



Broad Agency Announcement  
Assured Neuro Symbolic Learning and Reasoning (ANSR)  
INFORMATION INNOVATION OFFICE  
HR001122S0039  
June 1, 2022

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## PART I: OVERVIEW INFORMATION

- **Federal Agency Name** – Defense Advanced Research Projects Agency (DARPA), Information Innovation Office (I2O)
- **Funding Opportunity Title** – Assured Neuro Symbolic Learning and Reasoning (ANSR)
- **Announcement Type** – Initial Announcement
- **Funding Opportunity Number** – HR001122S0039
- **Catalog of Federal Domestic Assistance Numbers (CFDA)** – 12.910 Research and Technology Development
- **Dates**
  - o Posting Date: June 1, 2022
  - o Proposers Day: June 1, 2022
  - o Abstract Due Date and Time: June 13, 2022, 12:00 noon (ET)
  - o Questions Due: June 24, 2022, 12:00 noon (ET)
  - o Proposal Due Date and Time: July 26, 2022, 12:00 noon (ET)
- Anticipated individual awards – DARPA anticipates multiple awards in technical area (TA) 1. No more than two awards in each of TA2 and TA3, and one award in TA4
- Types of instruments that may be awarded – Procurement Contract, Cooperative Agreement or Other Transaction
- Agency contact
  - o Points of Contact
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## PART II: FULL TEXT OF ANNOUNCEMENT

### I. Funding Opportunity Description

This publication constitutes a Broad Agency Announcement (BAA) as contemplated in Federal Acquisition Regulation (FAR) 6.102(d)(2) and 35.016 and 2 C.F.R. § 200.203. Any resultant award negotiations will follow all pertinent laws and regulations, and any negotiations and/or awards for procurement contracts will use procedures under FAR 15.4, Contract Pricing, as specified in the BAA.

The Defense Advanced Research Projects Agency (DARPA) is soliciting innovative proposals in the following areas of interest: Artificial Intelligence (AI) algorithms and architectures that deeply integrate symbolic reasoning with data-driven machine learning to create robust, assured, and, therefore, trustworthy AI-based systems. 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.

#### A. Introduction and Background

Autonomy and highly autonomous systems are a desired capability for many Department of Defense (DoD) missions – Intelligence, Surveillance and Reconnaissance (ISR), Logistics, Planning, Command and Control among others. The purported benefits are many, including – (1) improved operational tempo and mission speeds; (2) reduced cognitive demands on warfighter in operation and supervision of autonomous systems; and (3) increased standoff for improved warfighter safety. A crucial desideratum associated with autonomy is the need for trustworthiness and trust, as emphasized by the 2016 Defense Science Board (DSB) Report on Autonomy<sup>1</sup>. Informally, trust is an expression of confidence in an autonomous system’s ability to perform an underspecified task. Assuring that autonomous systems will operate safely and perform as intended is integral to trust, which is key to DoD’s success in adoption of autonomy.

In the six years since the publication of the DSB report on Autonomy, significant improvements have been made in machine learning (ML) algorithms that are central to achieving autonomy. Simultaneously, innovations in assurance technologies have delivered mechanisms to assess the correctness and safety trustworthiness of systems at design time and be resilient at operation time. In spite of this progress, high levels of autonomy remain elusive, which we attribute to fundamental limitations of data-driven ML (discussed below), motivating new thinking and approaches that will take ML beyond data-driven pattern recognition and augment it with knowledge-driven reasoning that includes context, physics, and other background information.

The last decade witnessed tremendous progress in applications of data-driven ML, fueled by growth in compute power and data, in areas that span a wide spectrum ranging from board games to protein folding, language translation to medical image analysis. In several of these

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<sup>1</sup> Report of the Defense Science Board Summer Study on Autonomy 2016: <https://irp.fas.org/agency/dod/dsb/autonomy-ss.pdf>

applications, ML and related techniques have demonstrated performance that rivals, and occasionally surpasses, human capability with respect to a set of narrowly curated metrics. However, despite these apparent successes, there are a number of concerns associated with state-of-the-art (SOTA) ML algorithms. It is well known, for example, that SOTA ML algorithms do not generalize well<sup>2</sup>, lack transparency and interpretability, and are not robust to environmental<sup>3</sup> and adversarial perturbations. Some of the limitations, such as a lack of robustness to adversarial examples, have been theoretically determined to be fundamental<sup>4</sup> in nature.

The prevailing trend in industrial ML research is towards scaling up to Giga- and Tera- scale models (100's of billions of parameters) as a means to improve accuracies and performance. These trends are not sustainable because of the extremely high computational<sup>5</sup> and data needs for training such models, as well as scaling laws<sup>6</sup>. These trends are also not responsive to the needs of DoD applications, which are typically data- and compute-starved with limited access to cloud-scale compute resources. Furthermore, DoD applications are safety and mission-critical, need to operate in unseen environments, need to be auditable, and need to be trustable by human operators. In sum, the prevailing trends in ML research are not conducive to the assurability and trustworthiness needs of DoD applications.

The traditional approaches to building intelligent applications and autonomous systems<sup>7,8</sup> rely heavily on knowledge representations and symbolic reasoning. For example, complex decision-making in these approaches is often implemented with programmed condition-based rules, stateful logic encoded in finite state machines, and physics-based dynamics of environments and objects represented using ordinary differential equations. There are numerous advantages of these classical techniques:

- they use rich abstractions that are grounded in domain theories and associated formalisms and that are supported by advanced tools and methods (Statecharts, Stateflow, Simulink, etc.);
- they can be modular and composable in ways supported by software engineering practices that promote reuse, precision, and automated analyses; and
- they can be analyzable and assurable in ways supported by formal specification and verification technologies that have been demonstrated in hardening mission and safety critical systems against cyber attacks<sup>9</sup>.

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<sup>2</sup> Recht et al, "Do ImageNet Classifiers Generalize to ImageNet?," arXiv, 2019, <https://arxiv.org/abs/1902.10811>.

<sup>3</sup> Zhao et al, "Sim-to-Real Transfer in Deep Reinforcement Learning for Robotics: a Survey," arXiv 2021, <https://arxiv.org/abs/2009.13303>.

<sup>4</sup> Shafahi et al, "Are Adversarial Examples Inevitable?," arXiv, 2020, <https://arxiv.org/abs/1809.02104>.

<sup>5</sup> <https://cset.georgetown.edu/wp-content/uploads/AI-and-Compute-How-Much-Longer-Can-Computing-Power-Drive-Artificial-Intelligence-Progress.pdf>.

<sup>6</sup> Thompson et al, "Deep Learning's Diminishing Returns", IEEE Spectrum, September 2021, Part of special report on The Great AI Reckoning - Deep learning has built a brave new world—but now the cracks are showing <https://spectrum.ieee.org/deep-learning-computational-cost>.

<sup>7</sup> Schrage et al, "Software-enabled control for intelligent UAVs," Proceedings of the 1999 IEEE International Symposium on Computer Aided Control System Design (Cat. No.99TH8404), 1999, pp. 528-532, doi: 10.1109/CACSD.1999.808703.

<sup>8</sup> Venugopalan et al, "Autonomous landing of an Unmanned Aerial Vehicle on an autonomous marine vehicle," 2012 Oceans, 2012, pp. 1-9, doi: 10.1109/OCEANS.2012.6404893.

<sup>9</sup> Cofer et. Al, "Steal This Drone: DEF CON 29 Aerospace Village Activity," <http://loonwerks.com/publications/cofer2021defcon.html>.

However, these approaches also have limitations when used in real-world autonomy applications. They fare poorly when dealing with real-world uncertainty and high dimensional sensory data, which is integral to perception and situation-understanding applications<sup>10</sup>. The rule-set and stateful logic in these decision-making applications are often incomplete and insufficient when exposed to unanticipated situations. Further, it is well understood that common-sense knowledge is intractable to codify. For example, the Cyc<sup>11</sup> knowledge base includes millions of concepts and tens of millions of rules and yet is inadequate for many real-world tasks.

The challenge of assuring cyber physical systems (CPS) with ML components has been an active area of research supported by DARPA's ongoing Assured Autonomy program as well as other research initiatives. Specifically, in Assured Autonomy, the assurance approach developed by the program has resulted in: (1) formal and simulation-based verification tools that can comprehensively explore the behavior of a CPS; (2) monitoring tools that can detect deviations of ML components from expected inputs and behavior; resilience and recovery strategies to avoid worst-case safety consequences; and (3) an assurance case framework that enables structured argumentation backed by evidence in support of the claim that major safety hazards have been identified and their root causes have been adequately mitigated.

The advances in assurance technologies, including formal and simulation-based approaches, have helped in accelerating identification of failure modes and defects of the ML algorithms. Unfortunately, the ability to repair defects in SOTA ML remains limited to retraining<sup>12</sup>, which is not guaranteed to eliminate defects or to improve the generalizability of ML algorithms. Further, while the runtime assurance architecture – including monitoring and recovery – ensures operational safety, frequent invocations of fallback recovery – triggered by brittleness and generalizability of ML – compromises the ability to accomplish the mission.

The ANSR program seeks breakthrough innovations in the form of new hybrid AI algorithms that deeply integrate symbolic reasoning with data-driven learning to create robust, assured, and therefore trustworthy systems. We define a system as trustworthy, if it is: (a) robust to domain-informed and adversarial perturbations; (b) supported by an assurance framework that creates and analyzes heterogeneous evidence towards safety and risk assessments; and (c) predictable with respect to some specification and models of "fitness."

We hypothesize that several of the limitations in ML today are a consequence of (1) the inability to incorporate contextual and background knowledge; and (2) treating each data set as an independent uncorrelated input. In the real-world, observations are often correlated and a product of an underlying causal mechanism, which can be modeled and understood. We posit that hybrid AI algorithms capable of acquiring and integrating symbolic knowledge and performing symbolic reasoning at scale, will deliver robust inference, generalize to new situations, and

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<sup>10</sup> Davies, Alex, "An Oral History of the DARPA Grand Challenge, the Grueling Robot Race That Launched the Self-Driving Car," Wired Magazine, <https://www.wired.com/story/darpa-grand-challenge-2004-oral-history/>

<sup>11</sup> Lenat, D., "CYC: a large-scale investment in knowledge infrastructure," Commun. ACM 38, 11 (Nov. 1995), 33–38. <https://doi.org/10.1145/219717.219745>

<sup>12</sup> Dreossi et al, "Counterexample-Guided Data Augmentation," in 27th International Joint Conference on Artificial Intelligence (IJCAI), 2018.

provide evidence for assurance and trust.

We envision modifying both the training and inference procedures to interleave symbolic and neural representations for iterative inference and mutual adaptation of the representations to exploit the benefits and reduce the limitations of each representation. The modified training procedure will result in representations that are grounded in domain-specific symbols, essentially a symbolic equivalent of the Neural Network’s (NN) implicit data representation. The modified inference procedure iteratively converges to a response that is conformant to both the symbolic and neural representations. The symbolic representation can explicitly include prior knowledge and domain-specific rules and constraints and enables verification against specification and construction of assurance arguments.

Some recent results for specific applications provide the basis for confidence. For example, a recent study<sup>13</sup> prototyped a hybrid reinforcement learning (RL) architecture that acquires a set of symbolic policies through data-driven learning. The symbolic policies are in the form of a small program that is interpretable and verifiable. The approach demonstrably inherits the best of both worlds: it learns policies that are highly performant in a known environment, and it generalizes well by remaining safe (crash-free) in an unknown environment. Another recent approach<sup>14</sup> uses symbolic reasoning to fix errors in a NN in estimating the object-poses in a scene, and it achieves substantially higher (30-40% above baseline) accuracy in several cases.

The hybrid AI techniques developed by the program will enable new mission capabilities. The program intends to demonstrate assured execution of an unaided ISR mission to develop a Common Operating Picture (COP) of a highly dynamic dense urban environment. The autonomous system performing the ISR mission will carry an effects payload to reduce sensor-to-effects delivery time. While the delivery of effects is gated by human on-the-loop, an effects-carrying system is quintessentially a safety and mission-critical system and, therefore, requires strong guarantees of collision avoidance and mission performance. The capabilities required of the autonomous system in terms of deep situational understanding and decision-making are not achievable by SOTA machine learning or standalone symbolic reasoning systems. The training data is sparse, further motivating the use of hybrid AI methods.

## B. Program Description

The overarching goal of the ANSR program is to advance hybrid AI algorithms and develop evidence-based techniques that support confident assurance judgments for these algorithms. The program intends to explore diverse hybrid architectures that can be seeded with prior knowledge, acquire both statistical and symbolic knowledge through learning, and adapt learned representations. The program intends to demonstrate and evaluate hybrid AI techniques through DoD mission-relevant use-cases where assurance and autonomy are mission-critical.

The program envisions a new take on representation learning and inference to lead towards hybrid AI. The SOTA ML, specifically NNs, can be viewed as learning a low-dimensional

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<sup>13</sup> “Neurosymbolic Reinforcement Learning with Formally Verified Exploration”, Anderson G. et al., NeurIPS, 2020.

<sup>14</sup> “3DP3: 3D Scene Perception via Probabilistic Programming”, Gothoskar et al., arXiv, 2021, <https://arxiv.org/abs/2111.00312>



representation of a high-dimensional data set. Figure 1 provides a grossly oversimplified rendering of the training process. The gray hill is a depiction of an objective function (loss function) with respect to the parameters (or weights) of the NN. Each dot on the gray hill is a point in this parametric space and represents the value of the objective function with respect to the current parametric configuration of the NN.

Standalone neural machine learning entails a climb up the gradient to optimize the objective function. The optimal configuration represents a best fit for the training data. The representation, while being a good fit to the underlying training data, remains agnostic about the causality or the underlying mechanisms that produced the data. In the absence of any knowledge about the underlying mechanisms, inference tasks remain bound by the distribution of the training data and are unable to generalize beyond the training data distribution.

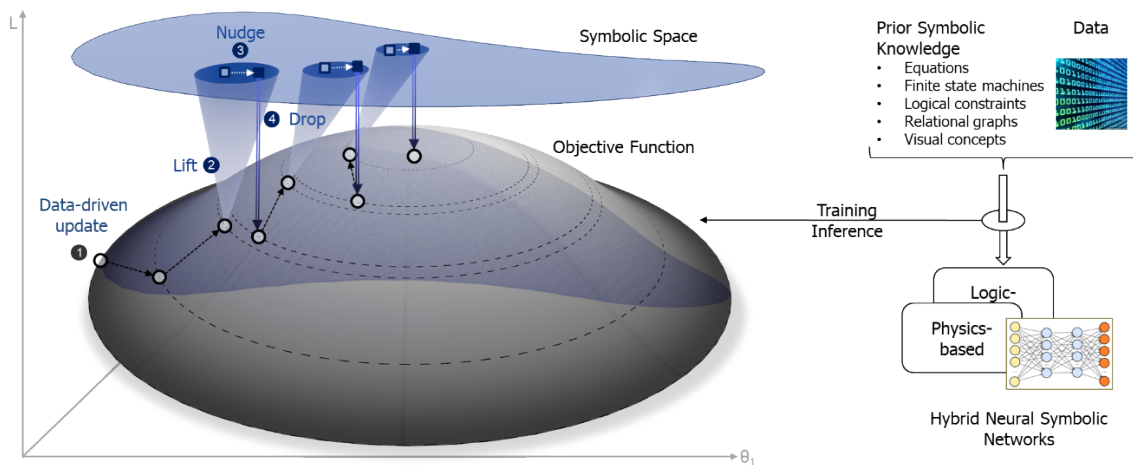


Figure 1: Neuro Symbolic Representation Learning

A variant on this training procedure may take domain knowledge into consideration and attempt to learn the representation of the data in terms of the domain primitives. The light blue cloud in the figure depicts the space of such domain primitives, which could be mathematical equations, symbolic programs composed from domain-specific primitives (components or functions), or other representations. The revised training procedure entails interleaving data-driven updates with a synthesis problem of finding a composition of domain-specific primitives that can reproduce the data. The learned symbolic representation can be combined with the neural representation and used to reassess the objective function. The iterative updates continue until reaching a fixpoint in the symbolic representation that, when combined with the neural representation, maximizes the objective function. The outcome of this training procedure is a hybrid neural and symbolic representation of the data that can be used for inference. Arguably, such a hybrid representation could combine the best of both worlds, i.e., data-driven learning and symbolic reasoning, with potential benefits of better performance in uncertain real-world situations, generalizability, interpretability, and assurability.

It is worth noting that the approach articulated above is only a notional approach towards learning hybrid neural and symbolic representations, and it is not intended as a prescription for a solution. The program anticipates many architectures – best suited for the specific application task – that combine neural and symbolic representations with different approaches to acquire, optimize, and use in inference the closely coupled neural and symbolic representations.

The development in the program will be orchestrated in four technical areas (TAs) summarized below:

TA1. Algorithms and Architecture – The goal of TA1 is to develop and model new AI algorithms and architectures that deeply integrate symbolic reasoning with data-driven machine learning. TA1 will explore and evaluate a range of possible algorithms and architecture patterns that are suitable for different tasks.

TA2. Specification and Assurance – The goal of TA2 is to develop an assurance framework and methods for deriving and integrating evidence of correctness and quantifying mission-specific risks. TA2 will establish a pipeline that abstracts the hybrid neuro-symbolic representations into formally analyzable representations and analyzes them with respect to a set of mission-dependent specifications. TA2 will also explore techniques to estimate and quantify mission-specific risks.

TA3. Platforms and Capability Demonstration – The goal of TA3 is to develop use-cases and an architecture for engineering mission-relevant applications of hybrid AI algorithms suitable for the demonstration and evaluation of robust and assured performance. Specifically, the program intends to pursue demonstration through assured execution of an unaided ISR mission to develop a Common Operating Picture (COP) of a highly dynamic dense urban environment.

TA4. Assurance Assays and Evaluation – The goal of TA4 is to 1) develop an assurance test harness with adversarial AI; and 2) evaluate the technologies in individual technical areas and their compositions in systems. TA4 will act as a red team that probes the validity of assurance claims through adversarial evaluations. TA4 will also refine the proposed program metrics and define measures to characterize the trustworthiness of the system. TA4 will need to assess robustness, generalizability, and assurance claims through adversarial evaluation that employs confounding perturbations and quantify the loss of system performance.

The guiding challenge for the program will be the assured execution of an unaided ISR mission in a highly dynamic dense urban environment. At present, ISR missions are conducted by warfighters either through forward presence, or through teleoperated ISR assets such as drones. The ISR asset in these cases simply provides a video feed to the warfighter, who then has to process and analyze video feeds. The warfighter needs to distinguish adversaries from non-combatants, understand adversarial activities, analyze the scene to identify additional scan paths and focus areas, and maneuver the ISR asset to maximize stealth and safety. These are challenging activities that currently impose high cognitive burden on the warfighter and require them to continuously be in-the-loop. These activities cannot be realized with direct applications of SOTA ML, and they will require substantial use of context and background knowledge, interleaved reasoning with learning, and rigorous analyses and evidence to derive assurance claims about safety and mission success.

The program will seek to demonstrate a fully autonomous ISR mission with the warfighter only identifying the area of interest (AOI). The autonomous system provisioned with ANSR technologies will need to develop a comprehensive situation understanding that encompasses navigability and characterizes potential threat actors. The autonomous system will need to make maneuver decisions that maximize the situation understanding while maintaining safety. The system will autonomously and incrementally generate a comprehensive, timely, and accurate COP and deliver insights that help characterize friendly, adversary, and neutral entities, the operating environment, and threat and safe corridors. The program anticipates multiple demonstrations beginning with simulation-based experiments (SIMexp) conducted in multi-player role-playing gaming environments and concluding with live experiments at DoD facilities.

Phase 1 of the program will develop and prove out high-risk technology components – situation understanding, activity recognition, and safe maneuver decision making. The Phase 1 experiments will be multiple partial threads conducted in gaming environments and through SIMexp: (thread 1) demonstrate safe and assured decision making for maneuvers, while assuming perfect perception; (thread 2) demonstrate both activity recognition and situation understanding, while assuming human-guided safe maneuvers; and (thread 3) demonstrate COP development, insights, and analytics, while assuming perfect perception and human guided safe maneuvers. The evaluation will be performed against mission capability metrics as well as against SOTA baselines.

Phase 2 of the program will integrate these individual threads and demonstrate close-loop situation understanding, assured and safe maneuvers decision-making, COP building and analytics for end-to-end demonstration of unaided ISR missions. The evaluation will be done with respect to mission capability metrics (e.g., COP completeness, accuracy, and timeliness, scan efficiency, human effort required, sensor-to-effect timeline), and technology metrics (e.g., assurance validity, robustness, generalizability, and accuracy).

Phase 3 of the program will demonstrate an end-to-end ISR mission with live exercises in DoD facilities. The evaluation will include after-action reviews and soldier feedback in addition to the mission capability and technology metrics.

### C. Technical Areas

The program has four technical areas (TAs):

- TA1: Algorithms and Architectures
- TA2: Specification and Assurance
- TA3: Platforms and Capability Demonstration
- TA4: Assurance Assays and Evaluation

There are multiple points of essential collaboration among TAs, and the Government expects all performers to collaborate effectively. Proposers should read the descriptions of all TAs and the Program Assessments/Schedule section to ensure a full understanding of the program context, structure, and anticipated relationships required among performers. To facilitate the open

exchange of information, all program performers will have Associate Contractor Agreement (ACA) language included in their award. See Section VIII for further information. Proposers may submit a single TA proposal or an integrated TA1 and TA2 proposal. No additional combination of proposals will be accepted.

### ***TA1: Algorithms and Architectures***

The goal of TA1 is to develop and model new AI algorithms and architectures that deeply integrate symbolic reasoning with data-driven ML. The TA will explore and evaluate a range of possible architectures suitable for different components of the autonomy pipeline in an unaided ISR mission.

The applications for hybrid AI algorithms may include deep situational understanding, activity recognition, and developing safe and optimal maneuvers. Situational understanding in these applications may entail not just a labeling of the entities in a scene, but more complex attributions such as trajectories, capabilities, and even intent. The tasks are expected to require the fusion of diverse knowledge sources and modalities in addition to perceptual data alone.

The deep integration of interleaved symbolic and NN elements at multiple scales should enable vastly superior performance in terms of accuracy, robustness, and generalizability over the SOTA of either type of methods - symbolic alone or data-driven alone – in applications of interest in this BAA such as perception, planning, and control. The feedback between symbolic and neural components should enable performance improvements at all scales and quantities of interest, for example, in perception, from entity identification and resolution to more complex situational understanding, as well as in timeliness for decision making in closed-loop systems such as real-time control.

It is desirable that the hybrid AI algorithms be generalizable to diverse symbolic domains both for incorporating available prior knowledge as well as for being suitable for inter-working with the domain tools for assurance reasoning (see TA2). The underlying knowledge representation for the application domains of interest may include logic systems (e.g., first-order logic, linear temporal logic), dynamical systems (e.g., differential equations), finite state machines, graphs, visual concepts, etc.

The program seeks hybrid AI algorithms that are application-specific (algorithms for perception, algorithms for planning, algorithms for control, etc.), as well as architectures in which many such algorithms could be composed in a federated or hierarchical configuration. TA1 proposers should present approaches for monitoring and regulating individual hybrid AI algorithms in such a federated architecture.

Research challenges in TA1 include, but are not limited to: (a) symbolic knowledge extraction from latent representation of NN so that such extracted knowledge could be pooled with other available symbolic knowledge to support reasoning to derive context and for adaptation; (b) cueing the NN for continual adaptation (parameters, architectures) based on contextual knowledge for hypothesis resolution and better performance; and (c) integrated and iterative reasoning over symbolic and neural representations.

These challenges are important and illustrative, but are not exhaustive, so proposals should clearly articulate other challenges considered in the proposal and the methods to address them. The BAA considers the deep integration of symbolic reasoning with data-driven ML sought here to be a fertile ground for new ideas. Proposals may bring to bear multiple methods (for example, imitation learning and mirror descent, hierarchical predictive processing, generative models, neural network adaptation, etc.) or propose entirely new approaches. In all cases, the proposals should explain, presenting any preliminary results as evidence, how the proposed approaches are likely to be successful in terms of the desired algorithmic capabilities and the ability to meet the program metrics.

### ***TA2: Specification and Assurance***

The goal of TA2 is to develop an assurance framework as well as methods for deriving and integrating evidence of correctness and methods for quantifying mission-specific risks. Given a deeply integrated neuro-symbolic algorithm trained for a certain set of specifications, the goal of this TA is to ‘assure’ its workings, i.e., formally establish that its function and behavior satisfies the specifications, some of which are dynamic and evolving based on mission needs. Additionally, when the entire behavior space could not be analyzed a priori, which is likely to be the case for these systems, the goal of the TA is to provide a characterization of risk to inform system operators.

The assurance challenges for the ANSR program include dealing with (a) composed hybrid neural and heterogeneous symbolic representations; (b) dynamic mission-dependent specifications; and (c) the integration of heterogeneous evidence to satisfy assurance claims and quantify residual risk. The methods should be applicable to different symbolic representations such as state machines or differential equations and across applications such as perception, planning, and control.

The algorithmic technical challenges include: (a) mapping the composed hybrid neural and symbolic representations into representations suitable for formal analysis, and (b) developing methods for analysis to find proofs through evidence and claims and to characterize ‘assured regions’ in the behavior space as well as ‘regions of no-assurance’ for given specifications. With respect to assurance, a fundamental difference between ANSR and assurance in traditional systems is the inherent uncertainty involved in learning systems, which has to be considered by the algorithms, along with possible effects of feedback loops in deep neuro-symbolic integration.

The proposed methods should ensure that the ‘assured region’ so derived is maximal relative to the ‘expected mission region’ implied by the specifications. Proposals should also address methods for analyzing the fundamental tradeoffs involved between the specifications (introducing relaxation/restrictions) and the ‘assured region’ (expansion/contraction), and they should develop methods to change the specification and/or the neuro-symbolic parameters to maximize the assurance envelop. Further, proposals should propose methods to quantify the risk involved in regions of no-assurance and methods to minimize the risk.

The BAA considers the assurance methods for deeply-integrated symbolic reasoning and data-driven machine learning sought here to be a fertile ground for new ideas. Proposals may bring to

bear a combination of multiple methods (for example, probabilistic and hybrid model checking, dynamic assurance case technology, runtime risk assessment, etc.) or propose entirely new approaches. In all cases, the proposals should describe, presenting any preliminary results, how the proposed approaches are likely to be successful in terms of the assurance capabilities desired here and the ability to meet the program metrics.

### ***TA3: Platforms and Capability Demonstration***

The goal of TA3 is to develop use-cases and an architecture for engineering mission-relevant applications of hybrid AI algorithms for the demonstration and evaluation of robust and assured performance. Specifically, the program intends to pursue demonstration through assured execution of an unaided ISR mission to develop a COP of a highly dynamic dense urban environment. The demonstration will entail fully autonomous operation, with the warfighter identifying an AOI to an autonomous system. The autonomous system will be provisioned with ANSR technologies. It will autonomously and incrementally generate a comprehensive, timely, and accurate COP and deliver insights that help characterize friendly, adversarial and neutral entities, the operating environment, and threat and safety corridors.

Multiple demonstrations are anticipated, beginning with simulation-based experiments (e.g., SIMexp) using multi-player role-playing gaming environments, while program capabilities are being developed and concluding with live experiments at a DoD facility.

TA3 proposers should propose an autonomy platform on which ANSR technologies could be deployed. The platform should be provisioned with a baseline autonomy stack that enables autonomous navigation using a suite of perceptual sensors. TA3 proposers will need to develop challenge problems and tasks for TA1 performers. TA3 proposers will also need to provide the background knowledge and datasets necessary for developing the hybrid AI algorithms for these challenge problems – which may include, but are not limited to, deep situational understanding, activity recognition, maneuver planning, and COP construction and analytics – capabilities integral to executing an unaided ISR mission. Further, each TA3 proposed platform should be able to support simulation-based experiments and as well as be used in eventual live experiments. Simulation-based experiments would require an embodiment of the platform including the necessary sensors and actuators, high-fidelity dynamics, and an encapsulation of the baseline autonomy stack in a simulation environment such as Gazebo or Airsim.

The mission and technology challenges for such an integrated platform include, but are not limited to the abilities to: (a) generate comprehensive, timely, and accurate COP; (b) demonstrate generalizability and adaptability to different urban environments and scenarios; (c) provide activity and scene understanding with different sensory data; (d) ingest and reason with symbolic knowledge, for example, maps, entity dynamics, mission specification, and rules of engagement; and (e) provide assurance and quantify risk to mission performance to establish trustworthiness. The TA3 performers should work closely and support TA1 and TA2 performers to address these mission and technology challenges.

#### ***TA4: Assurance Assays and Evaluation***

The goal of TA4 is to (a) develop an assurance test harness that includes adversarial AI, and (b) evaluate ANSR technologies both in individual technical areas and in their compositions into complete systems, especially for the use case described in TA3. TA4 proposals should address both of these goals. TA4 proposals should clearly describe an approach to achieving these goals and articulate the unique benefits of the proposed approach in comparison to other possible approaches.

*Assurance test harness with adversarial AI:* TA4 will act as a red team that probes the validity of assurance claims and assurance case through adversarial evaluations. Proposals must present the approaches to generate adversarial methods for anticipated hybrid-AI algorithms (to be developed by TA1) and methods for spoofing the ML, also considering the full range of the ‘expected mission region’ (see TA2 description). Proposal must present a technical rationale and any preliminary evidence they have for the potential success of their approach.

*Evaluate individual technologies and composed systems:* The program seeks to characterize the performance of individual hybrid AI components with respect to accuracy metrics using benchmarks and the performance of composed systems using mission-specific metrics. TA4 proposals must present approaches to (a) develop benchmarks for individual technologies in the domains of perception, planning, and control; (b) develop and refine mission-specific metrics for the use case of unaided dense-urban ISR described in the TA3 section; and (c) develop a test harness to characterize the performance of said systems in all program phases including field experiments.

TA4 will also refine the proposed program metrics (listed in Section E), identify baselines, and evaluate the program developed technologies (encompassing TA1, TA2, and TA3) with respect to the proposed metrics. Trustworthiness is challenging to quantify, and measurement will be a topic of research for TA4 performers. The program seeks to characterize trustworthiness along two dimensions: (1) ability to operate with acceptable performance even when diverging from the planned scenario; and (2) transparency and predictability in the behavior of the system obtained by assurance argumentation and evidence. TA4 proposals should present in detail the Test and Evaluation (T&E) approaches for these two dimensions. They are further encouraged to present other compelling ways to perform T&E of the use case described in the TA3 section.

#### **D. Program Phase and Schedule**

The ANSR program is organized in three phases. Phase 1 will be eighteen (18) months and will consist of Prototype Hybrid AI Algorithms and Mission Threads. Phase 2 will be fifteen (15) months and will focus on System Composition and Mission Assurance. Phase 3 will also be fifteen (15) months and will focus on Live Demonstration and Transition. Each phase will end with demonstrations on the selected challenge problems, which will provide an opportunity to evaluate the progress made against the program objectives (See Figure 2). Proposers should submit a detailed schedule of logically sequenced tasks and subtasks that in sum constitute a constructive plan for achieving the proposed technical objectives while appropriately managing risk. Schedules will be synchronized across performers, as required, and monitored and reviewed throughout the ANSR program’s period of performance. For budgeting purposes, use January 5, 2023, as a start date for all TAs.

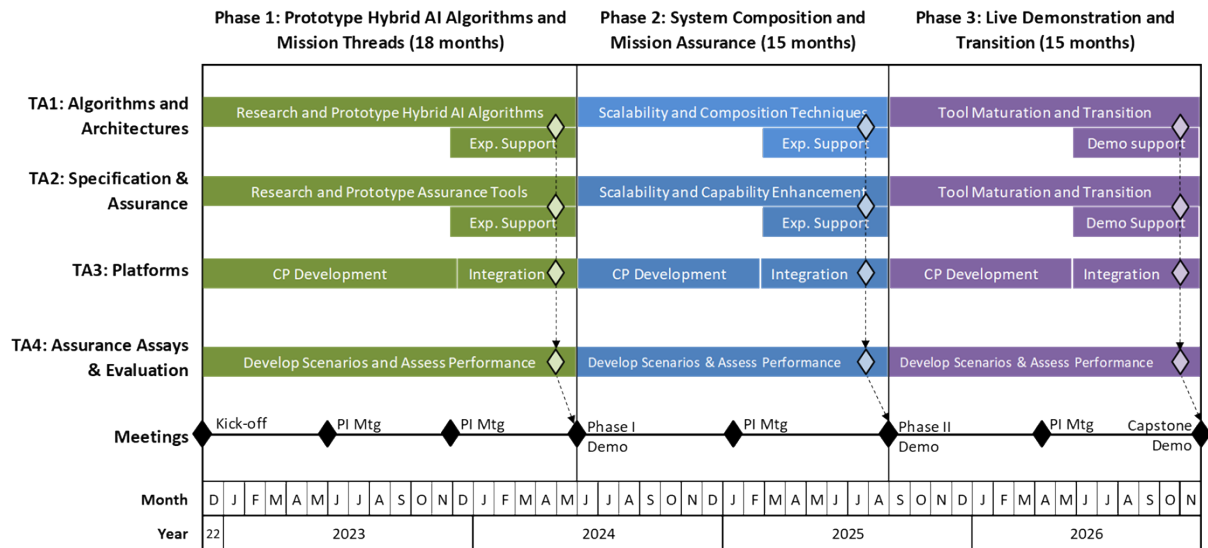


Figure 2: Schedule

The Government will specify the locations for Principal Investigator (PI) meetings during program performance. There will be two PI meetings in Phase 1, held approximately 6 months and 12 months after the kick-off meeting. There will be one PI meeting in both Phase 2 and Phase 3, held roughly 7.5 months after the beginning of each phase. Each phase will end with a demonstration workshop. PI meeting locations are likely to be spread across performer locations, and the proposers should plan to host at least one PI meeting over the duration of the program. The goals of the PI meetings will be to present new research findings and accomplishments, review plans for the next period, discuss implementation milestones, and resolve any programmatic, budgeting, or logistics issues.

In addition to these program-wide events, the Government team will conduct site visits and will hold monthly teleconference meetings with each PI to enhance communications with the Government team.

For travel planning and costing, assume eight (8) trips during the entire three (3) phases (2022-2026) per the program schedule shown above, alternating between Washington, DC and San Diego, CA, with each trip requiring 3-days and 2-nights.

### E. Metrics

For the Government to evaluate the effectiveness of a proposed solution in achieving the stated program objectives, proposers should note that the Government hereby promulgates the following program metrics (Table 1 below) that may serve as the basis for determining whether satisfactory progress is being made to warrant continued funding of the program. Although the following program metrics are specified, proposers should also note that the Government has identified these goals with the intention of bounding the scope of effort, while affording the maximum flexibility, creativity, and innovation in proposing solutions to the stated problem.



Trustworthiness is challenging to quantify, and measurement remains a topic of research on its own. Consistent with the definition offered earlier, the program will characterize trustworthiness along two dimensions: (1) ability to operate with acceptable performance even when diverging from the planned scenario; and (2) transparency and predictability in the behavior of the system obtained by assurance argumentation and evidence. The program will characterize performance of individual hybrid AI components with respect to accuracy metrics using benchmarks and performance of composed systems using mission-specific metrics (e.g., completeness and accuracy of COP), and target an order of magnitude improvement over current baselines. The program will assess robustness, generalizability, and assurance claims by an adversarial evaluation (akin to red teaming for cyber assurance) that employs semantic variations (for example changing movement and types of entities in a scene) from baseline (training) scenarios and quantify the loss of system performance (target degradation below 5%).

Table 1: Program Metrics

	MOE – Metrics of Effectiveness	Phase 1	Phase 2	Phase 3
<b>Mission Capability (TA3 + TA4)</b>	COP completeness (% relative ground-truth) <sup>1</sup>	75%	85%	95%
	COP accuracy, entities characterization (accuracy %)	60%	75%	90%
	COP time & effort reduction	-	0.5x	0.1x
<b>Algorithm Performance (TA1)</b>	Accuracy % govt team benchmarks; (perception, planning, control) in multiple datasets (research data sets and COPter) <sup>2</sup>	75%	90%	95%
	Training efficiency increase – time, #training data	2x	5x	10x
<b>Robustness &amp; Generalizability (TA1)</b>	Semantic Perturbation ( $\Delta$ ) – change in symbols or relations in scenario	10% symbols or relations	10% symbols or entity dynamics	10% in symbols or dynamics
	Perf. Degradation (accuracy < % relative to SOTA)	10%	5%	5%
<b>Assurance (TA2 + TA1)</b>	Assured Region (%) – characterize scalability and applicability of assurance methods (% behavior space)	60%	80%	99%
	Assurance Efficacy (#’s) – evaluate assurance claim using adversarial assays (100’s), count violations	-	10’s	1’s

<sup>1</sup>Includes object classification, geolocation, and activity recognition (from a defined set).

<sup>2</sup>SOTA COPter (name given to the ISR platform for developing COP) will be teleoperation with SOTA ML. Training data will be from exercises and synthetic. The projected SOTA accuracy for object recognition from video/images is 60% at moderate size training data; SOTA activity recognition accuracy is only 30-40% or less in 2020 Activity-Net benchmarks (<https://aiindex.stanford.edu/wp-content/uploads/2021/03/2021-AI-Index-Report-Chapter-2.pdf>).

## F. Deliverables

All performers will be required to provide the following deliverables:

- Technical papers covering work funded by the ANSR program;
- Source code, build scripts, and any toolchains required to compile code, algorithms and interface description documents, user guides, other necessary data, and documentation, assumptions, and limitations for all software developed under this program;
- Slide Presentations. Annotated slide presentations shall be submitted within one month after the program kick-off meeting and after each program event (program reviews, PI meetings, and technical interchange meetings);
- Quarterly Progress Reports. A quarterly progress report describing technical progress made, resources expended, major risks, planned activities, trip summaries, changes to key personnel, and any potential issues or problem areas that require the attention of the Government team shall be provided within 15 days after the end of each quarter;
- Monthly Progress Reports. A monthly progress report in the form of a PowerPoint document describing technical progress, planned activities for the next month, and any

technical, financial, and programmatic issues shall be provided and presented in a teleconference with DARPA;

- Monthly financial status reports;
- A final phase report after each program phase. The final phase report shall concisely summarize the effort conducted within that phase; and
- Final Technical Report.

### **G. Intellectual Property**

The program will emphasize creating and leveraging open source technology and architectures. Intellectual property rights asserted by proposers are strongly encouraged to be aligned with open source regimes.

A key goal of the program is to establish an open architecture and algorithms that allow for integrating symbolic knowledge and domain-specific representations with data-driven machine learning. This goal includes the ability to easily add, remove, substitute, and modify the type of symbolic representation as well the type of data. This capability will facilitate rapid innovation by providing a base for future users or developers of program technologies and deliverables to build upon and rapidly customize and reuse for different AI applications in both DoD and non-DoD use-cases. Therefore, it is desired that all noncommercial software (including source code), software documentation, hardware designs and documentation, and technical data generated under the program be provided as deliverables to the Government, with a minimum of Government Purpose Rights (GPR), as lesser rights may adversely impact the lifecycle costs of affected items, components, or processes.

## **II. Award Information**

### **A. General Award Information**

Multiple awards are anticipated. The amount of resources made available under this BAA will depend on the quality of the proposals received and the availability of funds.

The Government reserves the right to select for negotiation all, some, one, or none of the proposals received in response to this solicitation and to make awards without discussions with proposers. The Government also reserves the right to conduct discussions if it is later determined to be necessary. Additionally, DARPA reserves the right to accept proposals in their entirety or to select only portions of proposals for award. In the event that DARPA desires to award only portions of a proposal, negotiations may be opened with that proposer. The Government reserves the right to fund proposals in phases with options for continued work, as applicable.

The Government reserves the right to request any additional, necessary documentation once it makes the award instrument determination. Such additional information may include but is not limited to Representations and Certifications (see Section VI.B.2., “Representations and Certifications”). The Government reserves the right to remove proposers from award consideration should the parties fail to reach agreement on award terms, conditions, and/or cost/price within a reasonable time, and the proposer fails to timely provide requested additional

information. Proposals identified for negotiation may result in a procurement contract, grant, cooperative agreement, or other transaction, depending upon the nature of the work proposed, the required degree of interaction between parties, whether or not the research is classified as Fundamental Research, and other factors.

Proposers looking for innovative, commercial-like contractual arrangements are encouraged to consider requesting Other Transactions. To understand the flexibility and options associated with Other Transactions, consult <http://www.darpa.mil/work-with-us/contract-management#OtherTransactions>.

In accordance with 10 U.S.C. § 4003(f), the Government may award a follow-on production contract or Other Transaction (OT) for any OT awarded under this solicitation if: (1) that participant in the OT, or a recognized successor in interest to the OT, successfully completed the entire prototype project provided for in the OT, as modified; and (2) the OT provides for the award of a follow-on production contract or OT to the participant, or a recognized successor in interest to the OT.

In all cases, the Government contracting officer shall have sole discretion to select award instrument type, regardless of instrument type proposed, and to negotiate all instrument terms and conditions with selectees. DARPA will apply publication or other restrictions, as necessary, if it determines that the research resulting from the proposed effort will present a high likelihood of disclosing performance characteristics of military systems or manufacturing technologies that are unique and critical to defense. Any award resulting from such a determination will include a requirement for DARPA permission before publishing any information or results on the program. For more information on publication restrictions, see the section below on Fundamental Research

## **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 proposed efforts for fundamental research and non-fundamental research. Some proposed research may present a high likelihood of disclosing performance characteristics of military systems or manufacturing technologies that are unique and critical to defense. Based on the anticipated type of proposer (e.g., university or industry) and the nature of the solicited work, the Government expects that some awards will include restrictions on the resultant research that will require the awardee to seek DARPA permission before publishing any information or results relative to the program.

University or non-profit research institution performance under this solicitation may 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/092021DARPA CFIP Rubric.pdf>
  - iii. Examples of lists that DARPA leverages to assess potential undue foreign influence factors include, but are not limited to:

1. Executive Order 13959 “Addressing the Threat From Securities Investments That Finance Communist Chinese Military Companies”: <https://www.govinfo.gov/content/pkg/FR-2020-11-17/pdf/2020-25459.pdf>
2. The U.S. Department of Education’s College Foreign Gift and Contract Report: [College Foreign Gift Reporting \(ed.gov\)](#)
3. The U.S. Department of Commerce, Bureau of Industry and Security, List of Parties of Concern: <https://www.bis.doc.gov/index.php/policy-guidance/lists-of-parties-of-concern>
4. Georgetown University’s Center for Security and Emerging Technology (CSET) Chinese Talent Program Tracker: <https://chinatalenttracker.cset.tech>
5. Director of National Intelligence (DNI) “World Wide Threat Assessment of the US Intelligence Community”: [2021 Annual Threat Assessment of the U.S. Intelligence Community \(dni.gov\)](#)
6. Various Defense Counterintelligence and Security Agency (DCSA) products regarding targeting of US technologies, adversary targeting of academia, and the exploitation of academic experts: <https://www.dcsa.mil/>

DARPA’s analysis and assessment of 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.

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

- iv. Upon conclusion of the negotiations, if DARPA determines, despite any proposed mitigation terms (e.g. mitigation plan, alternative research personnel), the participation of any Senior/Key Research Personnel still represents high risk to the program, or proposed mitigation affects the Government’s confidence in proposer’s capability to successfully complete the research (e.g., less qualified Senior/Key Research Personnel) the Government may determine not to award the proposed effort. Any decision not to award will be predicated upon reasonable disclosure of the pertinent facts and reasonable discussion of any possible alternatives while balancing program award timeline requirements.
- (b) Failure of the academic or non-profit research performer or recipient to reasonably exercise due diligence to discover or ensure that neither it nor any of its Senior/Key Research Personnel involved in the subject award are participating in a Foreign Government Talent Program or have a Foreign Component with an a strategic competitor or country with a history of targeting U.S. technology for unauthorized transfer may result in the Government exercising remedies in accordance with federal law and regulation.

- i. If, at any time, during performance of this research award, the academic or non-profit research performer or recipient should learn that it, its Senior/Key Research Personnel, or applicable team members or subtier performers on this award are or are believed to be participants in a Foreign Government Talent Program or have Foreign Components with a strategic competitor or country with a history of targeting U.S. technology for unauthorized transfer, the performer or recipient will notify the Government Contracting Officer or Agreements Officer within 5 business days.
  1. This disclosure must include specific information as to the personnel involved and the nature of the situation and relationship. The Government will have 30 business days to review this information and conduct any necessary fact-finding or discussion with the performer or recipient.
  2. The Government's timely determination and response to this disclosure may range anywhere from acceptance, to mitigation, to termination of this award at the Government's discretion.
  3. If the University receives no response from the Government to its disclosure within 30 business days, it may presume that the Government has determined the disclosure does not represent a threat.
- ii. The performer or recipient must flow down this provision to any subtier contracts or agreements involving direct participation in the performance of the research.

(c) Definitions

- i. Senior/Key Research Personnel
  1. This definition would include the Principal Investigator or Program/Project Director and other individuals who contribute to the scientific development or execution of a project in a substantive, measurable way, whether or not they receive salaries or compensation under the award. These include individuals whose absence from the project would be expected to impact the approved scope of the project.
  2. Most often, these individuals will have a doctorate or other professional degrees, although other individuals may be included within this definition on occasion.
- ii. Foreign Associations/Affiliations
  1. Association is defined as collaboration, coordination or interrelation, professionally or personally, with a foreign government-connected entity where no direct monetary or non-monetary reward is involved.
  2. Affiliation is defined as collaboration, coordination, or interrelation, professionally or personally, with a foreign government-connected entity where direct monetary or non-monetary reward is involved.
- iii. Foreign Government Talent Recruitment Programs
  1. In general, these programs will include any foreign-state-sponsored attempt to acquire U.S. scientific-funded research or technology through

foreign government-run or funded recruitment programs that target scientists, engineers, academics, researchers, and entrepreneurs of all nationalities working and educated in the U.S.

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

Proposers should indicate in their proposal whether they believe the scope of the research included in their proposal is fundamental or not. While proposers should clearly explain the intended results of their research, the Government shall have sole discretion to determine whether the proposed research shall be considered fundamental and to select the award instrument type. Appropriate language will be included in resultant awards for non-fundamental research to prescribe publication requirements and other restrictions, as appropriate. This language can be found at <http://www.darpa.mil/work-with-us/additional-baa>.



For certain research projects, it may be possible that although the research to be performed by a potential awardee is non-fundamental research, its proposed subawardee's effort may be fundamental research. It is also possible that the research performed by a potential awardee is fundamental research while its proposed subawardee's effort may be non-fundamental research. In all cases, it is the potential awardee's responsibility to explain in its proposal which proposed efforts are fundamental research and why the proposed efforts should be considered fundamental research.

### **III. Eligibility Information**

#### **A. Eligible Applicants**

All responsible sources capable of satisfying the Government's needs may submit a proposal that shall be considered by DARPA.

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

##### **a) FFRDCs**

FFRDCs are subject to applicable direct competition limitations and cannot propose to this solicitation in any capacity unless they meet the following conditions. (1) FFRDCs must clearly demonstrate that the proposed work is not otherwise available from the private sector. (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 awardees or subawardees.

##### **b) Government Entities**

Government Entities (e.g., Government/National laboratories, military educational institutions, etc.) 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. This information is required for Government Entities proposing to be awardees or subawardees.

##### **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. Other Applicants

Non-U.S. organizations and/or individuals 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.

### B. Organizational Conflicts of Interest

#### FAR 9.5 Requirements

In accordance with FAR 9.5, proposers are required to identify and disclose all facts relevant to potential OCIs 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 outlined in FAR 9.505-1 through FAR 9.505-4.

#### 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 FAR 9.5 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 in accordance with FAR 9.5.

#### Government Procedures

In accordance with FAR 9.503, 9.504 and 9.506, 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.

### **C. Cost Sharing/Matching**

Cost sharing is not required; however, it will be carefully considered where there is an applicable statutory condition relating to the selected funding instrument. Cost sharing is encouraged where there is a reasonable probability of a potential commercial application related to the proposed research and development effort.

For more information on potential cost sharing requirements for Other Transactions for Prototype, see <http://www.darpa.mil/work-with-us/contract-management#OtherTransactions>.

### **D. Other Eligibility Criteria**

The Government discourages proposers from submitting multiple prime contractor proposals for the same TA. However, if appropriate the Government does not discourage subsidiaries of a prime contractor from submitting a prime contractor proposal for any technical area.

While proposers may submit proposals for all four TAs, proposers selected for TA3 or TA4 as a prime contractor cannot be selected for any portion of another TA unless there is a clear deconfliction between the proposing teams. This policy is to avoid OCI situations between the TAs and to ensure objective test and evaluation results. The decision as to which proposal to consider for award is at the discretion of the Government.

## **IV. Application and Submission Information**

### **A. Address to Request Application Package**

This announcement, any attachments, and any references to external websites herein constitute the total solicitation. If proposers cannot access the referenced material posted in the announcement found at [www.darpa.mil](http://www.darpa.mil), contact the BAA Coordinator listed herein.

### **B. Content and Form of Application Submission**

All submissions, including abstracts and proposals must be written in English with type not smaller than 12 point font. Smaller font may be used for figures, tables, and charts. Copies of all documents submitted must be clearly labeled with the DARPA BAA number, proposer

organization, and proposal title/proposal short title. All monetary references shall be in U.S. Dollars.

## **1. Abstracts Format**

Proposers are strongly encouraged to submit an abstract in advance of a full proposal. The abstract is a concise version of the proposal comprising a maximum of # pages including all figures, tables, and charts. The required cover sheet, and optional submission letter, table of contents, or appendices are not included in the page count.

The suggested abstract components are:

- A. Cover Sheet (required): Include the administrative and technical points of contact (title, name, address, phone, e-mail, lead organization). Also include the BAA number, title of the proposed project (not the BAA title), Technical Area, subcontractors, estimated cost, duration of the project, and the label “ABSTRACT.”
- B. Executive Summary: Clearly describe what is being proposed and what difference it will make (qualitatively and quantitatively).
- C. Technical Plan: Outline and address all technical challenges inherent in the approach and possible solutions for overcoming potential problems. Describe milestones and how they will be achieved.
- D. Management and Capabilities Plan: Identify the principal investigator, provide a brief summary of expertise of the team, including subcontractors and key personnel, and include relevant expertise to develop AI algorithms and architectures that deeply integrate symbolic reasoning with data-driven machine learning to create robust, assured, and therefore trustworthy AI-based systems.
- E. Cost and Schedule: Provide a cost estimate for resources over the proposed timeline of the project, broken down by phase and major cost items (e.g., labor, materials, etc.). Include cost estimates for each potential subcontractor (it may be a rough order of magnitude).
- F. Executive Summary Slide: The slide template is provided as Appendix 1 to the BAA posted at <https://SAM.gov>.

## **2. Proposals Format**

All proposals should be in the format given below. The typical proposal should express a consolidated effort in support of one or more related technical concepts or ideas. Disjointed efforts should not be included into a single proposal. Proposals shall consist of two volumes: 1) Volume I, Technical and Management Proposal (composed of 3 parts), and 2) Volume II, Cost Proposal. The maximum page count for Volume I is 25 pages for a proposal addressing a single technical area and 30 pages for a proposal addressing multiple technical areas (i.e., TA1 and TA2), and excludes the cover page, summary slide, official transmittal letter, and any table of contents or appendices, but does include figures, tables, and charts.

**Do not include any proprietary information in the Statement of Work (SOW).**

NOTE: Non-conforming submissions that do not follow the instructions herein may be rejected without further review.

a) Volume I, Technical and Management Proposal

(1) Section I: Administrative

(a) Cover Sheet to Include

- (1) BAA number (HR001122S0039)
- (2) Technical area;
- (3) Lead Organization submitting proposal;
- (4) Type of organization, selected among the following categories: "LARGE BUSINESS", "SMALL DISADVANTAGED BUSINESS", "OTHER SMALL BUSINESS", "HBCU", "MI", "OTHER EDUCATIONAL", OR "OTHER NONPROFIT";
- (5) Proposer's reference number (if any);
- (6) Other team members (if applicable) and type of organization for each;
- (7) Proposal title;
- (8) Technical point of contact to include: salutation, last name, first name, street address, city, state, zip code, telephone, fax (if available), electronic mail (if available);
- (9) Administrative point of contact to include: salutation, last name, first name, street address, city, state, zip code, telephone, fax (if available), electronic mail (if available);
- (10) Total funds requested from DARPA, and the amount of cost share (if any); AND
- (11) Date proposal was submitted.

(b) Official transmittal letter

(2) Section II: Summary of Proposal

- A. {1 page}- Executive Summary:
- B. {2 pages} Innovative claims for the proposed research. This section is the centerpiece of the proposal and should succinctly describe the uniqueness and benefits of the proposed approach relative to the current state-of-art alternate approaches.
- C. {2 pages} Technical rationale, technical approach, and constructive plan for accomplishment of technical goals in support of innovative claims and deliverable creation. (In the full proposal, this section should be supplemented by a more detailed plan in Section III of the Technical and Management Proposal.)
- D. A summary slide of the proposed effort, in PowerPoint format, should be submitted with the proposal. Submit this PowerPoint file in addition to Volumes 1 and 2. The format for the summary slide is included as Appendix 1 to this BAA and does not count against the page limit.

(3) Section III: Detailed Proposal Information

- A. {10 pages [15 pages if addressing multiple TA]} Detailed technical approach enhancing and completing the Summary of Proposal.
- B. {1 page} Comparison with other ongoing research indicating advantages and disadvantages of the proposed effort.

- C. {2 pages} A clearly defined organization chart for the program team which includes, as applicable: (1) the programmatic relationship of team member; (2) the unique capabilities of team members; (3) the task of responsibilities of team members; (4) the teaming strategy among the team members; and (5) the key personnel along with the amount of effort to be expended by each person during each year.

*Note: It is recommended that the SOW should be developed so that each Phase of the program is separately defined.*

- D. {3 pages} Statement of Work (SOW) – Clearly define the technical tasks/subtasks to be performed, their durations, and dependencies among them. The page length for the SOW will be dependent on the amount of the effort. For each task/subtask, provide:
- A general description of the objective (for each defined task/activity);
  - A detailed description of the approach to be taken to accomplish each defined task/activity;
  - Identification of the primary organization responsible for task execution (prime, sub, team member, by name, etc.);
  - The completion criteria for each task/activity – a product, event or milestone that defines its completion.
  - Define all deliverables (reporting, data, reports, software, etc.) to be provided to the Government in support of the proposed research tasks/activities; and
  - Clearly identify any tasks/subtasks (to be performed by either a awardee or subawardee) that will be accomplished on-campus at a university, if applicable.
- E. {1 page} Provide description of milestone, cost, and accomplishments.
- F. {2 pages} Deliverables associated with the proposed research and the plans and capability to accomplish technology transition and commercialization. Include in this section all proprietary claims to the results, prototypes, intellectual property, or systems supporting and/or necessary for the use of the research, results, and/or prototype. If there are no proprietary claims, this should be stated. For forms to be completed regarding intellectual property, see Section IV.B.3.h of this BAA. There will be no page limit for the listed forms.
- G. {1 page} Discussion of proposer’s previous accomplishments and work in closely related research areas.

b) Volume II, Cost Proposal

All proposers, including FFRDCs, must submit the following:

1. Cover sheet to include:
  - (1) BAA number (HR001122S0039);
  - (2) Technical area;
  - (3) Lead Organization submitting proposal;
  - (4) Type of organization selected among the following categories: “LARGE BUSINESS”, “SMALL DISADVANTAGED BUSINESS”, “OTHER SMALL BUSINESS”, “HBCU”, “MI”, “OTHER EDUCATIONAL”, OR “OTHER NONPROFIT”;

- (5) Proposer's reference number (if any);
- (6) Other team members (if applicable) and type of organization for each;
- (7) Proposal title;
- (8) Technical point of contact to include: salutation, last name, first name, street address, city, state, zip code, telephone, fax (if available), electronic mail (if available);
- (9) Administrative point of contact to include: salutation, last name, first name, street address, city, state, zip code, telephone, fax (if available), and electronic mail (if available);
- (10) Award instrument requested: cost-plus-fixed-fee (CPFF), cost-contract—no fee, cost sharing contract – no fee, or other type of procurement contract (specify), grant, cooperative agreement, or Other Transaction;
- (11) Place(s) and period(s) of performance;
- (12) Total proposed cost separated by basic award and option(s) (if any);
- (13) Name, address, and telephone number of the proposer's cognizant Defense Contract Management Agency (DCMA) administration office (if known);
- (14) Name, address, and telephone number of the proposer's cognizant Defense Contract Audit Agency (DCAA) audit office (if known);
- (15) Date proposal was prepared;
- (16) Data Universal Numbering System (DUNS) number;
- (17) Taxpayer Identification Number (TIN);
- (18) Commercial and Government Entity (CAGE) Code;
- (19) Subawardee information; and
- (20) Proposal validity period.

## 2. Additional Cost Proposal Information

### (a) Supporting Cost and Pricing Data

The proposer should include supporting cost and pricing information in sufficient detail to substantiate the summary cost estimates and should include a description of the method used to estimate costs and supporting documentation.

### (b) Cost Breakdown Information and Format

#### **Detailed cost breakdown to include:**

- Total program costs broken down by major cost items (direct labor, including labor categories; subcontracts; materials; other direct costs; overhead charges, etc.) and further broken down by task and phase
- Major program tasks by fiscal year
- An itemization of major subcontracts and equipment purchases.

- Documentation supporting the reasonableness of the proposed equipment costs (vendor quotes, past purchase orders/purchase history, detailed engineering estimates, etc.) shall be provided.
- An itemization of any information technology (IT) purchase, as defined by FAR 2.101 – Documentation supporting the reasonableness of the proposed equipment costs (vendor quotes, past purchase orders/purchase history, detailed engineering estimates, etc.) shall be provided, including a letter stating why the proposer cannot provide the requested resources from its own funding for prime and all sub-awardees.
- A summary of projected funding requirements by month
- The source, nature, and amount of any industry cost-sharing
- Identification of pricing assumptions of which may require incorporation into the resulting award instrument (e.g., use of Government Furnished Property/Facilities/Information, access to Government subject matter experts, etc.)

**Tables included in the cost proposal in editable (e.g. MS Excel) format with calculation formulas intact.** NOTE: If PDF submissions differ from the Excel submission, the PDF will take precedence.

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

NOTE: The cost proposal spreadsheet is a supplement to, and not a substitution for, the Cost Volume. The Cost Volume should be submitted as previously outlined.

Per FAR 15.403-4, certified cost or pricing data shall be required if the proposer is seeking a procurement contract award per the referenced threshold, unless the proposer requests and is granted an exception from the requirement to submit cost or pricing data. Certified cost or pricing data is not required if the proposer proposes an award instrument other than a procurement contract (e.g., a grant, cooperative agreement, or other transaction.)

(c) Subaward Proposals



The proposer is responsible for compiling and providing all subaward proposals for the Procuring Contracting Officer (PCO)/Grants Officer (GO)/Agreements Officer (AO), as applicable. Subaward proposals should include Interdivisional Work Transfer Agreements (ITWA) or similar arrangements. Where the effort consists of multiple portions which could reasonably be partitioned for purposes of funding, these should be identified as options with separate cost estimates for each.

All proprietary subaward proposal documentation, prepared at the same level of detail as that required of the proposer's proposal and which cannot be uploaded with the proposal, shall be provided to the Government either by the proposer or by the subawardee organization when the proposal is submitted. Subaward proposals submitted to the Government by the proposer's awardee should be submitted electronically to ANSR@darpa.mil , and the proposed awardee will not be allowed to view. The subawardee must provide the same number of electronic copies to the PCO/GO/AO as is required of the awardee. See Section IV.B.5.b. of this BAA for proposal submission information.

#### **(d) Other Transaction (OT) Requests**

All proposers requesting an OT must include a detailed list of milestones. Each milestone must include the following:

- milestone description,
- completion criteria,
- due date, and
- payment/funding schedule (to include, if cost share is proposed, awardee and Government share amounts).

It is noted that, at a minimum, milestones should relate directly to accomplishment of program technical metrics as defined in the BAA and/or the proposer's proposal. Agreement type, expenditure or fixed-price based, will be subject to negotiation by the Agreements Officer. Do not include proprietary data.

### **3. Additional Proposal Information**

#### **a) Proprietary Markings**

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." 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.

#### **b) Security Information**

##### **(1) Program Security Information**

##### **(a) Program Security (as applicable)**

Proposers should include with their proposal any proposed solution(s) to program security requirements unique to this program. Common program security requirements include but are

not limited to: operational security (OPSEC) contracting/sub-contracting plans; foreign participation or materials utilization plans; program protection plans (which may entail the following) manufacturing and integration plans; range utilization and support plans (air, sea, land, space, and cyber); data dissemination plans; asset transportation plans; classified test activity plans; disaster recovery plans; classified material / asset disposition plans and public affairs / communications plans.

(2) Controlled Unclassified Information (CUI)

For unclassified proposals containing controlled unclassified information (CUI), applicants will ensure personnel and information systems processing CUI security requirements are in place.

(a) CUI Proposal Markings

If an unclassified submission contains CUI or the suspicion of such, as defined by Executive Order 13556 and 32 C.F.R. Part 2002, the information must be appropriately and conspicuously marked CUI in accordance with DoD Instruction (DoDI) 5200.48. Identification of what is CUI about this DARPA program will be detailed in a DARPA CUI Guide and will be provided as an attachment to the BAA or may be provided at a later date.

(b) CUI Submission Requirements

Unclassified submissions containing CUI may be submitted via DARPA's BAA Website (<https://baa.darpa.mil>) in accordance with Part II Section VIII of this BAA.

(c) Proposers submitting proposals involving the pursuit and protection of DARPA information designated as CUI must have, or be able to acquire prior to contract award, an information system authorized to process CUI information in accordance with (IAW) NIST SP 800-171 and DoDI 8582.01.

(d) Unclassified Submissions

DARPA anticipates that submissions received under this BAA will be unclassified. However, should a proposer wish to submit classified information, an unclassified email must be sent to the BAA mailbox requesting submission instructions from the Technical Office Program Security Officer (PSO). If a determination is made that the award instrument may result in access to classified information, a Security Classification Guide (SCG) and/or DD Form 254 will be issued by DARPA and attached as part of the award.

(c) Unclassified Submissions

DARPA anticipates that submissions received under this BAA will be unclassified. However, should a proposer wish to submit classified information, an unclassified email must be sent to the BAA mailbox requesting submission instructions from the Technical Office Program Security Officer (PSO). If a determination is made that the award instrument may result in access to classified information, a Security Classification Guide (SCG) and/or DD Form 254 will be issued by DARPA and attached as part of the award.

### **c) Disclosure of Information and Compliance with Safeguarding Covered Defense Information Controls**

The following provisions and clause apply to all solicitations and contracts; however, the definition of “controlled technical information” clearly exempts work considered fundamental research and therefore, even though included in the contract, will not apply if the work is fundamental research.

DFARS 252.204-7000, “Disclosure of Information”

DFARS 252.204-7008, “Compliance with Safeguarding Covered Defense Information Controls”

DFARS 252.204-7012, “Safeguarding Covered Defense Information and Cyber Incident Reporting”

The full text of the above solicitation provision and contract clauses can be found at

<http://www.darpa.mil/work-with-us/additional-baa#NPRPAC>.

Compliance with the above requirements includes the mandate for proposers to implement the security requirements specified by National Institute of Standards and Technology (NIST) Special Publication (SP) 800-171, “Protecting Controlled Unclassified Information in Nonfederal Information Systems and Organizations” (see

<https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-171r2.pdf>) and DoDI

8582.01 that are in effect at the time the solicitation is issued.

For awards where the work is considered fundamental research, the contractor will not have to implement the aforementioned requirements and safeguards. However, should the nature of the work change during performance of the award, work not considered fundamental research will be subject to these requirements.

### **d) Representations and Certifications**

In accordance with FAR 4.1102 and 4.1201, proposers requesting a procurement contract must complete electronic annual representations and certifications at <https://www.sam.gov/>.

In addition, all proposers are required to submit for all award instrument types supplementary DARPA-specific representations and certifications at the time of proposal submission. See <http://www.darpa.mil/work-with-us/reprs-certs> for further information on required representation and certification depending on your requested award instrument.

### **e) 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.

### **f) Approved Cost Accounting System Documentation**

Proposers that do not have a Cost Accounting Standards (CAS) compliant accounting system considered adequate for determining accurate costs that are negotiating a cost-type procurement contract must complete a Standard Form, (SF 1408). For more information on CAS compliance, see <http://www.dcaa.mil>. To facilitate this process, proposers should complete the SF 1408

found at <http://www.gsa.gov/portal/forms/download/115778> and submit the completed form with the proposal.

**g) Small Business Subcontracting Plan**

Pursuant to Section 8(d) of the Small Business Act (15 U.S.C. § 637(d)) and FAR 19.702(a)(1), each proposer who submits a proposal for a procurement contract and includes subcontractors might be required to submit a subcontracting plan with their proposal. The plan format is outlined in FAR 19.704.

**h) Section 508 of the Rehabilitation Act (29 U.S.C. § 749d)/FAR 39.2**

All electronic and information technology acquired or created through this BAA must satisfy the accessibility requirements of Section 508 of the Rehabilitation Act (29 U.S.C. § 749d)/FAR 39.2.

**i) Intellectual Property**

All proposers must provide a good faith representation that the proposer either owns or possesses the appropriate licensing rights to all intellectual property that will be utilized under the proposed effort.

**(1) For Procurement Contracts**

Proposers responding to this BAA requesting procurement contracts will need to complete the certifications at Defense Federal Acquisition Regulation Supplement (DFARS) 252.227-7017. See <http://www.darpa.mil/work-with-us/additional-baa> for further information. If no restrictions are intended, the proposer should state “none.” The table below captures the requested information:

Technical Data Computer Software To be Furnished With Restrictions	Summary of Intended Use in the Conduct of the Research	Basis for Assertion	Asserted Rights Category	Name of Person Asserting Restrictions
(LIST)	(NARRATIVE)	(LIST)	(LIST)	(LIST)

**(2) For All Non-Procurement Contracts**

Proposers responding to this BAA requesting a Grant, Cooperative Agreement, Technology Investment Agreement, or Other Transaction for Prototypes shall follow the applicable rules and regulations governing these various award instruments, but, in all cases, should appropriately identify any potential restrictions on the Government’s use of any Intellectual Property contemplated under the award instrument in question. This includes both Noncommercial Items and Commercial Items. Proposers are encouraged use a format similar to that described in Paragraph (1) above. If no restrictions are intended, then the proposer should state “NONE.”

## **j) System for Award Management (SAM) and Universal Identifier Requirements**

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

International entities can register in SAM by following the instructions in this link: [https://www.fsd.gov/sys\\_attachment.do?sys\\_id=c08b64ab1b4434109ac5ddb6bc4bcbb8](https://www.fsd.gov/sys_attachment.do?sys_id=c08b64ab1b4434109ac5ddb6bc4bcbb8).

### **4. Submission Information**

For abstract and proposal submission dates, see Part 1, Overview Information. Submissions received after these dates and times may not be reviewed.

Abstracts must be received via DARPA's BAA Website (<https://baa.darpa.mil>) on or before the submission dated stated in Part 1, Overview Information.

The proposal must be received via DARPA's BAA Website (<https://baa.darpa.mil>) on or before the submission dated stated in Part 1, Overview Information., in order to be considered during the initial round of selections. Proposals received after this deadline may be received and evaluated up to 6-months (180 calendar days) from date of posting on the SAM, Contract Opportunities website (<https://SAM.gov>). Proposals submitted after the due date specified in the BAA, but before the solicitation closing date, may be selected. Proposers are warned that the likelihood of available funding is greatly reduced for proposals submitted after the initial closing date deadline.

DARPA will acknowledge receipt of all submissions and assign an identifying control number that should be used in all further correspondence regarding the submission. DARPA intends to use electronic mail correspondence regarding HR001122S0039. Submissions may not be submitted by fax or e-mail; any submission received through fax or e-mail will be disregarded.

Submissions will not be returned. An electronic copy of each submission received will be retained at DARPA and all other non-required copies destroyed. A certification of destruction may be requested, provided the formal request is received by DARPA within five (5) business days after notification that a proposal was not selected.

*Proposers may encounter heavy traffic on the web server, it is highly recommended that proposers not wait until the day proposals are due to request an account and/or upload a submission. Full proposals should not be submitted via e-mail. Any full proposals submitted by e-mail will not be accepted or evaluated.*

### **a) Abstract Submission**

Refer to Section VI.A.1 for DARPA response to abstract submissions.

## b) Proposal Submission

Refer to Section VI.A.2 for how DARPA will notify proposers as to whether or not their proposal has been selected for potential award.

### (1) For Proposers Requesting Grants or Cooperative Agreements

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

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

Form 1: SF 424 Research and Related (R&R) Application for Federal Assistance, available on the Grants.gov website at [https://apply07.grants.gov/apply/forms/sample/RR\\_SF424\\_2\\_0-V2.0.pdf](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](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](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.*

- (3) For Proposers Requesting Procurement Contracts or OTs and Submitting to a DARPA-approved Proposal Submissions Website

Unclassified full proposals sent in response to this BAA may be submitted via DARPA's BAA Website (<https://baa.darpa.mil>). 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 (via the form at the URL listed above) and wait for two separate e-mails containing a username and temporary password. The “Password Reset” option

at the URL listed above can be used if the password is not received in a timely fashion. 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 unclassified proposals submitted electronically through DARPA's BAA Website 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.

Classified submissions and proposals requesting grants or cooperative agreements should NOT be submitted through DARPA's BAA Website (<https://baa.darpa.mil>), though proposers will likely still need to visit <https://baa.darpa.mil> to register their organization (or verify an existing registration) to ensure the BAA office can verify and finalize their submission. Proposal abstracts will not be accepted if submitted via Grants.gov.

Proposers using the DARPA BAA Website may encounter heavy traffic on the submission deadline date; proposers should start this process as early as possible. Technical support for DARPA's BAA Website may be reached at [BAAT\\_Support@darpa.mil](mailto:BAAT_Support@darpa.mil), and is typically available during regular business hours (9:00 AM – 5:00 PM Eastern Time).

## **5. Funding Restrictions**

Not Applicable.

## **6. Frequently Asked Questions (FAQ)**

DARPA will post a consolidated Frequently Asked Questions (FAQ) document. To access the posting go to: <http://www.darpa.mil/work-with-us/opportunities>. Under the HR001122S0039 summary will be a link to the FAQ. Submit your question/s by E-mail to [ANSR@darpa.mil](mailto:ANSR@darpa.mil). Questions must be received by the FAQ/Questions due date listed in Part 1, Overview Information.

## **7. Other Submission Requirements**

Not Applicable.

# **V. Application Review Information**

## **A. Evaluation Criteria**



Proposals will be evaluated using the following criteria, listed in descending order of importance:

### **1. 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 proposal clearly explains the technical approach(es) that will be employed to meet or exceed each program goal and metric listed in Section I.B. and provides ample justification as to why the approach(es) is feasible. The Government will also consider the structure, clarity, and responsiveness to the Statement of Work; the quality of proposed deliverables; and the linkage of the Statement of Work, technical approach(es), risk mitigation plans, costs, and deliverables of the prime awardee and all subawardees through a logical, well structured, and traceable technical plan.

### **2. Potential Contribution and Relevance to the DARPA Mission**

The potential contributions of the proposed effort are relevant to the national technology base. Specifically, DARPA's mission is to make pivotal early technology investments that create or prevent strategic surprise for U.S. National Security.

### **3. Cost Realism**

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

## **B. Review of Proposals**

### **1. Review Process**

It is the policy of DARPA to ensure impartial, equitable, comprehensive proposal evaluations based on the evaluation criteria listed in Section V.A. and to select the source (or sources) whose offer meets the Government's technical, policy, and programmatic goals.

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.

Award(s) will be made to proposers whose proposals are determined to be the most advantageous to the Government, consistent with instructions and evaluation criteria specified in the BAA herein, and availability of funding.

## **2. Handling of Source Selection Information**

DARPA policy is to treat all submissions as source selection information (see FAR 2.101 and 3.104), and to disclose their contents only for the purpose of evaluation. Restrictive notices notwithstanding, during the evaluation process, submissions may be handled by support contractors for administrative purposes and/or to assist with technical evaluation. All DARPA support contractors performing this role are expressly prohibited from performing DARPA-sponsored technical research and are bound by appropriate nondisclosure agreements. Subject to the restrictions set forth in FAR 37.203(d), input on technical aspects of the proposals may be solicited by DARPA from non-Government consultants/experts who are strictly bound by the appropriate non-disclosure requirements.

## **3. Federal Awardee Performance and Integrity Information (FAPIIS)**

Per 41 U.S.C. § 2313, as implemented by FAR 9.103 and 2 C.F.R. § 200.205, prior to making an award above the simplified acquisition threshold, DARPA is required to review and consider any information available through the designated integrity and performance system (currently FAPIIS). Awardees have the opportunity to comment on any information about themselves entered in the database, and DARPA will consider any comments, along with other information in FAPIIS or other systems prior to making an award.

## **4. 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.

# **VI. Award Administration Information**

## **A. Selection Notices and Notifications**

### **1. Abstracts**

DARPA will respond to abstracts with a statement as to whether DARPA is interested in the idea. If DARPA does not recommend the proposer submit a full proposal, DARPA will provide feedback to the proposer regarding the rationale for this decision. Regardless of DARPA's response to an abstract, proposers may submit a full proposal. DARPA will review all conforming full proposals using the published evaluation criteria and without regard to any comments resulting from the review of an abstract.

### **2. Proposals**

As soon as the evaluation of a proposal is complete, the proposer will be notified that (1) the proposal has been selected for funding pending award negotiations, in whole or in part, or (2) the proposal has not been selected. These official notifications will be sent via e-mail to the Technical Point of Contact (POC) and/or Administrative POC identified on the proposal coversheet.

## **B. Administrative and National Policy Requirements**

### **1. Meeting and Travel Requirements**

There will be a program kickoff meeting and all key participants are required to attend. Performers should also anticipate regular program-wide PI Meetings and periodic site visits at the Program Manager's discretion.

### **2. Solicitation Provisions and Award Clauses, Terms and Conditions**

Solicitation clauses in the FAR and DFARS relevant to procurement contracts and FAR and DFARS clauses that may be included in any resultant procurement contracts are incorporated herein and can be found at <http://www.darpa.mil/work-with-us/additional-baa>.

### **3. Controlled Unclassified Information (CUI) and Controlled Technical Information (CTI) on Non-DoD Information Systems**

Further information on Controlled Unclassified Information identification, marking, protecting, and control, to include processing on Non-DoD Information Systems, is incorporated herein and can be found at <http://www.darpa.mil/work-with-us/additional-baa>.

### **4. Terms and Conditions**

For terms and conditions specific to grants and/or cooperative agreements, 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>.

### **C. Reporting**

The number and types of reports will be specified in the award document, but will include at a minimum monthly technical and financial status reports. The reports shall be prepared and submitted in accordance with the procedures contained in the award document and mutually agreed on before award. A final report that summarizes the project and tasks will be required at the conclusion of the period of performance for the award.

### **D. Electronic Systems**

#### **1. Wide Area Work Flow (WAWF)**

Performers will be required to submit invoices for payment directly to <https://piee.eb.mil/>, unless an exception applies. Performers must register in WAWF prior to any award under this BAA.

#### **2. i-Edison**

The award document for each proposal selected for funding will contain a mandatory requirement for patent reports and notifications to be submitted electronically through i-Edison (<https://public.era.nih.gov/iedison>).

### **E. DARPA Embedded Entrepreneur Initiative (EEI)**

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

There are three elements to DARPA's EEI: (1) A Senior Commercialization Advisor (SCA) from DARPA who works with the Program Manager (PM) to examine the business case for the awardee's technology and uses commercial methodologies to identify steps toward achieving a successful transition of technology to the government and commercial markets; (2) Connections to potential industry and investor partners via EEI's Investor Working Groups; and (3) Additional funding on an awardee's contract for the awardee to hire an embedded entrepreneur to achieve specific milestones in a Go-to-Market strategy for transitioning the technology to

products that serve both defense and commercial markets. This embedded entrepreneur's qualifications should include business experience within the target industries of interest, experience in commercializing early stage technology, and the ability to communicate and interact with technical and non-technical stakeholders. Funding for EEI is typically no more than \$250,000 per awardee over the duration of the award. An awardee may apportion EEI funding to hire more than one embedded entrepreneur, if achieving the milestones requires different expertise that can be obtained without exceeding the awardee's total EEI funding. The EEI effort is intended to be conducted concurrent with the research program without extending the period of performance.

#### EEI Application Process:

After receiving an award under the solicitation, awardees interested in being considered for EEI should notify their DARPA Program Manager (PM) during the period of performance. Timing of such notification should ideally allow sufficient time for DARPA and the awardee to review the awardee's initial transition plan, identify milestones to achieve under EEI, modify the award, and conduct the work required to achieve such milestones within the original award period of performance. These steps may take 18-24 months to complete, depending on the technology. If the DARPA PM determines that EEI could be of benefit to transition the technology to product(s) the Government needs, the PM will refer the performer to DARPA Commercial Strategy.

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

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

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

## **VII. Agency Contacts**

Administrative, technical, or contractual questions should be sent via email to ANSR@darpa.mil. All requests must include the name, email address, and phone number of a point of contact.

#### Points of Contact

The BAA Coordinator for this effort may be reached at ANSR@darpa.mil.  
The Technical POC for this effort is Dr. Sandeep Neema, Program Manager  
DARPA/I2O  
ATTN: HR001122S0039  
675 North Randolph Street  
Arlington, VA 22203-2114

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

## VIII. Other Information

### Proposers Day

A Proposers Day for this effort will be held on June 1, 2022 virtually through Zoom conference. The Special Notice regarding this Proposers Day can be found at <https://sam.gov/opp/ed5a2c8ff5004e5d97f1f61a575296bf/view>. For further information regarding the ANSR Proposers Day, including slides from the event, please see <http://www.darpa.mil/work-with-us/opportunities> under HR001122S0039.

### Associate Contractor Agreement (ACA)

This same or similar language will be included in procurement contract awards against HR001122S0039. Awards other than FAR based contracts will contain similar agreement language:

(a) It is recognized that success of the ANSR research effort depends in part upon the open exchange of information between the various Associate Contractors involved in the effort. This language is intended to ensure that there will be appropriate coordination and integration of work by the Associate Contractors to achieve complete compatibility and to prevent unnecessary duplication of effort. By executing this contract, the Contractor assumes the responsibilities of an Associate Contractor. For the purpose of this ACA, the term Contractor includes subsidiaries, affiliates, and organizations under the control of the contractor (e.g. subcontractors).

(b) Work under this contract may involve access to proprietary or confidential data from an Associate Contractor. To the extent that such data is received by the Contractor from any Associate Contractor for the performance of this contract, the Contractor hereby agrees that any proprietary information received shall remain the property of the Associate Contractor and shall be used solely for the purpose of the ANSR research effort. Only that information which is received from another contractor in writing and which is clearly identified as proprietary or confidential shall be protected in accordance with this provision. The obligation to retain such

information in confidence will be satisfied if the Contractor receiving such information utilizes the same controls as it employs to avoid disclosure, publication, or dissemination of its own proprietary information. The receiving Contractor agrees to hold such information in confidence as provided herein so long as such information is of a proprietary/confidential or limited rights nature.

(c) The Contractor hereby agrees to closely cooperate as an Associate Contractor with the other Associate Contractors on this research effort. This involves as a minimum:

- (1) maintenance of a close liaison and working relationship;
- (2) maintenance of a free and open information network with all Government-identified associate Contractors;
- (3) delineation of detailed interface responsibilities;
- (4) entering into a written agreement with the other Associate Contractors setting forth the substance and procedures relating to the foregoing, and promptly providing the Agreements Officer/Procuring Contracting Officer with a copy of same; and,
- (5) receipt of proprietary information from the Associate Contractor and transmittal of Contractor proprietary information to the Associate Contractors subject to any applicable proprietary information exchange agreements between associate contractors when, in either case, those actions are necessary for the performance of either.

(d) In the event that the Contractor and the Associate Contractor are unable to agree upon any such interface matter of substance, or if the technical data identified is not provided as scheduled, the Contractor shall promptly notify the DARPA Program Name Program Manager. The Government will determine the appropriate corrective action and will issue guidance to the affected Contractor.

(e) The Contractor agrees to insert in all subcontracts hereunder which require access to proprietary information belonging to the Associate Contractor, a provision which shall conform substantially to the language of this ACA, including this paragraph (e).

(f) Associate Contractors for the Program Name research effort include:

Contractor

Technical Area

# IX. APPENDIX 1 – PROPOSAL SUMMARY SLIDE



FP-001 – Prime Contractor  
 PI: Title Firstname Lastname (xx% LOE)  
 Subcontractors:  
 Title: Proposal Title

TA#

- Summary of proposed overall technical approach:
- How does the approach address the key challenges of the program?
  - What is unique about your approach? Why will it succeed?

Replace this image with a  
**GRAPHIC**  
 representative of the proposed technical  
 approach

**Technical Rationale:**

- What are you trying to do? Articulate your objectives using absolutely no jargon.
- Summarize how you plan to accomplish technical goals and program metrics stated in the BAA.
- How will progress be measured?
- What are the major technical risk elements and the plan to address/mitigate them?

**Other Relevant Information:**

- Is any work expected to be fundamental research?
- Foreign persons proposed? (if yes, how many)
- Intellectual Property (IP) or Data Rights Assertions?
- Government Furnished Equipment/Materials/Information (GFE/GFM/GFI) requested?
- Human Subject Research (HSR) proposed?

Cost Summary	Phase 0	Phase 1	Phase 2	Total
Proposed	\$	\$	\$	\$

Distribution Statement

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