Broad Agency Announcement

Intent-Defined Adaptive Software (IDAS)

HR001119S0074

July 10, 2019

Defense Advanced Research Projects Agency
Information Innovation Office
675 North Randolph Street
Arlington, VA 22203-2114

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PART I: OVERVIEW INFORMATION

- **Federal Agency Name:** Defense Advanced Research Projects Agency (DARPA), Information Innovation Office (I2O)

- **Funding Opportunity Title:** Intent-Defined Adaptive Software (IDAS)

- **Announcement Type:** Initial Announcement

- **Funding Opportunity Number:** HR001119S0074

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- **Dates**
  o Posting Date: July 10, 2019
  o Proposers Day: July 9, 2019
  o Abstract Due Date: July 24, 2019, 12:00 noon (ET)
  o Proposal Due Date: September 10, 2019, 12:00 noon (ET)
  o BAA Closing Date: September 10, 2019, 12:00 noon (ET)

- **Anticipated Individual Awards:** DARPA anticipates multiple awards for Technical Area 1 and a single award for Technical Areas 2 – 4.

- **Types of Instruments that May be Awarded:** Procurement contracts or cooperative agreements.

- **Agency Contacts**

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  o **I2O Solicitation Website:** http://www.darpa.mil/work-with-us/opportunities

PART II: FULL TEXT OF ANNOUNCEMENT

I.   Funding Opportunity Description

DARPA is soliciting innovative research proposals to create novel software engineering technologies that enable automated adaptation of the resulting software system to radical changes in requirements and/or the computational environment. Proposed research should investigate innovative approaches that enable revolutionary advances in science, software technologies, or systems. Specifically excluded is research that primarily results in evolutionary improvements to the existing state of practice.

This Broad Agency Announcement (BAA) is being issued, and any resultant selection will be made, using procedures under Federal Acquisition Regulation (FAR) 6.102(d)(2) and 35.016. Any negotiations and/or awards will use procedures under FAR 15.4 (or 32 CFR § 200.203 for cooperative agreements). Proposals received as a result of this BAA shall be evaluated in accordance with evaluation criteria specified herein through a scientific review process.

DARPA BAAs are posted on the Federal Business Opportunities (FBO) website (https://www.fbo.gov/) and the Grants.gov website (https://www.grants.gov/).

The following information is for those wishing to respond to this BAA.

A. Introduction & Background

The Department of Defense (DoD) is highly dependent on software. The increasing complexity and scale of this software is creating new attack surfaces for adversaries and reducing the DoD's ability to react to new threats[1]. As currently practiced the cost of software engineering is constraining the ability of the U.S. Government to deploy new software-based capabilities, as more than 70% of the federal information technology (IT) budget is dedicated to operations and management (O&M)[2]. Software today is brittle with respect to changes in requirements and/or computing resources, requiring frequent and ultimately unaffordable modernization efforts to maintain adequate functionality.

Management of complexity is a central problem in software engineering. A common approach is *concretization*, in which the software engineer chooses from a set of apparently or almost equivalent options a particular choice that enables the resulting code to compile. Ideally, the engineer makes this choice by considering its impact on the system when running under a variety of likely future conditions. For example, the engineer might assume that network latency will never exceed a particular value, select a 16-bit integer to represent the horizontal velocity of a rocket, or implement data management tools using the Application Programming Interfaces (APIs) of a specific cloud service offering. Concretization makes the process of software development tractable, allowing the engineer to define and implement an architecture, split up the development tasks into manageable parts, establish conventions to enable their integration, and integrate them into a cohesive software system. However, this process occurs at design time,

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[1] E.g., many mission-critical tactical IT systems in the DoD are still reliant on Windows XP
[2] White House Office of Management and Budget, "Information Technology," US Federal Government, Washington, DC, 2017.

when information about all possible future environments of the operational system is not available to guide the choice of concrete values or types. A substantial fraction of these choices will be wrong at some point in the system's lifecycle, in the sense that they will require adaptation to unanticipated requirements or changes in computing resources. Concretization also creates inefficiencies in software, as engineers tend to choose conservative values that account for worst-case scenarios or future uncertainty but waste resources when handling the far more common average cases. Software engineers make dozens of concretization decisions every day of development. In the vast majority of cases, they do not document the rationale for their choice of a particular concrete value, so the context of their decisions is lost. Even if these rationales are documented, they are likely expressed in human-readable format that is not semantically accessible to automation and can quickly become out-of-sync with the code.

Agile software development methodologies address the problem of complexity in software design by structuring development in short sprints of two to four weeks that culminate in demonstrations of developed capabilities to the end users of the system. This process can produce better concretization decisions, because the engineers and end users can spot problems earlier in the development process, when the rationale for particular choices is still readily available, but it does not prevent concretizations and the brittleness these decisions cause in software systems. In the context of some unknown future change in requirements, each sprint adds more technical debt, increasing the cost of future maintenance and adaptation.

As large software projects mature, they often become locked to specific versions of the resources on which they depend. System maintainers of these projects often struggle to keep up with changes in protocols and APIs in software system dependencies. To fix critical security weaknesses, developers maintaining large software systems often have to adapt or backport the fixes to old software, increasing their work load. Upgrading systems to take advantage of modern computational resource features often requires many of hours of effort to either completely reengineer the software, or meticulously change and test interfaces across dozens or hundreds of dependencies.

B. Program Description & Scope

The Intent-Defined Adaptive Software (IDAS) program will develop technologies that capture the intentions of software engineers, to enable rapid code generation to support the continual adaptation of DoD software-enabled systems. In practice, changes in requirements and resources are a common occurrence. The program will develop new methods for representing the intent of software and its abstract constraints separately from its concrete instantiation, and will leverage automated methods to adjust to a particular instance.

Technologies developed on the IDAS program will enable rapid adaptation of software to changes in requirements and/or operating environments. A feasibility study framed one possible approach in terms of a constraint satisfaction problem. This study explored problems such as efficiently storing large amounts of streaming data in a distributed cluster, while maintaining a guarantee of lookup within a fixed time bound. A set of constraints defined the problem that the resulting software would address, and the software was specified in terms of the programmer's intentions. A partially-automated software generation process took these constraints and intentions as input and produced compiled code. To adapt to changes in either requirements or computational resources, system maintainers were able to modify the constraints and/or the

intentions of the software system, and then generate a new version of the software with limited human effort.

Key findings from the study include:
1. Creating separate representations of the problem to be addressed by the software (e.g., the constraints on a viable solution), and the actual solution (e.g., a specific software architecture and program that addresses the problem), is essential for scalability. If the problem constraints include aspects of the intended solution (e.g., opting for the use of a particular algorithm that now implicitly fixes certain data types and concurrency requirements when there are viable alternatives that do not add such constraints), the resulting constraint satisfaction problem is drastically more difficult to solve, because such aspects ramify the dimensions of the problem, creating a more complex search space.
2. Representing the program as a set of higher-level programmer intentions rather than just as specific, concrete source code that addresses a current set of problem constraints is essential for enabling rapid future changes.
3. APIs and pre-defined interfaces are concretizations that hamper software flexibility.

This third point requires some unpacking. Conventional APIs and interfaces hide the underlying implementation of a software module from its users, creating an abstraction boundary that enables the module users and module developers to conduct their development activities independently. For this to work in practice, however, the APIs must not change in ways that invalidate the assumptions of the API users. The specification of an API therefore requires extensive commitments to design choices, in other words, many concretizations and conventions (typically described in human-readable documentation). The feasibility study explored the use of dynamic controllers embedded within software modules as a way to provide an invariant abstraction (i.e., an API) that is independent of a specific implementation, thus allowing for greater flexibility of the resulting codebase. Such a controller can either take inputs at runtime or be adapted at compile time to meet new requirements and/or use new computational resources. The controllers were automatically generated and allowed for compositional stability analysis to verify that the specific dependencies between modules were upheld, separately from the specific implementation automatically generated.

To illustrate how a controller can generate a simple solution that addresses uncertainty, consider a restaurant. The restaurateur must provide tables for parties coming to dine, and desires to maximize the efficiency of table use, via a seating algorithm. A naïve approach would be to statically over-provision for the expected worst-case scenario (e.g., New Year's Eve) by ordering many large tables that can accommodate parties of any size up to a set maximum, say 12 people (note the concretization here in the problem description). On most nights, many of the tables would be under- or unutilized. However, the seating algorithm would have to make efficient use of the tables on each night, as it would have no way to forecast a surge in demand.

The simplest seating algorithm would assign parties as they arrive to the first open seat at a table. However, this would split some parties across two tables, creating customer dissatisfaction. The seating algorithm must therefore take into account the constraint that each party must be seated at the same table. To maximize efficiency, the restaurant could wait to seat people until enough parties of the right sizes had arrived to optimally occupy each table (the NP-hard bin packing problem). However, customers dislike long wait times, particularly when they can see empty tables in the restaurant, so the seating algorithm will be unable to efficiently use the statically

provisioned table resources.

A controller, or in this example a maître d′, can provide a more efficient solution. Rather than statically allocating an abundance of overly large tables, the restaurant can get by with a collection of smaller (e.g., two-seat) tables. The controller then adapts to the flow of customers by dynamically moving sufficient tables together to accommodate parties of any size. In effect, the controller provides the seating algorithm with a way to dynamically allocate optimally-sized table resources as needed. As a result, the complexity of the seating algorithm no longer scales with the size of the table resources (i.e., this approach is not tied to the number of tables in the restaurant). Such a seating algorithm could serve the same number of customers with a much smaller footprint, while respecting the problem constraints of keeping parties together and seating them soon after they arrive. This solution focuses on only the essential constraints of the problem, while ignoring *don't care* properties, such as the size of tables or the table arrangement at the end of the night, which enables it to scale up to handle complex problems.

When using a constraint satisfaction approach, solving time can scale exponentially, limiting the size of problems that can be attempted. There are two conventional approaches for simplifying a problem: (a) removing constraints, and (b) adding degrees of freedom. Removing constraints makes the problem easier; for example, removing the constraint that parties should sit together simplifies the process of producing an acceptable seating arrangement. However, adding degrees of freedom can (counter-intuitively) at times implicitly introduce new dimensions to the problem, making the solving process more difficult. For example, adding degrees of freedom by having more tables in a restaurant (more options for an algorithm to seat parties) actually increases solve time compared to the controller-based approach that can ignore the implied dimensions of total seating capacity and allocation to specific table sizes. Premature concretization into a problem (e.g., bin packing to fixed sized resources) tends to increase the difficulty of generating a solution by adding constraints (fixed table sizes) that now scale in the size of the solution (restaurant size) rather than solely in the size of the problem. A controller-based solution will work for any (reasonable) number of tables, because the problem and the solution representations are not as tightly coupled.

In addition to the feasibility study, other research efforts in this field[3] have identified the following elements of an approach to generate software that can be readily adapted to be flexible to future changes:

1. A problem representation, in terms of constraints on any viable solution, that is separate from the solution representation that consists of programmer intentions for how the software should behave. Defining the problem's uncertainties and solution constraints separately, instead of as parts of a single solution, creates a solution space. Within this defined space, solvers can ignore *don't care* variables, in effect relaxing constraints without increasing the dimensionality. The feasibility study discovered that additional degrees of freedom can *increase* the difficulty for constraint solvers by implicitly adding dimensions, whereas *don't care* variables simplify solving. Separating problem and solution representations assists in the identification of these *don't care* variables by preventing a single concretization from dictating further constraints (as in the example of

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[3] For example: P. Hawkins, A. Aiken, K. Fisher, M. Rinard and M. Sagiv, "Concurrent data representation synthesis," in *PLDI'12 Proceedings of the 33rd ACM SIGPLAN Conference on Programming Language Design and Implementation*, Beijing, 2012.

choosing a specific algorithm that requires certain considerations of data formats and concurrency models). In the restaurant example, the dynamic controller enables one to treat table size and number of tables as *don't care* variables. As a result, searching for a viable seating solution becomes much simpler.

2. A controller generator. Once programmer intentions are captured and problem constraints identified, sources of uncertainty must be controlled and resolved. Controllers allow for a partial abstractions to be considered complete, because they stabilize behaviors below the controller to offer a guarantee that can be relied upon without needing the details. Controllers may be able to resolve uncertainties at compile time, or may incorporate logic to sense and respond to runtime changes. In the restaurant example, the controller creates tables of approximately the needed size at runtime, effectively removing the need for the seating algorithm to run an NP-hard bin packing routine to seat parties efficiently at tables of fixed size.

3. An analyzer, which determines if the controllers meet the problem requirements by verifying that their stability guarantees are within the operating bands for controllers at higher levels of abstraction, and that no constraints could be violated by a solution in the defined allowable space.

4. An optimizer/generalizer, which either adds constraints to increase the efficiency of the software system or removes constraints to create a more general solution.

In summary, the IDAS program (envisioned in Figure 1) will enable adaptation of software to radical changes in requirements or its computational environment with an order-of-magnitude reduction in the effort required. The key idea of IDAS is the separation of problem description (in terms of intentions and constraints) from any particular, concrete instantiation. This intent and constraint model must be semantically accessible to an IDAS toolchain, yet expressive enough to capture the relationships between the problem and the method by which generated software can solve and validate a solution. For IDAS to transition, this capture process should be done to the greatest extent possible within the familiar process of writing software, and impose minimal additional tasks on developers who may not understand formal methods. Through additional automation of specific implementation generation, software sustainment effort should be drastically reduced, freeing engineers to focus on the design of the software and adding new functionality.
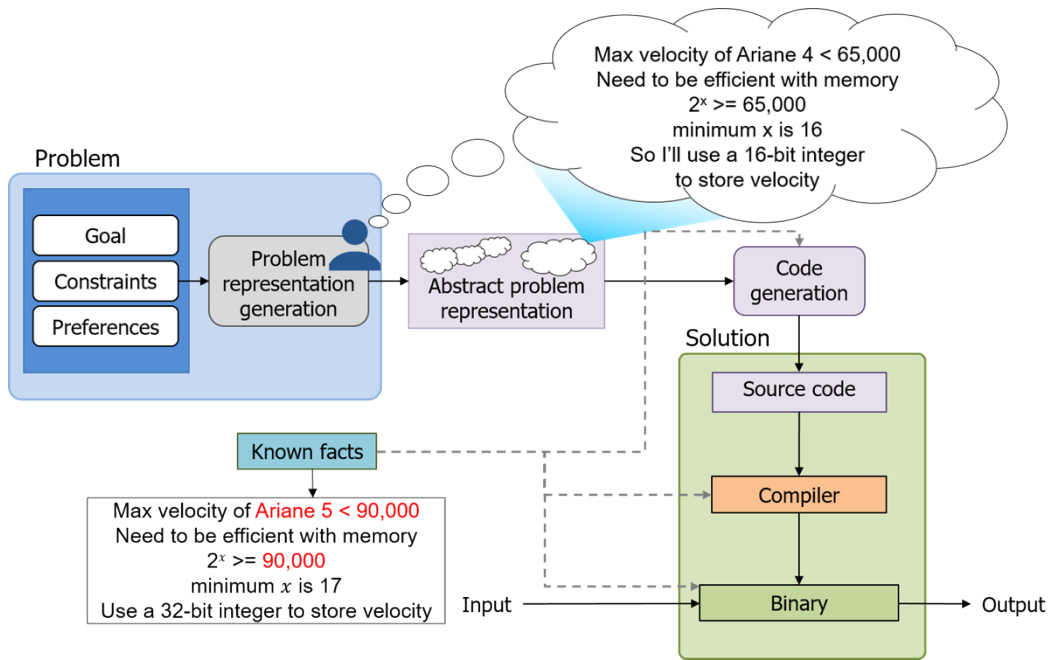
Figure 1: Intent-Defined Software Adaptation

DARPA anticipates that achieving the goals of IDAS will require research breakthroughs in:

- Capturing, learning, or annotating software intent and constraints separate from the concrete decisions required to create a specific instance of software.
- Using captured intent to drastically reduce the human-in-the-loop effort needed to adapt software to new requirements, platforms, and resources.
- Verifying that the newly-adapted software provides the functional needs of the customer/end user and that the instance does not violate any requirements.
- Integrating a new intent-defined software development paradigm into existing Agile workflows to enable adoption and transition into the greater programmer community.

C. Program Structure

IDAS will consist of three phases (see schedule in Section E). Phase 1 will be 18 months in duration and will emphasize research and initial development of the tools and technologies needed to realize a deferred-concretization development paradigm. Phase 2 will be 18 months and focus on iterative exercises to evaluate prototype Technical Area (TA)1 technologies against the current state of the art represented by TA4. Phase 3 will scale up and provide the TA1-developed technologies to TA4 to measure the learning curve and adoption likelihood for traditional developers to develop real-world software in an IDAS paradigm.

Phase 1 will have two testing exercises that will not be used to evaluate performers, but offer an opportunity to practice the evaluation exercise flow. Phase 2 will focus on repeated exercises across the problem domains to measure and differentiate how software is built and adapted to address changing requirements and platforms by TA1 performers and the TA4 control. Phase 3 aims to both scale up the IDAS technologies to real-world problems, measure the learning curve, and assess transition strategies across the commercial and DoD software landscape.

D. Technical Areas

The IDAS program comprises four Technical Areas (TAs):

1. TA1 – Automated software generation
2. TA2 – Problem set generation
3. TA3 – Integrated test and evaluation
4. TA4 – Experimental control and transition

The Government anticipates multiple awards for TA1, and single awards in each of TA2, TA3, and TA4. Proposals shall address only one technical area. Proposers may submit multiple proposals for any or all four TAs, but only TA2 and TA3 may be awarded to the same organization to prevent conflicts of interest (see Section III.D.1 for more details).

TA1 – Automated Software Generation

The goal of TA1 is to create technologies that enable software engineers to develop and verify adaptive software through a deferred-concretization methodology. The core challenge will be to enable traditional developers to work at a higher level of abstraction than currently possible with minimal additional effort. TA1 will produce an augmented development pipeline that can capture abstract descriptions of a problem and its solution (in terms of intentions), and assist in the generation of either source or binary code that meets all stated requirements, with assurance evidence. TA1 technologies should remove or minimize the human-in-the-loop effort when adapting software to address changes in requirements and/or the computational environment. The process of adaptation must produce evidence that the resulting software satisfies the new requirements. DARPA encourages diverse approaches for TA1.

While many possible approaches could achieve the IDAS goals, DARPA expects that, at a high level, there will be a process or approach for the IDAS system to learn or capture the core problem that the software or component is aiming to solve, coupled with automation to adapt the solution to changes in either requirements or computational resources. Today the problem is partially expressed in terms of requirements. Software engineers compensate for the imprecision of this representation with conventions for how components should interact, and programming methods and intuitions acquired through study and experience. A primarily manual engineering process produces a single software instance that embodies a point solution to the problem. Skilled engineers who are familiar with the system are required to address any substantial changes in the system's requirements.

The IDAS workflow should in some way instrument, augment, and/or change the development workflow to capture these requirements, conventions, and human intuitions as constraints and *intentions*, a formalized, semantically-analyzable body of knowledge that represents the problem and constraints on the solution space in a manner that an IDAS development pipeline or source code generator can use to create a viable solution instance. These formalisms could be captured in a number of ways. TA1 proposals should describe how a traditional developer could make use of IDAS tools with minimal additional effort. When there are changes to the requirements or resources available, minor manual edits to these formalized constraints and intentions should enable rapid adaptation and generation of a new version of the software.

Proposed approaches should facilitate the production of verification or assurance evidence that

any generated or synthesized implementation will respect the stated problem constraints and programmer intentions. The abstracted problem description should be far smaller than specific instantiation of the software, potentially enabling substantial scaling up of formal methods approaches to assurance.

A high-level example of how this workflow differs from today's development practices is shown in Figure 2.
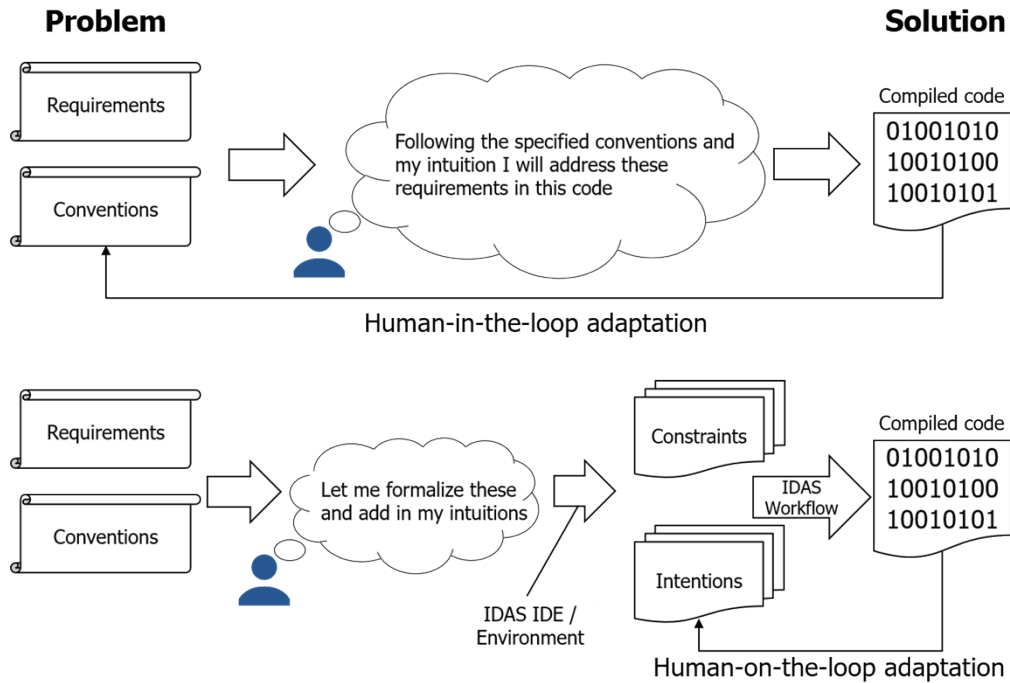
Figure 2 Traditional versus IDAS workflow

Strong TA1 proposals should, at a minimum, address the following:
- Methods to capture programmer intent at design, development, or build time while keeping that intent separate from the concrete decisions needed to execute in a specific instance. These methods must be sufficiently intuitive to enable programmers to readily learn and apply them, and should not impose burdens that discourage adoption and use.
- A compelling argument that the proposed methods can be learned and adopted by traditional developers without advanced training in topics such as formal logic.
- Automation technologies to generate or adapt software to new requirements, resources, and platforms. These technologies should reduce human-in-the-loop effort in the sustainment tail of software.
- Evidence generation to provide assurance that the adapted software satisfies the new environment/requirements.

Approaches that are likely to exhibit exponential performance in the size of the solution (e.g., naïve applications of SMT or ILP solvers, see Section B for more details) are considered **non-responsive** to the TA1 requirements. TA1 proposers should describe an approach that allows developers to express the problem to be solved without coupling it to a partial or complete solution, as is done currently. When a solution space is embedded into the problem

representation, it includes known facts or assumptions that, while correct for a certain use-case, are unlikely to hold for a timescale of DoD-relevance.

Research performed on TA1 may be considered fundamental in nature. TA1 may propose a 12-month, 1.5 full-time equivalent (FTE) optional Phase 4 for transition partner-funded efforts; this option will not be considered fundamental research as it would apply research findings to specific DoD needs.

TA2 – Problem Set Generation

Beginning in Phase 1, the TA2 performer will develop sets of requirements and environments that are comparable in complexity to, but lack the security sensitivities of, actual DoD systems. These surrogate problem sets should map to DoD use cases, but will be temporally compressed into an evaluation period to test the ability of TA1 and TA4 performers to keep pace with changing requirements and environments. These problem sets will be held back from the TA1 and TA4 performers, to prevent familiarization prior to an evaluation exercise. After each exercise, the TA2 performer will submit the problem sets to the Government for review to be publically released. The publication of these problem sets will allow other researchers in the community to use them as representatives of real-world use cases beyond that of the IDAS program. Due to the potential for interactions between TA2 and DoD operational elements, the TA2 performer team will be required to have a minimum of two individuals with a minimum of a SECRET clearance (TOP SECRET preferred) at time of award in order to meet with stakeholders and understand all aspects of DoD-relevant software systems. In Phase 1, TA2 must prepare for the two planned test exercises. These can be drawn from any domain and do not need a high degree of realism.

Two of the three IDAS problem domains are Logistics and Cloud Agility. Each requires computing an optimal or near-optimal allocation of fixed or limited resources in changing situations based on software (rather than hardware) limitations. This might entail, for example, determining the best method of routing supplies to an area of responsibility via multiple transport means with evolving political and military realities. Over time, the requirements for transport and the means available may change substantially, requiring TA1 and TA4 to produce new software versions. The TA2 performer must understand these problem domains at a granular level, so that they can produce relevant technical requirements and resource changes without reference to sensitive specifics. During the evaluation exercises, the TA2 performer will act as the customer for TA1 and TA4 performers. TA2 must be able to describe the requirements of each problem domain in the preferred formats and/or representations of each TA1 and TA4 performer.

Logistics domain:
Global supply chains require complex optimization and routing, as well as fault-management when mistakes or failure occur. These supply chains are also highly susceptible to disruption or changes in policy. As an example, certain types of cargo (e.g., lithium ion batteries) create constraints on their transportation. Changes in policies are hard to anticipate, so many modern logistics organizations have fragmented, separate systems for managing their supply chains.

Cloud agility domain:
The DoD is migrating its operations to the cloud. However, the cloud is far from a location-independent, vendor-neutral environment. Choosing a specific cloud provider or service API

may lock in the DoD for an extended period of time, reducing agility, and increasing costs. Problems of this type should demonstrate how migration of complex Software as a Service (SaaS) stacks (such as machine learning frameworks) can be done rapidly from one service API to another. Additionally, changes in international policies are breaking the abstraction that the cloud is location-independent. For example, the recent European privacy laws (GDPR) now dictate how personal information must be handled, requiring software behavior to change based on the physical location of the host server.

Proposals for TA2 **must** include a third problem domain that is of comparable complexity to the logistics and cloud agility domains. The proposal should, at a minimum, include an explanation of the proposed domain, and how it is relevant to DoD interests. Compelling problem domain proposals should show a clear focus on software in environments undergoing frequent requirements churn and/or changes in computational resources, along with a description of the process for gathering domain ground-truth data.

Strong TA2 proposals should, at a minimum, address the following:
- Developing evaluation exercises that subject all portions of the software development lifecycle to repeated changes in requirements, platforms, and computational resources.
- Methods for protecting any security sensitivities of the problem domains to ensure that the generated exercises can be publicly released (e.g., within an academic paper).
- Identification of ways to reduce overall engineering effort during exercises that does not provide experimental value, while still exploring the scalability of approaches (e.g., a problem that only requires a system of 100s of source lines of code [SLOC] may not reveal exponential behavior in a solver, but a system with 10,000s of SLOC that does not provide insight into key IDAS problems adds cost without utility).
- Representation of the end customer's needs in a variety of means to suit each TA1 and the TA4 performer, from a written requirements document to meetings with developers in a more agile approach.

TA3 – Integrated Test & Evaluation

TA3 will ensure the proper execution of experimentation by deeply understanding the nuances of the TA4 and each TA1 approach, and adjusting the specifics of timing for the release of changed requirements during a 1-4 month evaluation exercise engagement. A sufficient understanding of the technical approaches will enable TA3 to guide TA2 to tailor the exercises to stress each performer system just enough to provide useful feedback. The TA3 performer will coordinate the test and evaluation activities of all other performers in order to ensure that TA2-produced problems sets are neither too simple nor too complex. The TA3 performer will act as referee and judge during each evaluation exercise, and will evaluate the TA1 performers against the benchmark that the TA4 experimental control team establishes. The TA3 performer will establish an Associate Contractor Agreement (ACA) that spans all performers (See Section VIII.D. for additional ACA details).

TA3 proposals should discuss measurement of IDAS metrics, shown in Figure 3. DARPA expects that such measurement for complex, distributed systems will be challenging. After each evaluation exercise, TA3 will report on the performance of each TA1 team, and provide feedback to TA2 and the Government team for improvements of future evaluation exercises.

Additionally, TA3 must produce a report after each exercise on the extent to which the TA1 R&D systems are progressing relative to the TA4 baseline.

TA1 Metrics (vs TA4 control)	Phase 1	Phase 2	Phase 3
Human effort (FTE per exercise)	150%	50%	10%
Human skillset	IDAS Expert	IDAS Journeyman	Traditional developer
Synthesis time (From problem to binary)	Days	~Day	~Hour

Figure 3 IDAS Metrics and Goals

Strong TA3 proposals should, at a minimum, address the following:
- Identifying problem set weaknesses and directing TA2 to adapt problem sets to differentiate and maximize exercise value to the IDAS program.
- Evaluating TA1 compliance with the TA2 problem sets when requirements may be ambiguous or difficult to measure.
- Measuring performance of TA1 approaches, both compared to TA4, as well as ranking strengths and weaknesses between each TA1 approach.

The Government anticipates between one and a maximum of ten TA1 awards. For costing purposes, TA3 proposals should assume a single TA1 performer, and provide up to nine (9) additional costed options spanning the entire IDAS period of performance. Each option's pricing is for supporting a single, additional TA1 performer. Include any pricing ground rules and assumptions based on the award of any number of options that could increase/decrease the overall value (e.g. economies of scale could reduce the costs by an amount if X number of options are selected for award). The government will determine the number of these TA3 options to negotiate for award based on the actual number of TA1 performers selected for award.

TA4 – Experimental Control and Transition

In order to properly evaluate and measure TA1 performer approaches, the TA4 experimental control and transition team will establish a baseline of performance, against which TA1-developed software and workflows will be compared. The TA4 performer should apply current software engineering best practices to develop software that addresses the same requirements and environmental constraints as TA1 during each evaluation exercise, and will respond to all changes in requirements or computational resources. The TA4 team must therefore have skilled software engineers who have a deep command of the current state of the art in software architecture, operating systems, middleware frameworks, distributed, cloud and web-based computing, build processes, and agile development methods. During Phase 3, this team will adopt the most successful of the TA1 technologies in order to measure the learning curve required for traditional developers to adopt emerging IDAS capabilities.

TA4 proposals should describe the proposer's track record of applying agile development paradigms to produce large software systems, preferably across a broad spectrum of platforms and architectures. Strong proposals should include detailed past use cases in which agile development practices were used to rapidly address changes in broad requirements or resources (e.g., OSes, data back ends, UIs). Research performed on TA4 may be considered fundamental in nature as it will be the application of state of practice agile development routines to IDAS-

generated evaluation problems for the express purpose of understanding the types of requirements changes that modern agile paradigms struggle to cope with. TA4 proposals may also include a Phase 4 option to support transition, at a scale of 1.5 FTE for 12 months.

E.   Schedule/Milestones

For cost estimation purposes, the IDAS program kick off is tentatively scheduled for February 2020, and will run for 48 months. The program will conduct tri-annual Principal Investigator (PI) meetings. Over the course of the program the eight evaluation exercises that increase in complexity, scale (ranging from one to four months in duration, worked from performer locations), and realism will be the primary focus of the IDAS evaluation. Participation is also required at the three demonstrations (single-day technology highlights to Government attendees).

For costing purposes, proposers should assume that all PI meetings will alternate between the Washington, D.C. metro area and San Francisco metro area, and will run for 1.5 days. Assume that demonstrations will require one day in addition to the PI meeting.

The program is structured to contain three phases (Figure 4); proposals should be scoped for all three phases:

a) Phase 1: Research and initial prototypes
b) Phase 2: Robust prototypes
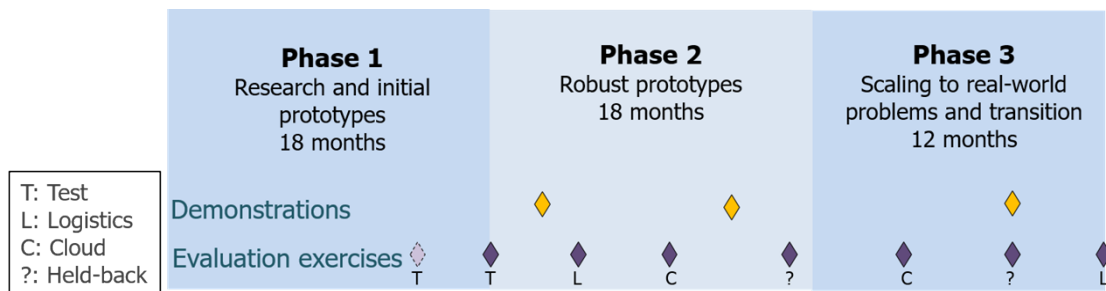c) Phase 3: Scaling to real-world problems and transition

Figure 4 IDAS Program Schedule

During Phase 1 (18 months), TA1 performers will design and implement an initial proof-of-concept of their toolchain, while the TA4 performer will develop abstraction layers and other frameworks to support evaluation in later phases. The TA2 performer will generate two test exercises and to work closely with mission partners across the three problem domains to generate representative surrogate problems for Phases 2 and 3. The TA2 performer will work with the Government team and TA3 to plan the Phase 2 evaluation exercises, and will work closely with each TA1 performer to understand the nuances of their approach and how best to differentiate the performance of each team. Phase 1 will contain two test exercises (the first of which is optional for TA4) to prepare performers for later phases; TA3 will score these test exercises, but the objective is to familiarize performers with the mechanics and operation of evaluation rather than to measure performance.

In Phase 2 (18 months), performers will conduct a set of development exercises across the multiple problem domains. The exercises will use the TA2 problem domains over multiple weeks

to months to develop software systems and respond to changing requirements, environmental constraints, and other confounding factors. The TA3 performer will release a TA2-generated set of system requirements to all TA1 performers and the TA4 control team, followed by revisions and alterations to those requirements with successively shorter deadlines. [4] TA3 will monitor the progress of all TA1 performers and the TA4 control team to validate implementations and measure the effort required to overcome each change in requirements or computational resource availability. In addition to modifying the Phase 2 problem sets and supporting the evaluation exercises as a client, TA2 will develop larger-scale problems for Phase 3.

The evaluation structure is depicted in Figure 5. TA2 transforms DoD problems from the three diverse domains into representative time-series of changing requirements and environments and delivers them to TA3 for feedback, per the needs of a specific experiment. During evaluations, TA3 will deliver these requirements to all TA1 and TA4 performers concurrently, with TA2 acting as the end customer. As satisfying candidate software is delivered or as timelines dictate, TA3 will publish changes to requirements and/or computational resource availability, testing the ability of TA1 and TA4 performers to rapidly adapt their software systems.
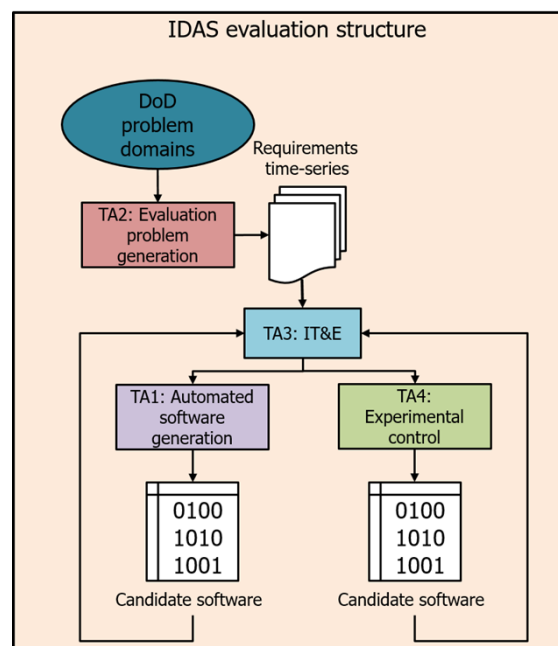
Figure 5 IDAS Evaluation Structure

In Phase 3 (12 months), the IDAS program will focus on preparing the TA1 technologies that have empirically out-performed TA4 in Phase 2 exercises for transition. This will entail providing these TA1 systems/tool-chains to TA4 and measuring the learning curve for conventional developers to understand and apply the IDAS approach and technologies. Additional exercises will assist TA4 in learning the TA1 tools. During Phase 3, TA1 performers will improve scalability of their technologies and mature the user experience to guide developers to use the developed technologies most effectively. The goal for Phase 3 is for the TA4 performer to become as effective as TA1 performers in the evaluation exercises at handling requirements and environmental changes.

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[4] The requirements release process must be responsive to each TA1 and TA4 performers' needs. For example, instead of a formal requirements document, a performer applying agile methods may request an in-person or remote meeting with the "client" (TA2) to understand their needs and problem, from which to derive their requirements.

F. Deliverables

All performers awarded procurement contracts or OTs will be required to provide, at a minimum, the following deliverables:

- All technical papers derived from work funded by IDAS;
- Commented source code, any other necessary data and documentation (including at minimum user manuals and a detailed software design document) for all IDAS technologies developed under this program;
- Annotated slide presentations must be submitted within one month after the program kickoff meeting and after each program event (program reviews, PI meetings, and technical interchange meetings);
- Monthly technical status reports detailing progress made, tasks accomplished, 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 must be provided within 15 days of the end of each calendar month;
- Monthly financial status reports and copies of invoices must be provided within 15 days of the end of each calendar month;
- A final report for each program phase that concisely summarizes the effort conducted, technical achievements, and remaining technical challenges will be due 30 days after the end of each phase; and
- A final report at the end of the overall period of performance that summarizes the project.

In addition, the following deliverables are required for particular technical areas:

TA1 & TA4: All code developed during evaluation engagements must be provided to TA3 per a jointly-established individual exercise schedule, to include all source code, binaries, build scripts, test harnesses, development environments, unit tests and system tests. Performers in TA1 and TA4 are also expected to track FTE effort for each of the evaluation exercises and report these metrics to TA3 for evaluation.

TA2: Develop and provide to the government a detailed security plan for providing realism of development/evaluation problems. This plan must describe procedures for abstracting system requirements and constructing test cases representative of DoD needs without reliance on DoD-specific data or information. The TA2 performer must submit this plan to DARPA no less than 90 days prior to commencing analysis of a DoD relevant software system, to allow sufficient time for discussion with the Government team and the completion of any necessary revisions. TA2 must provide evaluation problems (sets of changing requirements and resources) to TA3 prior to each exercise with an anticipated duration for each development cycle between issuance of the next change in requirements. The mapping from each exercise to a DoD need should be delivered via appropriate channels to DARPA.

TA3: Develop and provide an evaluation plan prior to each exercise, defining metrics for testing and evaluation, and discussing a concept of operations for conducting evaluations of any software that requires user interaction, to be produced in collaboration with TA2. Facilitating the establishment of an ACA for the program is the responsibility of TA3.

Proposers receiving assistance instrument awards may be requested to make similar deliveries or provide software solutions for program test and evaluation before being returned to the performer by the Government.

G. Government-furnished Information

TA2 proposals should suggest sources of data relevant to their particular proposed third problem domain, and describe how they would obtain such datasets. The proposal should discuss the extent to which the Government would be able to obtain such data more easily and/or more quickly. Absent such discussion, the Government does not intend to furnish data.

H. Intellectual Property

The program will emphasize creating and leveraging open source technology and architecture. Intellectual property rights asserted by proposers are strongly encouraged to be aligned with open source regimes. See Section VI.B.1 for more details on intellectual property.

A key goal of the program is to establish an open, standards-based, multi-source, plug-and-play architecture that allows for interoperability and integration. This includes the ability to easily add, remove, substitute, and modify software and hardware components. This will facilitate rapid innovation by providing a base for future users or developers of program technologies and deliverables. Therefore, it is desired that all software (including source code), software documentation, hardware designs and documentation, and technical data generated by 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. Awards

Multiple awards are anticipated. The level of funding for individual awards made under this solicitation has not been predetermined and will depend on the quality of the proposals received and the availability of funds. Awards will be made to proposers whose proposals are determined to be the most advantageous and provide the best value to the Government, all factors considered, including the potential contributions of the proposed work, overall funding strategy, and availability of funding. See Section V for further information

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

Proposals selected for award negotiation may result in a procurement contract, or cooperative agreement depending upon the nature of the work proposed, the required degree of interaction between parties, and other factors.

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 BAA, 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.

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.

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://doi.org/10.6028/NIST.SP.800-171r1) that are in effect at the time the BAA 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.

III. Eligibility Information

A. Eligible Applicants

DARPA welcomes engagement from all responsible sources capable of satisfying the Government's needs, including academia (colleges and universities); businesses (large, small, small disadvantaged, etc.); other organizations (including non-profit); other entities (foreign, domestic, and government); FFRDCs; minority institutions; and others.

DARPA welcomes engagement from non-traditional sources in addition to current DARPA performers.

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 BAA 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.§ 2539b may be the appropriate statutory starting point for some entities, specific supporting regulatory guidance, together with evidence of agency approval, will still be required to fully establish eligibility. DARPA will consider FFRDC and Government Entity eligibility submissions on a case-by-case basis; however, the burden to prove eligibility for all team members rests solely with the proposer.

2. Foreign Participation

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 BAA. 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 BAA 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 (e.g., OTs under the authority of 10 U.S.C. § 2371).

D. Other Eligibility Requirements

1. Ability to Receive Awards in Multiple Technical Areas - Conflicts of Interest

While an organization may submit separate proposals to any or all four of the technical areas, an organization will only be selected for award of a single technical area, except in the case of both TA2 and TA3 (e.g., a single organization could be selected for TA2 and TA3, but not for TA2 and TA4). Except for TA2 and TA3, proposers cannot be selected for any portion of the other technical areas, whether as a prime, subcontractor, or in any other capacity from an organizational level. This is to avoid OCI situations between the technical areas 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.

2. Ability to Support Classified Development

At the time of proposal submission, all proposers wishing to submit proposals under TA2 must have at least two personnel on their teams with a Secret clearance (Top Secret preferred) at time of award. TA2 proposers must provide their CAGE code and security point(s) of contact in their proposals.

Proposers to all other TAs are not required to hold or obtain security clearances.

IV. Application and Submission Information

A. Address to Request Application Package

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

B. Content and Form of Application Submission

1. Abstracts

Proposers are highly encouraged to submit an abstract in advance of a proposal to minimize effort and reduce the potential expense of preparing an out of scope proposal. The abstract provides a synopsis of the proposed project, including brief answers to the following questions:

- What is the proposed work attempting to accomplish or do?
- How is it done today, and what are the limitations?
- Who will care and what will the impact be if the work is successful?
- How much will it cost, and how long will it take?

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.

Abstract Format: Abstracts shall not exceed a maximum of 5 pages including the cover sheet and all figures, tables, and charts. The page limit does not include a submission letter (optional).

Reminder – Each abstract submitted in response to this BAA shall address only one TA. Organizations may submit multiple abstracts to any one TA, or they may submit abstracts to multiple TAs.

All pages shall be formatted for printing on 8-1/2 by 11 inch paper with 1-inch margins and font size not smaller than 12 point. Font sizes of 8 or 10 point may be used for figures, tables, and charts. Document files must be in .pdf, .odx, .doc, .docx, .xls, or .xlsx formats. Submissions must be written in English. All pages should be numbered.

Abstracts must include the following components:

- **Cover Sheet**: Provide the administrative and technical points of contact (name, address, phone, email, lead organization). Include the BAA number, title of the proposed project,

primary subcontractors, estimated cost, duration of the project, and the label "Abstract."

– **Goals and Impact:** Describe what is being proposed and what difference it will make (qualitatively and quantitatively) if successful. Describe the innovative aspects of the project in the context of existing capabilities and approaches, clearly delineating the relationship of this work to any other projects from the past and present.

– **Technical Plan:** Outline and address all technical challenges inherent in the approach and possible solutions for overcoming potential problems. Provide appropriate specific milestones (quantitative, if possible) at intermediate stages of the project to demonstrate progress.

– **Capabilities/Management Plan:** Provide a brief summary of expertise of the team, including subcontractors and key personnel. Identify a principal investigator for the project and include a description of the team's organization including roles and responsibilities. Describe the organizational experience in this area, existing intellectual property required to complete the project, and any specialized facilities to be used as part of the project. List Government-furnished property, facilities, or data assumed to be available.

– **Cost and Schedule:** Provide a cost estimate for resources over the proposed timeline of the project, broken down by year. Include labor, materials, a list of deliverables and delivery schedule. Provide cost estimates for each subcontractor (may be a rough order of magnitude).

2. Proposals

Proposals consist of Volume 1: Technical and Management Proposal (including mandatory Appendix A); Volume 2: Cost Proposal; the Level of Effort Summary by Task Excel spreadsheet; and the PowerPoint summary slide.

All pages shall be formatted for printing on 8-1/2 by 11-inch paper with 1-inch margins, single-line spacing, and a font size not smaller than 12 point. Font sizes of 8 or 10 point may be used for figures, tables, and charts. Document files must be in .pdf, .odx, .doc, .docx, .xls, or .xlsx formats. Submissions must be written in English. All pages of Volume 1 should be numbered.

A summary slide of the proposed effort, in PowerPoint format, should be submitted with the proposal. A template slide is provided as an Attachment 1 to the BAA. Submit this PowerPoint file in addition to Volumes 1 and 2 of your full proposal. This summary slide does not count towards the total page count.

Reminder – Each proposal submitted in response to this BAA shall address only one TA. Organizations may submit multiple proposals to any one TA, or they may propose to multiple TAs.

Proposals not meeting the format prescribed herein may not be reviewed.

a. Volume 1: Technical and Management Proposal

The maximum page count for Volume 1 is 40 pages, including all figures, tables and charts but not including the cover sheet, table of contents or appendices. A submission letter is optional and is not included in the page count. Appendix A does not count against the page limit and is mandatory.

Volume 1 must include the following components:

i. Cover Sheet: Include the following information.

- Label: "Proposal: Volume 1"
- BAA number (HR001119S0074)
- Technical Area
- Proposal title
- Lead organization (prime contractor) name
- Type of organization, selected from the following categories: Large Business, Small Disadvantaged Business, Other Small Business, HBCU, MI, Other Educational, or Other Nonprofit
- Technical point of contact (POC) including name, mailing address, telephone number, and email address
- Administrative POC including name, mailing address, telephone number, and email address
- (If proposing to TA2, please provide)
  Security POC including name, mailing address, telephone number, and email address (classified and unclassified)
- Award instrument requested: procurement contract (specify type), or cooperative agreement.[5]
- Total amount of the proposed effort
- Place(s) and period(s) of performance
- Other team member (subcontractors and consultants) information (for each, include Technical POC name, organization, type of organization, mailing address, telephone number, and email address)
- Proposal validity period (minimum 120 days)
- Data Universal Numbering System (DUNS) number[6]
- Taxpayer Identification Number (TIN)[7]
- Commercial and Government Entity (CAGE) code[8]
- Proposer's reference number (if any)

ii. Table of Contents

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[5] Information on award instruments can be found at http://www.darpa.mil/work-with-us/contract-management.
[6] The DUNS number is used as the Government's contractor identification code for all procurement-related activities. Go to http://fedgov.dnb.com/webform/index.jsp to request a DUNS number (may take at least one business day). For further information regarding this subject, please see www.darpa.mil/work-with-us/additional-baa for further information.
[7] See http://www.irs.gov/businesses/small/international/article/0,,id=96696,00.html for information on requesting a TIN. Note, requests may take from 1 business day to 1 month depending on the method (online, fax, mail).
[8] A CAGE Code identifies companies doing or wishing to do business with the Federal Government. For further information regarding this subject, please see www.darpa.mil/work-with-us/additional-baa.

iii. **Innovative Claims and Deliverables:** Describe the innovative aspects of the project in the context of existing capabilities and approaches, clearly delineating the uniqueness and benefits of this project in the context of the state of the art, alternative approaches, and other projects from the past and present. Describe how the proposed project is revolutionary and how it significantly rises above the current state of the art.

Describe the deliverables associated with the proposed project and any plans to commercialize the technology, transition it to a customer, or further the work. Discuss the mitigation of any issues related to sustainment of the technology over its entire lifecycle, assuming the technology transition plan is successful.

iv. Technical Plan: Outline and address technical challenges inherent in the approach and possible solutions for overcoming potential problems. Demonstrate a deep understanding of the technical challenges and present a credible (even if risky) plan to achieve the project's goal. Discuss mitigation of technical risk. Provide appropriate measurable milestones (quantitative if possible) at intermediate stages of the project to demonstrate progress, and a plan for achieving the milestones.

v. Management Plan: Provide a summary of expertise of the proposed team, including any subcontractors/consultants and key personnel who will be executing the work. Identify a principal investigator (PI) for the project. Provide a clear description of the team's organization including an organization chart that includes, as applicable, the relationship of team members; unique capabilities of team members; task responsibilities of team members; teaming strategy among the team members; and key personnel with the amount of effort to be expended by each person during the project. Provide a detailed plan for coordination including explicit guidelines for interaction among collaborators/subcontractors of the proposed project. Include risk management approaches. Describe any formal teaming agreements that are required to execute this project. List Government-furnished materials or data assumed to be available.

vi. Personnel, Qualifications, and Commitments: List key personnel (no more than one page per person), showing a concise summary of their qualifications, discussion of previous accomplishments, and work in this or closely related research areas. Indicate the level of effort in terms of hours to be expended by each person during each contract year and other (current and proposed) major sources of support for them and/or commitments of their efforts. DARPA expects all key personnel associated with a proposal to make a substantial time commitment to the proposed activity and the proposal will be evaluated accordingly. It is DARPA's intention to put key personnel conditions into the awards, so proposers should not propose personnel that are not anticipated to execute the award.

Key Individual	Project	Status (Current, Pending, Proposed)	Hours on Project		
			Phase 1	Phase 2	Phase 3
Name 1	**Program name**	Proposed	x	x	x
	Project Name 1	Current	x	x	n/a
	Project Name 2	Pending	n/a	x	x
Name 2	**Program Name**	Proposed	x	x	x
	Project Name 3	Proposed	x	x	x

vii. Capabilities: Describe organizational experience in relevant subject area(s), existing intellectual property, or specialized facilities. Discuss any work in closely related research areas and previous accomplishments.

viii. Statement of Work (SOW): The SOW must provide a detailed task breakdown, citing specific tasks and their connection to the interim milestones and metrics, as applicable. Each year of the project should be separately defined. The SOW must not include proprietary information. For each defined task/subtask, provide:

- − A general description of the objective.
- − A detailed description of the approach to be taken to accomplish each defined task/subtask.
- − Identification of the primary organization responsible for task execution (prime contractor, subcontractor(s), consultant(s)), by name.
- − A measurable milestone, (e.g., a deliverable, demonstration, or other event/activity that marks task completion).
- − A definition of all deliverables (e.g., data, reports, software) to be provided to the Government in support of the proposed tasks/subtasks.

Identify any tasks/subtasks (by the prime or subcontractor) that will be accomplished at a university and believed to be fundamental research.

ix. Schedule and Milestones: Provide a detailed schedule showing tasks (task name, duration, work breakdown structure element as applicable, performing organization), milestones, and the interrelationships among tasks. The task structure must be consistent with that in the SOW. Measurable milestones should be clearly articulated and defined in time relative to the start of the project.

x. Level of Effort Summary by Task: Provide a one-page table summarizing estimated level of effort per task (in hours) broken out by senior, mid-level and junior personnel, in the format shown below in Figure 2. Also include dollar-denominated estimates of travel, materials and equipment. For this table, consider materials to include the cost of any data sets or software licenses proposed. For convenience, an Excel template is available for download along with the BAA. This summary slide does not count towards the total page count.

	Duration (months)	Labor Hours						
SOW Task		Senior	Mid	Junior	Total	SubC	Conslt	Total
1.1.0 <Phase 1 Task 1 name>	7	240	680	24	944	-	200	944
1.1.1 <Subtask 1.1.1 name>	4	80	280	-	360	-	200	360
1.1.2 <Subtask 1.1.2 name>	3	160	400	24	584	-	-	584
1.2.0 <Phase 1 Task 2 name>	6	108	400	1,800	2,308	1,400	-	3,708
1.2.1 <Subtask 1.2.1 name>	3	48	320	1,600	1,968	600	-	2,568
1.2.2 <Subtask 1.2.2 name>	3	60	80	200	340	800	-	1,140
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
Phase 1 Total Hours	**16**	**348**	**1,080**	**1,824**	**3,252**	**1,400**	**200**	**4,652**
Phase 1 Costs — Travel	$ 44,000					$12,000	$2,000	$ 58,000
Materials & Equipment	$ 8,000					$ -	$ -	$ 8,000
2.1.0 <Phase 2 Task 1 name>	8	176	560	64	800	100	100	900
2.1.1 <Subtask 2.1.1 name>	7	96	240	24	360	100	100	460
2.1.2 <Subtask 2.1.2 name>	4	80	320	40	440	-	-	440
2.2.0 <Phase 2 Task 2 name>	6	180	520	1,800	2,500	1,240	-	3,740
2.2.1 <Subtask 2.2.1 name>	4	140	400	1,200	1,740	400	-	2,140
2.2.2 <Subtask 2.2.2 name>	4	40	120	600	760	840	-	1,600
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
Phase 2 Total Hours	**16**	**356**	**1,080**	**1,864**	**3,300**	**1,340**	**100**	**4,640**
Phase 2 Costs — Travel	$ 48,000					$13,000	$2,400	$ 63,400
Materials & Equipment	$ -					$ -	$ -	$ -
3.1.0 <Phase 3 Task 1 name>	9	120	400	120	640	100	100	740
3.1.1 <Subtask 3.1.1 name>	3	40	200	40	280	100	100	380
3.1.2 <Subtask 3.1.2 name>	6	80	200	80	360	-	-	360
3.2.0 <Phase 3 Task 2 name>	6	160	800	1,800	2,760	1,200	-	3,960
3.2.1 <Subtask 3.2.1 name>	4	80	400	1,000	1,480	600	-	2,080
3.2.2 <Subtask 3.2.2 name>	3	80	400	800	1,280	600	-	1,880
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
Phase 3 Total Hours	**16**	**280**	**1,200**	**1,920**	**3,400**	**1,300**	**100**	**4,700**
Phase 3 Costs — Travel	$ 49,000					$12,000	$2,000	$ 63,000
Materials & Equipment	$ -					$ -	$ -	$ -
Project Total Hours	**48**	**984**	**3,360**	**5,608**	**9,952**	**4,040**	**400**	**13,992**
Project Costs — Travel	**$141,000**					**$37,000**	**$6,400**	**$ 184,400**
Materials & Equipment	$ 8,000					$ -	$ -	$ 8,000

Figure 6: Example level-of-effort summary table. Numbers illustrate roll-ups and subtotals. The SubC column captures all subcontractor hours and the Conslt column captures all consultant hours.

xi. Appendix A: This section is mandatory and must include all of the following components. If a particular subsection is not applicable, state "NONE". There is no page limit on Appendix A.

(1). Team Member Identification: Provide a list of all team members including the prime, subcontractor(s), and consultant(s), as applicable. Identify specifically whether any are a non-US organization or individual, FFRDC and/or Government entity. Use the following format for this list:

| Individual Name | Role (Prime, Subcontractor or Consultant) | Organization | Non-US? | | FFRDC or Govt? |
			Org	Ind.	

(2). Government or FFRDC Team Member Proof of Eligibility to Propose: If none of the team member organizations (prime or subcontractor) are a Government entity or FFRDC, state "NONE".

If any of the team member organizations are a Government entity or FFRDC, provide documentation (per Section III.A.1) citing the specific authority that establishes the applicable team member's eligibility to propose to Government solicitations to include: 1) statutory authority; 2) contractual authority; 3) supporting regulatory guidance; and 4) evidence of agency approval for applicable team member participation.

(3). Government or FFRDC Team Member Statement of Unique Capability: If none of the team member organizations (prime or subcontractor) are a Government entity or FFRDC, state "NONE".

If any of the team member organizations are a Government entity or FFRDC, provide a statement (per Section III.A.1) that demonstrates the work to be performed by the Government entity or FFRDC team member is not otherwise available from the private sector.

(4). Organizational Conflict of Interest Affirmations and Disclosure: If none of the proposed team members is currently providing SETA or similar support as described in Section III.B, state "NONE".

If any of the proposed team members (individual or organization) is currently performing SETA or similar support, furnish the following information:

Prime Contract Number	DARPA Technical Office supported	A description of the action the proposer has taken or proposes to take to avoid, neutralize, or mitigate the conflict

(5). Intellectual Property (IP): If no IP restrictions are intended, state "NONE". The Government will assume unlimited rights to all IP not explicitly identified as having less than unlimited rights in the proposal.

For all technical data or computer software that will be furnished to the Government with other than unlimited rights, provide (per Section VI.B.1) a list describing all proprietary claims to results, prototypes, deliverables or systems

supporting and/or necessary for the use of the research, results, prototypes and/or deliverables. Provide documentation proving ownership or possession of appropriate licensing rights to all patented inventions (or inventions for which a patent application has been filed) to be used for the proposed project. Use the following format for these lists:

NONCOMMERCIAL				
Technical Data and/or 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)
(List)	(Narrative)	(List)	(List)	(List)

COMMERCIAL				
Technical Data and/or 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)
(List)	(Narrative)	(List)	(List)	(List)

(6). Human Subjects Research (HSR): If HSR is not a factor in the proposal, state "NONE".

If the proposed work will involve human subjects, provide evidence of or a plan for review by an Institutional Review Board (IRB). For further information on this subject, see Section VI.B.2.

(7). Animal Use: If animal use is not a factor in the proposal, state "NONE".

If the proposed research will involve animal use, provide a brief description of the plan for Institutional Animal Care and Use Committee (IACUC) review and approval. For further information on this subject, see Section VI.B.2.

(8). Representations Regarding Unpaid Delinquent Tax Liability or a Felony Conviction under Any Federal Law: For further information regarding this subject, please see www.darpa.mil/work-with-us/additional-baa.

Please also complete the following statements.

(1) The proposer is [ ] is not [ ] a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability,

(2) The proposer is [ ] is not [ ] a corporation that was convicted of a felony criminal violation under a Federal law within the preceding 24 months.

(9). Cost Accounting Standards (CAS) Notices and Certification: For any proposer who submits a proposal which, if accepted, will result in a CAS-compliant contract, must include a Disclosure Statement as required by 48 CFR 9903.202. The disclosure forms may be found at https://www.whitehouse.gov/wp-content/uploads/2017/11/CASB_DS-1.pdf.

If this section is not applicable, state "NONE". For further information regarding this subject, please see www.darpa.mil/work-with-us/additional-baa.

xii. Summary Slide: The submission of a PowerPoint slide summarizing the proposed effort is mandatory. A template PowerPoint slide is provided on the FedBizOpps website as an attachment. Submit the PowerPoint file (do not convert PowerPoint file to pdf format) in addition to Volume 1, Volume 2 of your full proposal. This summary slide does not count towards the total page count.

b. Volume 2 - Cost Proposal

This volume is mandatory and must include all the listed components. No page limit is specified for this volume.

The cost proposal should include a working spreadsheet file (.xls, .xlsx or equivalent format) that provides formula traceability among all components of the cost proposal. The spreadsheet file should be included as a separate component of the full proposal package. Costs must be traceable between the prime and subcontractors/consultants, as well as between the cost proposal and the SOW.

Pre-award costs will not be reimbursed unless a pre-award cost agreement is negotiated prior to award.

i. Cover Sheet: Include the same information as the cover sheet for Volume 1, but with the label "Proposal: Volume 2."

ii. Cost Summary Tables: Provide a single-page summary table broken down by fiscal year listing cost totals for labor, materials, other direct charges (ODCs), indirect costs (overhead, fringe, general and administrative [G&A]), and any proposed fee for the project. Include costs for each task in each Government fiscal year of the project by prime and major subcontractors, total cost and proposed cost share, if applicable. Provide a second table containing the same information broken down by project phase.

iii. Cost Details: For each task, provide the following cost details by month. Include supporting documentation describing the method used to estimate costs. Identify any cost sharing.

(1) Direct Labor: Provide labor categories, rates and hours. Justify rates by providing examples of equivalent rates for equivalent talent, past commercial or Government rates from a Government audit agency such as the Defense Contract Audit Agency (DCAA), the Office of Naval Research (ONR), the Department of Health and Human Services (DHHS), etc.

(2) Indirect Costs: Identify all indirect cost rates (such as fringe benefits, labor overhead, material overhead, G&A or F&A, etc.) and the basis for each.

(3) Materials: Provide an itemized list of all proposed materials, equipment, and supplies for each Government fiscal year including quantities, unit prices, proposed vendors (if known), and the basis of estimate (e.g., quotes, prior purchases, catalog price lists, etc.). For proposed equipment/information technology (as defined in FAR 2.101) purchases equal to or greater than $50,000, include a letter justifying the purchase. Include any requests for Government-furnished equipment or information with cost estimates (if applicable) and delivery dates.

(4) Travel: Provide a breakout of travel costs including the purpose and number of trips, origin and destination(s), duration, and travelers per trip.

(5) Subcontractor/Consultant Costs: Provide above information for each proposed subcontractor/consultant. Subcontractor cost proposals must include interdivisional work transfer agreements or similar arrangements. If the proposer has conducted a cost or price analysis to determine reasonableness, submit a copy of this along with the subcontractor proposal.

The proposer is responsible for the compilation and submission of all subcontractor/consultant cost proposals. At a minimum, the submitted cost volume must contain a copy of each subcontractor or consultant non-proprietary cost proposal (i.e. cost proposals that do not contain proprietary pricing information such as rates, factors, etc.). Proprietary subcontractor/consultant cost proposals may be included as part of Volume 2. Proposal submissions will not be considered complete unless the Government has received all subcontractor/consultant cost proposals.

If proprietary subcontractor/consultant cost proposals are not included as part of Volume 2, they may be emailed separately to IDAS@darpa.mil. Email messages must include "Subcontractor Cost Proposal" in the subject line and identify the principal investigator, prime proposer organization and proposal title in the body of the message. Any proprietary subcontractor or consultant proposal documentation which is not uploaded to the DARPA BAA Submission Website as part of the proposer's submission or provided by separate email shall be made immediately available to the Government, upon request, under separate cover (i.e., mail, electronic/email, etc.), either by the proposer or by the subcontractor/consultant organization.

Please note that a ROM or similar budgetary estimate is not considered a fully qualified subcontract cost proposal submission. Inclusion of a ROM or similar budgetary estimate, or failure to provide a subcontract proposal, will result in the full proposal being deemed non-compliant.

(6) Other Direct Costs (ODCs): Provide an itemized breakout and explanation of all anticipated ODCs.

iv. **Proposals Requesting a Procurement Contract:** Provide the following information where applicable.

(1) **Proposals exceeding the Certification of Cost or Pricing Threshold**: Provide "certified cost or pricing data" (as defined in FAR 2.101) or a request for exception in accordance with FAR 15.403.

(2) **Proposals for $700,000 or more:** Pursuant to Section 8(d) of the Small Business Act (15 U.S.C. § 637(d)), it is Government policy to enable small business and small disadvantaged business concerns to be considered fairly as subcontractors to organizations performing work as prime contractors or subcontractors under Government contracts, and to ensure that prime contractors and subcontractors carry out this policy. In accordance with FAR 19.702(a)(1) and 19.702(b), prepare a subcontracting plan, if applicable. The plan format is outlined in FAR 19.704.

(3) **Proposers without an adequate cost accounting system:** If requesting a cost-type contract, provide the DCAA Pre-award Accounting System Adequacy Checklist to facilitate DCAA's completion of an SF 1408. Proposers without an accounting system considered adequate for determining accurate costs must complete an SF 1408 if a cost type contract is to be negotiated. 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. To complete the form, check the boxes on the second page, then provide a narrative explanation of your accounting system to supplement the checklist on page one.

3. **Proprietary and Classified Information**

DARPA policy is to treat all submissions as source selection information (see FAR 2.101 and 3.104) and to disclose the 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.

a. **Proprietary Information**

Proposers are responsible for clearly identifying proprietary information. Submissions containing proprietary information must have the cover page and each page containing such information clearly marked.

b. **Classified Information**

DARPA anticipates that all submissions received under this solicitation will be unclassified; classified submissions will NOT be accepted.

If a determination is made that the award instrument may result in access to classified information, a DD Form 254, "DoD Contract Security Classification Specification," will be issued by DARPA and attached as part of the award. A DD Form 254 will not be provided

to proposers at the time of submission. For reference, the DD Form 254 template is available at http://www.dtic.mil/whs/directives/forms/eforms/dd0254.pdf.

C. Submission Dates and Times

Proposers are warned that submission deadlines as outlined herein are strictly enforced. Note: some proposal requirements may take from 1 business day to 1 month to complete. See the proposal checklist in Section VIII.D for further information.

When utilizing the DARPA BAA Submission Website, as described below in Section IV.E.1 below, a control number will be provided at the conclusion of the submission process. This control number should be used in all further correspondence regarding your abstract/proposal submission.

For proposal submissions requesting cooperative agreements, Section IV.E.1.c, you must request your control number via email at IDAS@darpa.mil. Please note that the control number will not be issued until after the proposal due date and time.

Failure to comply with the submission procedures outlined herein may result in the submission not being evaluated.

1. Abstracts

Abstracts must be submitted per the instructions outlined herein and received by DARPA no later than **July 24, 2019, at 12:00 noon (ET)**. Abstracts received after this date and time will not be reviewed.

2. Proposals

The proposal package -- full proposal (Volume 1 and 2) and, as applicable, proprietary subcontractor cost proposals -- must be submitted per the instructions outlined herein and received by DARPA no later than **September 10, 2019, at 12:00 noon (ET)**. Proposal submissions received after this date and time will not be reviewed.

D. Funding Restrictions

Not applicable.

E. Other Submission Requirements

1. Unclassified Submission Instructions

Proposers must submit all parts of their submission package using the same method; submissions cannot be sent in part by one method and in part by another method nor should duplicate submissions be sent by multiple methods. Emailed submissions of abstracts or full proposals will not be accepted.

a. Abstracts

DARPA/I2O will employ an electronic upload submission system (https://baa.darpa.mil/) for all UNCLASSIFIED abstract responses under this solicitation.

First time users of the DARPA BAA Submission Website must complete a two-step account creation process at https://baa.darpa.mil/. The first step consists of registering for an Extranet account by going to the above URL and selecting the "Account Request" link on the right side of the page, using the Chrome browser. Upon completion of the online form, proposers will receive two separate emails; one will contain a user name and the second will provide a temporary password. Once both emails have been received, proposers must go back to the submission website and log in using that user name and password. After accessing the Extranet, proposers must create a user account for the DARPA BAA Submission Website by selecting the "Register Your Organization" link at the top of the page. The DARPA BAA Submission Website will display a list of solicitations open for submissions. Once a proposer's user account is created, they may view instructions on uploading their abstract.

Proposers who already have an account on the DARPA BAA Submission Website may simply log in at https://baa.darpa.mil/, select this solicitation from the list of open DARPA solicitations and proceed with their abstract submission. Note: Proposers who have created a DARPA BAA Submission Website account to submit to another DARPA Technical Office's solicitations do not need to create a new account to submit to this solicitation.

All submissions submitted electronically through DARPA's BAA website must be uploaded as zip files (.zip or .zipx extension). The final zip file should contain only the files requested herein and must not exceed 50 MB in size. Only one zip file will be accepted per submission. Note: Submissions not uploaded as zip files will be rejected by DARPA.

Please note that all submissions MUST be finalized, meaning that no further editing will be possible, when submitting through the DARPA BAA Submission Website in order for DARPA to be able to review your submission. If a submission is not finalized, the submission will not be deemed acceptable and will not be reviewed.

Website technical support may be reached at Action@darpa.mil and is typically available during regular business hours (9:00 AM – 5:00 PM ET, Monday-Friday). Questions regarding submission contents, format, deadlines, etc. should be emailed to IDAS@darpa.mil.

Since abstract submitters may encounter heavy traffic on the web server, they should not wait until the day abstracts are due to request an account and/or upload the submission.

Abstracts should not be submitted via Email or Grants.gov. Any abstracts submitted by Email or Grants.gov will not be accepted or reviewed.

b. Proposals Requesting a Procurement Contract

DARPA/I2O will employ an electronic upload submission system (https://baa.darpa.mil/) for UNCLASSIFIED proposals requesting award of a procurement contract under this solicitation.

First time users of the DARPA BAA Submission Website must complete a two-step account creation process at https://baa.darpa.mil/. The first step consists of registering for an Extranet account by going to the above URL and selecting the "Account Request" link on the right side of the page, using the Chrome browser. Upon completion of the online form, proposers will receive two separate emails; one will contain a user name and the second will provide a temporary password. Once both emails have been received, proposers must go back to the submission website and log in using that user name and password. After accessing the Extranet, proposers must create a user account for the DARPA BAA Submission Website by selecting the "Register Your Organization" link at the top of the page. The DARPA BAA Submission Website will display a list of solicitations open for submissions. Once a proposer's user account is created, they may view instructions on uploading their proposal.

Proposers who already have an account on the DARPA BAA Submission Website may simply log in at https://baa.darpa.mil/, select this solicitation from the list of open DARPA solicitations and proceed with their proposal submission. Note: Proposers who have created a DARPA BAA Submission Website account to submit to another DARPA Technical Office's solicitations do not need to create a new account to submit to this solicitation.

All submissions submitted electronically through DARPA's BAA website must be uploaded as zip files (.zip or .zipx extension). The final zip file should contain only the files requested herein and must not exceed 50 MB in size. Only one zip file will be accepted per submission. Note: Submissions not uploaded as zip files will be rejected by DARPA.

Please note that all submissions MUST be finalized, meaning that no further editing will be possible, when submitting through the DARPA BAA Submission Website in order for DARPA to be able to review your submission. If a submission is not finalized, the submission will not be deemed acceptable and will not be reviewed.

Website technical support may be reached at Action@darpa.mil and is typically available during regular business hours (9:00 AM – 5:00 PM ET, Monday-Friday). Questions regarding submission contents, format, deadlines, etc. should be emailed to IDAS@darpa.mil.

Since 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 the submission. Full proposals should not be submitted via Email. Any full proposals submitted by Email will not be accepted or evaluated.

c. Proposals Requesting a Cooperative Agreement

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; 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: Proposers must submit the three forms listed below.

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

> To evaluate compliance with Title IX of the Education Amendments of 1972 (20 U.S.C. A§ 1681 Et. Seq.), the Department of Defense is using the two forms below to collect 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. Detailed instructions for each form are available on Grants.gov.

> Research and Related Senior/Key Person Profile (Expanded), available on the Grants.gov website at https://apply07.grants.gov/apply/forms/sample/RR_KeyPersonExpanded_2_0-V2.0.pdf. *This form must be completed and submitted.*

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

Grants.gov requires proposers to complete a one-time registration process before a proposal can be electronically submitted. If proposers have not previously registered, this process can take between three business days and four weeks if all steps are not completed in a timely manner. See the Grants.gov user guides and checklists at https://www.grants.gov/web/grants/applicants.html for further information.

Once Grants.gov has received an uploaded proposal submission, Grants.gov will send two email messages to notify proposers that: (1) their submission has been received by Grants.gov; and (2) the submission has been either validated or rejected by the system. It may take up to two business days to receive these emails. If the proposal is rejected by Grants.gov, it must be corrected and re-submitted before DARPA can retrieve it (assuming the solicitation has not expired). If the proposal is validated, then the proposer has successfully submitted their proposal and Grants.gov will notify DARPA. Once the proposal is retrieved by DARPA, Grants.gov will send a third email to notify the proposer. If requested by the proposer, a control number for the cooperative agreement submission can

be provided following the due date and time for the proposals. This control number should be used in all further correspondence regarding this submission.

To avoid missing deadlines, proposers should submit their proposals to Grants.gov in advance of the proposal due date, with sufficient time to complete the registration and submission processes, receive email notifications and correct errors, as applicable.

For more information on submitting proposals to Grants.gov, visit the Grants.gov submissions page at: http://www.grants.gov/web/grants/applicants/apply-for-grants.html.

Proposers electing to submit cooperative agreement proposals as hard copies must complete the SF 424 R&R form (Application for Federal Assistance, Research and Related) available on the Grants.gov website http://apply07.grants.gov/apply/forms/sample/RR_SF424_2_0-V2.0.pdf.

Proposers choosing to mail hard copy proposals to DARPA must include one paper copy and one electronic copy (e.g., CD/DVD) of the full proposal package.

Technical support for the Grants.gov website may be reached at 1-800-518-4726 and support@grants.gov. Questions regarding submission contents, format, deadlines, etc. should be emailed to IDAS@darpa.mil.

V.   Application Review Information

A. Evaluation Criteria

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

- *Overall Scientific and Technical Merit*:
  The proposed technical approach is innovative, feasible, achievable, and complete.

  The task descriptions and associated technical elements are complete and in a logical sequence, with all proposed deliverables clearly defined such that a viable attempt to achieve project goals is likely as a result of award. The proposal identifies major technical risks and clearly defines feasible mitigation efforts.

  Proposer should also take note to the information provided in Section I, as DARPA will also look at how a proposer addresses the technical challenges relevant to each TA, as well as view how key personnel will work on those challenges.

- *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.

  This includes considering the extent to which any proposed intellectual property restrictions will potentially impact the Government's ability to transition the technology.

– *Cost Realism:*

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

B. Review and Selection Process

The review process identifies proposals that meet the evaluation criteria described above and are, therefore, selectable for negotiation of awards by the Government. DARPA policy is to ensure impartial, equitable, comprehensive proposal evaluations and to select proposals that meet DARPA technical, policy, and programmatic goals. If necessary, panels of experts in the appropriate areas will be convened. As described in Section IV, proposals must be deemed conforming to the solicitation to receive a full technical review against the evaluation criteria; proposals deemed non-conforming will be removed from consideration.

DARPA will conduct a scientific/technical review of each conforming proposal. Conforming proposals comply with all requirements detailed in this BAA; 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.

Selections may be made at any time during the period of solicitation. Pursuant to FAR 35.016, the primary basis for selecting proposals for award negotiation shall be technical, importance to agency programs, and fund availability. Conforming proposals based on a previously submitted abstract will be reviewed without regard to feedback resulting from review of that abstract. Furthermore, a favorable response to an abstract is not a guarantee that a proposal based on the abstract will ultimately be selected for award negotiation. Proposals that are determined selectable will not necessarily be selected to receive awards.

For evaluation purposes, a proposal is defined to be the document and supporting materials as described in Section IV.B. 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. No submissions (abstract or proposal) will be returned.

VI. Award Administration Information

A. Selection Notices

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

B. Administrative and National Policy Requirements

1. Intellectual Property

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

If proposers desire to use proprietary software or technical data or both as the basis of their proposed approach, in whole or in part, they should: (1) clearly identify such software/data and its proposed particular use(s); (2) explain how the Government will be able to reach its program goals (including transition) within the proprietary model offered; and (3) provide possible nonproprietary alternatives in any area that might present transition difficulties or increased risk or cost to the Government under the proposed proprietary solution.

Proposers expecting to use, but not to deliver, commercial open source tools or other materials in implementing their approach may be required to indemnify the Government against legal liability arising from such use.

All references to "Unlimited Rights" or "Government Purpose Rights" are intended to refer to the definitions of those terms as set forth in the Defense Federal Acquisition Regulation Supplement (DFARS) Part 227.

a. Intellectual Property Representations

All proposers must provide a good faith representation of either ownership or possession of appropriate licensing rights to all other IP to be used for the proposed project. Proposers must provide a short summary for each item asserted with less than unlimited rights that describes the nature of the restriction and the intended use of the IP in the conduct of the proposed research. If proposers desire to use proprietary software or technical data or both as the basis of their proposed approach, in whole or in part, they should: (1) clearly identify in Appendix A such software/data and its proposed particular use(s); (2) explain how the Government will be able to reach its program goals (including transition) within the proprietary model offered; and (3) provide possible nonproprietary alternatives in any area that might present transition difficulties or increased risk or cost to the Government under

the proposed proprietary solution.

b. Patents

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

c. Procurement Contracts

- **Noncommercial Items (Technical Data and Computer Software):** Proposers requesting a procurement contract must list all noncommercial technical data and computer software that it plans to generate, develop, and/or deliver, in which the Government will acquire less than unlimited rights and to assert specific restrictions on those deliverables. In the event a proposer does not submit the list, the Government will assume that it has unlimited rights to all noncommercial technical data and computer software generated, developed, and/or delivered, unless it is substantiated that development of the noncommercial technical data and computer software occurred with mixed funding. If mixed funding is anticipated in the development of noncommercial technical data and computer software generated, developed, and/or delivered, proposers should identify the data and software in question as subject to GPR. In accordance with DFARS 252.227-7013, "Rights in Technical Data - Noncommercial Items," and DFARS 252.227-7014, "Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation," the Government will automatically assume that any such GPR restriction is limited to a period of 5 years, at which time the Government will acquire unlimited rights unless the parties agree otherwise. The Government may use the list during the evaluation process to evaluate the impact of any identified restrictions and may request additional information from the proposer, as may be necessary, to evaluate the proposer's assertions. Failure to provide full information may result in a determination that the proposal is not compliant with the solicitation. A template for complying with this request is provided in Section IV.B.2.a.xi.(5).

- **Commercial Items (Technical Data and Computer Software):** Proposers requesting a procurement contract must list all commercial technical data and commercial computer software that may be included in any deliverables contemplated under the research project, and assert any applicable restrictions on the Government's use of such commercial technical data and/or computer software. In the event a proposer does not submit the list, the Government will assume there are no restrictions on the Government's use of such commercial items. The Government may use the list during the evaluation process to evaluate the impact of any identified restrictions and may request additional information from the proposer to evaluate the proposer's assertions. Failure to provide full information may result in a determination that the proposal is not compliant with

the solicitation. A template for complying with this request is provided in Section IV.B.2.a.xi.(5).

d. Other Types of Awards

Proposers responding to this solicitation requesting an award instrument other than a procurement contract shall follow the applicable rules and regulations governing those award instruments, but in all cases should appropriately identify any potential restrictions on the Government's use of any intellectual property contemplated under those award instruments in question. This includes both noncommercial items and commercial items. The Government may use the list as part of the evaluation process to assess the impact of any identified restrictions, and may request additional information from the proposer, to evaluate the proposer's assertions. Failure to provide full information may result in a determination that the proposal is not compliant with the solicitation. A template for complying with this request is provided in Section IV.B.2.a.xi.(5).

2. 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.

3. Electronic and Information Technology

All electronic and information technology acquired through this solicitation must satisfy the accessibility requirements of Section 508 of the Rehabilitation Act (29 U.S.C. § 794d) and FAR 39.2. Each project involving the creation or inclusion of electronic and information technology must ensure that: (1) Federal employees with disabilities will have access to and use of information that is comparable to the access and use by Federal employees who are not individuals with disabilities; and (2) members of the public with disabilities seeking information or services from DARPA will have access to and use of information and data that is comparable to the access and use of information and data by members of the public who are not individuals with disabilities.

4. 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 BAA. 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/fsd-gov/answer.do?sysparm_kbid=dbf8053adb119344d71272131f961946&sysparm_search=KB0013221.

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

- DUNS number
- TIN

- CAGE Code. If a proposer does not already have a CAGE code, one will be assigned during SAM registration.

C. Electronic Funds Transfer information (e.g., proposer's bank account number, routing number, and bank phone or fax number).Reporting

1. Technical and Financial Reports

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

2. 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, resultant procurement contracts will require supplementary DARPA-specific representations and certifications. See http://www.darpa.mil/work-with-us/additional-baa for further information.

3. Wide Area Work Flow (WAWF)

Unless using another means of invoicing, performers will be required to submit invoices for payment directly at https://wawf.eb.mil. If applicable, WAWF registration is required prior to any award under this solicitation.

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.

5. FAR and DFARS Clauses

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 www.darpa.mil/work-with-us/additional-baa.

See also Section II.C regarding the disclosure of information and compliance with safeguarding covered defense information controls (for FAR-based procurement contracts only).

6. i-Edison

Award documents will contain a requirement for patent reports and notifications to be submitted electronically through the i-Edison Federal patent reporting system at http://s-edison.info.nih.gov/iEdison.

7. Controlled Unclassified Information (CUI) on Non-DoD Information Systems

Further information on Controlled Unclassified Information on Non-DoD Information Systems is incorporated herein can be found at www.darpa.mil/work-with-us/additional-baa.

VII.   Agency Contacts

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

– **Technical POC:** Jacob I. Torrey, Program Manager, DARPA/I2O

– **Email:** IDAS@darpa.mil

– **Mailing address**:
DARPA/I2O
ATTN: HR001119S0074
675 North Randolph Street
Arlington, VA 22203-2114

– **I2O Solicitation Website:** http://www.darpa.mil/work-with-us/opportunities

VIII.   Other Information

A. Frequently Asked Questions (FAQs)

Administrative, technical, and contractual questions should be sent via email to
IDAS@darpa.mil. All questions must be in English and must include the name, email address,
and the telephone number of a point of contact.

DARPA will attempt to answer questions in a timely manner; however, questions submitted
within 7 days of closing may not be answered. If applicable, DARPA will post FAQs to
http://www.darpa.mil/Opportunities/Solicitations/I2O_Solicitations.aspx.

B. Proposers Day

DARPA held the IDAS Proposers Day on July 9, 2019, in Arlington, VA. The special notice
regarding the IDAS Proposers Day, DARPA-SN-19-57, can be found at
https://www.fbo.gov/index?s=opportunity&mode=form&id=abc6bc1eba0cf061c7cdd12af856603
80&tab=core&_cview=0

For further information regarding the IDAS Proposers Day, including slides from the event,
please see http://www.darpa.mil/work-with-us/opportunities under HR001119S0074.

C. Submission Checklist

The following items apply prior to proposal submission. Note: some items may take up to 1
month to complete.

✔	Item	BAA Section	Applicability	Comment
	Abstract	IV.B.1	Optional, but recommended	Conform to stated page limit.
	Obtain DUNS number	IV.B.2.a.i	Required of all proposers	The DUNS Number is the Federal Government's contractor identification code for all procurement-related activities. See http://fedgov.dnb.com/webform/index.jsp to request a DUNS number. Note: requests may take at least one business day.
	Obtain Taxpayer Identification Number (TIN)	IV.B.2.a.i	Required of all proposers	A TIN is used by the Internal Revenue Service in the administration of tax laws. See https://www.irs.gov/forms-pubs/about-form-w-9l for information on requesting a TIN. Note: requests may take from 1 business day to 1 month depending on the method (online, fax, mail).
	Register in the System for Award Management (SAM)	VI.B.4	Required of all proposers	The SAM combines Federal procurement systems and the Catalog of Federal Domestic Assistance into one system. See https://www.sam.gov for information and registration. Note: new registrations can take an average of 7-10 business days. SAM registration requires the following information: -DUNS number -TIN -CAGE Code. A CAGE Code identifies companies doing or wishing to do business with the Federal Government. If a proposer does not already have a CAGE code, one will be assigned during SAM registration.

✔	Item	BAA Section	Applicability	Comment
				-Electronic Funds Transfer information (e.g., proposer's bank account number, routing number, and bank phone or fax number).
	Ensure eligibility of all team members	III	Required of all proposers	Verify eligibility, as applicable, for in accordance with requirements outlined in Section 3.
	Register at Grants.gov	IV.E.1.c	Required for proposers requesting grants or cooperative agreements	Grants.gov requires proposers to complete a one-time registration process before a proposal can be electronically submitted. If proposers have not previously registered, this process can take between three business days and four weeks if all steps are not completed in a timely manner. See the Grants.gov user guides and checklists at https://www.grants.gov/web/grants/applicants.html for further information.

The following items apply as part of the submission package:

✔	Item	BAA Section	Applicability	Comment
	Volume 1 (Technical and Management Proposal)	IV.B.2	Required of all proposers	Conform to stated page limits and formatting requirements. Include all requested information.
	Appendix A	IV.B.2.a.xi	Required of all proposers	-Team member identification - Government/FFRDC team member proof of eligibility - Organizational conflict of interest affirmations - Intellectual property assertions - Human subjects research - Animal use - Unpaid delinquent tax liability/felony conviction representations -CASB disclosure, if applicable
	Appendix B	IV.B.2.a.xii	Optional of all proposers	- Appendix B does not count against the page limit - A brief bibliography to relevant papers, reports, or resumes - Do not include technical papers - The materials in Appendix B will not be evaluated as part of the proposal review
	Volume 2 (Cost Proposal)	IV.B.2.b	Required of all proposers	- Cover Sheet - Cost summary - Detailed cost information including justifications for direct labor, indirect costs/rates, materials/equipment, subcontractors/consultants, travel, ODCs - Cost spreadsheet file (.xls or equivalent format) - If applicable, list of milestones for 845 OTs - Subcontractor plan, if applicable Subcontractor cost proposals - Itemized list of material and equipment items to be purchased with vendor quotes or engineering estimates for material and equipment more than $50,000 - Travel purpose, departure/arrival destinations, and sample airfare
	Level of Effort Summary by Task Excel spreadsheet	IV.B.2.c	Required of all proposers	A template LoE Excel file will be provided on the FedBizOpps website as an attachment. Submit the LoE Excel file (do not convert Excel file to pdf format).
	PowerPoint Summary Slide	IV.B.2.d	Required of all proposers	A template PowerPoint slide will be provided on the FedBizOpps website as an attachment. Submit the PowerPoint file (do not convert PowerPoint file to pdf format).

D. Associate Contractor Agreement (ACA)

This same or similar language will be included in contract awards against HR001119S0074. Awards other than FAR based contracts will contain similar agreement language:

(a) It is recognized that success of the IDAS 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 insure 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 IDAS 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 IDAS 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 IDAS research effort include:

Contractor	Technical Area

(end of ACA)

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