Broad Agency Announcement

Verified Security and Performance Enhancement of Large Legacy Software (V-SPELLS)

Information Innovation Office

HR001120S0058

July 24, 2020

Amendment #2

Amended on September 1, 2020

The purpose of this amendment is to update information regarding the cost model under Part II, Section IV, B.1.b. and to update the certification requirements under Part II, Section VI, C.2. Changes are highlighted in yellow.

Defense Advanced Research Projects Agency
Information Innovation Office
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PART I: OVERVIEW INFORMATION

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

    - **Funding Opportunity Title:** Verified Security and Performance Enhancement of Large Legacy Software (V-SPELLS)

- **Announcement Type:** Initial Announcement

- **Funding Opportunity Number:** HR001120S0058

- **Catalog of Federal Domestic Assistance Numbers (CFDA):** 12.910 Research and Technology Development

- **Dates**
    - Posting Date: July 24, 2020
    - Proposal Due Date: September 9, 2020, 12:00 noon (ET)
    - Proposers Day: July 29, 2020

- **Anticipated Individual Awards:** There are multiple technical areas for this solicitation. Currently, DARPA anticipates multiple awards in Technical Area 1, Technical Area 2 and Technical Area 3; and a single award for Technical Area 4. DARPA anticipates making multiple awards under this BAA, which has a total anticipated funding amount of approximately $40 million.

- **Types of Instruments that May be Awarded:** Procurement contracts or cooperative agreements or Other Transactions (grants will not be awarded)

- **Agency Contacts**

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    - **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 in the area of software verification and assurance by enabling piecewise, compatible-by-construction enhancement of software components in legacy United States Department of Defense (DoD) systems, and creating methods and tools to recover succinct models of domain data abstractions and logic from the source code, adding enhancements at the level of these models, and converting them to performant new component implementations, which are verified to be compatible and secure. Proposed research should investigate innovative approaches that enable revolutionary advances in science, devices, or systems. Specifically excluded is research that primarily results in evolutionary improvements to the existing state of practice.

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 grants and 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 posts BAAs on the System for Award Management, Contract Opportunities (Beta.Sam.Gov) website (https://beta.sam.gov/) and, when applicable, the Grants.gov website (https://www.grants.gov/).

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

Introduction

The DoD has a critical need for enhancing and replacing components of existing software with more secure and more performant code. This includes cases where a key performance or security benefit comes from moving parts of the software to new hardware, such as utilizing hardware accelerators, isolation enclaves, offload processors, and distributed computation. However, introducing enhancements or replacements into large legacy code bases carries a high risk that new code will not safely compose with the rest of the system. Verified programming methodologies for creating software that is correct-by-construction are currently not effective for lowering this risk, because they focus on clean-slate software construction, assume an existing formal specification that is typically not available for a legacy system, and require formal methods expertise typically not accessible to developers.

The goal of the V-SPELLS program is to create a developer-accessible capability for piece-by-piece enhancement of software components with new verified code that is both correct-by-construction and compatible-by-construction, i.e., safely composable with the rest of the system. V-SPELLS will create practical tools for developers to gain benefits of formal software verification in incremental software (re)engineering rather than only in clean-slate introduction. V-SPELLS tools will enable developers to deliver assured incremental modernization of legacy systems in a manner that leverages verification technologies and reduces rather than raises risk. V-SPELLS aims to radically broaden adoption of software verification by enabling incremental

introduction of superior technologies into systems that cannot be re-designed from scratch and replaced as a whole.

To accomplish these goals, the V-SPELLS program will leverage a combination of novel concepts in program understanding and verification, as well as recent developments in domain specific languages and composable system architectures for production systems at scale. The program seeks breakthroughs in and novel approaches to the following technical challenges, Including, but not limited to:

- Automated program understanding to infer architectural structure, assumptions, and dependencies in a legacy source code base, enabling its decomposition into components with explicit modular structure, interfaces, dependencies, and constraints. Recovery of domain abstractions and models from legacy code bases, in succinct and expressive representations suitable for programming functional component enhancements or replacements that are safely composable with the existing systems.
- Matching known and extracted domain abstractions and models with legacy code, lifting of legacy code to succinct, enhanceable, safely composable, and inter-operating representations, and automated specification inference leveraging such representation. Provably safe composition of enhancements with the rest of the system.
- Overcoming performance reduction due to added layers of abstraction with novel verified cross-layer optimization and distribution techniques ("verified stack flattening and distribution"). Development of non-brittle and granular rules for composable representation, packaging, and transformation of software verification proofs that support distribution and orchestration of verified programs.

Background

Sustainers of today's critical infrastructure and DoD code bases struggle to gain effective understanding of legacy code. Legacy code tends to entangle high-level application domain logic with low-level implementation detail and accumulated performance optimizations for past hardware that remain in the code despite being no longer useful. Code may also be difficult to comprehend due to "shortcut" paths unintended by software architects but expediently introduced by developers, and other developer deviations from the intended design and architecture. Often, component specifications aren't available and must be inferred from implementation, or the existing interface control documents do not account for differences between software and hardware versions. As a result, critical systems are locked into obsolete hardware and software components. Capability upgrades become increasingly difficult over time, with no capability for high assurance functional enhancement of legacy components.

Today's focus on clean-slate methodologies limits applicability of verified programming to legacy systems. Today, verified software is written from scratch, starting with a formal specification. In recent scale-oriented approaches pioneered by DARPA's High-Assurance Cyber Military Systems (HACMS) program and adopted by National Science Foundation DeepSpec, the specification is written in a proof assistant such as Coq or Isabelle in its respective functional language (e.g., Gallina for Coq), by a hybrid team of logic-focused formal methods experts and domain-focused requirements engineers. Domain expert programmers (e.g., network programmers, control system programmers, signal processing programmers, embedded systems programmers, avionics programmers, etc.) who implement this specification are typically not familiar with verified programming environments and conventions. They are provided with a Domain-Specific Language (DSL) or similar domain-focused model that imitates a programming

style familiar to them, e.g., a bespoke imperative DSL, but is designed by the domain logicians to be translated into the specification language. Domain specific models or codes are then proven to be equivalent to the specification, i.e., functionally correct. The structure of functional correctness proofs follows the structure of the system's stack of abstractions, down to a formal description of the hardware if available (such as RISC-V).

Today, there are no technologies to effectively understand legacy code bases to reap the benefits of verification approaches for their incremental, assured enhancement, or to apply verification for safe composition of enhancements with large legacy systems. V-SPELLS will bridge this gap.

Desired assured enhancement scenarios and their respective challenges to overcome include but are not limited to the following:

- Significant performance gains are possible by shifting operations to modern hardware (packet processing, data stream reassembly, signal processing, etc.), but refactored software must have isomorphic functionality;
- A new memory-safe technology to replace legacy vulnerability-prone networking code is available, but legacy under-specified behavior must be replicated precisely;
- Side-channel vulnerability mitigation requires isolating parts of computation on dedicated CPUs, but distributing execution of software written for a single CPU is risky.

Insufficiency of Current Approaches

Today, enhancing legacy software components or replacing them with technologically superior ones for performance or security faces high risk that the new code, despite being proven correct according to a specification, will not be fully compatible with the rest of the existing system. System owners fear that they might need years of additional adjustments to new code (and its proofs, if any) to reliably interoperate with the actual behaviors of the system. The risk is concentrated towards the end of the effort, when the verified software is complete enough to be integrated, run, and tested, and is often further amplified by the need to preserve bug-compatibility of new components with the rest of the code in legacy systems.

Neither proof assistants nor any other part of today's verified programming toolchains mitigate this risk. Crucially, these tools are not aware of the existing source code or binaries of the old component or of the other system components, and can't examine such source code or binaries or draw on them in the course of the verified code development. Today, compatibility is a matter of getting the specification right and staying consistent with it.

Adjustments to the specification require costly combined effort of multiple mathematicians conversant in the proof assistant languages, besides the domain requirements engineers who formulate the system's desired functional properties and the software engineers who actually implement the system. This inhibits the use of verification for enhancing or replacing parts of existing infrastructures.

Today's software engineering tools and standards for composing software offer meager support for reasoning about software components at the implementation level, and thus enabling their seamless enhancement or replacement. For example, the designs of Application Binary Interfaces (ABIs)—the mechanisms that translate the abstraction of software libraries into binary linking and loading, and so underlie all code reuse—saw their last major advancement in late 1990. These advances enabled binary code relocation and runtime loading of binary libraries within a single address space, but offer no help for distributing code units across computing

nodes, reasoning about code unit dependencies, or for combining proofs. Shortcomings of native ABI library mechanisms led to an explosion in container-based solutions (e.g., allowing developers to maintain dozens of versions of a library dependency within a system), but these only increase technical debt, creating potential for avalanching flaws. Similarly, failure of ABIs to express known structure and properties of software doesn't allow software orchestration to take advantage of such knowledge, requiring introduction of cumbersome additional levels of complexity to achieve desired decoupling and composability. ABI research needs new clearly posed challenges to advance.

Today, standard ABIs and other software engineering abstractions do not commonly offer first-class mechanisms and design patterns for safely composing new functional logic with the existing codebases and executable systems. Conversely, although examples of such safe composition patterns exist in systems programming practice, in the form of hook systems and DSLs recognized for their unprecedented stability, compositional safety, and ease of debugging—and delivering outstanding "return on investment" capability for safe, secure enhancements for production systems at scale—the root causes of these properties are not studied by program verification theory.

Finally, no metadata standards exist to support composition and translation of verification proofs. For example, there is no support for granular, composable packaging of proofs with the binary code they prove correct, for automated translation of proofs between different hardware models, or for automated adaptation of proofs to distributed and orchestrated refactoring of code. The lack of standard, practical, and theoretically sound approaches to these tasks impedes proof engineering.

The V-SPELLS program seeks to address these gaps by combining novel concepts in verified programming with recent developments in domain specific languages and composable system architectures in production systems at scale.

Program Scope

The V-SPELLS program will enable piecewise, compatible-by-construction enhancement of software components in legacy computer systems. To accomplish this, V-SPELLS will create methods and tools to recover succinct expressions and models of domain data abstractions and domain logic from source code, add enhancements at the level of these models and expressions, produce performant executable artifacts of these enhancements together with proofs of their safety and correctness, and safely compose these artifacts with the legacy system.

V-SPELLS tools will leverage iterative and interactive automated program understanding of a large code base to semi-automatically derive concise representations (such as DSLs, models, or specialized virtual machine operations) of the domain data structures and domain logic of a targeted component or subsystem. The tools will also concurrently infer the component's specification within the larger environment. V-SPELLS tools will support safe and composable functional enhancements of the system using these representations, and then will generate, optimize, and distribute executable artifacts of these enhancements across the system, creating and validating relevant proofs.

V-SPELLS will combine novel concepts in verified programming that enable granularity and composability of proofs with recent developments in application of domain specific languages and systems architecture patterns for safe composition of functional software enhancements in production systems at scale.

Program Structure
The program will produce theories, technologies, tools and formal proof methodologies leading to experimental prototype(s) that provide capabilities for piece-by-piece performance and security enhancement or replacement of legacy code in mission-critical systems. It is expected that these prototypes will provide a starting point for technology transition and assured incremental modernization of mission-critical software in cyber-physical system domains.

The V-SPELLS program is a 48 month program organized into three (3) phases: Phases 1 and 2 will be 18-months each, followed by a 12-month Phase 3, with milestones as described in Table 1. The program is divided into four Technical Areas (TAs):

- TA1 Automated, iterative interactive program understanding
- TA2 Compositional DSL programming, component specification inference
- TA3 Verified layer flattening and distribution
- TA4 Demonstration and Evaluation

DARPA anticipates funding multiple technical approaches and performers across the V-SPELLS technical areas. Beyond Phase 1, subsequent phases will be considered options, and may or may not be exercised at the sole discretion of the Government. Funding of option phases will be based on demonstrated technical progress towards the goals of the V-SPELLS program and the availability of funds. There will be no forced down selects at the end of phases 1 and 2, but continued funding will depend on demonstrated progress in achieving program goals. It is desired that selected performers be funded through Phases 1, 2, and 3 of the program.

TA1 and TA2 performers should be prepared to work closely with each other in order to support integration of the TA1 tools for automated, iterative, interactive program understanding results with the TA2 environment for compositional DSL programming and component and interface specification inference, so that inferred specifications effectively inform further iterations of program understanding. In addition, TA2 and TA3 performers should be prepared to work closely with each other in order to support integration of the TA2 environment for compositional DSL programming results with the TA3 framework for verified layer flattening and distribution results, so that the enhanced code is performant, safely integrates with the code base, does not compromise the code base security, and can be suitably distributed among the hardware units, if needed for the enhancement.

To facilitate the open exchange of information, performers will have Associate Contractor Agreement (ACA) language included in their award. TA4 will be responsible for executing the V-SPELLS ACA. See Section VIII.D for more information regarding an ACA. While TA4 performers will be a party to the ACA, it is expected that TA4 outputs will be largely independent of TA1, TA2, and TA3 work.

Each proposal may address any one TA or any combination of TA1, TA2, and TA3. Proposals covering a combination of TA1, TA2, and TA3 must make the respective efforts and costs proposed on the different TAs clearly separable. Proposals covering combinations other that the full combination of the TA1, TA2, and TA3 should explain their rationale for the chosen TA combination and their collaboration plans with the TA not covered by their proposal.

Proposers may submit multiple proposals, and they may propose to multiple TAs or combinations of TA1, TA2, and TA3. In the case of submissions to multiple TAs or

combinations of TAs as above, the Government reserves the right to decide which, if any, to select for award. A proposer submitting proposals to TA1, TA2, and TA3 may be selected to perform on one, two, or all three of these TAs. When submitting separate proposals for more than one TA, and selected for more than one TA, significant cost reductions for the combined effort will be expected, through synergies of the proposed approaches. However, TA4 performers cannot perform on any other TA, to protect the integrity of program evaluation.

DARPA encourages proposers to consider the investigation and creation of open source and free software approaches and strongly encourages proposals that will provide an overall open source V-SPELLS framework that will result in open, modular tool architectures. Restricting technology transition of a proposed V-SPELLS technology may be considered a weakness of the proposal.

The Government will assess performer progress against target goals set for each phase, using a progression of technical use case challenges as outlined below in the Technical Areas. In addition, an advisory panel composed of participants from interested Government partners may participate in the meetings and in the informal challenges to provide feedback to the Program Manager.

Technical Areas

The program will enable piecewise, compatible-by-construction enhancement of software components in legacy DoD systems by creating methods and tools to recover succinct expressions and models of domain data abstractions and logic from the source code, add enhancements at the level of these expressions and models, and produce performant component implementations incorporating these enhancements that are verified to be compatible and secure, through progress in four key technical areas:

- Automated, iterative, interactive program understanding (TA1)
- Compositional DSL programming (TA2)
- Verified layer flattening and distribution (TA3)
- Demonstration and evaluation (TA4)

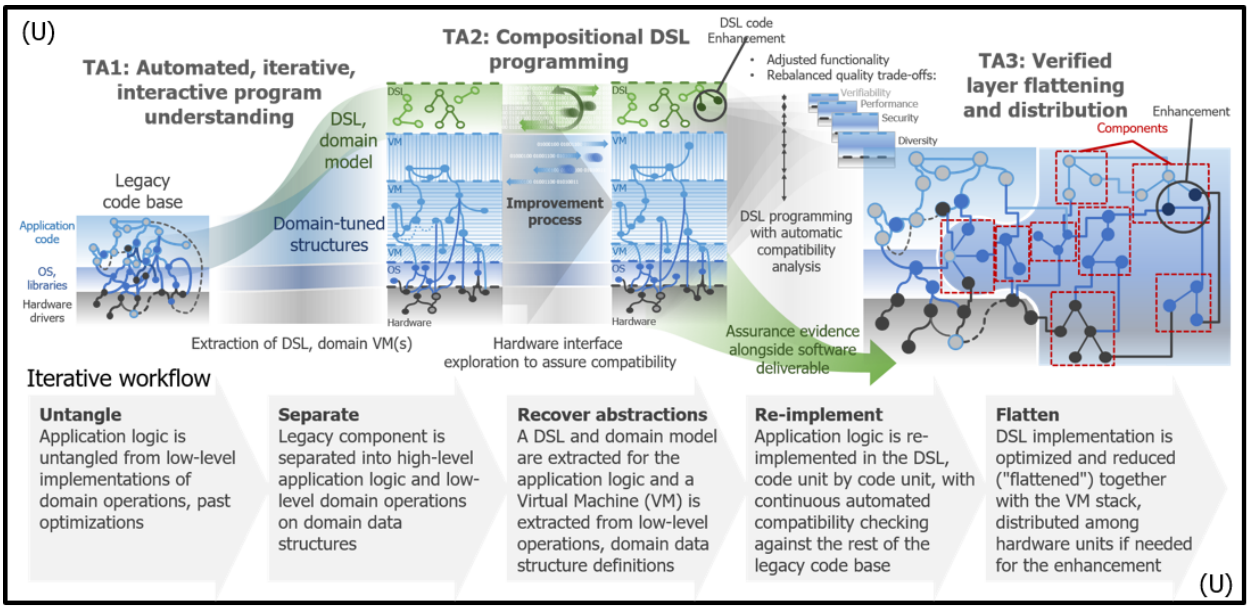

Figure 1: V-SPELLS Technical Areas (TAs) 1-3

Technical Area 1 (TA1) – Automated, iterative, interactive program understanding:

V-SPELLS TA1 performers will develop novel approaches that provide methods and tools for automated, iterative, interactive program understanding of software components in large code bases, based on extraction, matching, and application of domain-specific structures, expressions, and models.

In particular, TA1 tools will create the capability to interactively, iteratively extract domain abstractions and semantic models—such as concise descriptions of domain data structures and operations—and identify locations and paths in the code where these are instantiated. They will use this capability to infer architectural structure, composition patterns, assumptions, and dependencies in a legacy source code base, enabling its decomposition into components with explicit modular structure, interfaces, dependencies, and constraints.

TA1 tools will recover succinct expressions of the domain's application logic—such as domain-specific semantic models (DSSMs) and domain-specific languages (DSLs). They will thereby untangle the targeted components' application logic from low-level data representations and low-level implementations of notional operations of this data, performance optimizations driven by particular hardware choices, and similar detail incidental to the software components' intended architecture, interfaces, and function.

A V-SPELLS TA1 capability will require research breakthroughs in *convergent compositional verification*, in which the specification of a component in the context of a larger system is inferred *iteratively* and *interactively,* through the effort of domain expert software developers supported by the appropriate code analysis tools, rather than primarily through the effort of software verification experts. V-SPELLS changes the role of the domain expert software developer from a mere implementer of a specification created by verification logic experts to the primary discoverer of the specification.

Strong TA1 proposals should discuss how the proposed effort will progress from effective methods of identifying and instrumenting all uses and operations on domain-specific data abstractions in legacy source code to replacement and enhancement of these operations with high-level DSL code, safely and usably composed with the rest of the legacy code base. The

Government desires this anticipated progression would be discussed in the context of a concrete open source software (or open software/hardware combination) solution that is commonly deployed in industry and has a known need for modernization. The discussion will clearly and quantitatively identify the challenges and obstacles to achieving safe composition and enhancement in this system, and present a compelling rationale for anticipated success of proposed approaches.

Proposals will present metrics and milestones for evaluating the progress of the proposed approaches in the context of the discussed use case, in line with the general program metrics in Table 1. For example, a strong TA1 proposal may argue that it will achieve refactoring of a significant open source software stack or its subsystem for safe instrumentation and functional enhancements such as protocol feature additions in months rather than years, and will automate code lifting to succinct enhanceable DSLs for the majority of the code rather than for isolated code fragments.

Strong TA1 proposals will present a review of the existing approaches, techniques, and challenges, emphasizing industry experience with and applications to large legacy systems, supported with appropriate literature citations.

The program will emphasize creating and leveraging open source technology and open source architectures. Strong proposals will offer metrics and benchmarks for evaluating the success of the existing and newly developed technologies, in open reproducible settings. 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.

Technical Area 2 (TA2) – Compositional DSL Programming:
V-SPELLS TA2 performers will focus on creating the capability for regular developers to quickly create new verified component replacements and enhancements that safely compose with the rest of the system.

TA2 performers will create a developer-usable integrated environment for *compositional DSL programming* and component specification inference in the context of a large existing code base. This compositional DSL programming environment will enable developers to re-implement, re-engineer, and enhance a component of the system in a combination of DSLs and models derived for that component via TA1 tools, with automated assistance from the environment to ensure that the replacement is not only correct but also *compatible-by-construction* with the rest of the system. The environment will enable developers to incrementally re-implement and enhance application logic in the DSL, code unit by code unit, with continuous automated compatibility checking against the rest of the legacy code base and hardware interfaces.

Developers working with the TA2 integrated environment will receive immediate, interactive, and intelligible feedback on compatibility of DSL code they write with the old code and the rest of the code base. TA2 performers will develop ensembles of novel *compatibility-focused* program analyses, including static, dynamic, symbolic, concrete, and orchestrated combinations thereof, and the TA2 integrated environment will apply these analyses in a usable, automated, interactive, and iterative manner to guide the developers.

The TA2 integrated environment will communicate the results of its analyses to the programmer in a form accessible to a developer who is a domain application expert but not a program verification expert. Strong proposals will emphasize accessibility of this communication,

preferring, e.g., iteratively refined counterexamples with suitable annotations to formal logic, type, or proof terms.

The TA2 implemented environment will also support extracting the specification of the components from the DSL created by the developers, for export to TA1 and TA3 tools.

Together with TA1, V-SPELLS TA2 changes the role of the domain expert software developer from a mere implementer of a specification created by verification logic experts to the primary discoverer of the specification. Additionally, TA2 enables the developer to produce code that is provably correct and safely composable, without exposing any of the proof machinery to the developers, and instead communicating with them by means of DSL constructs and counterexamples. Assurance evidence generated in TA2, such as proofs and specifications derived from the developers' DSL code, is communicated to TA3 tools transparently and without developer intervention.

The integrated environment will take advantage of the existing specification (if any), interface control documents (if any), source code and related metadata, build chain, unit tests, and other information available for the legacy code base. It is assumed that the source code and the build process are available for the majority of the system, and that interface specifications are available for the hardware and those components of the system, if any, that are opaque and cannot be rebuilt. However, it is not assumed that these specifications are fully faithful, and strong proposals will discuss approaches for validating these specifications against the actual hardware or opaque components, combining automated inference and automated interface exploration and interrogation to support compatibility analysis and verification.

Creating this V-SPELLS TA2 capability will require research breakthroughs in *compatibility-by-construction* and design patterns for *safe composition* with existing systems *at scale*, where a new developer-accessible verified programming workflow will be created specifically to replace components of an existing infrastructure.

Strong proposals should discuss the developer's workflows for re-engineering a component of a legacy system, wherein novel, compatibility-focused program analyses provide timely interactive feedback to the developer, seeking to amplify workflow efficiency through automation and interactivity. The developers are assumed to be experts in the application domain and familiar with advanced debugging techniques, but not experts in program verification, program logics, or proof assistants. Strong proposals should discuss how these analyses and workflows incorporate and leverage the existing legacy code base, its build process and tests, the capabilities developed in TA1, and any sources of information reasonably available in industry practice.

Strong proposals should couch the discussion within the context of a concrete open source software (or open software/hardware combination) that is commonly deployed in industry and has a known need for modernization. The discussion should clearly and quantitatively identify the challenges and obstacles to achieving safe composition and enhancement in this system, and present compelling rationale for anticipated success of proposed approaches. Proposals should present metrics and milestones for evaluating the progress of the proposed approaches in the context of the discussed use case, in line with the general program metrics in Table 1.

Strong proposals should address the challenges of interfacing with hardware functions, and providing usable compatibility analysis for changing hardware components and replacing software functions with hardware functions specified to implement the same interface.

Strong TA2 proposals should consider solutions that build on the experience of recent DSL-based systems engineering successes, which enabled safe kernel-level enhancement of production systems at unprecedented scales, by regular application programmers rather than highly specialized kernel experts. V-SPELLS observes that such engineering successes can be accelerated and applied to other code bases and domains, by automating the distillation of DSLs and domain-specific semantics interactively and iteratively, and effectively enabling domain experts to produce the equivalent of an actionable specification of the system sufficient for safe composition of functional and performance enhancements.

Strong TA2 proposals should present a review of the existing approaches, techniques, and challenges in academia and industry, supported by appropriate literature citations, and drawing on the industry experience of recent DSL systems engineering successes at scale.

The program will emphasize creating and leveraging open source technology and open source architectures. Strong proposals are encouraged to offer metrics and benchmarks for evaluating the success of the existing and newly developed technologies, in open reproducible settings. 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.

Technical Area 3 (TA3) – Verified layer flattening and distribution:
V-SPELLS TA3 performers will focus on processes, designs, standards, and tools for creating safe and performant executable artifacts for the composable DSL-based enhancements and replacements, to be created for legacy code bases with TA1 and TA2 tools. TA3 will leverage recovered higher-level domain abstractions and inferred specifications to optimize the resulting executable artifacts, prove their safe composability with the system, and improve their security. It is expected that the knowledge of higher-level domain abstractions and explicit component dependencies will help to overcome potential performance reduction due to added layers of abstraction, while maintaining the system's security guarantees. We refer to these novel verified cross-layer optimizations as *verified flattening*.

TA3 will also leverage recovered abstractions and inferred specifications, as well as any other suitable program analysis techniques, to restructure code among the target platform's available processors, computing enclaves, nodes, or devices. This capability will address security or performance enhancement scenarios that call for distributing the execution of legacy code for security isolation, shifting it to modern hardware, or partially offloading its functions to specialized hardware accelerators.

Alongside with the above artifacts and transformations, TA3 tools will produce proofs of their compositional correctness and safety. To achieve TA3's correctness-related goals, performers will develop non-brittle and granular rules for composable representation, packaging, and transformation of verification proofs that support distribution and orchestration of verified programs. Strong proposals should aim to achieve composability and granularity of proofs similar to or exceeding composability and granularity of executable binary code reuse enabled by the Application Binary Interfaces (ABIs).

Strong TA3 proposals will develop novel theories and approaches for compilation of TA2-developed DSL enhancements or replacements for platforms consisting of multiple distributed compilation targets. These compilation techniques should be tunable for the goals such as performance, security, diversity, or verifiability, and the proposal will discuss a progression of provable properties associated with these goals.

It is expected that strong TA3 proposals design and develop novel ABI extensions to enable multi-target composition and develop ways of capturing and maintaining dependencies and transformations for composable, granular proofs to support verification for such composition.

The TA3 capability will require research breakthroughs that will bridge the gap between program verification and actual code reuse, by creating a methodology and tools to explicitly and universally describe semantics of composability for existing major ABIs, and extending ABI mechanisms to include and enforce constraints for non-functional or intrinsic properties of the software, including timing-related constraints for real-time systems.

Strong TA3 proposals should discuss how the proposed effort will progress from overcoming potential performance overhead of a high-level DSL (e.g., due to a naïve virtual machine implementation of the DSL's operational semantics) to achieving superior performance, reduced resource footprint such as the initial memory load and shorter load times, and verified safe composition transparent to the developers using V-SPELLS tools. Strong proposals should also discuss progression in the scope and kinds of properties for which the granular and composable representation of proofs is achieved. This anticipated progression will be discussed in the context of concrete open source software (or open software/hardware combination) that is commonly deployed in industry and has a known need for composable feature addition and security enhancements. The discussion will clearly and quantitatively identify the challenges and obstacles to achieving safe composition and enhancement in this system, and present a compelling rationale for anticipated success of proposed approaches.

Strong TA3 proposals should present a review of the existing approaches, techniques, and challenges in academia and industry, supported by appropriate literature citations, with emphasis on industry experience of relevant engineering successes based on principled designs.

The program will emphasize creating and leveraging open source technology and open source architectures. Strong proposals should offer metrics and benchmarks for evaluating the success of the existing and newly developed technologies, in open reproducible settings. 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.

Essential Interactions between TA1 and TA2 and TA3

TA1's analysis tools are required to provide the extracted domain model and domain-tuned structures, as well as the architectural information recovered from the legacy code base, to TA2's reasoning about the component specifications and DSL code enhancements, as well as for TA2's compatibility and compositional safety analysis of the new DSL code. For example, TA1 tools should produce useful representations of the component boundaries, dependencies, interfaces, linking artifacts, and other relevant artifacts for TA2's use. TA2 is required to provide TA3 with the higher-level abstractions and inferred specifications of components recovered via compositional DSL programming, with assurance evidence alongside the newly developed DSL enhancements, and with other analysis artifacts necessary for TA3 to accomplish verified layer flattening and distribution. For example, TA2 tools should produce useful representations of the

DSL, interfaces, linking artifacts, and other relevant artifacts for TA3's use. Robust interaction is expected and should be planned for between TA1 and TA2, and between TA2 and TA3 in identifying the goals of the envisioned automated interactive verified enhancement via fast, secure DSLs.

V-SPELLS will require technological advances in comprehending and interrogating software and hardware interfaces at the lower layers of the computing stack. Strong TA2 proposals should demonstrate relevant technical capability and expertise, and plan to interact with TA1 and TA3 to effectively communicate the results of their analyses for the respective TA1 and TA3 needs. Proposals will be strengthened by combining a fundamental research capability with a team capability for handling legacy DoD code.

Technical Area 4 (TA4) – Demonstration and Evaluation:
The TA4 performer will assist the Government team in the development of evaluations for the technological capabilities developed by the TA1, TA2, and TA3 performers, and in providing feedback to the TA1, TA2, and TA3 performers. The TA4 performer will be responsible for defining and executing a testing approach that enables the incremental development, demonstration, evaluation, and eventual DoD transition of V-SPELLS capabilities.
The TA4 performer will produce evaluation exercises of increasing difficulty for assessing developed capabilities, and identify and curate a variety of use cases suitable for fundamental research, each advancing in coverage, automation, and assurance guarantees through the program phases. The case studies may include but are not limited to network daemon and client programming, Operating System (OS) subsystems and drivers operating on a standard bus such as USB, digital radio firmware, boot loader and chipset firmware (in particular, in chain-of-trust scenarios), and/or cloud applications, such as load balancing and staged input processing and validation.

Strong TA4 proposals are encouraged to consider developing evaluation approaches with open-source components that are a critical part of the DoD supply chains, and curate and provision open source software and hardware case studies suitable for fundamental research conducted in TA1, TA2, and TA3. Some examples are large deployments in industry, with a known need for modernization despite common use, realistic hardware offload scenarios and software decomposition/distribution for cloud deployments. There will be no Controlled Technical Information (CTI) in the use cases provided to TA1, TA2, and TA3 researchers, to facilitate broad research community engagement.

Strong TA4 proposals are encouraged to provide open-source activity approaches that represent diverse, DoD-relevant use cases of legacy software understanding and hardware platform modernization. TA4 proposals should also identify platforms and use cases for DoD transition, and apply tools and methodologies developed by the TA1 and TA2 and TA3 performers to these use cases.

The TA4 performer will produce the testbed for demonstrating the V-SPELLS technological capabilities developed by TA1, TA2, and TA3 performers and will evaluate these capabilities against the program metrics. Evaluation will include both security testing of the V-SPELLS superior technologies and rigorous testing of the functional enhancements produced with these technologies, via a series of evaluation/challenge exercises of increasing complexity and difficulty. The challenges should be suitable for fundamental research, shared without limitations

with the TA1 and TA2 and TA3 fundamental research teams, and should not contain Controlled Technical Information (CTI).

The TA4 performer will provide the transition use cases and work with the services to establish a V-SPELLS technology transition plan. The TA4 performer will also work with the transition partner for any transition accreditations or certifications required for transition of the resulting V-SPELLS capability to the services. The Government will require the TA4 performer to include personnel cleared at the SECRET level to work with transition partner(s).

The program will be reviewed in its entirety at the end of each phase to realign resources and focus effort during the next phase, as evaluated by program metrics included but not limited to the metrics in Table 1.

Security Testing Activities
TA4 proposals should describe methods for developing tactics, techniques, and procedures capable of demonstrating specific weaknesses in the TA1, TA2, and TA3 performers' technologies. Strong TA4 proposals should address TA1, TA2, and TA3 performer technologies, and integrated system software security proofs/analyses after component enhancement and replacement.

Evaluation Testbed Development
The series of evaluation/challenge exercises will progress in scale and complexity as detailed in Table 1, increasing the technical complexity of the challenges and the assurance guarantees that TA1 and TA2 and TA3 technologies must meet.

In each evaluation/challenge exercise, TA1 and TA2 and TA3 performers will receive software/firmware source-level or equivalent high-level representations of the code that needs to be enhanced or replaced. After the performers formulate and apply the enhancement, the enhanced code will be tested for desired functionality, robustness, and security.

Program challenge exercises will be conducted at the performer's site over the course of the program. The events will determine whether TA1 and TA2 and TA3 technologies are meeting program metrics, thereby aiding the Government in determining the value added for additional V-SPELLS program phases. Specific V-SPELLS end-of-program goals will be used during the Phase 3 evaluation/challenge assessment exercises. Strong proposals should present detailed plans for organizing the evaluations, demonstrations, and hackathons/challenges for the TA1 and TA2 and TA3 performers using the testbed, as well as plans for allowing the performers suitable access to the testbed to prepare for these events.

Challenges should be drawn from but not limited to a cyber-physical mission-critical software domain such as Air Force legacy code or a similar domain of mission-critical systems. The challenges should be suitable for fundamental research, should be shared without limitations with the TA1 and TA2 and TA3 fundamental research teams, and should not contain CTI.

To aid the TA4 proposers, the following discussion of an exemplary evaluation testbed from the Air Force domain is provided below. Proposers are encouraged to enhance it with other relevant challenges, systems, and domains as needed to demonstrate safe and effective composition with the legacy code base capabilities.

Exemplary Evaluation
Phase 1 will evaluate the capability to replace a known problematic driver in a large *monolithic* system, such as the Linux kernel or a real-time embedded system, in a subsystem currently lacking BPF-like instrumentation, with a correct and compatible DSL version, while creating such instrumentation for the subsystem.

Phase 2 will evaluate the capability to replace a component in a large *distributed* system. An example of a possible transition would be a software enhancement of an Air Force legacy embedded platform.

During Phase 3, with additional funding at a later date, accelerated transition could be undertaken involving an UAV hardware platform representative of the DoD incremental enhancement needs, provided that the Phase 2 evaluation is successful in its performance metrics.

Program Phases and Metrics
The capability milestones and metrics for the V-SPELLS program, shown in Table 1 below, are related to the capability to incrementally enhance legacy systems. The specific metrics provided in the remainder of this section are indicative of the expected progress. Proposers should describe specific approaches that they will use for test and evaluation purposes during each of the program phases.

Metric	Phase 1 goals (18 months)	Phase 2 goals (18 months)	Phase 3 goal (12 months)
Code scale	10Ks Source Lines of Code (SLoC)	100Ks SLoC	1000Ks SLoC
Program understanding capability	Effective hook system (at least 60% accuracy with over 70% code coverage) (all domain data types accesses and operations are instrumented)	Effective composition (80% accuracy/90% coverage) (all domain operations can be programmed in DSL, compatibly with native code)	Complete replacement (95% accuracy/99.9% coverage) (all code is translated to DSL/VM, except a few effectively analyzed enclaves)
Usability of interactive analyses	Hours at 60% completeness	Minutes at 80% completeness	Minutes at 97% completeness
Efficiency of flattened DSL (relative to initial system state)	70-80%	85-95%	>110-200% (>10x for some domains)
Initial memory load reduction	5x	10-20x	100x
DSL code size reduction	10x	100x	>500x for user-facing code

Table 1: V-SPELLS Metrics

The Government will assess individual performer efforts in terms of the viability of their technical approaches, the trend in the performance of their systems over time, and their overall progress toward V-SPELLS program objectives.

Schedule and Milestones
For each year of the effort, there will be quarterly meetings with the Program Manager (PM), consisting of two site visits and two Principal Investigator (PI) meetings. During these reviews, the PM will assess progress toward the solution via performer briefings, technical discussions, demonstrations, and informal end-of-phase evaluation/challenge exercises based on the target goals of each phase.

PI meetings will focus on open technical exchange. Difficulties encountered and possible solutions will also be discussed. The goals of the PI meetings will be to: (a) review and share

innovations/accomplishments of the V-Spells program; (b) review and discuss plans and options for technology demonstrations and prototypes and V-Spells evaluation/challenge exercises; (c) review and discuss results from meetings and events conducted prior to the tests and evaluation/ challenge exercises; (d) demonstrate prototypes; and (e) plan for the next six-month period.

The Government will specify the locations for the technical interchanges and PI meetings. Evaluation/challenge exercises will be held at the TA4 performer's site. For budgeting purposes, assume the locations of the two PI meetings held each year will alternate between Washington, D.C., and San Diego, CA. For budgeting travel to the TA4 performer's site, assume the location to be on the opposite coast from your location (or if regionally located in the Midwest, choose the more expensive coastal travel destination, San Diego, CA or Washington, DC). In addition to site visits, regular teleconference meetings are encouraged to enhance communications and collaborations, as required, among the performers. Should important issues arise between program reviews, the Government team will be available to support informal interim meetings. In-person meetings, evaluations, and site visits may be replaced with virtual ones if necessary.

Figure 2 provides a tentative evaluation schedule. Proposers should propose a detailed schedule that is consistent with the maturity of their approaches and the risk reduction required for their concepts, and their program plan. These schedules will be synchronized across performers, as required, and monitored and revised as necessary, throughout the V-Spells program's period of performance. A start date of April 1, 2021, should be assumed for budgeting purposes. Subject to the availability of funding, the program is intended to last for four years.

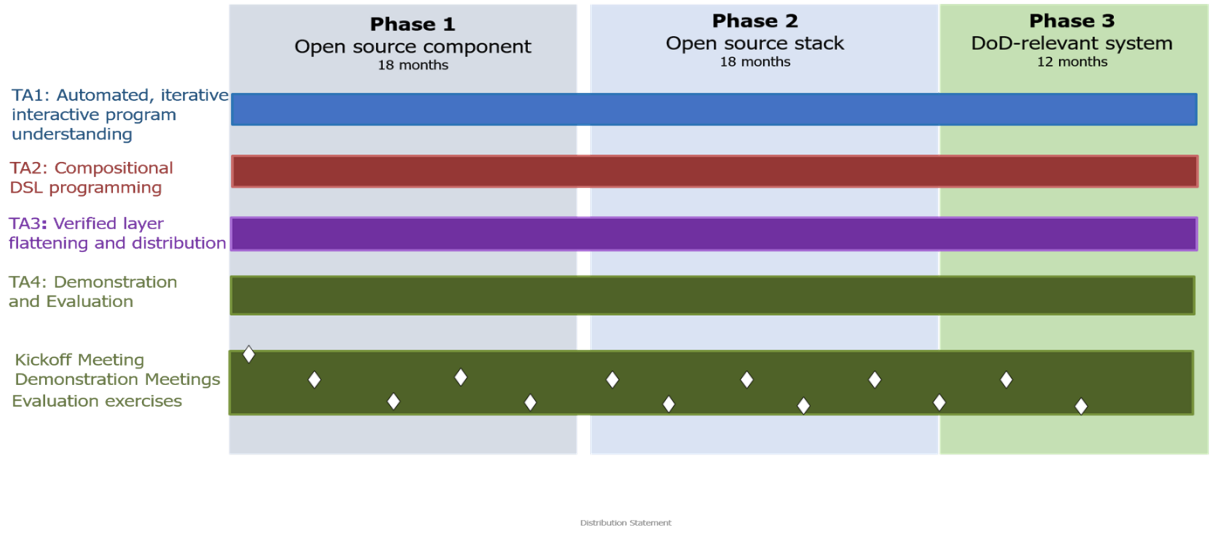

Figure 2-V-SPELLS Tentative Program Evaluation Schedule

Deliverables

Performers are responsible for providing the following deliverables, as applicable:

- Slide Presentations – Annotated slide presentations will be submitted within two weeks after program kick-off meeting and after each review.

- Quarterly Coordination Reports – A quarterly technical coordination report describing progress made, resources expended, and any issues requiring the attention of the

Government team will be provided within 10 calendar days after the end of each quarter.

- Monthly Financial Reporting – Monthly expenditure reports and uploading of required deliverables to the DARPA Technology Financial Information Management System (TFIMS) reporting system are required by all V-SPELLS program performers.

- System Development Plan (SDP) – A SDP will be provided within one month after the kickoff meeting for each phase, and shared with other performers for synchronization. The SDPs for each phase will be based on the performers' proposal and will be presented at the kickoff meeting for each phase. The SDP will describe the scope of the design and development effort, describe the hardware and software architecture in sufficient detail for review and planning, reference any applicable documents, and provide a program schedule.

- Software – All computer software delivered under the V-SPELLS program must be delivered as source and as object (executable) code. Include the source listings and source code for the target computer systems, as well as any build scripts or other technical information required for DARPA to compile all delivered source code. Delivered software under this effort is to be completely maintainable and modifiable with no reliance on any non-delivered computer programs or documentation.

- Software Documentation – Software documentation deliverables will be provided within one month after the end of each phase documenting source code, hardware description language specifications, system diagrams, part numbers and other data necessary to maintain and to produce copies of the software.

- Hardware - At the conclusion of the last Phase, all hardware procured or developed under the V-SPELLS program will be delivered unless otherwise stated in any resultant award. The delivered components will be the same as those used to perform the last Phase final performance tests and evaluations. The delivery is to include sufficient documentation so as to be completely operable, maintainable and modifiable with no reliance on any non-delivered hardware or hardware documentation developed or procured under the V-SPELLS program.

- End of Phase Technical Reporting – Phase reports are due at the end of their respective phase. The reports will concisely summarize the effort conducted and provide any lessons learned during the development of the V-SPELLS technology.

- Final Technical Report – The final report, due at contract completion (whether that occurs at the end of the optional Phase 3 or earlier), will concisely summarize the effort conducted and provide any lessons learned during the development of the V-SPELLS technology.

All reporting must be delivered as required in Section VI.C.

Government-furnished Property/Equipment/Information
Proposals should clearly state any assumptions regarding the use of proposed Government test facilities and capabilities, as well as any proposed Government Furnished Equipment (GFE) used as part of their development, test, and evaluation approach. Proposers should not assume

that the Government will provide them with any tools, hardware-in-the-loop testing tools, or ready-to-use threats needed to perform their tasks.

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 noncommercial 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

DARPA anticipates multiple awards for TA1 and TA2 and TA3, as well as a single award for TA4. 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 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, cooperative agreement, or Other Transaction (OT) depending upon the nature of the work proposed, the required degree of interaction between parties, and other factors. Grants will NOT be awarded under this program.

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

In accordance with 10 U.S.C. § 2371b(f), the Government may award a follow-on production contract or Other Transaction (OT) for any OT awarded under this BAA if: (1) that participant in the OT, or a recognized successor in interest to the OT, successfully completed the entire prototype project provided for in the OT, as modified; and (2) the OT provides for the award of a follow-on production contract or OT to the participant, or a recognized successor in interest to the OT.

In all cases, the Government contracting officer shall have sole discretion to select award instrument type, regardless of instrument type proposed, and to negotiate all instrument terms and conditions with selectees. DARPA will apply publication or other restrictions, as necessary, if it determines that the research resulting from the proposed effort will present a high likelihood of disclosing performance characteristics of military systems or manufacturing technologies that

are unique and critical to defense. Any award resulting from such a determination will include a requirement for DARPA permission before publishing any information or results on the program. For more information on publication restrictions, see the section below on Fundamental Research.

B. Fundamental Research

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

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

As of the date of publication of this BAA, the Government expects that program goals as described herein may be met by proposers intending to perform fundamental research and does not anticipate applying publication restrictions of any kind to individual awards for fundamental research that may result from this BAA. Notwithstanding this statement of expectation, the Government is not prohibited from considering and selecting research proposals that, while perhaps not qualifying as fundamental research under the foregoing definition, still meet the BAA criteria for submissions. If proposals are selected for award that offer other than a fundamental research solution, the Government will either work with the proposer to modify the proposed statement of work to bring the research back into line with fundamental research or else the proposer will agree to restrictions in order to receive an award.

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).

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 System for Award Management, Contract Opportunities website (https://beta.sam.gov), the Grants.gov website (https://www.grants.gov/), or referenced herein.

B. Content and Form of Application Submission

1. Proposals

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

All pages will 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 to the BAA. Submit this PowerPoint file in addition to Volumes 1 and 2 of your full proposal, and the Level of Effort Summary by Task Excel spreadsheet. 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, or a combination of TA1, TA2, and TA3. Organizations may submit multiple proposals to any one TA, or they may propose to multiple TAs. However, a TA4 submission selected for award excludes a TA1 and TA2 and TA3 proposal selection. 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 30 pages (no more than 50 pages overall for combo proposals), 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. Appendix B does not count against the page limit and is optional. Additional information not explicitly called for here must not be submitted with the proposal, but may be included in

the bibliography in Appendix B. Such materials may be considered for the reviewers' convenience only and not evaluated as part of the proposal.

Volume 1 must include the following components:

i. Cover Sheet: Include the following information.

- Label: "Proposal: Volume 1"
- BAA number (HR001120S0058)
- Technical Area(s)
- 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
- Award instrument requested: procurement contract (specify type), cooperative agreement or OT[1] (specify type)
- 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[2]
- Taxpayer Identification Number (TIN)[3]
- Commercial and Government Entity (CAGE) code[4]
- Proposer's reference number (if any)

ii. Table of Contents

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

[1] Information on award instruments can be found at http://www.darpa.mil/work-with-us/contract-management.
[2] 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.
[3] See https://www.irs.gov/government-entities/federal-state-local-governments/taxpayer-identification-matching-tin-tools information on requesting a TIN. Note, requests may take from 1 business day to 1 month depending on the method (online, fax, mail).
[4] 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.

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. Resumes count against the proposal page limit so proposers may wish to include them in Appendix B below. 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.

Include a table of key individual time commitments as follows:

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. 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 noncommercial IP not explicitly identified as having less than unlimited rights in the proposal.

For all noncommercial 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. Appendix B: If desired, include a brief bibliography to relevant papers, reports, or resumes. Do not include technical papers. This section is optional, and the materials will not be evaluated as part of the proposal review.

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

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

~~**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. The government strongly encourages that proposers use the provided MS Excel cost proposal spreadsheet in the development of their cost proposals. All tabs and tables in the spreadsheet should be developed in an editable format with calculation formulas intact to allow traceability of the cost proposal numbers across the spreadsheet.~~ ~~**This MS Excel cost proposal spreadsheet should be used by the prime organization and all subcontractors.**~~ ~~In addition to using the MS Excel cost proposal spreadsheet, Volume II still must include all other items discussed below that are not covered by the editable spreadsheet. Subcontractor MS Excel cost proposal spreadsheets may be submitted directly to the Government by the proposed subcontractor via e-mail to the address in Part I of this BAA. Using the provided MS Excel cost proposal spreadsheet will assist the Government in a rapid analysis of your proposed costs and, if your proposal is selected for award, speed up the negotiation and award execution process.~~

~~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: 1 page each, (by fiscal year and by phase). 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] or facilities and administrative [F&A]), and any proposed fee for the project. Include costs for each task in each 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 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 V-SPELLS@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 subcontractor 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.

v. Proposals Requesting an Other Transaction for Prototypes (845 OT) Agreement:

Proposers must indicate whether they qualify as a nontraditional Defense contractor[5], have teamed with a nontraditional Defense contractor, or are providing a one-third cost share for this effort. Provide information to support the claims.

Provide a detailed list of milestones including: description, completion criteria, due date, and payment/funding schedule (to include, if cost share is proposed, contractor and Government share amounts). Milestones must relate directly to accomplishment of technical metrics as defined in the solicitation and/or the proposal. While agreement type (fixed price or expenditure based) will be subject to negotiation, the use of fixed price milestones with a payment/funding schedule is preferred. Proprietary information must not be included as part of the milestones.

c. Summary Slide

The submission of a PowerPoint slide summarizing the proposed effort is mandatory. A template PowerPoint slide will be provided on the Beta.Sam (Beta.Sam.Gov) website, as well as on the Grants.gov website, as an attachment. Submit the PowerPoint file (do not convert PowerPoint file to pdf format) in addition to Volume 1 and Volume 2 of your full proposal. This summary slide does not count towards the total page count.

2. 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

Classified submissions (classified technical proposals or classified appendices to unclassified proposals) will not be accepted under this solicitation.

C. Submission Date and Time

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

[5] For definitions and information on 845 OT agreements see https://www.darpa.mil/work-with-us/contract-management#OtherTransactions.

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 V-SPELLS@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. Proposals

The proposal package -- full proposal (Volume 1 and 2) and, as applicable, proprietary subcontractor cost proposals, classified appendices to unclassified proposals -- must be submitted per the instructions outlined herein and received by DARPA no later than **September 9, 2020 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. Proposals Requesting a Procurement Contract or Other Transaction

DARPA/I2O will employ an electronic upload submission system (https://baa.darpa.mil/) for UNCLASSIFIED proposals requesting award of a procurement contract or Other Transaction 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 V-SPELLS@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.

b. 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.

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

To evaluate compliance with Title IX of the Education Amendments of 1972 (20 U.S.C. § 1681 et.seq.), the Department of Defense (DoD) is collecting certain demographic and career information to be able to assess the success rates of women who are proposed for key roles in

applications in science, technology, engineering or mathematics disciplines. In addition, the National Defense Authorization Act (NDAA) for FY 2019, Section 1286, directs the Secretary of Defense to protect intellectual property, controlled information, key personnel, and information about critical technologies relevant to national security and limit undue influence, including foreign talent programs by countries that desire to exploit United States' technology within the DoD research, science and technology, and innovation enterprise. This requirement is necessary for all research and research-related educational activities. The DoD is using the two forms below to collect the necessary information to satisfy these requirements. Detailed instructions for each form are available on Grants.gov.

The Research and Related Senior/Key Person Profile (Expanded) form will be used to collect the following information for all senior/key personnel, including Project Director/Principal Investigator and Co-Project Director/Co-Principal Investigator, whether or not the individuals' efforts under the project are funded by the DoD:

- Degree Type and Degree Year.
- Current and Pending Support, including:
    - A list of all current projects the individual is working on, in addition to any future support the individual has applied to receive, regardless of the source.
    - Title and objectives of the other research projects.
    - The percentage per year to be devoted to the other projects.
    - The total amount of support the individual is receiving in connection to each of the other research projects or will receive if other proposals are awarded.
    - Name and address of the agencies and/or other parties supporting the other research projects
    - Period of performance for the other research projects.

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

Form 2: 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.*

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

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 V-SPELLS@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 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.

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/open architecture regimes.

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.

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

C. 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 quarterly 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, all proposers are required to submit for all award instrument types (i.e., procurement contract, cooperative agreement, grant, and other transaction for prototype) supplementary DARPA-specific representations and certifications at the time of proposal submission. See http://www.darpa.mil/work-with-us/reps-certs for further information on required representation and certification depending on your requested award instrument.

~~**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:** Dr. Sergey Bratus, Program Manager, DARPA/I2O

- **Email:** V-SPELLS@darpa.mil

- **Mailing address**:
  DARPA/I2O
  ATTN: HR001120S0058
  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 V-SPELLS@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

The V-SPELLS Proposers Day will be held on July 29, 2020, via webinar. The special notice regarding the V-SPELLS Proposers Day, DARPA-SN-20-55, can be found at https://beta.sam.gov/opp/30fda7e00b4f44a3a2aaa49ef26bb512/view/.

For further information regarding the V-SPELLS Proposers Day, including slides from the event, please see http://www.darpa.mil/work-with-us/opportunities under HR001120S0058.

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
	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/government-entities/federal-state-local-governments/taxpayer-identification-matching-tin-tools 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://sam.gov/SAM 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.

				-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 document provided 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	IV.B.2.d	Required of all proposers	A template PowerPoint slide will be provided on

	Summary Slide			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 HR001120S0058. Awards other than FAR based contracts will contain similar agreement language:

(a) It is recognized that success of the V-SPELLS 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 will remain the property of the Associate Contractor and will be used solely for the purpose of the V-SPELLS research effort. Only that information which is received from another contractor in writing and which is clearly identified as proprietary or confidential will 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 will promptly notify the DARPA V-SPELLS 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 will conform substantially to the language of this ACA, including this paragraph (e).

(f) Associate Contractors for the V-SPELLS research effort include:

Contractor	Technical Area

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