

Broad Agency Announcement

Computers and Humans Exploring Software Security (CHESS)

HR001118S0040

April 18, 2018



Defense Advanced Research Projects Agency

Information Innovation Office

675 North Randolph Street

Arlington, VA 22203-2114

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PART I: OVERVIEW INFORMATION

- **Federal Agency Name:** Defense Advanced Research Projects Agency (DARPA), Information Innovation Office (I2O)
- **Funding Opportunity Title:** Computers and Humans Exploring Software Security (CHESS)
- **Announcement Type:** Initial Announcement
- **Funding Opportunity Number:** HR001118S0040
- **Catalog of Federal Domestic Assistance Numbers (CFDA):** 12.910 Research and Technology Development
- **Dates**
 - Proposers Day: April 19, 2018
 - Posting Date: April 18, 2018
 - Abstract Due Date: May 3, 2018, 12:00 noon (ET)
 - Proposal Due Date: June 15, 2018, 12:00 noon (ET)
 - BAA Closing Date: June 15, 2018, 12:00 noon (ET)
- **Anticipated Individual Awards:** DARPA anticipates multiple awards for technical areas 1 and 2; and single awards for technical areas 3, 4 and 5.
- **Types of Instruments that May be Awarded:** Procurement contracts or cooperative agreements
- **Agency Contacts**
 - **Technical POC:** Mr. Dustin Frazee, Program Manager, DARPA/I2O
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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 to develop techniques and systems that will substantially accelerate software vulnerability research (VR). The goal of the CHES program is to develop computer-human systems to rapidly discover all classes of vulnerability in complex software. These novel approaches for the rapid detection of vulnerabilities will focus on identification of system information gaps that require human assistance, generation of representations of these gaps appropriate for human collaborators, capture and integration of human insights into the analysis process, and the synthesis of software patches based on this collaborative analysis.

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 cooperative agreements). Proposals received as a result of this BAA shall be evaluated in accordance with evaluation criteria specified herein through a scientific review process.

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

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

A. Introduction

The Department of Defense (DoD) maintains information systems that depend on Commercial off-the-shelf (COTS) software, Government off-the-shelf (GOTS) software, and Free and open-source (FOSS) software. Securing this diverse technology base requires highly skilled hackers who reason about the functionality of software and identify novel vulnerabilities. This process requires hundreds or thousands of hours of manual effort per discovered vulnerability and does not scale sufficiently to secure the continuously growing technology base.

Hackers use program analysis techniques and tools to identify and mitigate vulnerabilities, but this process requires considerable expertise, manual effort, and time. These techniques include dynamic analysis, static analysis, symbolic execution, constraint solving, data flow tracking, and fuzz testing. Automated program analysis capabilities can reason over only a few vulnerability classes without human involvement, such as memory corruption or integer overflow, but cannot address the majority of vulnerabilities. These unaddressed vulnerability types depend on subtle semantic and contextual information, which is beyond the grasp of modern automation. Scaling up existing approaches to address the size and complexity of modern software packages is not possible given the limited number of expert hackers in the world, much less the DoD.

The CHESS program will develop capabilities to discover and address vulnerabilities of all types in a scalable, timely, and consistent manner. DARPA believes that achieving the necessary scale and timelines in vulnerability discovery will require innovative combinations of automated program analysis techniques with support for advanced computer-human collaboration (CHC). Due to the cost/scarcity of expert hackers, such capabilities must be able to collaborate with humans of varying skill levels, even those with no previous hacking experience or relevant domain knowledge.

B. Program Description

The CHESS program will research the effectiveness of enabling computers and humans to collaboratively reason over software artifacts (source code, compiled binaries, etc.) with the goal of finding 0-day vulnerabilities at a scale and speed appropriate for the complex software ecosystem upon which the U.S. Government, military, and economy depend.

Achieving these goals will require research breakthroughs in:

- Developing instrumentation to capture and analyze the process by which hackers reason over software artifacts to provide a basis for developing new forms of highly effective communication and information sharing between computers and humans;
- Creating techniques for addressing classes of vulnerability that are currently hampered by information gaps and require human insight and/or contextually sensitive reasoning;
- Generating representations of the information gaps for human collaborators of varying skill levels to reason over;
- Integrating human-generated insights into the vulnerability discovery process;
- Emitting a Proof of Vulnerability (PoV) to confirm existence of the 0-day vulnerability, and generating a non-disruptive, specific patch to neutralize the 0-day vulnerability; and
- Synthesizing vulnerable Challenge Set (CS) corpora representative of large, real world, complex software packages.

The following figure illustrates a high-level overview of the CHES system:

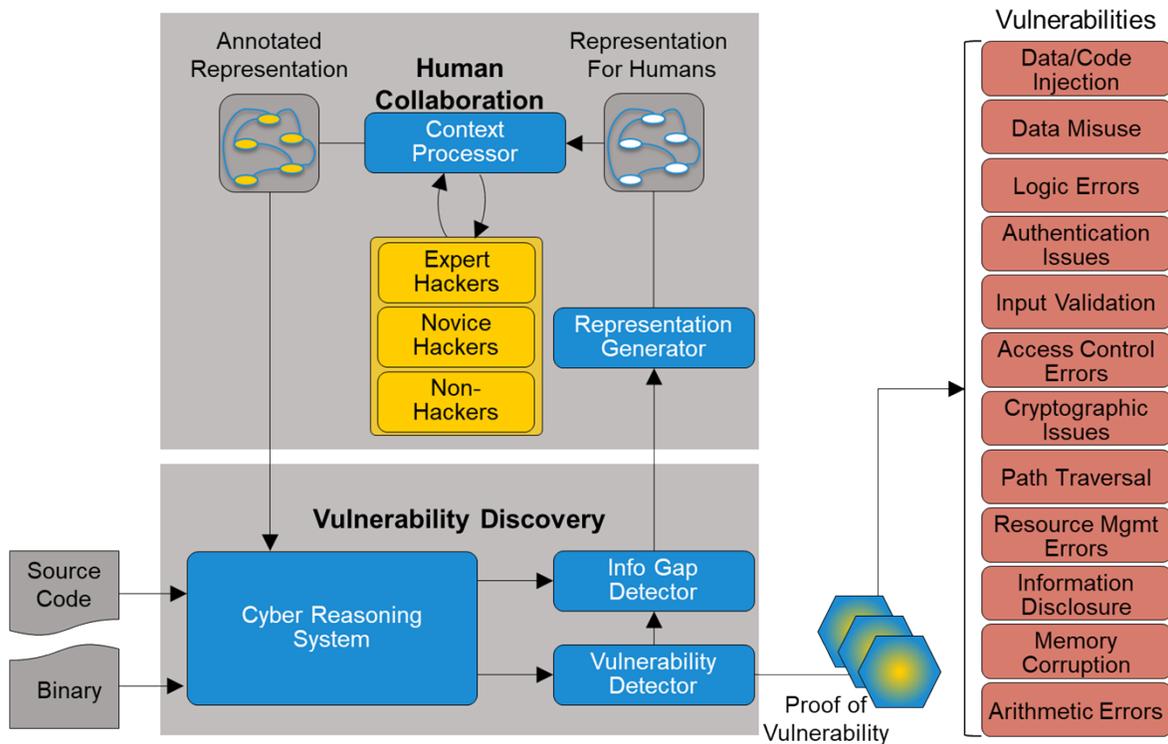


Figure 1: CHES System Overview

The CHES program will involve human subjects research (HSR), and defines three (3) classes of human subjects as follows:

Human Subject Class	Description
Expert Hacker	A professional with 5+ years' experience in software reverse engineering, program analysis or exploit development, should have proven experience finding vulnerabilities in operating systems and large software packages.
Novice Hacker	A professional with less than 2 years' experience in software development, reverse engineering, program analysis and exploit development, should have 4 or fewer years formal education/background in computer science, computer engineering, software development or related disciplines.
Non-Hacker	Any adult with basic computing skills and no formal background in computer science, computer engineering, software development or any related disciplines.

Table 1: Human Subject Classes

All CHES proposals should be applicable to at least one of the following source code languages or compiled binary targets:

Source Code Languages
C/C++
Python
Javascript

Table 2: Source Code Languages

Compiled Binary Targets	
Platform	Architecture
Linux	x86-64
Windows	x86-64

Table 3: Compiled Binary Targets

Specific platform versions should be representative of the systems currently deployed and of interest to the DoD. Proposals should consider approaches that apply to multiple languages/platforms or are largely language/platform agnostic.

The CHES program will target the vulnerability classes shown in Table 4, which also provides the relevant parent Common Weakness Enumerations (CWEs). Each class subsumes the listed CWEs, including all child CWEs, per MITRE’s CWE List Version 3.0.¹ Proposals need not address all the vulnerability classes or CWEs of interest. While reasoning over vulnerabilities in all systems of interest (Table 2, Table 3) is the primary CHES goal, it is understood that certain CWEs are relevant only to a subset of these systems. CHES will achieve maximal effective coverage of the vulnerability classes through collaboration between all performers.

Vulnerability Class	Parent CWEs
Data/Code Injection	74
Data Misuse	471, 501, 610, 628, 642, 662, 665, 673, 704, 706
Logic Errors	691, 697, 703, 758, 768
Authentication Issues	287
Input Validation	20, 138, 170, 172, 228, 463
Access Control Errors	269, 285, 282, 286, 923
Cryptographic Issues	324, 325, 326, 330, 347
Path Traversal	22, 41, 59
Resource Management Errors	400, 404, 405, 665, 666
Information Disclosure	668
Memory Corruption	118
Arithmetic Errors	682

Table 4: Target Vulnerability Classes

¹ <https://cwe.mitre.org/data/index.html>

Proposals may also address additional vulnerabilities that are not on the list, in which case there should be a justification describing the importance of the additional vulnerabilities and how the proposed techniques substantially improve the state of the art.

C. Program Structure

The CHESS program is divided into five (5) technical areas (TAs) that will be working in parallel, starting at program kickoff. The program will span 42 months divided into one 18-month phase and two 12-month phases. Each phase will focus on increasing the application complexity for which the CHESS system is able to effectively analyze. Based on consultation with performers, DARPA will decide which vulnerability classes (Table 4) are in scope during each phase of the CHESS program. (Figure 3, Figure 4)

Phase 1 (18 months) will emphasize initial development of the tools and techniques needed to capture human insight and communicate context to computers covering four (4) vulnerability classes. The scale of the target software in Phase 1 will be on the order of small software libraries (low complexity).

Phase 2 (12 months) will emphasize refining the insight capture and communication mechanisms while expanding coverage to eight (8) vulnerability classes. The scale of the target software in Phase 2 will be on the order of whole software packages (moderate complexity).

Phase 3 (12 months) will emphasize scaling techniques while expanding coverage to twelve (12) vulnerability classes. The scale of the target software in Phase 3 will be on the order of modern web browsers (high complexity).

In Phase 1, there will be one kickoff meeting, four hackathons, two demonstrations, and a final evaluation event. Phases 2 and 3 will each have two hackathons and one late-phase demonstration to identify and correct any weaknesses, which should provide ample time to address any shortcomings before each end-of-phase evaluation. Hackathons and evaluations will also serve as PI meetings. (Figure 3)

D. Technical Areas

CHESS will be structured with five (5) technical areas as shown in Figure 2:

- TA1 - Human Collaboration
- TA2 - Vulnerability Discovery
- TA3 - Voice of the Offense
- TA4 - Control Team
- TA5 - Integration, Test, and Evaluation

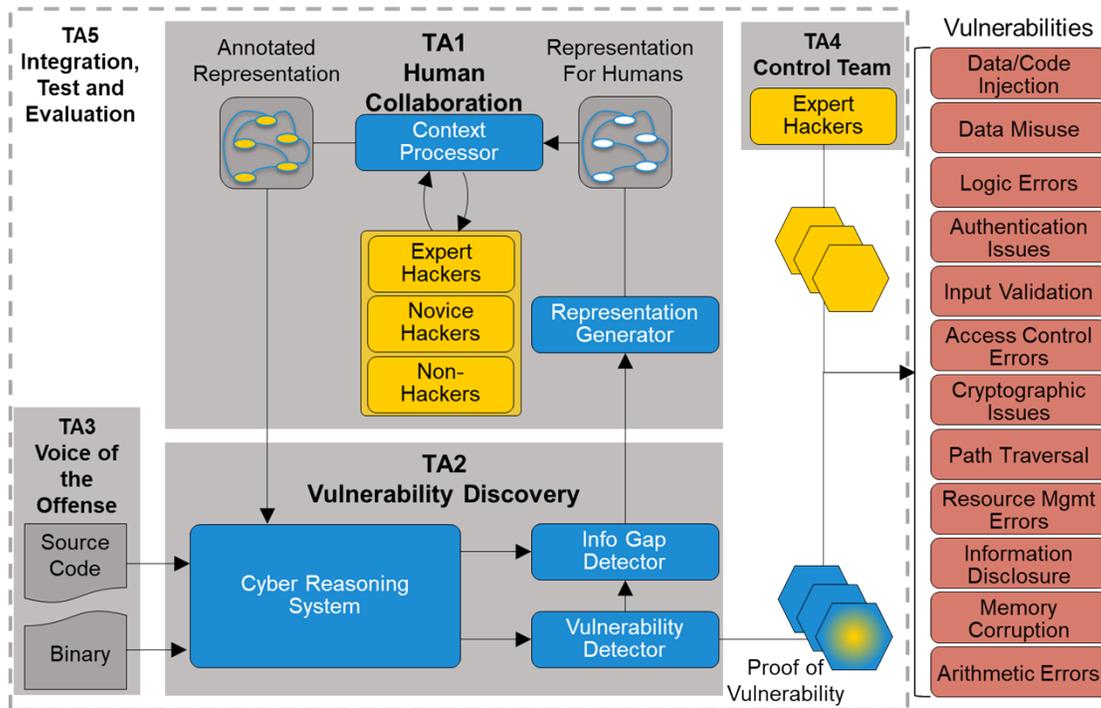


Figure 2: CHES Technical Areas

TA1 performers will focus on capturing and decomposing hacker workflow and all other human-computer interaction (HCI) aspects of the program. TA2 performers will develop technologies for discovery and patching of specified vulnerability classes in both source code and compiled binaries. These vulnerabilities will be synthetic, but representative of vulnerabilities facing the DoD and the U.S. Government. The TA3 performer will create challenges for the evaluations. The TA4 performer will provide a baseline for measuring CHES improvement over the current edge of the art by tackling the TA3 challenges with existing tools and techniques. The TA5 performer will manage evaluations, integration, and transition to government, and commercial partners.

It is anticipated that TA1 and TA5 may both involve human subjects research (HSR). TA1 may need to study the workflow of expert and novice hackers, as well as identify tasks appropriate for non-hackers. TA5 may need to recruit human subjects in each of the three (3) categories of expert, novice, and non-hackers for evaluations (Table 1). Any HSR efforts will require approval by an institutional review board (IRB). TA5 may leverage IRB-approved protocols, data anonymization strategies and other artifacts from TA1, but TA5 will still need separate IRB approval if TA5 recruits human test subjects for evaluation.

TA1 proposals involving HSR should include at least one draft HSR protocol, a plan for IRB approval, and an anonymization strategy for HSR-related data. TA5 proposals involving HSR should include a plan for transitioning and adapting IRB-approved protocols and data anonymization strategies from TA1 for evaluations, as well as a draft plan for IRB approval of TA5's test subject recruitment strategy. TA1 and TA5 should consolidate all HSR work into separate sections of the Statement of Work (SOW) and cost proposal as options. Any HSR involving invasive medical procedures or implantation is out of scope.

The Government anticipates one (1) or more awards for TA1 and TA2, and single awards for TA3, TA4, and TA5. **Each abstract and proposal submitted against this solicitation shall address only one (1) TA.** Organizations may submit multiple abstract/proposals to any one TA, or they may propose to multiple TAs. A proposer submitting a proposal to TA1 and another to TA2 may be selected to perform on both TAs. However, TA3, TA4, and TA5 performers cannot perform on any other TA.

Proposers for TA1, TA2, TA3 or TA4 are not required to hold or obtain security clearances; however, having cleared personnel will be viewed positively. It is preferable (but not required) that the Principal Investigator in each TA1, TA2, TA3, and TA4 proposal be cleared at the final Top Secret level. Academic and small company participation is explicitly encouraged, regardless of possession of a security clearance.

At the time of proposal submission, all proposers submitting proposals under TA5 must have some personnel with a final Top Secret clearance that are eligible for Sensitive Compartmented Information (SCI). It is preferable (but not required) that the Principal Investigator in TA5 proposals be cleared at the SCI level.

TA1 and TA2 performers may elect to build and integrate their tools with the rest of the CHES system such that the performers themselves are not exposed to DoD transition systems. In this case, the research performed by a TA1 or TA2 performer **could** be considered fundamental research. See the CHES Program Controlled Unclassified Information (CUI) guide for further information.² Any proposal for work that requires access to specific information regarding a DoD system will not be considered fundamental research and will require security clearances and secure facilities commensurate with any relevant security classification guides. At a minimum, such research will be considered Controlled Technical Information (CTI) and subject to mandatory pre-publication review. (See also Section II.B).

There are several points of potential collaboration among TAs, and the Government expects that all performers producing software will interact closely with the Integrator/Evaluator (TA5). TA1 and TA2 will interact closely with each other, and with TA5, as TA1 and TA2 develop techniques for information gap identification, insight extraction, and communication to computers. All proposers should read the descriptions of all TAs, as well as the evaluation section (Section I.E), to ensure there is a full understanding of the program context, structure, and anticipated relationships required among performers. To facilitate the open exchange of information, performers will have Associate Contractor Agreement (ACA) language included in their award contract or agreement. TA5 will lead the development of the ACA for the program. See Table 6 for further detail on the collaboration between TAs, and Section VIII.E for more information regarding an ACA.

² <http://www.darpa.mil/work-with-us/opportunities>

Human Collaboration (TA1)

TA1 performers will research how expert hackers discover software vulnerabilities, and develop technologies to enable humans and machines to collaboratively reason over software artifacts (source code, compiled binaries, abstract syntax trees, and any other intermediate format involved in the build process) for the purpose of vulnerability discovery.

Humans have world knowledge and semantic/contextual understanding that is beyond the reach of automated program analysis alone. These information gaps inhibit machine understanding of many classes of software vulnerability. Properly communicated, human insights can fill these information gaps and enable expert hacker-level vulnerability analysis at machine speeds.

TA1 performers will collaborate with TA2 to identify information gaps impeding the vulnerability discovery process. Once identified by TA2, TA1 will generate representations of these gaps with the goal of highlighting them for human collaborators. As the humans reason over these representations, a context processor will capture human insights that may improve the vulnerability discovery process. These insights will be collected and aggregated by a context processor, and then delivered back to TA2.

TA1 performers will also be responsible for decomposing and identifying sub-tasks that are appropriate for expert hackers, novice hackers, and non-hacker human collaborators.

TA1 may involve HSR, and performers will ensure all human subject interactions are documented in an IRB-approved protocol. Proposals that will rely on HSR should segregate those tasks in the TA1 SOW so that the Government can allow them to start on non-HSR tasks prior to receiving IRB approval. This segregation should be reflected in the cost proposal with a cost option that includes all HSR-related tasks. All data derived from human subjects must be anonymized for sharing with other TAs and/or use in future research.

The technologies developed by TA1 performers may use a combination of active and passive techniques for capturing and interacting with human collaborators. These may include, but are not limited to, text-based, graphical user interface (GUI), and non-invasive biofeedback, etc. Any HSR involving invasive medical procedures or implantation is out of scope.

TA1 performers must produce software that is sufficiently mature to preclude lengthy bug finding on the part of TA5 during integration. Proposals should describe approaches for doing so.

TA1 proposals should address the following topics:

1. The vulnerability discovery process is long, complex, and places a heavy cognitive load on expert hackers. Proposers should discuss how TA1 solutions will convert insights from human observations into measurable, succinct, consistent characteristics of successful vulnerability discovery. Proposals should address how these characteristics will support reducing the effort required by expert hackers throughout the vulnerability discovery process.

2. The methods of representing and communicating program analysis data to expert hackers have not changed significantly in 20+ years. Proposers should discuss the strengths and weaknesses of existing representations and provide improvements to these existing representations and/or new representations to substantially accelerate the vulnerability discovery process. Proposals should consider the applicability of state of the art human-computer interaction (HCI) technologies from other domains.
3. The community of expert hackers is small and tight-knit. TA1 proposers should discuss how they will gain sufficient access to enough of these individuals to ensure robust, accurate results.
4. Expert hacker time is expensive and scarce. Proposers should discuss how TA1 solutions will capture/make use of feedback from both expert and novice hackers as well as non-hackers. Proposals should describe approaches that enable novices and non-hackers to take on challenges that currently require expert hackers.
5. Proposers may need to study the workflow of expert and novice hackers as well as identify tasks appropriate for non-hackers. Proposals should discuss how they will address any relevant HSR issues. Proposals relying on HSR should describe the protocols to be followed, how they will obtain IRB approval and an anonymization strategy for any data collected on human subjects.

Vulnerability Discovery (TA2)

TA2 performers will develop techniques and systems to discover vulnerabilities matching the vulnerability classes of interest to CHESS (Table 4). The world knowledge and semantic/contextual information that humans can provide create higher-order models of software behavior that computers cannot currently discern on their own. Once captured, these insights may enable modern program analysis techniques to reason about vulnerabilities at scale and speed appropriate for modern software. Approaches primarily based on fuzzing are out of scope.

A key part of this process is identifying missing, but relevant, information to vulnerability analysis. TA2 will develop techniques to detect information gaps impeding the vulnerability analysis and leverage human-generated insights from TA1 to fill those gaps.

TA2 will collaborate with TA1 to define a common format for communicating identified information gaps to TA2. Both TAs must jointly produce a common data format to exchange information gap queries and insights from humans.

TA2 performers will generate a PoV and patch for each discovered vulnerability. A PoV is an executable that activates and proves the existence of a hidden vulnerability. The vulnerabilities in scope for the CHESS program are only those that enable a remote adversary with minimal or no privileges to compromise a target system. PoVs may span multiple CWEs of interest (Table 4). Patches should be as specific as possible to the identified vulnerability or vulnerabilities while not interfering with the normal CS functionality. All approaches must be able to meet the program objectives for vulnerability class coverage and speed.

TA2 will be provided documentation by TA3 for each vulnerability class and CWE early in each phase, along with an example CS corpus prior to the midpoint of each phase to allow TA2 sufficient time to prepare for evaluation and demonstration.

TA2 performers will produce software that is sufficiently mature to preclude lengthy bug finding on the part of TA5 during integration. Strong proposals will describe approaches for doing so.

TA2 performers may work on source, binary, or both. TA2 is therefore divided into two tasks, the first for working with source, the second with binaries. TA2 proposers should declare one of these tasks as part of the TA2 base proposal. If the proposed approach will address both, the task not declared as part of the base proposal must be proposed as a discrete option.

Approaches based on binary or source code differencing tools that discover TA3-inserted vulnerabilities are out of scope. DARPA will consider a proposal using such an approach as non-responsive to the BAA and will not be evaluated.

The Government prefers focused proposals on a single TA2 task rather than shallow proposals covering both TA2 tasks. Approaches that address both tasks should be structured as distinct and separable tasks in the SOW.

TA2 Task 1: Source-Assisted Vulnerability Discovery

TA2 Task 1 performers will be allowed access to the source code and all related build artifacts of each CS for analysis.

TA2 Task 1 proposals should address the following:

1. There is currently a wide variety of source code analysis tools available for general use. Proposers should discuss the applicability or lack thereof of these tools and the underlying techniques. Proposals should identify and discuss semantic and/or contextual information gaps in proposed techniques that human collaborators can assist with and what level of expertise (expert hacker, novice hacker or non-hacker) is required to address each gap.
2. While TA2 Task 1 performers will have access to source code for challenges, proposers should discuss how they could make use of the software artifacts involved in the build process, up to and including the compiled binary. While use of Requests for Comments (RFC) and other public documentation are also in scope for this task, proposals should use the source and build artifacts as the primary source of knowledge, and leverage human-provided insights to address identified information gaps.
3. Many generic software protections exist that make exploitation of vulnerabilities more challenging, but do not fix the underlying vulnerabilities. Generated patches should address detected vulnerabilities completely and specifically without interfering with normal program behavior. Proposals should also minimize modifications to software

behavior and testbed resource usage. Approaches that make exploitation more challenging but do not fix the underlying vulnerability are out of scope.

4. TA2 Task 1 proposers should discuss which source code language(s) of interest to CHES their techniques will address. (Table 2) Proposals should consider techniques that are source code language agnostic.

TA2 Task 2: Binary Vulnerability Discovery

TA2 Task 2 performers will not be allowed access to source code for the CS corpus. Each CS will include a compiled binary.

TA2 Task 2 proposals should address the following topics:

1. There are a wide variety of binary analysis tools available for general use. Proposers should discuss the applicability or lack thereof of these tools and their underlying techniques. Proposals should identify semantic/contextual information gaps that proposed techniques will address, and discuss how non-hackers, novices, or experts could assist with any gaps beyond the proposed techniques.
2. TA2 Task 2 performers will not have access to source code for challenges but may be allowed access to debug symbols for some challenges. Use of RFCs and other public documentation are also in scope for this task. Proposers should discuss the potential value of these artifacts. Proposals should use the binary as the primary source of knowledge and leverage human-provided insights to address identified information gaps.
3. Many generic software protections exist that make exploitation of vulnerabilities more challenging but do not fix the underlying vulnerabilities. Generated patches should address detected vulnerabilities completely and specifically without interfering with normal program behavior. Proposals should also minimize modifications to software behavior and testbed resource usage. Approaches that make exploitation more challenging but do not fix the underlying vulnerability are out of scope.
4. TA2 Task 2 proposers should discuss which operating systems and platforms of interest to CHES (Table 3) their techniques will address. Proposals should consider techniques that are operating system or platform agnostic.

Voice of the Offense (TA3)

The TA3 performer will research and produce Challenge Set (CS) corpora representative of the vulnerability classes of interest to CHES (Table 4) to challenge the effectiveness of the vulnerability discovery and mitigation techniques developed by TA1 and TA2. TA3 will also produce PoV specifications describing the features and scope of each vulnerability class and CWE of interest to the CHES program.

Each CS is comprised of the following components:

- **Challenge Executable (CE)**

A CE can be either a network service that accepts remote network connections, or client meant to connect to arbitrary servers and perform processing on network-supplied data, and interact with remote hosts over network connections. CEs will be used as analysis challenges for the vulnerability discovery and mitigation techniques developed by TA1 and TA2. Each CE will be implemented performing tasks emulating real world software; examples include but are not limited to file transfer, remote procedure call, remote login, peer-to-peer (P2P) networking. Each CE will contain at least one vulnerability hidden in the program and reachable via network input. Vulnerabilities should cover the classes and CWEs listed in Table 4 and the compilation targets listed in Table 3. Non-compiled source code languages of interest (Table 2) should have an equivalent portable executable, or containerized configuration, such that running the CE is straight forward. (e.g., Javascript shell, frozen Python binary, Docker container, etc.)

- **Challenge Source Code (CSrc)**

The source code for the CEs, which will also be used as analysis challenges for the source-assisted vulnerability discovery and mitigation techniques developed by TA1 and TA2. Intentionally inserted vulnerabilities should be well commented and documented for TA5 review. Each CSrc should include an accompanying script for straight forward automated removal of these comments before delivery for an evaluation.

- **Reference Patched Binary (RPB)**

The patched CE delivered in each CS will function identically to the unpatched CE, but will not contain known, hidden vulnerabilities. This Reference Patched Binary should take realistic actions when encountering malicious/irregular inputs like those in PoVs or the RPoV. A realistic action might be continuing to process an input or releasing program resources and exiting. Any actions that require prior knowledge of the known, hidden vulnerabilities are out of scope.

- **Reference Proof of Vulnerability (RPoV)**

A Reference Proof of Vulnerability (RPoV) is an executable that activates and proves the existence of a hidden vulnerability in each CE. For CEs with multiple, hidden vulnerabilities, a separate RPoV must be delivered for each vulnerability.

- **Service Poller (SP)**

A Service Poller (SP) will implement a functionality test suite to detect whether the baseline function or performance of the corresponding CE has been impaired. A successfully patched CE will cause the corresponding SP to report no errors. Each SP should generate repeatable queries when provided with a random seed value and queries generated by different seed values should be highly diverse. Over a large number of randomly seeded network tests, SPs should be capable of exercising a majority of expressed CE code.

Each CS should be designed such that it does not function outside the CHESSTEST environment developed by TA5. Although TA3 proposers may propose to survey existing vulnerabilities found in the wild in order to inform TA3 efforts, searching for exploitable

vulnerabilities in deployed systems is out of scope. Independent verification and validation (IV&V), red teaming, and penetration testing approaches are also out of scope.

Many of the vulnerabilities of interest to the CHES program lack standardized, computer-generated oracles (e.g., signals, exceptions, interrupts). This is one of the challenges TA2 performers must overcome in TA2 development of novel techniques to detect these vulnerabilities, and as such, is not in scope for TA3. However, to ensure alignment between TA3 CSs and TA2 vulnerability detection techniques, TA3 will provide TA2 with a PoV specification for each of these CWEs. The PoV specification will inform TA2 on the features, constraints, and scoping of each CWE.

The TA3 performer will also provide TA2 performers with an example CS corpus covering vulnerability classes/CWEs in scope for each phase of the CHES program.

TA3 proposals should address the following topics:

1. The target vulnerability classes (Table 4) cover a wide range of CWEs, some of which are less common than others. TA3 proposers should discuss how they will ensure effective coverage of all vulnerability classes of interest and provide appropriate justification if certain classes receive more attention than others.
2. The role of TA3 in measuring and pushing the progress of the CHES system requires that the TA3 evaluation CS corpus is representative of vulnerabilities in realistically large, complex codebases. TA3 proposers should discuss how they will address this scaling issue across all phases of the CHES program.
3. The TA3 performer may construct each CS from scratch, or may modify existing software and firmware as part of CS development. However, when a new CS contains code reused from existing open source programs or previous challenge programs, TA1 and TA2 teams may be able to find vulnerabilities simply by looking for differences between the new code and the old, instead of employing novel techniques and tools. Proposals should describe a method for avoiding or mitigating this problem.
4. While introducing vulnerabilities into existing software is in scope, each TA3 CS must be constructed or modified so that they only run in the testbed environment developed by TA5. TA3 proposals should discuss approaches for limiting execution to the TA5 testbed.
5. To ensure sufficient realism, the evaluation CS corpus should contain some vulnerabilities that require leveraging the effects of multiple CWEs in concert. TA3 proposers should discuss how they will select the CWEs for these combined vulnerabilities, and develop the necessary CSs and PoV specifications.
6. TA3 proposers should discuss how they will ensure effective coverage of CS functionality and how the SP will identify any interference caused by TA2 patches.
7. TA3 proposers must provide an example CS corpus and documentation at least 6 months

prior to each evaluation. (Figure 4) This corpus must to provide other TAs with working CS examples covering vulnerability classes in scope for each phase. These should illustrate baseline CE performance, how the CE behaves when successfully exploited via the RPoV and how the RPB behaves when presented with the RPoV or SP.

Control Team (TA4)

The TA4 performer will create an expert hacker performance baseline against TA3 evaluation CS corpus. The TA4 performer will not be allowed to use any of the research technologies that TA1 and TA2 produce. The TA4 performer will instead research and leverage the current edge of the art outside of the CHES program, and decide which of these tools to use against the evaluation CS corpus and produce PoVs for each set. The results of the TA4 evaluations will serve as a baseline for measuring improvements in performance attributable to TA1 and TA2.

TA4 proposals should address the following topics:

1. Many tools and techniques exist for analyzing software for vulnerabilities. TA4 proposers should discuss how they will ensure maximal coverage of emerging tools and techniques. Strong proposals will produce detailed and methodical analyses of the strengths and weaknesses of each technique and tool considered against each specific challenge. An initial Edge of the Art report on the performer's research will be due to DARPA five (5) months after kickoff. Thereafter, the TA4 performer will be expected to provide an updated Edge of the Art report delivered 6 months prior to each evaluation and at the beginning of Phase 2 and Phase 3. (Figure 4)
2. The TA4 performer will perform against the CS corpus with and without source code. TA4 proposers should discuss how they will approach analysis of the CS corpus in both cases.
3. The CWE categories in scope for this program encompass a wide array of vulnerabilities, some without real world examples. TA4 proposers should demonstrate a deep and broad understanding of the edge of the art in vulnerability research, program analysis and reverse engineering.
4. The TA4 performer will provide detailed feedback on their experience reasoning over the CS corpus after each evaluation. This report should be sufficiently detailed so as to capture all attempted analysis tasks, both successful and unsuccessful. This report will be shared with other performers after each evaluation to help characterize how expert hackers reason over and find software vulnerabilities.

Integration, Test, and Evaluation (TA5)

The TA5 performer will handle integration of technology produced by TA1 and TA2, evaluation of the integrated CHES system against the TA3 evaluation CS corpus, evaluation of TA4's performance against the TA3 evaluation CS corpus and transition efforts to Government and commercial partners. TA5 will also be responsible for leading the development of the required Associate Contractor Agreement (ACA), in close collaboration with all other performers.

Evaluation:

The TA5 performer will be responsible for evaluating the performance of TA1 and TA2 systems using the CHES program metrics described in Section I.E (Table 5) and integrating TA1 and TA2 systems into source-assisted and binary subsystems. TA5 proposals should discuss additional, objective metrics for determining the vulnerability discovery improvements of the overall CHES system. These metrics should account for and scale representative software characteristics, including but not limited to the number of source lines of code, system calls, multiple threads, and multiple processes.

Human-Subjects Research (HSR):

TA5 may involve HSR during evaluations, as TA1 techniques may require human collaborators for evaluation. TA5 may need to recruit human subjects in each of the three (3) categories of expert, novice, and non-hackers (Table 1). TA5 may leverage IRB-approved protocols, data anonymization strategies and other artifacts from TA1, but will still need separate IRB approval for TA5 recruitment of human test subjects for evaluation. TA5 proposals involving HSR should include a plan for transitioning and adapting IRB-approved protocols and data anonymization strategies from TA1 for evaluations, as well as a draft plan for IRB approval of TA5 test subject recruitment strategy.

The technologies evaluated by TA5 performers may use a combination of active and passive techniques for capturing and interacting with human collaborators. These may include but are not limited to text-based, graphical user interface (GUI), non-invasive biofeedback, etc. HSR involving invasive medical procedures or implantation is out of scope and will not be part of the evaluations.

TA5 proposals should segregate HSR-related tasks in the TA5 SOW so that the Government can allow them to start on non-HSR tasks prior to receiving IRB approval. This segregation should be reflected in the cost proposal with a cost option that includes all HSR-related tasks. All data derived from human subjects must be anonymized for sharing with other TAs and/or use in future research.

Integration Frameworks:

TA5 must propose a simple integration framework for each target platform (Table 3) that can be provided (with initial functionality) to CHES performers within four (4) months after kickoff. TA5 should augment and expand this framework for the duration of the effort to facilitate automated regression testing and evaluation. The TA5 performer will be responsible for coordinating the development of interface specifications and overall system design with TA1 and TA2. TA5 should expect containerized software from TA1 and TA2 that interfaces via a common data format.

The integration framework should be able to isolate source-assisted and binary analysis techniques from TA2 into separate workflows for evaluation. TA5 will manage the integration process with the assumption that TA1 and TA2 performers will produce software that is sufficiently mature to preclude lengthy bug finding on the part of TA5. The framework should be tested in an automated fashion after each code delivery from TA1 and TA2 delivery on the aforementioned simple surrogate system of TA5's devising to prevent regressions.

Testbed Environment:

TA5 must propose a testbed environment for evaluation of the CS corpus developed by TA3. This testbed should include instrumentation for evaluations, automated deployment of challenges sets, and testing of PoVs and patches from other performers. The testbed environment should also isolate the running CS from any production networks. TA5 will coordinate the development of common data formats and interfaces for the testbed with all other TAs. TA5 will provide specifications for the interfaces and formats to all other TAs at least six (6) months prior to each evaluation.

Over the three phases of the CHES program, the TA5 performer will lead eight (8) hackathons, four (4) demonstrations, and three (3) evaluations as described in Figure 3. The TA5 performer will submit plans for these events as described in Section I.E to the Government team at least two months prior to each event.

TA5 proposals should address the following topics:

1. The tools and techniques produced by the research TAs should be integrated into a single framework for each target platform (Table 3) with an installation guide and a usage guide. TA5 proposers should discuss their approach to the development of the integrated CHES framework, and how they will ensure interoperability with TA1 and TA2 software. The most current, stable version of the TA5 framework should be delivered to the Government at the end of each phase of the program. Proposals should deliver this integrated framework in a common installation package (.msi, .deb, etc.), Docker container or similar format.

2. The TA5 performer must provide a testbed environment for each target platform (Table 3). These testbeds should provide appropriate instrumentation for evaluation of the TA3 CS corpus and compatibility with the integrated CHES system. The testbeds should also provide sufficient isolation that any CS cannot influence or run on commercial or open source software platforms.
3. The TA5 performer must research the designated vulnerability classes (Table 4) and assess each TA1 and TA2 performer's coverage of those classes, both in terms of TA1 and TA2's current technical progress, and in terms of what TA1 and TA2 would likely cover if they ultimately met all of their technical goals. Relevant staff from the TA5 performer must accompany DARPA representatives on visits to the other TA1 and TA2 performer sites, and study TA1 and TA2 technical approaches.
4. To properly evaluate the technologies and techniques produced by the research TAs, human subjects will be required. TA5 proposers should discuss how they plan to provide human test subjects that fulfill the necessary criteria for the "expert hacker," "novice hacker," and "non-hacker" groups (Table 1). TA5 proposers should discuss how they will address any HSR issues. Proposals should include at least one draft experiment protocol, a plan for IRB approval, and an anonymization strategy for any data collected on human subjects.
5. To jumpstart research and development efforts and collaboration across all performers and TAs, a single kickoff meeting will be held at the onset of the CHES program. The kickoff meeting will focus on open technical exchange, discussion of the research problems encompassed by the CHES program, and how effective cross-discipline collaboration may address these research problems. TA5 proposers should discuss how they will facilitate these events, including the acquisition and provisioning of appropriate event facilities and resources. (See Section I.F for further detail).
6. To encourage innovative research and prevent duplicate effort, eight (8) hackathons involving participants from TA1, TA2, TA3, and TA5 will be held throughout the program. All TA1, TA2, TA3, and TA5 performers are expected to attend the entirety of all hackathons. TA5 proposers should discuss how they will facilitate these events, including the acquisition and provisioning of appropriate event facilities and resources. (See Section I.F for further detail).
7. To engage and solicit feedback from potential transition partners, the TA5 performer will be responsible for facilitating four (4) demonstrations involving the integrated CHES framework. To measure the progress of the CHES system, the TA5 performer will organize three (3) evaluation events, which will occur at the end of each phase. These evaluation events will involve representatives from each performer as well as human subjects. TA5 proposers should discuss how they will facilitate these events, including the acquisition and provisioning of appropriate event facilities and resources. (See Section I.F for further detail).

8. To encourage collaboration between CHES performers, all performers producing software will regularly commit to a common shared, version-controlled source code repository administered by TA5. TA5 will ensure appropriate access control between performers that enable sharing when necessary and preclude inappropriate information exchange when deemed necessary by DARPA.

TA5 proposers should submit a base proposal assuming one performer in each of the first two technical areas (TAs 1-2), and two additional cost options. The additional costs should cover: the incremental cost of an additional performer in TA1, and the incremental cost of an additional performer for TA2. The Government will determine the total contract value to award during contract negotiations based on the selection of performers for awards and the nature of their proposed efforts. TA5 proposals should also include an option scoped for 1-2 full-time equivalents (FTEs) to begin performance at the end of the 42 month program period of performance and continue for an additional 18 months to assist in supporting CHES transition.

E. Evaluation

The CHES program Integrator/Evaluator (TA5) will provide engineering input to the Government team in the development of evaluations to provide feedback to the TA1 and TA2 performers. These evaluations will take place in an isolated testbed environment hosting the CS corpus developed by TA3 to characterize the capabilities TA1 and TA2 performers produce. TA4 will analyze this same CS corpus to provide a baseline for expert hacker performance to measure the CHES system against.

DARPA will assess individual performer effort in terms of the viability of their technical approaches, the trend in the performance of their systems over time, and their overall progress toward CHES program objectives. Proposers are encouraged to provide additional metrics, as appropriate for their technical approach and methodology.

Phase Duration	Phase 1 18 months	Phase 2 12 months	Phase 3 12 months
Vulnerability Discovery Speed	As fast as control	10x faster than control	100x faster than control
Vulnerability Discovery Accuracy with Source Code	70%	85%	99%
Vulnerability Discovery Accuracy without Source Code	50%	75%	99%
Software Complexity	Small Software Library (Low)	Whole Software Package (Moderate)	Web Browser (High)

Table 5: CHES System Metrics

Vulnerability Discovery Speed will measure the vulnerabilities found in the evaluation CS corpus per unit of expert hacker collaborator time. TA4 will act as the control for this metric. Novice and non-hacker time will not factor directly into this metric.

Vulnerability Discovery Accuracy will measure how many known vulnerabilities in the evaluation CS corpus are discovered versus total known vulnerabilities in the evaluation CS corpus. Vulnerabilities found by the CHES system during evaluation that were unintentionally introduced by TA3 will count toward both discovered and total known vulnerabilities. TA1 and TA2 capabilities that do not leverage CS source code are allowed lower accuracy in Phase 1 and Phase 2 than capabilities that do leverage CS source code. All capabilities have the same, near complete accuracy target for Phase 3.

Software Complexity is a compound metric incorporating characteristics of large, real-world, complex software packages. These characteristics will include but are not limited to the number of source lines of code, system calls, multiple threads, and multiple processes. TA5 will lead development of this metric and provide a detailed explanation of it to all TAs within four (4) months after kickoff.

DARPA expects all performers producing software to follow an agile software development process. Initial code drops should consist of largely stubbed-out, end-to-end systems, with capabilities added and refined incrementally over the period of performance. Code drops (delivered every two months) shall include all source code, build scripts, test harnesses, development environments, unit tests, and system tests that TA5 can readily use for integration (e.g., a Vagrant or Docker container).

Additionally, all performers producing software will regularly commit to a common shared, version-controlled source code repository administered by TA5. TA5 will ensure appropriate segmentation between performers when deemed necessary by DARPA. Individual commits and commit history will not be reviewed by DARPA, except for those tagged for review by TA5. See Table 6 for more information regarding required collaboration between performers for integration.

TA1 & TA2:

All TA1 and TA2 proposals must describe a set of metrics specific to the proposed approach. In the first weeks of the program, each TA1 and TA2 performer will collaborate with TA5 to produce a document defining the metrics for measuring TA1 and TA2 performance in addition to those in Table 5. Each phase will increase the number of classes addressed, as well as the complexity of the CS corpus. Insight capture and processing strategies must scale appropriately for each phase. This document is due four (4) months after kickoff for Phase 1, with an updated version delivered in the second month of Phase 2 and Phase 3.

TA5:

The Integrator/Evaluator (TA5) will develop objective metrics for determining the vulnerability discovery improvements of the overall CHES system in addition to those in Table 5. These metrics should account for and scale representative software characteristics including but not limited to the number of source lines of code, system calls, multiple threads, and multiple processes. These metrics are due four (4) months after kickoff and will be shared with all performers.

The Integrator/Evaluator (TA5) will develop and conduct largely automated testing on a monthly basis to verify that each system builds and executes its tests properly. Each performer developing software will receive build and regression reports to assist their development efforts. Over the course of each phase, TA5 will build out additional test cases for each system, to augment performer-provided and TA3-developed tests.

Collaboration:

Close collaboration is expected on this effort. Proposers of TA1 and TA2 will have to work closely to coordinate common data formats and interfaces for information gaps and human-generated insights. TA3 will have to work closely with TA2 and TA5 to produce a CS corpus appropriate for newly proposed techniques. TA4 will share HCI data from CS evaluations with TA1.

A more detailed table is provided below to call attention to a subset of the expected touch-points between performers. An understanding of the metrics used to evaluate every TA will help inform the responsibilities and dependencies between performers.

TA	Required Collaboration
TA1	<p>With TA2: Collaboratively identify sources of human insight that may be valuable to TA2 analysis, and assist TA2 with how human collaborators may factor into the program analysis and vulnerability discovery workflow. Establish common data formats and interfaces for receiving information gaps and sending captured human insights. TA1 will use IRB-approved anonymization protocols on any HSR-derived data before sharing with TA2.</p> <p>With TA4: Engage TA4 expert hackers after each evaluation to determine differences between the CHES system and the edge of the art, and ultimately improve the CHES system during subsequent development. Capture HCI data from CS evaluations. This may require some instrumentation based on TA1-developed tools and techniques, which should be provided by TA1 to TA4 along with IRB-approved anonymization protocols.</p> <p>With TA5: Coordinate common data formats and interfaces for integration framework development and evaluation. Establish human collaborator requirements prior to evaluations. Provide TA5 with supplementary metrics data.</p>

TA	Required Collaboration
TA2	<p>With TA1: Collaborate and advise TA1 throughout their decomposition of the vulnerability discovery process. Provide feedback based on proposed and prototype TA1 techniques and tools. Establish common data formats and interfaces for communicating information gaps and receiving captured human insights.</p> <p>With TA5: Coordinate common data formats and interfaces for integration framework development and evaluation. Coordinate common data formats and interfaces for PoVs and patches. Provide TA5 with supplementary metrics data as needed.</p>
TA3	<p>With TA2 & TA4: Coordinate common data formats for the CS corpora, PoVs, patches and any other deliverables needed for accurate CS deployment and analysis. Provide a PoV specification for each vulnerability class/CWE in scope for each phase of the CHESS program. Provide working CS examples for each new PoV specification.</p> <p>With TA5: Coordinate common data formats and interfaces for CS integration into the testbed environment, testing PoVs, patches, and Service Pollers. Assist with integration framework and testbed environment design to ensure CS compatibility.</p>
TA4	<p>With TA1: Share HCI data from CS evaluations. This may require some instrumentation based on TA1-developed tools and techniques, which should be provided by TA1 to TA4.</p> <p>With TA2 & TA3: Provide detailed feedback on CS analysis and solutions, especially for any CS, PoV or patch where CHESS system and TA4 performance diverge.</p> <p>With TA5: Provide regular updates to the Edge of the Art report. Provide detailed feedback on evaluations.</p>
TA5	<p>With TA1: Coordinate common data formats and interfaces for integration framework development and evaluation. Establish human collaborator requirements prior to evaluations. Develop and deliver detailed evaluation metrics for each phase. Use IRB-approved anonymization protocols on any HSR-derived data prior to sharing with TA1.</p> <p>With TA2: Coordinate common data formats and interfaces for integration framework development and evaluation. Coordinate common data formats and interfaces for PoVs and patches. Develop and deliver detailed evaluation metrics for each phase.</p>

TA	Required Collaboration
TA5 cont.	<p>With TA3: Coordinate common data formats and interfaces for CS integration into the testbed environment, testing PoVs, patches and Service Pollers. Coordinate design and development of the integration framework and testbed environment design to ensure CS compatibility.</p> <p>With TA4: Develop and deliver detailed evaluation metrics for each phase.</p> <p>With all TAs: Coordinate common data formats and interfaces for the integration framework and testbed environment. Deliver specifications and usage documents for all integration and evaluation artifacts, systems and processes. Maintain a common shared, version-controlled source code repository and Wiki for all performers to use. These shared resource may require some access controls based on CTI/CUI.</p>

Table 6: TA Collaboration

F. Schedule and Milestones

DARPA anticipates a November 2018 start date for the CHESSE program. The program will run for 42 months and will comprise three (3) phases. Phase 1 will be 18 months and include one kickoff meeting, four (4) hackathons, two (2) demonstrations and one evaluation. Phases 2 and 3 will be 12 months each and include two (2) hackathons, one demonstration, and one evaluation as shown in Figure 3 below. Hackathons and evaluations will also serve as PI meetings. During these events, DARPA will assess progress toward solution via performer briefings, technical discussions, demonstrations, and end of phase evaluations based on the target goals of each phase. See Figure 5, Figure 6, and Figure 7 for detailed per-phase event and key deliverable schedules.

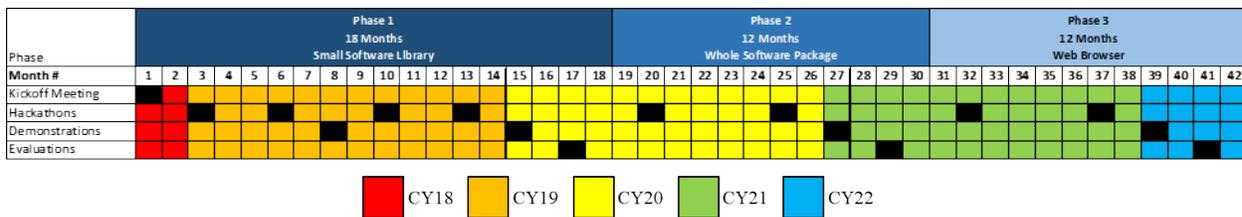


Figure 3: CHESSE Event Schedule

Kickoff Meeting:

The kickoff meeting will jumpstart research and development efforts and collaboration across all performers and TAs. The kickoff meeting will focus on open technical exchange, discussion of the research problems encompassed by the CHESSE program, and how effective cross-discipline collaboration may address these research problems. The kickoff meeting will take place in Arlington, VA, run for 2.5 days, and include a majority of each team’s personnel.

Hackathons:

Hackathons will start at three (3) months, to accelerate research and development efforts and collaboration across performers and TAs. Hackathons will focus on open, technical exchange that includes discussion of difficulties encountered and possible solutions. The goals of the hackathons will be to: (a) review and share innovations/accomplishments of the program; (b) review and discuss plans and options for technology demonstrations and prototypes; (c) review and discuss results from meetings and events conducted prior to the tests and evaluations; (d) demonstrate prototypes; and (e) plan for the following evaluation.

The Government will specify the location for the hackathons. For budgeting purposes, assume the hackathons will alternate between San Francisco, CA and Boston, MA, run for 3.5 days, and include a majority of each TA1, TA2, TA3, and TA5 team's personnel.

Demonstrations:

Demonstrations will start at eight (8) months and provide the Government team a chance to see the CHES system operating against a target system that may be partially or wholly simulated. These target systems will be known to performers with clearances, and accessible for testing and development purposes prior to the demonstration. Each demonstration will last 1.5 days and will include representatives from TA5, the Government team, and transition system stakeholders. Demonstrations will also include a presentation produced by TA5 summarizing the results of the most recent CHES hackathon and development roadmap leading to the next evaluation.

Initial demonstrations may be paper-based. In these events, the focus will gradually shift to the utility of the CHES subsystems in the hands of operators. DARPA will arrange to have transition partner subject matter experts (SMEs) participate in each of these events to help performers understand the domain (e.g., industrial control system, avionic subsystem, etc.) in sufficient detail. These SMEs will execute non-disclosure agreements (NDAs) with CHES performers as needed.

The Government will specify the location for the demonstrations. For budgeting purposes, proposers should assume that all demonstrations will take place in the Washington, D.C. metro area, will run for 1.5 days, and include 1-2 representatives from each performer.

Evaluations:

Evaluations will test the integrated CHES system against a CS corpus of increasing scale and realism. A limited test window will approximate the application of CHES to a new transition system, with less information on the target available to performers a priori. TA5, with guidance from TA3, will provide vulnerability classes in scope for each evaluation six (6) months prior to each evaluation. Evaluations should be designed to minimize the impact of outlier human collaborators and provide accurate measurements of the CHES system.

The TA5 performer will design and run the evaluations, provide appropriate human test subjects for use with the CHES system, as well as anonymized sets of any resulting data. These human

subjects will execute NDAs with CHESSE performers as needed. The TA5 performer will deliver a final report on the results of each evaluation.

The Government will specify the location for the evaluations. For budgeting purposes, assume the evaluations will be held in the Washington, D.C. metro area, will run for 3.5 days and include a majority of all TA1, TA2, TA3, TA4, and TA5 team's personnel.

Teleconferences:

All performers will schedule bi-weekly teleconferences with the CHESSE team to provide status updates, identify and address any issues with CHESSE tasking or scheduling, and ensure that all performers are collaborating effectively. For budgeting purposes, assume these teleconferences will last 15 minutes each and involve key technical personnel from each performer.

In addition to the bi-weekly teleconferences, regular meetings are encouraged to enhance communication 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 and teleconferences.

Proposals should include a detailed schedule that is consistent with the proposer's technical plan and the risk reduction required for their concepts, as well as their program plan. These schedules will be synchronized across performers, as required, and monitored and revised as necessary, throughout the program's period of performance. A start date of November 1, 2018, should be assumed for budgeting purposes. Subject to the availability of funding, the program is intended to last for 42 months.

G. Deliverables to DARPA

All FAR-based contract performers will be required to provide, at a minimum, the following deliverables:

- Any technical papers derived from work funded by CHESSE
- Commented source code, any other necessary data and documentation (including at minimum user manuals and a detailed software design document) for all software developed under this program
- For all performers developing software (TA1, TA2, TA3), code/data drops will be provided to the Integrator/Evaluator (TA5) every two months, to include all source code, build scripts, test harnesses, development environments, unit tests and system tests
- For all performers developing software (TA1, TA2, TA3), in the first two (2) months of each phase, a document defining metrics for testing and evaluation and discussing a concept of operations for conducting evaluations of any software that requires user interaction, to be produced in collaboration with the Integrator/Evaluator (TA5)

TA2:

Documentation for each vulnerability discovery technique, related information gaps that must be addressed, and potential insights that human collaborators may be able to provide. This will be shared with TA1 and TA5 performers to direct insight capture strategies and evaluation framework development.

TA3:

Documentation describing the PoV specifications for each vulnerability class in scope will be delivered five (5) months after kickoff and in the first four (4) months of Phase 2 and Phase 3. This will be shared with TA1, TA2, TA4, and TA5 performers to ensure the techniques developed by TA1 and TA2 and that TA5's evaluation framework are appropriate for the CS corpus.

TA3 will also provide all other TAs with an example CS corpus for vulnerability classes appropriate for each phase at least six (6) months before each evaluation. These examples will include source code, compiled binaries, a working PoV and automated tests to check for patch non-interference in CS functionality. See Section I.D for further CS details.

The evaluation CS corpus will be delivered to TA5 in month 14, 28, and 40 of the CHES program. This will ensure sufficient time for integration and testing before evaluations.

TA4:

Edge of the Art report on vulnerability discovery in the classes of interest to CHES will be delivered five (5) months after kickoff, with updated reports delivered six (6) months before each evaluation and at the beginning of Phase 2 and Phase 3.

A detailed report on the Control Team's evaluation strategies and performance will be delivered no less than one month after each evaluation event.

TA5:

Based on consultation with performers, DARPA will decide which vulnerability classes (Table 4) are in scope during the first month of each phase of the CHES program. (Figure 3, Figure 4) TA5 must then develop and deliver additional metrics for TA1 and TA2 that account for and scale representative software characteristics including but not limited to the number of source lines of code, system calls, multiple threads, and multiple processes. These metrics will be delivered to the Government and all performers four (4) months after kickoff and in the second month of Phase 2 and Phase 3.

An integration specification describing initial data formats and interfaces for the integration framework, delivered within two (2) months after kickoff. TA5 should augment and expand this specification over the duration of the effort to facilitate automated regression testing and

evaluation. The TA5 performer will be responsible for coordinating the development of interface specifications with TA1 and TA2.

An integration framework for each target platform (Table 2, Table 3) that can be provided (with initial functionality) to CHESS performers four (4) months after kickoff. TA5 should augment and expand this framework over the duration of the effort to facilitate automated regression testing and evaluation. The TA5 performer will be responsible for coordinating overall system design with TA1 and TA2. TA5 should expect containerized software from TA1 and TA2 that interfaces via a common data format.

An installation and usage guide for the integrated CHESS system. TA5 will deliver the initial guide prior to the first Phase 1 demonstration and deliver an updated guide prior to each subsequent demonstration and evaluation.

A testbed specification describing initial data formats and interfaces for the testbed environment, delivered within five (5) months after kickoff. TA5 should augment and expand this specification over the duration of the effort to facilitate automated regression testing and evaluation. The TA5 performer will be responsible for coordinating the development of interface specifications with all other TAs. TA5 will provide a final specification for the interfaces and formats to all other TAs at least six (6) months prior to each evaluation.

A testbed environment for evaluation of the TA3 CS corpus. This testbed should include instrumentation for evaluations, automated CS deployment and testing of PoVs and patches from other performers. The testbed environment should also isolate each running CS from any production networks. TA5 will deliver complete testbed environments at least six (6) months before the Phase 1 evaluation and five (5) months before the Phase 2 and Phase 3 evaluations.

An installation and usage guide for each CHESS testbed environment. TA5 will deliver the initial guides prior to the second Phase 1 demonstration and deliver an updated guide prior to each subsequent demonstration and evaluation.

Monthly build and regression reports for the integration framework, testbed environment, and integrated CHESS system with the initial delivery within five (5) months after kickoff.

A detailed Controlled Unclassified Information (CUI) plan for providing feedback to other performers regarding the performance of their systems without divulging any CTI or classified information. This plan must describe procedures for abstracting system failures and constructing test cases that replicate these failures without recourse to data or information specific to the military platform under test. The TA5 performer must submit this plan to DARPA no less than 90 days prior to commencing work on a militarily relevant platform, to allow sufficient time for discussion with the Government team and the completion of any necessary revisions.

An access-controlled program Wiki and source code version control repository to facilitate collaboration and information sharing amongst CHESS performers. These resources should be made available to the CHESS performers within the first two (2) months after kickoff and actively maintained throughout the CHESS program.

A recruitment plan for human collaborators for evaluation and any related tasking involving human subjects will be delivered at least 30 days before recruitment efforts begin. This will include an IRB-approved protocol, proof of IRB approval and DoD headquarters level review, a data anonymization plan, and a copy of any document (releases, NDAs, etc.) requiring the human subject's signature.

Any HSR data resulting from evaluations, anonymized per the IRB-approved protocol, will be delivered within 30 days of evaluation completion. This data may be shared with all other performers.

While the Government will decide on the date and location of all events (hackathons, demonstrations, and evaluations), detailed plans for these events will be delivered to the Government at least two (2) months prior to each event. See Section E for further detail.

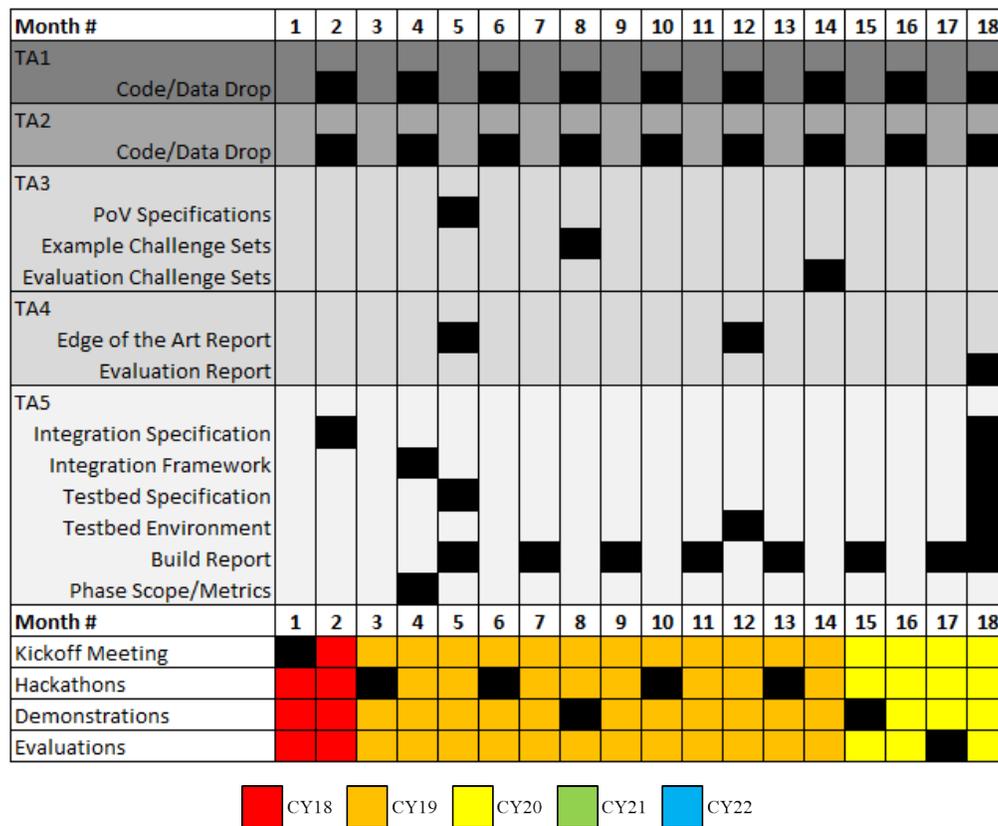


Figure 5: CHES Phase 1 Schedule

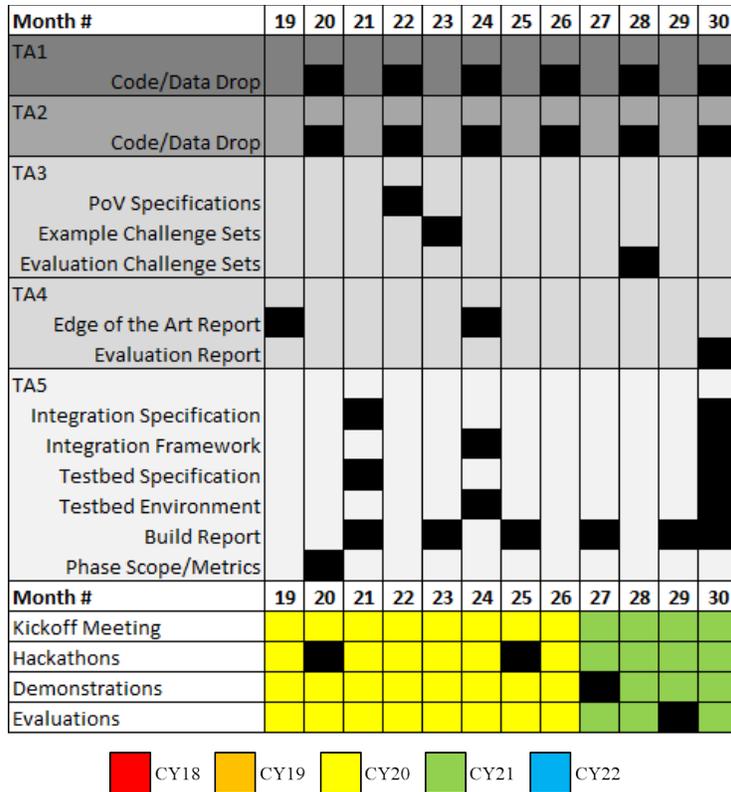


Figure 6: CHES Phase 2 Schedule

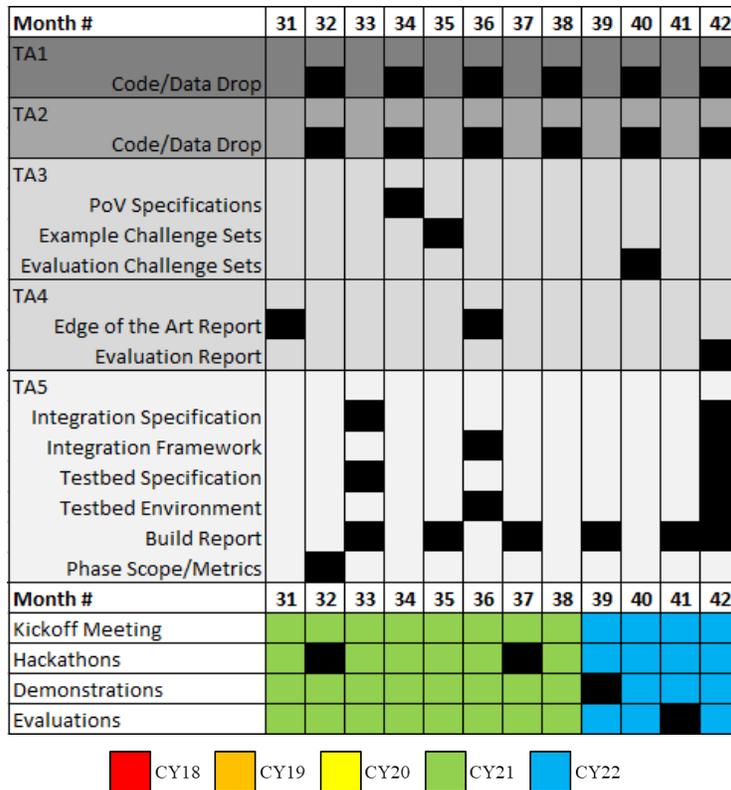


Figure 7: CHES Phase 3 Schedule

H. Intellectual Property

A key goal of the program is to establish an open, standards-based, plug-and-play architecture that allows for interoperability and integration across diverse target systems. This includes the ability to easily add, remove, substitute, and modify software and hardware components. This will facilitate rapid innovation by providing a base for future users or developers of program technologies and deliverables. Therefore, it is desired that all software (including source code), associated 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. See Section VI.B.1 for more details on intellectual property.

I. Glossary

ACA	Associate Contractor Agreement
CE	Challenge Executable
CHC	Computer-human collaboration
COTS	Commercial off-the-shelf
CS	Challenge Set
CSrc	Challenge Source Code
CTI	Controlled Technical Information
CUI	Controlled Unclassified Information
CWE	Common Weakness Enumeration
FOSS	Free and open-source
GOTS	Government off-the-shelf
GPR	Government Purpose Rights
GUI	Graphical user interface
HCI	Human-computer interaction
HSR	Human subjects research
IRB	Institutional review board
PoV	Proof of Vulnerability
RFC	Request for Comments
RPB	Reference Patched Binary
RPoV	Reference Proof of Vulnerability
SP	Service Poller
TA	Technical area
VR	Vulnerability research

II. Award Information

A. Awards

DARPA anticipates multiple awards for technical areas 1 and 2; and single awards for technical areas 3, 4 and 5. The level of funding for individual awards made under this solicitation has not been predetermined and will depend on the quality of the proposals received and the availability of funds. Awards will be made to proposers whose proposals are determined to be the most advantageous and provide the best value to the Government, all factors considered, including the potential contributions of the proposed work, overall funding strategy, and availability of funding. See Section V for further information.

The Government reserves the right to:

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

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

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

In 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 proposers not intending to perform fundamental research or the proposed research may present a high likelihood of disclosing performance characteristics of military systems or manufacturing technologies that are unique and critical to defense. Based on the nature of the performer and the nature of the work, the Government anticipates that some awards will include restrictions on the resultant research that will require the awardee to seek DARPA permission before publishing any information or results relative to the program.

Proposers should indicate in their proposal whether they believe the scope of the research included in their proposal is fundamental or not. While proposers should clearly explain the intended results of their research, the Government shall have sole discretion to select award instrument type and to negotiate all instrument terms and conditions with selectees. Appropriate clauses will be included in resultant awards for non-fundamental research to prescribe publication requirements and other restrictions, as appropriate. This clause 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 being performed by the awardee is restricted research, a subawardee may be conducting fundamental research. In those cases, it is the awardee’s responsibility to explain in their proposal why its subawardee’s effort is 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); 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 citing the specific authority establishing their eligibility to propose to Government solicitations and compete with industry, and their compliance with the associated FFRDC sponsor agreement's terms and conditions. This information is required 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.

c. Authority and Eligibility

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

2. Foreign Participation

Non-U.S. organizations and/or individuals may participate to the extent that such participants comply with any necessary nondisclosure agreements, security regulations, export control laws, and other governing statutes applicable under the circumstances.

B. Organizational Conflicts of Interest

FAR 9.5 Requirements

In accordance with FAR 9.5, proposers are required to identify and disclose all facts relevant to potential OCIs involving the proposer's organization and *any* proposed team member (subawardee, consultant). Under this Section, the proposer is responsible for providing this disclosure with each proposal submitted to the BAA. The disclosure must include the proposer's, and as applicable, proposed team member's OCI mitigation plan. The OCI mitigation plan must include a description of the actions the proposer has taken, or intends to take, to prevent the existence of conflicting roles that might bias the proposer's judgment and to prevent the proposer from having unfair competitive advantage. The OCI mitigation plan will specifically discuss the disclosed OCI in the context of each of the OCI limitations outlined in FAR 9.505-1 through FAR 9.505-4.

Agency Supplemental OCI Policy

In addition, DARPA has a supplemental OCI policy that prohibits contractors/performers from concurrently providing Scientific Engineering Technical Assistance (SETA), Advisory and Assistance Services (A&AS) or similar support services and being a technical performer. Therefore, as part of the FAR 9.5 disclosure requirement above, a proposer must affirm whether the proposer or *any* proposed team member (subawardee, consultant) is providing SETA, A&AS, or similar support to any DARPA office(s) under: (a) a current award or subaward; or (b) a past award or subaward that ended within one calendar year prior to the proposal's submission date.

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

- The name of the DARPA office receiving the support;
- The prime contract number;
- Identification of proposed team member (subawardee, consultant) providing the support; and
- An OCI mitigation plan in accordance with FAR 9.5.

Government Procedures

In accordance with FAR 9.503, 9.504 and 9.506, the Government will evaluate OCI mitigation plans to avoid, neutralize or mitigate potential OCI issues before award and to determine whether it is in the Government's interest to grant a waiver. The Government will only evaluate OCI mitigation plans for proposals that are determined selectable under the BAA evaluation criteria and funding availability.

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

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

C. Cost Sharing/Matching

Cost sharing is not required; however, it will be carefully considered where there is an applicable statutory condition relating to the selected funding instrument (e.g., OTs under the authority of 10 U.S.C. § 2371).

D. Other Eligibility Requirements

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

While proposers may submit proposals for all five Technical Areas, a proposer submitting a proposal to TA1 and another to TA2 may be selected to perform work on both technical areas. However, proposers selected for TA3, TA4, or TA5 cannot be selected for any portion of other technical areas, whether as a prime, subcontractor, or in any other capacity from an organizational to individual level. This is to avoid organizational conflict of interest (OCI) situations between the technical areas and to ensure objective test and evaluation results. The decision as to which proposal(s) to consider for award is at the discretion of the Government.

2. Ability to Support Classified Development

Proposers for TA1, TA2, TA3 or TA4 are not required to hold or obtain security clearances; however, having cleared personnel will be viewed positively. It is preferable (but not required) that the Principal Investigator in each TA1, TA2, TA3, and TA4 proposal be cleared at the final Top Secret level. Academic and small company participation is explicitly encouraged, regardless of possession of a security clearance.

At the time of proposal submission, all proposers submitting proposals under TA5 must have some personnel with a final Top Secret clearance that are eligible for SCI. It is preferable (but not required) that the Principal Investigator in TA5 proposals be cleared at that level.

Proposers to TA5 must provide their CAGE code and security point(s) of contact in their proposals.

IV. Application and Submission Information

A. Address to Request Application Package

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

B. Content and Form of Application Submission

1. Abstracts

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

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

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

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

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

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

Abstracts must include the following components:

- **Cover Sheet:** Provide the administrative and technical points of contact (name, address,

phone, email, lead organization). Include the BAA number, title of the proposed project, primary subcontractors, and the label “Abstract.”

- **Goals and Impact:** Describe what is being proposed and what difference it will make (qualitatively and quantitatively) if successful. Describe the innovative aspects of the project in the context of existing capabilities and approaches, clearly delineating the relationship of this work to any other projects from the past and present.
- **Technical Plan:** Outline and address all technical challenges inherent in the approach and possible solutions for overcoming potential problems. Provide appropriate specific milestones (quantitative, if possible) at intermediate stages of the project to demonstrate progress.
- **Statement of Work:** Provide a high-level statement of work for the proposed project, broken down by year.

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

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. This summary slide does not count towards the total page count.

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

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

a. Volume 1: Technical and Management Proposal

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

Appendix A does not count against the page limit and is mandatory.

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 will 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 (HR001118S0040)
- Technical Area
- Proposal title
- Lead organization (prime contractor) name
- Type of organization, selected from the following categories: Large Business, Small Disadvantaged Business, Other Small Business, HBCU, MI, Other Educational, or Other Nonprofit
- Technical point of contact (POC) including name, mailing address, telephone, and email
- Administrative POC including name, mailing address, telephone number, and email address
- (TA5 Proposers) - Security POC including name, mailing address, telephone number, and email address and Commercial and Government Entity (CAGE) code (if different than proposing entities CAGE)
- Award instrument requested: procurement contract (specify type), cooperative agreement or OT³
- 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 180 days)
- Data Universal Numbering System (DUNS) number⁴
- Taxpayer identification number⁵
- Commercial and Government Entity (CAGE) code⁶
- Proposer's reference number (if any)

ii. Table of Contents

³ Information on award instruments can be found at <http://www.darpa.mil/work-with-us/contract-management>.

⁴ 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.

⁵ See <http://www.irs.gov/businesses/small/international/article/0,,id=96696,00.html> for information on requesting a TIN. Note, requests may take from 1 business day to 1 month depending on the method (online, fax, mail).

⁶ A CAGE Code identifies companies doing or wishing to do business with the Federal Government. For further information regarding this subject, please see www.darpa.mil/work-with-us/additional-baa.

iii. Executive Summary: Provide a synopsis of the proposed project, including answers to the following questions:

- What is the proposed work attempting to accomplish or do?
- How is it done today, and what are the limitations, in detail, on the current state of the art? How does the proposed work advance current technology?
- Who or what will be affected and what will be the impact if the work is successful?
- How much will it cost, and how long will it take?

The executive summary should include a description of the key technical challenges, a concise review of the technologies proposed to overcome these challenges and achieve the project's goal, and a clear statement of the novelty and uniqueness of the proposed work.

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

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

If proposers desire to use proprietary software or technical data or both as the basis of their proposed approach, in whole or in part, they should: (1) clearly identify such software/data and its proposed particular use(s); (2) explain how the Government will be able to reach its program goals (including transition) within the proprietary model offered; and (3) provide possible nonproprietary alternatives in any area that might present transition difficulties or increased risk or cost to the Government under the proposed proprietary solution. Proposers must also submit a detailed plan for mitigating the impact of proprietary software or technical data on the required program collaboration as outlined in Table 6.

v. 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.

vi. 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.

vii. 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	CHES	Proposed	x	x	x
	Project Name 1	Current	x	x	n/a
	Project Name 2	Pending	n/a	x	x
Name 2	CHES	Proposed	x	x	x
	Project Name 3	Proposed	x	x	x

viii. 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.

ix. 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.

x. 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.

xi. Appendix A: This section is mandatory and must include all of the following components. If a particular subsection is not applicable, state “NONE.”

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

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

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

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

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

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

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

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

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

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

For all technical data or computer software that will be furnished to the Government with other than unlimited rights, provide (per Section VI.B.1) a list describing all proprietary claims to results, prototypes, deliverables or systems supporting and/or necessary for the use of the research, results, prototypes and/or deliverables. Provide documentation proving ownership or possession of appropriate licensing rights to all patented inventions (or inventions for which a patent application has been filed) to be used for the proposed project. Use the following format for these lists:

NONCOMMERCIAL				
Technical Data and/or Computer Software To be Furnished With Restrictions	Summary of Intended Use in the Conduct of the Research	Basis for Assertion	Asserted Rights Category	Name of Person Asserting Restrictions
(List)	(Narrative)	(List)	(List)	(List)
(List)	(Narrative)	(List)	(List)	(List)

COMMERCIAL				
Technical Data and/or Computer Software To be Furnished With Restrictions	Summary of Intended Use in the Conduct of the Research	Basis for Assertion	Asserted Rights Category	Name of Person Asserting Restrictions
(List)	(Narrative)	(List)	(List)	(List)
(List)	(Narrative)	(List)	(List)	(List)

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

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

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

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

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

Please also complete the following statements.

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

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

- (9). Cost Accounting Standards (CAS) Notices and Certification:** For any proposer who submits a proposal which, if accepted, will result in a CAS-compliant contract, must include a Disclosure Statement as required by 48 CFR 9903.202. The disclosure forms may be found at http://www.whitehouse.gov/omb/procurement_casb.

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. This section may also 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 cost proposal should include a working spreadsheet file (.xls or equivalent format) that

provides formula traceability among all components of the cost proposal. The spreadsheet file should be included as a separate component of the full proposal package. Costs must be traceable between the prime and subcontractors/consultants, as well as between the cost proposal and the SOW.

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

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

ii. Cost Summary Tables: Provide a single-page summary table broken down by fiscal year listing cost totals for labor, materials, other direct charges (ODCs), indirect costs (overhead, fringe, general and administrative (G&A)), and any proposed fee for the project. Include costs for each task in each 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. Proposers should include a \$150 meeting registration fee per traveler per trip.

(5) Subcontractor/Consultant Costs: Provide above info 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 CHESS@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 BAAT 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) ODCs: Provide an itemized breakout and explanation of all anticipated other direct costs.

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

(1) Proposals for \$750,000 or more: Provide "certified cost or pricing data" (as defined in FAR 2.101) or a request for exception in accordance with FAR 15.403 or DFARS 215.403-1.

(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.

(2) 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 (OT) for Prototypes Agreement:

Proposers must indicate whether they qualify as a nontraditional Defense contractor⁷, 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. Level of Effort Summary by Task Spreadsheet

Provide a one-page table summarizing estimated level of effort per task (in hours) broken out by senior, mid-level and junior personnel, in the format shown below in Figure 8. Also include dollar-denominated estimates of travel, materials and equipment. For this table, consider materials to include the cost of any data sets or software licenses proposed. For convenience, an Excel template is available for download along with the BAA. Submit the Level of Effort Summary Excel file (do not convert the Excel file to pdf format) in addition to Volume 1 and Volume 2 of your full proposal. This Excel file does not count towards the total page count.

⁷ For definitions and information on OT agreements see <http://www.darpa.mil/work-with-us/contract-management>.

SOW Task	Duration (months)	Intensity (hrs/mo)	Labor Hours for Prime						Labor Hours for Subcontractor/Consultants						Total	
			Sr	Skill set(s)	Mid	Skill set(s)	Jr	Skill set(s)	Total	SubC-Sr	Skill set(s)	SubC-Mid	Skill set(s)	SubC-Jr		Skill set(s)
1.1.0 <Phase 1 Task 1 name>	7	135	240		680		24		944	-					200	1,144
1.1.1 <Subtask 1.1.1 name>	4	90	80		280		-		360	-					200	560
1.1.2 <Subtask 1.1.2 name>	3	195	160		400		24		584	-					-	584
1.2.0 <Phase 1 Task 2 name>	6	385	108		400		1,800		2,308	1,400					-	3,708
1.2.1 <Subtask 1.2.1 name>	3	656	48		320		1,600		1,968	600					-	2,568
1.2.2 <Subtask 1.2.2 name>	3	113	60		80		200		340	800					-	1,140
:	:	:	:		:		:		:	:					:	:
Phase 1 Total Hours			348		1,080		1,824		3,252	1,400					200	4,652
Phase 1 Costs <i>First column is prime, second is total subcontractor, third is total consultant, fourth is total</i>			Travel						\$ 44,000	\$ 12,000					\$ 2,000	\$ 58,000
			Materials & Equipment						\$ 8,000	\$ -					\$ -	\$ 8,000
2.1.0 <Phase 2 Task 1 name>	8	100	176		560		64		800	100					100	1,000
2.1.1 <Subtask 2.1.1 name>	7	51	96		240		24		360	100					100	560
2.1.2 <Subtask 2.1.2 name>	4	110	80		320		40		440	-					-	440
2.2.0 <Phase 2 Task 2 name>	6	417	180		520		1,800		2,500	1,240					-	3,740
2.2.1 <Subtask 2.2.1 name>	4	435	140		400		1,200		1,740	400					-	2,140
2.2.2 <Subtask 2.2.2 name>	4	190	40		120		600		760	840					-	1,600
:	:	:	:		:		:		:	:					:	:
Phase 2 Total Hours			356		1,080		1,864		3,300	1,340					100	4,640
Phase 2 Costs <i>First column is prime, second is total subcontractor, third is total consultant, fourth is total</i>			Travel						\$ 47,000	\$ 12,000					\$ 2,000	\$ 61,000
			Materials & Equipment						\$ 4,000	\$ -					\$ -	\$ 4,000
3.1.0 <Phase 3 Task 1 name>	9	71	120		400		120		640	100					100	840
3.1.1 <Subtask 3.1.1 name>	3	93	40		200		40		280	100					100	480
3.1.2 <Subtask 3.1.2 name>	6	60	80		200		80		360	-					-	360
3.2.0 <Phase 3 Task 2 name>	6	460	160		800		1,800		2,760	1,200					-	3,960
3.2.1 <Subtask 3.2.1 name>	4	370	80		400		1,000		1,480	600					-	2,080
3.2.2 <Subtask 3.2.2 name>	3	427	80		400		800		1,280	600					-	1,880
:	:	:	:		:		:		:	:					:	:
Phase 3 Total Hours			280		1,200		1,920		3,400	1,300					100	4,800
Phase 3 Costs <i>First column is prime, second is total subcontractor, third is total consultant, fourth is total</i>			Travel						\$ 48,000	\$ 12,000					\$ 2,000	\$ 62,000
			Materials & Equipment						\$ -	\$ -					\$ -	\$ -
Project Total Hours			984		3,360		5,608		9,952	4,040					400	14,092
Total Project Costs <i>First column is prime, second is total subcontractor, third is total consultant, fourth is total</i>			Travel						\$ 139,000	\$ 36,000					\$ 6,000	\$ 181,000
			Materials & Equipment						\$ 12,000	\$ -					\$ -	\$ 12,000

Figure 8: Example level-of-effort summary table. Numbers illustrate roll-ups and subtotals. The SubC column captures all subcontractor hours and the Conslt column captures all consultant hours. The Skill set(s) columns should indicate are of expertise (e.g., engineer, software developer, data scientist, subject matter expert).

d. Summary Slide

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

3. Proprietary and Classified Information

DARPA policy is to treat all submissions as source selection information (see FAR 2.101 and 3.104) and to disclose the contents only for the purpose of evaluation. Restrictive notices notwithstanding, during the evaluation process, submissions may be handled by support contractors for administrative purposes and/or to assist with technical evaluation. All DARPA support contractors performing this role are expressly prohibited from performing DARPA-sponsored technical research and are bound by appropriate nondisclosure agreements.

a. Proprietary Information

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

b. Classified Information

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

C. Submission Dates and Times

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

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

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

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

1. Abstracts

Abstracts must be submitted per the instructions outlined herein and received by DARPA no later than **May 3, 2018, at 12:00 noon (ET)**. Abstracts received after this date and time will not be reviewed.

2. Proposals

The proposal package -- full proposal (Volume 1 and 2) and, as applicable, proprietary subcontractor cost proposals, classified appendices to unclassified proposals -- must be submitted per the instructions outlined herein and received by DARPA no later than **June 15, 2018, at 12:00 noon (ET)**. Submissions received after this date and time will not be reviewed.

D. Funding Restrictions

Not applicable.

E. Other Submission Requirements

1. Submission Instructions

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

a. Abstracts

DARPA/I2O will employ an electronic upload submission system (<https://baa.darpa.mil/>) for all UNCLASSIFIED abstract responses under this solicitation. *Abstracts should not be submitted via Email or Grants.gov.*

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. Upon completion of the online form, proposers will receive two separate emails; one will contain a user name and the second will provide a temporary password. Once both emails have been received, proposers must go back to the submission website and log in using that user name and password. After accessing the Extranet, proposers must create a user account for the DARPA BAA Submission Website by selecting the “Register Your Organization” link at the top of the page. The DARPA BAA Submission Website will display a list of solicitations open for submissions. Once a proposer’s user account is created, they may view instructions on uploading their abstract.

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

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

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

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

Since abstract submitters may encounter heavy traffic on the web server, they should not wait until the day abstracts are due to request an account and/or upload the submission. Abstracts should not be submitted via Email or Grants.gov. Any abstracts submitted by Email or Grants.gov will not be accepted or reviewed.

b. Proposals Requesting a Procurement Contract 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. 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 CHESS@darpa.mil.

Since proposers may encounter heavy traffic on the web server, they should not wait until the day proposals are due to request an account and/or upload the submission. Full proposals should not be submitted via Email. Any full proposals submitted by Email will not be accepted or evaluated.

c. Proposals Requesting a Cooperative Agreement

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

part to Grants.gov and in part as a hard-copy. Proposers using Grants.gov do not submit hard-copy proposals in addition to the Grants.gov electronic submission.

Submissions: Proposers must submit the three forms listed below.

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

To evaluate compliance with Title IX of the Education Amendments of 1972 (20 U.S.C. A§ 1681 Et. Seq.), the Department of Defense is using the two forms below to collect certain demographic and career information to be able to assess the success rates of women who are proposed for key roles in applications in science, technology, engineering, or mathematics disciplines. Detailed instructions for each form are available on Grants.gov.

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

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

Grants.gov requires proposers to complete a one-time registration process before a proposal can be electronically submitted. If proposers have not previously registered, this process can take between three business days and four weeks if all steps are not completed in a timely manner. See the Grants.gov user guides and checklists at <http://www.grants.gov/web/grants/applicants/applicant-resources.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. The proposer will then receive an email from DARPA acknowledging receipt and providing a control number.

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 a grant or cooperative agreement proposal as a hard copy 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 CHESS@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.

TA1, TA2, and TA3 proposals will be evaluated in terms of their potential to advance the state of the art. TA4 and TA5 proposals will be evaluated in terms of their ability to enable and amplify high-payoff research in the other TAs.

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 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 technical data/computer software developed through DARPA sponsorship.

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

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

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

a. Intellectual Property Representations

All proposers must provide a good faith representation of either ownership or possession of appropriate licensing rights to all other intellectual property to be used for the proposed project. Proposers must provide a short summary for each item asserted with less than unlimited rights that describes the nature of the restriction and the intended use of the intellectual property in the conduct of the proposed research. If proposers desire to use proprietary software or technical data or both as the basis of their proposed approach, in whole or in part, they should: (1) clearly identify such software/data and its proposed particular use(s); (2) explain how the Government will be able to reach its program goals

(including transition) within the proprietary model offered; and (3) provide possible nonproprietary alternatives in any area that might present transition difficulties or increased risk or cost to the Government under the proposed proprietary solution.

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 Research Subjects/Animal Use

Proposers that anticipate involving Human Research Subjects or Animal Use must comply with the approval procedures detailed at <http://www.darpa.mil/work-with-us/additional-baa>.

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.

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

2. Representations and Certifications

If a procurement contract is contemplated, prospective awardees will need to be registered in the SAM database prior to award and complete electronic annual representations and certifications consistent with FAR guidance at 4.1102 and 4.1201; the representations and certifications can be found at www.sam.gov. Supplementary representations and certifications can be found at <http://www.darpa.mil/work-with-us/additional-baa>.

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

A link to the DoD General Research Terms and Conditions for Grants and Cooperative Agreements and supplemental agency terms and conditions can be found 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:** Mr. Dustin Frazee, Program Manager, DARPA/I2O
- **Email:** CHESS@darpa.mil
- **Mailing address:**
DARPA/I2O
ATTN: HR001118S0040
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 CHESS@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/work-with-us/opportunities>.

B. Collaborative Efforts/Teaming

It is DARPA's desire to receive comprehensive, quality responses to this solicitation. To facilitate strong, collaborative teaming efforts and business relationships, a website (<https://www.schafertmd.com/darpa/i2o/chess/pd/>) has been established. Specific content, communications, networking, and team formation are the sole responsibility of the participants. Neither DARPA nor the DoD endorses the destination web site or the information and organizations contained therein, nor does DARPA or the DoD exercise any responsibility at the destination. This website is provided consistent with the stated purpose of this solicitation.

C. Proposers Day

The Proposers Day will be held on April 19, 2018, in Arlington, VA. The special notice regarding the CHESS Proposers Day, DARPA-SN-18-40, can be found at https://www.fbo.gov/index?s=opportunity&mode=form&id=557cfe6440e774224a008f6923e526f3&tab=core&_cview=0.

For further information regarding the CHESS Proposers Day, including slides from the event, please see <http://www.darpa.mil/work-with-us/opportunities> under HR001118S0040.

D. Submission Checklist

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

✓	Item	BAA Section	Applicability	Comment
	Abstract	IV.B.1	Optional, but recommended	Conform to stated page limit.
	Obtain DUNS number	IV.B.2.a.i	Required of all proposers	The DUNS Number is the Federal Government's contractor identification code for all procurement-related activities. See http://fedgov.dnb.com/webform/index.jsp to request a DUNS number. Note: requests may take at least one business day.
	Obtain Taxpayer Identification Number (TIN)	IV.B.2.a.i	Required of all proposers	A TIN is used by the Internal Revenue Service in the administration of tax laws. See http://www.irs.gov/businesses/small/international/article/0,,id

				=96696.00.html for information on requesting a TIN. Note: requests may take from 1 business day to 1 month depending on the method (online, fax, mail).
	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 www.sam.gov for information and registration. Note: new registrations can take an average of 7-10 business days. SAM registration requires the following information: -DUNS number -TIN -CAGE Code. A CAGE Code identifies companies doing or wishing to do business with the Federal Government. If a proposer does not already have a CAGE code, one will be assigned during SAM registration. -Electronic Funds Transfer information (e.g., proposer's bank account number, routing number, and bank phone or fax number).
	Register in E-Verify	VI.B.6	Required for proposers requesting procurement contracts	E-Verify is a web-based system that allows businesses to determine the eligibility of their employees to work in the United States. See http://www.uscis.gov/e-verify for information and registration.
	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 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 http://www.grants.gov/web/grants/applicants/applicant-resources.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
	Volume 2 (Cost Proposal)	IV.B.2.b	Required of all proposers	- Cover Sheet - Cost summary - Detailed cost information including justifications for direct labor, indirect costs/rates, materials/equipment, subcontractors/consultants, travel, ODCs - Cost spreadsheet file (.xls or equivalent format) - If applicable, list of milestones for OTs - Subcontractor plan, if applicable Subcontractor cost proposals

				<ul style="list-style-type: none"> - Itemized list of material and equipment items to be purchased with vendor quotes or engineering estimates for material and equipment more than \$50,000 - Travel purpose, departure/arrival destinations, and sample airfare
	Level of Effort Summary by Task Excel spreadsheet	IV.B.2.c	Required of all proposers	A template LoE Excel file will be provided on the FedBizOpps website as an attachment. Submit the LoE Excel file (do not convert Excel file to pdf format).
	PowerPoint Summary Slide	IV.B.2.d		A template PowerPoint slide will be provided on the FedBizOpps website as an attachment. Submit the PowerPoint file (do not convert PowerPoint file to pdf format).

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

E. Associate Contractor Agreement (ACA)

The same or similar language will be included in awards against HR001118S0040.:

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

(b) Work under this contract may involve access to proprietary or confidential data from an Associate Contractor. To the extent that such data is received by the Contractor from any Associate Contractor for the performance of this contract, the Contractor hereby agrees that any proprietary information received shall remain the property of the Associate Contractor and shall be used solely for the purpose of the CHESS research effort. Only that information which is received from another contractor in writing and which is clearly identified as proprietary or confidential shall be protected in accordance with this provision. The obligation to retain such information in confidence will be satisfied if the Contractor receiving such information utilizes the same controls as it employs to avoid disclosure, publication, or dissemination of its own proprietary information. The receiving Contractor agrees to hold such information in confidence as provided herein so long as such information is of a proprietary/confidential or limited rights nature.

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

- (1) maintenance of a close liaison and working relationship;
- (2) maintenance of a free and open information network with all Government-identified associate Contractors;

(3) delineation of detailed interface responsibilities;

(4) entering into a written agreement with the other Associate Contractors setting forth the substance and procedures relating to the foregoing, and promptly providing the Agreements Officer/Procuring Contracting Officer with a copy of same; and,

(5) receipt of proprietary information from the Associate Contractor and transmittal of Contractor proprietary information to the Associate Contractors subject to any applicable proprietary information exchange agreements between associate contractors when, in either case, those actions are necessary for the performance of either.

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

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

(f) Associate Contractors for the CHESSE research effort include:

Contractor	Technical Area
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(end of ACA)