development of substrate agnostic, high-quality, printable dielectrics for inherently scalable direct-write applications; performance characteristics of interest include: loss tangent of <0.008 at 10 GHz, CTE-matching, 10 μm feature sizes, ten redistribution layers, and compatibility with state of the packaging techniques.

18. Monolithic Acoustoelectric Microwave Integrated Circuits (MAMIC)

Recent advances in demonstrated gain with acoustoelectric devices have opened the possibility of performing RF signal processing functions in purely acoustic technologies. The smaller acoustic wavelength in the material creates an opportunity for miniaturized RF front-ends on a single chip covering multiple frequency bands. This topic therefore seeks to develop and demonstrate foundational capabilities for acoustic circuits that combine acoustoelectric devices with acoustic waveguides to form RF component circuits, such as low noise acoustoelectric amplifiers. The goal is to create a diffraction-free platform for state-of-the-art RF signal processing in the acoustic domain, without compromising impedance matching, bandwidth, dispersion, loss, and power handling characteristics. Proposers will develop a waveguide-based acoustoelectric circuit platform and characterize it, examining waveguide metrics such as

waveguide loss, dispersion, cross-talk, and circuit density, as well as amplifier metrics such as gain, bandwidth, nonlinear saturation, power consumption, noise figure, and nonreciprocal isolation. Performers must demonstrate that the platform enables dense acoustoelectric circuits, and verify that loss, cross-talk, and self-interference performance are commensurate with state-of-the-art RF front-end circuits.

19. Hyperdimensional Learning for Efficient Edge Intelligence

Edge intelligence requires performing real-time cognitive tasks with limited energy and computing resources. Hyperdimensional computing (HDC) mimics human cognition by using high-dimensional vectors to represent information and algebraic operations to perform learning and inferencing tasks. Current HDC techniques are not suitable for edge processing due to the large memory and processing resources required for performing inferencing tasks on complex data structures representative of real sensing tasks. This research topic seeks to improve HDC capabilities and efficiency, for more cognitive tasks in varied domains at the edge, through the development of novel encoding schemes, algorithms, and hardware. Proposers are expected to improve data representations for more complex data types, and to enable efficient utilization of hardware resources for encoding, learning, and inferencing. The proposers are also expected to utilize a hardware-algorithm co-design approach to improve accuracy while reducing the computing complexity and power consumption.

20. Impact of Material and Deposition on Intrinsic Acoustic Material Limits at mm-Wave

RF acoustic and optoacoustic resonators are at the heart of many time keeping devices (clocks), filters, and sensors. Two emerging trends are converging to create both challenges and new opportunities for acoustic resonators. The first trend is the application push to higher RF frequencies to create differentiation in the electromagnetic spectrum. At high frequencies, acoustic resonators are challenged to maintain high quality factors (Q), a major factor influencing device performance for many DoD-related applications (e.g., RF front-end filter insertion loss, clock phase noise, resonant sensor sensitivity, etc.). Resonator material choices are a determining factor in the maximum intrinsic Q achievable for a given resonator design. The second trend is emerging thin film fabrication and integration techniques for high quality materials. There are opportunities to choose resonator materials from multiple deposition techniques, such as physical vapor deposition (PVD), metal organic chemical vapor deposition (MOCVD), molecular-beam epitaxy (MBE), single-crystal thin film transfer, etc. The choice of resonator material is typically based on experimentally reported Qs, biased by measurements incorporating extrinsic effects from device structures and other material layers. Alternatively, predictive techniques are based on losses due to phonon interactions in single crystal materials, and do not account for effects from crystal nonidealities. Knowledge of intrinsic acoustic loss dependence on material and deposition will shape investments in future high frequency resonator performance. Proposals should address the development of systematic processes to experimentally characterize resonator materials and their dependence on deposition technique over the full frequency range from 10-100 GHz. It is expected that proposals will address at least one material with three or more deposition techniques, though proposals of multiple materials and more deposition techniques are welcome. Proposals should Include modeling and simulation

of the resonators based on material characterization results, as well as characterization of resonators employing such materials.

21. Learning Relations for Formal Proof

Proof assistants make it possible to prove critical properties of software systems. Machine learning tools have shown promise for making this more tractable, but remain hampered by their inability to recognize, prove, and specifically apply deep semantic relations – for which no obvious proxy exists. This inability is a major barrier for important tasks like reusing related proofs across different libraries, repairing broken proofs in response to breaking changes, and searching for related proofs in other files or libraries. DARPA is seeking proposals to address this barrier, with the goals being twofold: (1) explore fundamental advances in machine learning that empower tools to automatically recognize, prove, and apply deep semantic relations, and (2) draw on these advances to build proof automation that furthers the state of the art in important tasks like reuse, repair, and search.

Proof automation is an ideal domain for this because even the simplest semantic relations in formal proofs (for example, equivalences) often lack syntactic proxies. This is in contrast with semantic relations in natural language, for which distributional similarity (the use of words in similar contexts) is a commonly accepted proxy. The struggle of machine learning tools to draw deep semantic relations has implications far beyond proof automation. Research aligned with the proposed topic, if successful, will make those fundamental advances, while also making it more tractable to prove critical properties of software systems. These goals are important to the military: the former to build more robust and powerful machine learning systems, and the latter to prove the absence of dangerous vulnerabilities in security-critical systems.

22. Augmented Reality Personnel Protection

Augmented reality (AR) offers performance enhancement through expanded situational awareness, data sharing, and intuitive data comprehension. Traditional Department of Defense AR applications such as fighter aircraft helmet-mounted displays operate in secure, controlled environments and involve substantial engineering investment and testing to assure that information augmentation improves human performance. Emerging technologies such as head-worn waveguide displays, very low power processing, high-speed networking, and efficient batteries are expected to lead to affordable AR that can be used in diverse applications, particularly for dismounted warfighters, but there is also potential for such systems to mislead or perhaps even harm users. These effects may result from unintentionally poor system designs that do not interact with users in ways that enhance performance or through purposeful adversary interference that is intended to reduce user effectiveness.

DARPA seeks proposals to explore how to reliably protect dismounted users from potential negative effects of using AR. This may include AR-specific run-time checking that keeps systems from unnecessarily distracting the user; guidelines that keep AR systems from inducing undesirable physiologic or psychologic effects through visual, auditory, or haptic data; or other system development approaches that mitigate against the potential negative effects of immersive AR use. Non-specific measures of task workload, cognitive workload, and stress are specifically out of scope. The research could ultimately lead to the development of rules that can be enforced

or shown to be enforced in working AR systems, or that can be used to automate monitoring the operation of such systems in order to detect system operation issues. DARPA expects that some proposed solutions for this topic may involve Human Subjects Research (HSR).

23. Energy and Resource-Aware Computing at the Edge (ENGRACE)

ENGRACE seeks aspiring research faculty to address the technical challenges in computing for machine learning at the edge by developing resilient AI algorithms applicable to SWAP-constrained Internet of Things (IoT) devices. Key to this endeavor will be hardware/software codesign that a) dynamically reduce the size of machine learning models and the information they share, while preserving model performance and accuracy, b) account for the highly heterogenous nature of incoming data that agents in a collective system must train and operate on, and c) enable noise immunity in the operation of the resource-aware models. The latter challenge is of particular interest not only to model the pertinent characteristics of inputs, but to make the machine learning resistant to adversarial input attacks. Machine learning algorithms to address underlying hardware include, but are not limited to, network pruning, weight and data flow quantization, new forms of Convolutional Neural Network (CNN) back propagation, spiking neural networks, etc. During the term of this research, the investigator will demonstrate the proofs of concept in the operation of resilient, size, weight and power (SWAP) -constrained AI through general purpose scenarios operating on commercial off the shelf (COTS) hardware implementations of the ENGRACE algorithms. Proposals should include a set of proposed benchmarks against which the work will be evaluated.

24. Causal Reinforcement Learning

Reinforcement Learning (RL) agents have been extremely successful in controlled environments where interventions can be performed without cost. Despite the impressive results achieved so far —predominantly in games such as Chess, Go, and various games from the Atari platform — most results do not translate to decision-making in the real world, where the underlying causal mechanisms are mostly unknown, and decisions can lead to catastrophic side effects. In fact, most of the RL literature assumes a specific causal model in the form of Markov Decision Processes (MDP) (or similar), which rarely conforms with the actual mechanisms of the underlying Structural Causal Model (SCM). Further, RL agents assume that experimentation is the primary way of interacting with the environment, largely ignoring observational data generated by other agents. Evidence from the cognitive sciences suggests that humans learn not by trying all combinations of experiments, but by observing others interacting in the same environment and by contemplating alternate counterfactual realities. This topic seeks to develop a general theory of Causal Reinforcement Learning (CRL), leveraging the structural invariances of causal reasoning and the efficient allocation-sampling capabilities of current RL approaches. In particular, CRL agents should leverage data from other agents, intervene more economically in the environment, use interventions to test causal hypotheses, and collaborate more naturally with humans, using their causal understanding of the system to explain why they chose a given action.

25. Rapid Mission-Specific Customization (RaMS-C)

This topic addresses the need for rapid, safe modification and enhancement to mission-critical vehicles in the field. Logistics has been a key stress point in recent conflicts, as vehicles often need modification to meet mission requirements. Mission-critical rapid field modification of vehicles could be provided by adapting usable parts from vehicle recycling, however, the skills and knowledge to successfully make modifications are in short supply, and the time and resources for soldiers to learn the indigenous technology are not available during a conflict. Vehicles have become so complex that even SMEs cannot keep tabs on the 30K parts in the average car. In-theater repairs are done by local mechanics who may not have the expertise needed, and who scavenge parts from local junkyards and cobble together the modified vehicle, which then contains undocumented changes and may be unsafe.

A renewed interest in parts recovery and component tracking is driven by tenuous supply chains and production disruptions. Recycling works by returning raw material (e.g., steel) to the supply chain. There is a far greater advantage to recovering fully working parts and sub-systems, as there is no need for the energy and tooling to recreate the item. Vehicle designs that facilitate deconstruction are becoming more common, as are manuals, drawings, and databases in machine-readable form, as well as deconstruction equipment and standardized processes. Machine-readable manuals provide a large validated learning set for research on extracting high-value subsystems from "junked" vehicles.

A successful proposal will use machine intelligence to gather information on available parts from commonly available references. Maintenance manuals, parts catalogues, and recycling instructions from manufacturers would be within scope. The proposed system should be able to establish an available parts inventory based on a set of vehicles available as parts donors and also provide instructions for removing the part from the donor vehicle. DARPA is specifically looking for approaches that can achieve extraction of high-value subsystems from scrapped vehicles to address limitations in mission-critical rapid field modification. Such proposals should focus on reuse and up-cycling of components. Approaches that are focused on additive manufacturing and numerical-control (NC) machining are out of scope.

26. Spectrum Sharing and Performance of Radar Systems

There is a continuing desire to reduce cost and improve the performance of DoD radars while simultaneously sharing spectrum with civil communications systems. Increasing radar performance has required a larger aperture size or transmit power and thus increased radar cost; rather than scaling the radar hardware, an alternative is to scale the signal processing without increasing cost. Historically, radar signal processing has often been limited by computing capability. Koomey's and Moore's laws predict a future where the current radar signal processing is an insignificant fraction of what could be applied. This topic seeks to investigate radar waveform design and signal processing unconstrained by today's limits on compute power and the foundational implications for target detection and tracking. Of particular interest are spectrum sharing with a plethora of communications emitters, iterative inversion of the signals from digitized apertures, and target tracking without thresholded data. DARPA is seeking proposals that enhance our fundamental understanding of radar processing to include mutual information and scenario entropy. Proposers should state radar types (SAR, GMTI, Air Surveillance) that the research might impact.

27. Neutron Transport Uncertainty Reduction for Thermal Spectrum Nuclear Thermal Rocket Reactors

The validity of neutron transport theories for interdependent attributes become difficult to reliably model for environments that change on aggressive time scales. These attributes drive rapid fluctuations in reactivity effects, which then drive changes in reactor power. This is typically captured in a single k-effective value per time unit. Changes in reactor power then drive updates of the attributes upon which neutron transport theory relies. The Nuclear Thermal Rocket (NTR) reactor operates on extremely aggressive time scales. A lack of experimentally collected benchmark data leads to uncertainties which couple to Monte Carlo methods for modeling neutron transport in NTR reactors. There is an absence of criticality data collected on transport behavior of neutrons through materials at the combined extreme environments, for example, materials which undergo heating from cryogenic (<30 K) to refractory (>2500 K) conditions over 60 second startup conditions.

Reactor performance based on predicted values that do not sufficiently capture uncertainties can lead to feedback predictions and neutron flux and power predictions with unacceptably high uncertainties. This YFA topic encourages the exploration of uncertainty reduction through experiments, improved measurement techniques, and/or high-fidelity simulations coupled to Monte Carlo methods. These efforts should lead to best practices of extrapolating unknown nuclear data for a moderated HALEU NTR reactor. Proposers should identify an existing benchmarked data set/neutron data library and reactor to validate their method against and demonstrate subsequent feedback with this data.

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 proposers[1] whose proposals are determined to be the most advantageous to the 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

[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.).

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. Inclusion of publication costs is highly discouraged, proposed costs should focus on program goals and objectives, please see FAQ for additional information.

University or non-profit research institution performance under this solicitation will include effort categorized as fundamental research. In addition to Government support for free and open scientific exchanges and dissemination of research results in a broad and unrestricted manner, the academic or non-profit research performer or recipient, regardless of tier, acknowledges that such research may have implications that are important to U.S. national interests and must be protected against foreign influence and exploitation. As such, the academic or non-profit research performer or recipient agrees to comply with the following requirements:

(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 relating to professional and financial activities. 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 professional and financial activities over the last 4 years. The majority of foreign entities lists used to make these determinations are publicly available. The DARPA Countering Foreign Influence Program (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/092021DARPACFIPRubric.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/

(b) DARPA's analysis and assessment of affiliations and associations 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.

(c) 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.

i. 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.

(d) 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.

(e) 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 includes 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 may only be proposed as subcontractors under YFA, but 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, with specific details, that the proposed work, expertise, and facilities are 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. FFRDC proposals that do not include these elements may be deemed non-conforming and removed from consideration.

b. Government Entities

Government Entities (e.g., Government/National laboratories, military educational institutions, etc.) may only be proposed as subcontractors under YFA, and 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.§ 4892 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 E: 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-conforming[2] 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.

[2] "Conforming" is defined as having been submitted in accordance with the requirements outlined 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 conducing 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 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 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) Amendment 1

- **Volume 3**
    - Attachment E: PROPOSAL TEMPLATE VOLUME 3: ADMINISTRATIVE & NATIONAL POLICY REQUIREMENTS

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 SAM.gov Unique Entity Identifier (UEI) 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 YFA2023@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/DSO 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 email. Note: If an account has recently been created for the DARPA BAA Website, this account may be reused. Accounts are typically disabled and eventually deleted following 75-90 days of inactivity – if you are unsure when the account was last used, it is recommended that you create a new account. If no account currently exists for the DARPA BAA Website, visit the website to complete the two-step registration process.

Submitters will need to register for an Extranet account (by clicking "Create New Account" at the URL listed above) and wait for two separate e-mails containing a username and temporary password. After accessing the Extranet, submitters may then create an account for the DARPA BAA website (via the "Register your Organization" link along the left side of the homepage), view submission instructions, and upload/finalize the proposal. Note: Even if a submitter's organization has an existing registration, each user submitting a proposal must create their own Organization Registration.

All executive summaries must be uploaded as zip archives (i.e., files with a .zip or .zipx extension). The final zip archive should be no greater than 100 MB in size. Only one zip archive will be accepted per submission - subsequent uploads for the same submission will overwrite previous uploads, and submissions not uploaded as zip archives will be rejected by DARPA.

Proposers may encounter heavy traffic on the submission deadline date; proposers should start this process as early as possible. Technical support for the DARPA BAA 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 YFA2023@darpa.mil. Questions regarding submission contents, format, deadlines, etc. should be emailed to YFA2023@darpa.mil. Questions/requests for support sent to any other email address may result in delayed/no response.

b. Proposals

Proposers requesting grants must submit proposals through one of the following methods: (1) electronic upload per the instructions at HYPERLINK "https://www.grants.gov/applicants/apply-for-grants.html" 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. All proposed labor, material, and travel costs are necessary to achieve the program metrics, 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 (FAPIIS)

Following the review and selection process described above, DARPA is required[3] to review and consider any information available through the designated integrity and performance system (currently FAPIIS). Selectees have the opportunity to comment on any information about themselves entered in the database. DARPA will consider any comments and other information in FAPIIS 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.

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

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 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 2 CFR §25.110. See Additional Requirements for Grants and Cooperative Agreements (darpa.mil)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:

- SAM Unique Entity Identifier (UEI)
- 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/reps-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 E: 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 E: 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://www.nist.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:** YFA2023@darpa.mil
- **RA Mailing Address:**

  DARPA/DSO
  ATTN: DARPA-RA-23-01
  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. Program Overview Slides

The YFA Program Overview slide presentation will be posted at: http://www.darpa.mil/work-with-us/opportunities.

B. Frequently Asked Questions (FAQs)

Administrative, technical, and contractual questions should be emailed to

YFA2023@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.