Broad Agency Announcement

Quantum Benchmarking

Defense Sciences Office

HR001121S0026

April 1, 2021

Table of Contents

BAA Attachments:

- Attachment A: ABSTRACT SUMMARY SLIDE TEMPLATE
- Attachment B: ABSTRACT TEMPLATE
- Attachment C: PROPOSAL SUMMARY SLIDE TEMPLATE
- Attachment D: PROPOSAL TEMPLATE VOLUME 1: TECHNICAL & MANAGEMENT
- Attachment E: PROPOSAL TEMPLATE VOLUME 2: COST
- Attachment F: MS ExcelTM DARPA COST PROPOSAL SPREADSHEET
- Attachment G: PROPOSAL TEMPLATE VOLUME 3: ADMINISTRATIVE & NATIONAL POLICY REQUIREMENTS

PART I: OVERVIEW INFORMATION

- **Federal Agency Name:** Defense Advanced Research Projects Agency (DARPA), Defense Sciences Office (DSO)
- **Funding Opportunity Title:** Quantum Benchmarking
- **Announcement Type:** Initial Announcement
- **Funding Opportunity Number:** HR001121S0026
- **Catalog of Federal Domestic Assistance (CFDA) Number(s):** 12.910 Research and Technology Development
- **Dates** (All times listed herein are Eastern Time.)
  - Posting Date: April 1, 2021
  - Proposers Day: April 20, 2021. See Section VIII.A.
  - Abstract Due Date: May 11, 2021, 4:00 p.m.
  - FAQ Submission Deadline: June 8, 2021, 4:00 p.m. See Section VIII.B.
  - Full Proposal Due Date: June 22, 2021, 4:00 p.m.
- **Anticipated Individual Awards:** DARPA anticipates multiple awards in both Technical Area 1 (TA1) and Technical Area 2 (TA2).
  - **Anticipated Funding Available for Award:** To maximize the diversity of approaches considered using available resources, DARPA is limiting funding for TA2 awards to $1,450,000 for the entire 18 months of Phase 1 and $1,500,000 for the entire 18 months of Phase 2. Funding guidance is not provided for TA1.
- **Types of Instruments that May be Awarded:** Procurement contracts, cooperative agreements, or Other Transactions. Award instruments will be limited to procurement contracts or Other Transactions for Proposers whose proposed solution includes Controlled Unclassified Information (CUI).
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  - **DARPA/DSO Opportunities Website:** http://www.darpa.mil/work-with-us/opportunities
- **Teaming Information:** See Section VIII.C for information on teaming opportunities.

- **Frequently Asked Questions (FAQ):** FAQs for this solicitation may be viewed on the DARPA/DSO Opportunities Website. See Section VIII.B for further information.
- **Security:** Quantum Benchmarking is an unclassified program. It is not anticipated that work in this program will generate controlled unclassified information (CUI).

PART II: FULL TEXT OF ANNOUNCEMENT

I. Funding Opportunity Description

This Broad Agency Announcement (BAA) constitutes a public notice of a competitive funding opportunity as described in Federal Acquisition Regulation (FAR) 6.102(d)(2) and 35.016 as well as 2 C.F.R. § 200.203. Any resultant negotiations and/or awards will follow all laws and regulations applicable to the specific award instrument(s) available under this BAA, e.g., FAR 15.4 for procurement contracts.

A. Introduction

The Defense Sciences Office (DSO) at the Defense Advanced Research Projects Agency (DARPA) is soliciting innovative research proposals in the area of quantum benchmarking. Proposed research should quantify the long-term utility of quantum computers. In particular, proposed research should center around either (1) the creation of application-specific, hardware-agnostic benchmarks for quantum computer utility or (2) hardware resource estimation for quantum computers. Specifically excluded is research that primarily results in evolutionary improvements to the existing state of practice.

B. Background

It has been credibly hypothesized that quantum computers will revolutionize multiple scientific and technical fields within the next few decades; examples include machine learning, quantum chemistry, materials discovery, molecular simulation, many-body physics, classification, nonlinear dynamics, supply chain optimization, drug discovery, battery catalysis, genomic analysis, fluid dynamics, protein structure prediction. For many of these examples, like quantum chemistry and protein structure prediction, quantum computers are hypothesized to be useful simulators because the target problem is inherently quantum mechanical. Other examples, like classification and nonlinear dynamics, center around problems that have nothing to do with quantum systems, but involve combinatorial complexity that is intractable for conventional computers.

For each of the fields listed above, it is unclear exactly what size, quality, and configuration of quantum computer – if any – will enable the hypothesized revolutionary advances. This lack of clarity may be the result of one or more of the following factors:

- Where only the technical field has been identified, the specific application instances[1] that would be solved by a hypothetical quantum computer – at specific scales, with specific identified values for key parameters, and with clearly identified impact if successful – have not been posed.

[1] "Application instance" is defined below in Section II.F; it refers to a particular computational problem to be solved within a specific application domain, e.g., simulating the ground state energy of one particular molecule. An "application domain" is defined as defined as a particular class of applications for which quantum computers may be useful, e.g., molecular simulation or materials discovery.

- Where application instances have been posed, the new core computational capability that would enable success is not understood. This often contributes to a lack of understanding about the gap between existing classical, state-of-the-art solutions and hypothesized quantum solutions.
- The appropriate metrics and testing procedures for quantifying progress towards critical new quantum computing capabilities are not known. This is especially problematic for problems where the testing procedures themselves may be classically intractable.
- Where benchmarks for quantum utility have been proposed, they are often distilled down to a single parameter that gives limited insight into the ability of a system under test to succeed at specific application instances. In almost all cases, it is not known how to measure hardware progress towards a specific application at a specific scale, especially using robust multi-dimensional metrics suitable for driving research and development into special-purpose hardware.
- The full-system-hardware resources required to solve particular problems at specific scales have not been estimated. This is particularly true where large, fault-tolerant quantum computers are expected to be required. When quantum hardware resources have been estimated, only the exponential scaling term(s) have been quantified and not the constant and polynomial scaling terms. The ancillary classical resources and low-level hardware configurations (e.g., connectivity requirements) that are required are either unaddressed or cursorily addressed.

In the past two years, two different groups have claimed to have achieved "quantum supremacy" – the ability to repeatably perform a computation that is unrealistic for classical systems to replicate. In addition, multiple commercial companies have published roadmaps showing that they will create universal, fault-tolerant quantum computers in the next decade. The extent to which these roadmaps, if realized, will represent significant and important new computational capabilities is not currently understood.

C. Program Description/Scope

Program Description

The Quantum Benchmarking program will create new benchmarks that quantitatively measure progress towards specific, transformational computational challenges. In parallel, the program will estimate the hardware-specific resources required to achieve different levels of benchmark performance.

The benchmarks will be hardware agnostic. This is essential for benchmarks that are focused on measuring utility, since a novel classical solution to an urgent problem is just as valuable as a novel quantum solution to an urgent problem. However, work in this program will focus on creating hardware-agnostic benchmarks for problems where quantum approaches are most likely to be needed.

The Quantum Benchmarking program will quantify the long-term utility of quantum computers by solving a series of hard problems:

- Compiling a list of specific utility-driven application instances from a variety of application domains
- Grouping these application instances according to common core enabling computational capabilities
- Developing novel test procedures for quantifying progress towards these core enabling computational capabilities
- Using all of the above to create scalable, robust multi-dimensional benchmarks that can act as guidestars for research and development aimed at long-term, real-world utility for a variety of application domains
- Creating tools for estimating the primary quantum hardware resources and ancillary classical hardware resources needed to achieve a specific level of benchmark performance

Each of these program goals is described in more detail below.

Compiling a list of application instances. The Quantum Benchmarking program will compile a list of specific application instances from across as many application domains as possible. These application instances are the answers to the question: "If you had a large, perfect quantum computer today, what would you ask it to do?" Each application instance will be a specific problem at a specific scale. For example, one application instance could be estimating the ground state energy of a particular molecule in a particular configuration.

Grouping application instances. The Quantum Benchmarking program will group application instances according to their core enabling computational capabilities. Because the primary goal of the program is to estimate the long-term utility of quantum computers, it is crucial to uncover the core enabling computational capabilities for the application instances that have been compiled. After grouping instances, performers will determine the key metrics that can be used to quantify these core enabling computational capabilities, e.g., the precision or accuracy of a specific class of matrix operation.

Developing test procedures. The Quantum Benchmarking program will discover novel methods for testing and predicting performance against the key metrics that quantify core enabling computational capabilities. The Quantum Benchmarking program recognizes that some metrics for measuring quantum computational capability may not be testable using finite classical resources. Instead, a new type of quantum device, referred to here as a *quantum benchmarking testbed* (QBT), may be needed to test certain metrics. A QBT would act as a synthetic problem with tunable size, complexity, and key parameters and serve as a *simulation target*. If a quantum computer under test can correctly simulate the behavior of the QBT, it passes that benchmarking challenge. Note that if all key metrics associated with a particular grouping of application instances can be tested using existing or realizable classical resources, then those classical resources may be the best means for testing progress toward realizing the core enabling computational capabilities.

Creating benchmarks. The Quantum Benchmarking program will create benchmarks that can act as guidestars for research and development into quantum computation. More specifically, the Quantum Benchmarking program will create scalable and predictive benchmarks that can not only make it clear when a particular performance threshold has been reached, but also quantify

progress towards important performance thresholds. The Quantum Benchmarking program will create robust and multi-dimensional benchmarks that embrace problem complexity by having many input parameters to define problem scope and scale, and by having even more output parameters that provide rich debugging information about not just if a system under test succeeded or failed but exactly how it succeeded or failed along as many relevant axes as possible. If successful, the Quantum Benchmarking program will provide benchmarks that provide rich debugging information for quantum computer developers.

Estimating hardware resources. The Quantum Benchmarking program will create tools for estimating the computational-paradigm-specific hardware resources needed to achieve specific benchmark performance thresholds. Existing estimates of resource scaling with problem size are often limited to the leading term in an asymptotic expansion of problem complexity. In some cases, quantum computers are assumed to be useful if quantum advantage scales exponentially with problem size. Of course, if the constant and polynomial scaling terms outweigh the exponential scaling terms for problem sizes of interest, quantum advantage may not exist. The Quantum Benchmarking program will provide estimates of these additional scaling terms by predicting not just the quantum resources needed to achieve a new computational capability but the ancillary classical resources (for example, from decoders and schedulers) needed to support the proposed quantum system. Estimates will necessarily be tied to a particular quantum computing technology, e.g., superconducting quantum computers or photonic quantum computers, because the hardware resources being estimated will vary dramatically with different hardware paradigms.

Program Scope

In scope. The following proposal elements are explicitly in-scope for the Quantum Benchmarking program:

- Analysis of applications that require large-scale, universal, fault-tolerant quantum computers to solve
- Estimates of the classical and quantum resources required to execute quantum algorithms on large-scale, universal, fault-tolerant quantum computers
- Applications of fault tolerance and error correction that are relevant to the benchmarks under study
- Nontraditional quantum computing paradigms

Out of scope. The following proposal elements are explicitly out-of-scope for the Quantum Benchmarking program:

- Approaches that focus exclusively on noisy intermediate-scale quantum computers
- Approaches to cryptanalysis and/or Shor's algorithm
- Development of new quantum computing hardware

D. Program Structure

Technical Areas (TAs)

Performer teams for the Quantum Benchmarking program are divided into hardware-agnostic teams (TA1) and hardware-specific teams (TA2). A performer may propose to both TAs if they wish, but this requires submitting two separate proposals. A single proposal must address only one of the two TAs.

TA1: Hardware-agnostic benchmark creation. TA1 will comprise interdisciplinary performer teams that combine application-domain experts with hardware-agnostic quantum computing experts. TA1 teams will lead the benchmark creation process and quantify computational utility as a function of benchmark performance.

TA2: Hardware-specific resource estimation. TA2 will comprise teams focusing on one or more hardware-specific quantum computing paradigms. Each team will determine the hardware-paradigm-specific resources – both classical and quantum – required to achieve a given benchmark performance level.

Government Test and Evaluation (T&E)

General T&E. As part of the Quantum Benchmarking program, the Government will create a robust Test & Evaluation effort designed to quantify and qualify progress in both TA1 and TA2. In particular, the T&E team will evaluate tools for both utility estimation and resource estimation. This BAA is not soliciting proposals for T&E.

QBT Prototype Development Team. A specific subset of the T&E team will be funded to evaluate efforts to design quantum benchmarking testbeds, or QBTs. It is an open question if QBTs will be a necessary tool for benchmarking, and if they are, what different QBT specifications will be required for different benchmarks. The QBT Prototype Development Team will create and test hardware prototypes relevant to basic research into QBTs, in order to test and evaluate performer designs as applicable. This BAA is not soliciting proposals for T&E, including proposals for the QBT Prototype Development Team.

Program Phases

The Quantum Benchmarking program will be structured into two phases, each 18 months long. Proposals should structure Phase 1 as the base effort, with Phase 2 included as an option. Participation in Phase 1 does not guarantee funding in Phase 2. Progression to Phase 2 is based on the availability of funds and on DARPA's estimate of the overall value to the Government from each team's continued participation.

To maximize the diversity of approaches considered using available resources, DARPA is limiting funding for TA2 awards to $1,450,000 for the entire 18 months of Phase 1 and $1,500,000 for the entire 18 months of Phase 2. Funding guidance is not provided for TA1.

Phase 1: Benchmark selection and tool development

In Phase 1, teams will propose utility-driven benchmarks to be studied in Phase 2, while at the same time developing the utility-estimation and resource-estimation tools that will be required to succeed in Phase 2.

TA1 teams will lead the benchmark selection process by compiling application instances, grouping them by candidate metrics for core enabling computational capabilities, and proposing candidate benchmarks. In parallel, they will develop utility estimation tools and investigate methods for scalable test procedures, possibly including the use of QBTs.

TA2 teams will assist in the benchmark selection process by compiling application instances with specific emphasis applicable to their chosen hardware paradigm. In parallel, they will develop tools for estimating the hardware resources required to reach specific performance thresholds.

Phase 2: Benchmark creation and resource estimation

In Phase 2, the Government will select specific candidate benchmarks for detailed study.

TA1 teams will expand the Phase 2 benchmarks to include test procedures that provide multi-dimensional output data, making the benchmarks applicable to a broad range of input problems and all scales, and making the benchmarks capable of quantifying progress towards critical performance thresholds. In parallel, teams will use their utility estimation tools to quantify utility as a function of benchmark performance.

TA2 teams will improve their hardware resource estimation tools and use those tools to estimate the required resources for a variety of benchmark performance levels.

E. Technical Area Descriptions

Technical Area 1: Hardware-agnostic benchmark creation

In order to understand the long-term utility of quantum computers for specific computational tasks, it is necessary to quantify the gap between proposed quantum approaches and the existing best classical approach. This requires a collaboration between multiple distinct communities: quantum computing experts who understand the former and application-domain experts who understand the latter. Quantum experts are required to ensure that the benchmarks that are proposed do not implicitly assume classical limitations and approaches; application-domain experts are required to assess the real utility of a new computational capability on specific unsolved application instances.

TA1 proposals should:

- Explicitly propose at least four application domains[2] that their team will specialize in.
- Clearly articulate why their proposed areas of application-domain expertise contain application instances[3], which, if solved satisfactorily using a novel computational approach, would result in transformational utility for Government and/or commercial applications.
- Include personnel who have application-domain expertise in state-of-the-art classical approaches in each of the proposed application domains.

[2] An "application domain" is defined as a particular class of applications for which quantum computers may be useful, e.g., molecular simulation or materials discovery.

[3] "Application instance" is defined in Section II.F; it refers to a particular computational problem to be solved within a specific application domain, e.g., simulating the ground state energy of one particular molecule.

- Include personnel with expertise in quantum computation, especially in the application of quantum algorithms to a wide variety of application domains.
- Propose a compelling approach to compiling application instances; clearly articulate why the approach will produce many distinct and specific application instances, which, if solved, would result in transformational utility.
- Propose a compelling approach to grouping application instances by core enabling computational capability.
- Offer an innovative approach for testing the metrics associated with core enabling mathematical operations, especially when these tests may themselves be classically intractable.
- Propose innovative methods for quantifying utility as a function of achieved benchmark performance.
- Propose to develop all program materials and research as publicly-releasable material open to robust scrutiny from the academic and commercial community both during and after the program; proprietary or restricted research is not appropriate for TA1.

TA1 proposals should NOT:

- Propose mathematically interesting application domains with little or no quantifiable utility to Government and/or commercial applications.
- Propose application domains where existing classical solutions are entirely satisfactory or where the proposal cannot quantify the application scale at which existing classical solutions become unsatisfactory.
- Propose research related to cryptographic application domains or application instances, including any applications of factoring or Shor's algorithm.

Technical Area 2: Hardware-specific resource estimation

Performers in TA2 are required to quantify the hardware-paradigm-specific quantum and classical resources to solve program-developed problems at scales of interest. In addition, TA2 teams will calculate the resources required for their proposed hardware paradigm(s) to act as suitable QBTs, if the Phase 2 benchmarks selected by the Government require QBTs for effective testing.

TA2 proposals should:

- Propose one or more specific quantum computing hardware paradigms that their team will specialize in.
- Include personnel with expertise in one or more specific quantum computing hardware paradigm(s).
- Propose a compelling approach to compiling application instances relevant to their chosen hardware paradigm(s); clearly articulate why the approach will produce several distinct and specific application instances, which, if solved, would result in transformational utility.

- Propose innovative methods for calculating both quantum and classical hardware resource requirements for multiple problem scales and target metrics.
- Offer innovative approaches for characterizing the hardware requirements and configurations needed to achieve specific levels of benchmark performance; these should include resources for classical control, scheduling, etc., in addition to the quantum resources.
- Offer innovative approaches to develop automated and scalable tools for estimating resource requirements, as successful TA2 teams will be required to provide estimates of resources for dozens of distinct, specific problem instances.
- Offer innovative methods for calculating how resource requirements scale, not just in the exponential limit, but also including polynomial and constant scaling terms.
- Clearly articulate the approach to justifying hardware resource estimates. Ideally, the approach will be in a manner that will allow a quantum computing expert who is not familiar with the team's code to verify and validate the team's claims.

TA2 proposals should NOT:

Propose to develop quantum computing hardware as part of this effort.

F. Schedule/Milestones

All proposals should support the following list of program milestones and the associated program schedules for both TAs. Performers are encouraged to include in their proposals additional milestones and an expanded schedule that supports their specific proposed course of research, but all efforts should support the program-wide schedule laid out below.

Throughout the course of this basic research effort, program-wide and performer-specific milestones and metrics are expected to be updated as progress is made, but the following structure should be used to estimate costs and other programmatic dependencies for proposing teams.

Definitions of Phase 1 Milestone Terms

The terms below are grouped by their relevance to the program goals described in Section II.C above.

Application instance. A specific example of one problem to be solved with a quantum computer. Examples include finding the ground state energy of one particular molecule or optimizing one particular logistics problem. The Quantum Benchmarking program will compile a large list of specific application instances from a variety of application domains. Teams are encouraged to take these instances from the vast existing literature on the potential uses of quantum computers as well as the literature describing the state of the art in other application domains. Teams are also encouraged to collaborate with all other teams on the creation of lists of application instances. Note that not all proposed application instances will be carried forward into Phase 2 of the program.

I**nstance group.** A group of instances that share the same core enabling computations – the critical mathematical operations that underpin a successful solution to the application instances. For example, a specific class of matrix operation might enable a wide variety of disparate

application instances. One of the primary goals of Phase 1 is to create these instance groups, as the identification of common core enabling computations is the first step to creating useful, general benchmarks that quantify a candidate quantum computer's utility for a particular type of task. The following sub-definitions are relevant to an instance group.

> **Candidate metric**. A measure that quantifies the ability of a computer to successfully perform the core enabling computation for an instance group. Some candidate metrics might apply to all instance groups (like time to solution) while others will be instance-group-specific (like the precision or accuracy of a specific class of matrix operation).
>
> **Utility threshold.** Specific values of a candidate metric or metrics that correspond to the performance needed to solve a particular application instance. A computer capable of exceeding these thresholds should therefore be quantifiably more useful than existing state-of-the-art solutions to the same problem. Note that passing one utility threshold will likely require minimum performance levels on multiple candidate metrics.
>
> **Utility estimation tools.** Performer-developed tools for estimating the impact of passing a given utility threshold. These will be very application-domain-specific.
>
> **Utility estimate.** The quantitative benefit to a user if a utility threshold is surpassed. The default unit of utility should be "dollars" and should be compared directly against the best state-of-the-art solution to the application instance.

Testing procedure. A procedure for testing all of the metrics associated with a particular benchmark. Note that metrics that are not testable are not useful as benchmarks. Moreover, testing some metrics may be computationally intractable for classical systems due to the exponential scaling in degrees of freedom present in some problems. However, it is also possible that some classically intractable testing procedures may be implementable using specially designed quantum systems capable of generating challenge problems for the computer under test. This type of system is referred to in this BAA as "quantum benchmarking testbed," and is defined below.

> **Quantum benchmarking testbed (QBT) (As applicable).** A scalable, multi-dimensional challenge problem generator that may be needed to provide intermediate computational targets toward a candidate metric or metrics. Teams are not required to produce such testbeds experimentally, but they are required to submit notional specifications for QBTs if their proposed testing procedures require them.

Candidate benchmark. The combination of all of the following: a candidate metric or metrics, a list of constituent application instances and associated utility thresholds, and a proposed testing procedure for measuring performance against the candidate metric or metrics (this testing procedure could require a quantum benchmarking testbed, but not necessarily). The quantum benchmarking program is seeking to create benchmarks that are useful as guidestars for research and development and that can provide robust, detailed debugging information. Good candidate benchmarks should have many "inputs" that can be used to parameterize the problem space for which a benchmark measures computational ability. Good candidate benchmarks likewise have many "outputs" that provide rich debugging information about a system under test. Key parameters relevant to candidate benchmarks are defined below.

- *Number of benchmark inputs.* The number of distinct degrees of freedom used to parameterize the problem space under test. Each of these inputs should be an

independent variable that affects the testing procedure to be performed.

- *Number of benchmark primary outputs.* The number of distinct degrees of freedom that describe the output of a benchmark. These outputs should allow a user to determine exactly which utility thresholds were surpassed by a computer under test.

Resource estimation tools. Performer-developed tools for estimating the hardware-specific resources needed to achieve a given utility threshold for a given metric or metrics. These tools will be hardware-paradigm-specific. The simplest tools will be first-order estimates only, of the type that can show an exponential quantum advantage over classical tools in the limit of infinite problem size. Intermediate versions should include additional terms, for example capturing polynomial scaling of resources. By the end of the program, estimates should include all scaling terms, including constant terms. The following sub-definition is the output of a resource estimation tool.

Resource estimate. The hardware resources needed to achieve a given utility threshold for a given metric or metrics. The estimate should not only include quantum resources but also ancillary classical resources needed for control, decoding, and scheduling. Resource estimates should address not only the number of resources required but also their required specifications and configuration. A key parameter for the resource estimate – the number of output parameters – is defined below.

- *Number of Output Parameters***.** The number of types of resources tracked by a particular resource estimate. The types of resources tracked should include the number of each type of primitive hardware element that is needed in a particular configuration or role, the amount and type of required ancillary classical computing resources, the energy to solution, the time to solution, etc.

Schedule of Phase 1 Milestones

Program Month	Technical Area 1	Technical Area 2
3	• 3+ Application Instances • 1+ Candidate Metric • Report on strategy for quantifying utility, including specifying units for utility	• 3+ Application Instances to be used as test cases for developing resource estimation tools • 1+ Candidate Metric • Report on strategy for estimating hardware resources as a function of problem scale, including constant, polynomial, and exponential terms.
6	• 50+ Application Instances (Teams are encouraged to collaborate with other teams from both TAs; overlap between team lists is expected.)	• 20+ Application Instances (Teams are encouraged to collaborate with other teams from both TAs. Teams in TA2 should either choose TA1-proposed instances or propose their own distinct instances; in either case TA2-

		proposed instances should be suitable for their specific hardware paradigm.)
9	• 3+ Utility Estimates (of 3+ Application Instances) • 1+ Initial Testing Procedure (of 1+ Candidate Metric)	• 3+ Resource Estimates (of 3+ Application Instances)
12	• 5+ initial Instance Groups (for 50+ Application Instances) o Associated Candidate Metrics o Associated Utility Thresholds (Teams are encouraged to collaborate with other teams from both TAs; overlap between team lists is expected.)	• 10+ proposed Resource Estimate Output Parameters
15	• Initial Utility Estimates (for mo. 12 Instance Groups and Candidate Metrics) • Initial Test Procedures (for mo. 12 Instance Groups) o Notional QBT designs, if required	• 10+ Resource Estimates (for mo. 6 Application Instances) o Include at least polynomial scaling terms
18	• 5+ Candidate Benchmarks o Calculation of the computational complexity of each associated Test Procedure	• 20+ Hardware Resource Estimates (for TA1 mo. 12 Utility Thresholds)

Definitions of Phase 2 Milestone Terms

Phase 2 benchmark. The Candidate Benchmarks from the Phase 1 Month 18 milestones that DARPA will select to carry forward into phase 2 of Quantum Benchmarking. Each phase 2 benchmark will be developed into one final benchmark.

Final benchmark. Final output of the program includes improved and expanded metrics, more robust list of constituent application instances and utility thresholds, and a more robust testing procedure that is both scalable and verbose. The following metrics and sub-definitions are relevant to the final benchmarks.

- Associated metrics → **Application instances, impact thresholds, benchmark inputs, benchmark primary outputs, testing procedure,** and **QBT** (see above).
- Associated metrics → **Number of benchmark ancillary outputs.** The number of distinct degrees of freedom that describe the output of a benchmark. These outputs should not directly determine which utility thresholds were surpassed by a computer under test but rather provide valuable ancillary information about the

operation of the computer under test that can be used for either debugging a faulty system or understanding the limitations of a particular system.

- Definition of a "**Scalable**" benchmark → A scalable benchmark shows progress towards a utility threshold, not just a test of when the threshold has been passed. Scalable benchmarks are predictive tools that can be used as research guidestars, not just verifiers.
- Definition of a "**Verbose**" benchmark → Here "verbose" is used in the context of a computer debugger; a "verbose" debugging output mode provides rich, detailed information about a computation's operation and context, not just information about the computation's success or failure.

Benchmark waypoints. Specific values of a candidate metric or metrics that correspond to the performance needed to make substantive progress towards a solution to a particular application instance. Benchmark waypoints are very similar to a utility threshold but are used to measure partial progress towards a solution. These waypoints are needed to provide specific test cases for TA2 resource estimation techniques used in the near-term and intermediate-term before a utility threshold is actually achieved.

Resource estimation tools, resource estimate, utility estimation tools, utility estimate, testing procedure. See Phase 1 definition.

Schedule of Phase 2 Milestones

Program Month	Technical Area 1	Technical Area 2
24	Per Phase 2 Benchmark: • Identify 10+ Problem Instances o Associated Utility Thresholds	Per Phase 2 Benchmark: • Appropriate Benchmark Waypoints

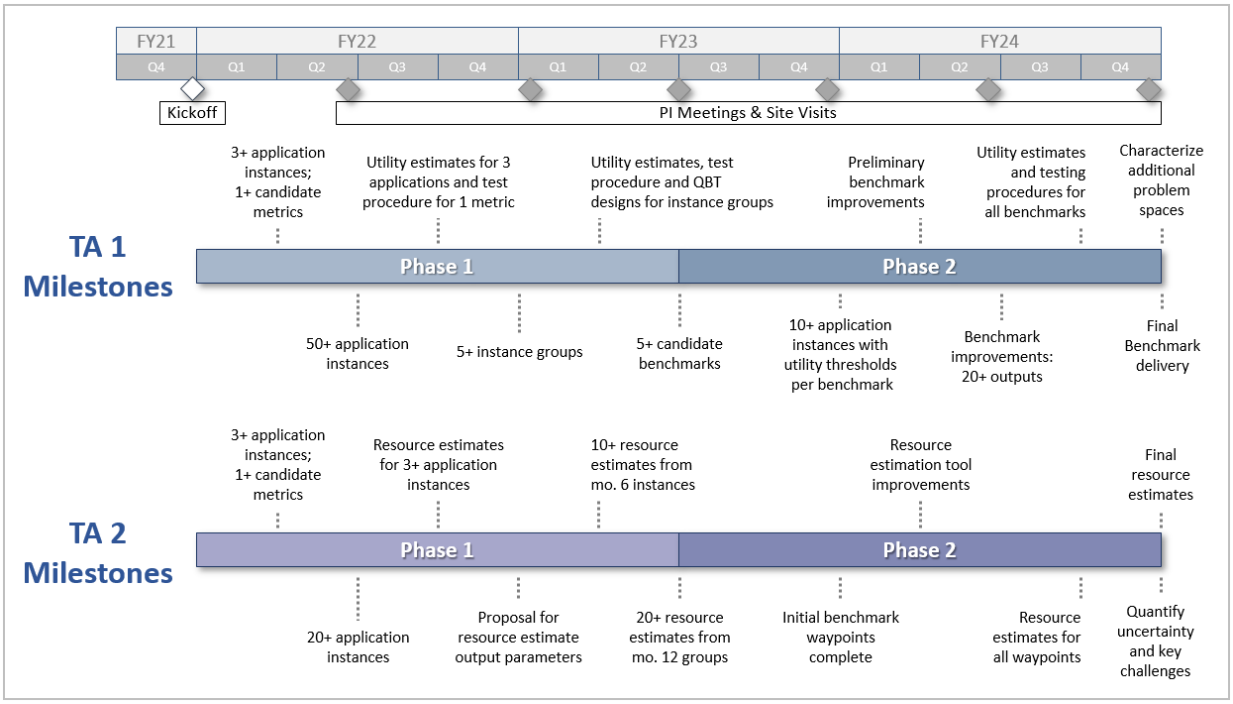
27	Per Phase 2 Benchmark:
	• Preliminary scalable and verbose benchmark improvements, including:
	  o 10+ inputs
	  o 10+ primary outputs, 10+ ancillary outputs
	• Intermediate Testing Procedures
		• Improved Resource Estimation Tools including:
		  o 50+ Output Parameters
		  o All scaling terms estimated, including constant terms

30	Per Phase 2 Benchmark: • Improvement to 20+ ancillary outputs	No milestone
33	• Deliver a complete example of each of the Final Benchmarks	• Resource Estimates for all benchmark waypoints

	○ 50+ ancillary outputs • Utility Estimates for all Application Instances for all Final Benchmarks • Final Testing Procedures for all Final Benchmarks	
36	• Final Benchmark delivery ○ 100+ ancillary outputs	• Final Resource Estimates ○ 100+ output parameters

Summary Tables for Milestones and Metrics

The following table summarizes the schedule and milestones for both phases of the program.



Additional Information Related to Schedule and Milestones

- Proposers should provide a technical and programmatic strategy that conforms to the entire program schedule and presents an aggressive plan to fully address all program goals, metrics, milestones, and deliverables.
- The task structure must be consistent across the proposed schedule, Statement of Work, and cost volume.
- A target start date of December 2021 may be assumed for planning purposes.
- Schedules will be synchronized across performers, as required, and monitored/revised as necessary throughout the program.

- All proposals must include the following meetings and travel in the proposed schedule and costs:
    - To continue integration and development between TAs, foster collaboration between teams and disseminate program developments, a two-day Principal Investigator (PI) meeting will be held approximately every six months with locations split between the East and West Coasts of the United States. For budgeting purposes, plan for seven two-day meetings over the course of 36 months: four meetings in the Washington, D.C. area and three meetings in the San Francisco, CA area.
    - Regular teleconference meetings will be scheduled with the Government team for progress reporting as well as problem identification and mitigation. Proposers should anticipate at least one site visit per phase by the DARPA Program Manager during which they will have the opportunity to demonstrate progress towards agreed-upon milestones.

G. Deliverables

Performer(s) will be expected to provide at a minimum the following deliverables:

- Comprehensive quarterly technical reports due within ten days of the end of the given quarter, describing progress made on the specific milestones as laid out in the SOW, including those milestones listed in Section F.
- A phase completion report submitted within 30 days of the end of each phase, summarizing the research done.
- Source code and other appropriate media for the utility estimation tools developed by TA1 over the course of the program. Source code should be well-documented and follow industry best practices for readability.
- Source code and other appropriate media for the resource estimation tools developed by TA2 over the course of the program. Source code should be well-documented and follow industry best practices for readability.
- Other negotiated deliverables specific to the objectives of the individual efforts. These may include registered reports; experimental protocols; publications; data management plan; intermediate and final versions of software libraries, code, and APIs, including documentation and user manuals; and/or a comprehensive assemblage of design documents, models, modeling data and results, and model validation data.
- Reporting as outlined in Section VI.C.

H. Government-furnished Property/Equipment/Information

No Government-furnished Property/Equipment/Information is anticipated.

I. Other Program Objectives and Considerations

1. Collaboration

Throughout the course of the program, it is likely to be necessary for all performers—regardless of category—to share relevant information regarding their research and development to support the larger program goals. DARPA expects all program performers to work collaboratively with one another to realize the program objectives outlined herein, so proposers should carefully review the goals for the entire program in order to fully understand the context of each program objective, performer category, and TA within the overall program structure. All proposals should describe plans for ensuring transparency of their processes to enable interactions with other program performers. Proposals that fail to include these plans may be deemed non-conforming and be removed from consideration.

2. Intellectual Property

- The Quantum Benchmarking program emphasizes creating and leveraging open source technologies and architectures, making data sharing and collaboration key aspects of this program. Therefore, intellectual property rights asserted by proposers are strongly encouraged to be aligned with open source regimes. See Section VI.B.4 for more information related to intellectual property.
- Because a key goal of the Quantum Benchmarking program is the creation of new benchmarks for quantum computers and because it is intended that these benchmarks be widely disseminated and adopted, all required milestones listed in Section F, except for Resource Estimation Tools, should be marked as publicly releasable, with no intellectual property restrictions of any kind.
- The following guidance refers to delivered Resource Estimates and Resource Estimation Tools developed in TA2. All Resource Estimates should be marked as publicly releasable, with sufficient supporting information that would allow an expert in the field to verify and validate the estimates. Resource Estimation Tools, including all noncommercial software (including source code), software documentation, and hardware designs and documentation, should be provided as deliverables to the Government with a minimum of Government Purpose Rights (GPR).

II. Award Information

A. General Award Information

DARPA anticipates multiple awards.

The level of funding for individual awards made under this BAA will depend on the quality of the proposals received and the availability of funds. Awards will be made to proposers[4] whose proposals are determined to be the most advantageous to the Government, all evaluation factors

[4] As used throughout this BAA, "proposer" refers to the lead organization on a submission to this BAA. The proposer is responsible for ensuring that all information required by a BAA--from all team members--is submitted in accordance with the BAA. "Awardee" refers to anyone who might receive a prime award from the Government, including recipients of procurement contracts, cooperative agreements, or Other Transactions. "Subawardee" refers to anyone who might receive a subaward from a prime awardee (e.g., subawardee, consultant, etc.).

considered. See Section V for further information.

The Government reserves the right to:

- select for negotiation all, some, one, or none of the proposals received in response to this solicitation;
- make awards without discussions with proposers;
- conduct discussions with proposers if it is later determined to be necessary;
- segregate portions of resulting awards into pre-priced options;
- accept proposals in their entirety or select only portions of proposals for award;
- fund awards in increments with options for continued work at the end of one or more 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 identified for 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 accordance with 10 U.S.C. § 2371b(f), the Government may award a follow-on production contract or Other Transaction (OT) for any OT awarded under this solicitation if: (1) that participant in the OT, or a recognized successor in interest to the OT, successfully completed the entire prototype project provided for in the OT, as modified; and (2) the OT provides for the award of a follow-on production contract or OT to the participant, or a recognized successor in interest to the OT.

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

B. Fundamental Research

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

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

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

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

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

III. Eligibility Information

A. Eligible Applicants

All responsible sources capable of satisfying the Government's needs may submit a proposal for DARPA's consideration.

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

a. FFRDCs

FFRDCs are subject to applicable direct competition limitations and cannot propose to this solicitation in any capacity unless they meet the following conditions. (1) FFRDCs must clearly

demonstrate that the proposed work is not otherwise available from the private sector. (2) FFRDCs must provide a letter, on official letterhead from their sponsoring organization, that (a) cites the specific authority establishing their eligibility to propose to Government solicitations and compete with industry, and (b) certifies the FFRDC's compliance with the associated FFRDC sponsor agreement's terms and conditions. These conditions are a requirement for FFRDCs proposing to be awardees or subawardees.

b. Government Entities

Government Entities (e.g., Government/National laboratories, military educational institutions, etc.) are subject to applicable direct competition limitations. Government Entities must clearly demonstrate that the work is not otherwise available from the private sector and provide written documentation citing the specific statutory authority and contractual authority, if relevant, establishing their ability to propose to Government solicitations and compete with industry. This information is required for Government Entities proposing to be awardees or subawardees.

c. Authority and Eligibility

At the present time, DARPA does not consider 15 U.S.C. § 3710a to be sufficient legal authority to show eligibility. While 10 U.S.C.§ 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. Other Applicants

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

B. Organizational Conflicts of Interest

FAR 9.5 Requirements

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

Agency Supplemental OCI Policy

In addition, DARPA has a supplemental OCI policy that prohibits contractors/performers from concurrently providing Scientific Engineering Technical Assistance (SETA), Advisory and Assistance Services (A&AS) or similar support services and being a technical performer.

Therefore, as part of the FAR 9.5 disclosure requirement above, a proposer must affirm whether the proposer or *any* proposed team member (subawardee, consultant) is providing SETA, A&AS, or similar support to any DARPA office(s) under: (a) a current award or subaward; or (b) a past award or subaward that ended within one calendar year prior to the proposal's submission date.

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

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

Government Procedures

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

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

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

Include any OCIs affirmations and disclosures in Attachment G: VOLUME 3: ADMINISTRATIVE & NATIONAL POLICY REQUIREMENTS.

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). Cost sharing is encouraged where there is a reasonable probability of a potential commercial application related to the proposed research and development effort.

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

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

Proposers wishing to propose to multiple TAs must submit separate technical and cost proposals for each. Proposers should not submit proposals that combine multiple TAs into a single effort; **DARPA may deem proposals that address multiple technical areas non-conforming and remove them from consideration for award.** Proposers should strive to provide a clear understanding of the cost, risk, and organizational expertise to be used within each proposed effort.

IV. Application and Submission Information

Prior to submitting a full proposal, proposers are *strongly encouraged* to first submit an abstract as described below. This process allows a proposer to ascertain whether the proposed concept is (1) applicable to the Quantum Benchmarking BAA and (2) currently of interest. For the purposes of this BAA, applicability is defined as follows:

- The proposed concept is applicable to the technical areas described herein.
- The proposed concept is important to DSO's current investment portfolio.
- The proposed concept investigates an innovative approach that enables revolutionary advances, i.e., will not primarily result in evolutionary improvements to the existing state of practice.
- The proposed work has not already been completed (i.e., the research element is complete but manufacturing/fabrication funds are required).
- The proposer has not already received funding or a positive funding decision for the proposed concept (whether from DARPA or another Government agency).

Abstracts and full proposals that are not found to be applicable to the Quantum Benchmarking BAA as defined above may be deemed non-responsive and removed from consideration. All abstracts and full proposals must provide sufficient information to assess the validity/feasibility of their claims as well as comply with the requirements outlined herein for submission formatting, content and transmission to DARPA. Abstracts and full proposals that fail to do so may be deemed non-conforming and removed from consideration. Proposers will be notified of non-conforming determinations via letter.

A. Address to Request Application Package

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

B. Content and Form of Application Submission

1. Abstract Information and Formatting

As stated above, proposers are strongly encouraged to submit an abstract in advance of a full proposal to minimize effort and reduce the potential expense of preparing an out of scope proposal. All proposers are required to use Attachment A: ABSTRACT SUMMARY SLIDE TEMPLATE and Attachment B: ABSTRACT TEMPLATE provided with this solicitation on https://beta.sam.gov/ and http://www.grants.gov. Attachment A: ABSTRACT SUMMARY SLIDE TEMPLATE described herein must be in .ppt or .pptx format and should be attached as a separate file to this document.

The abstract provides a synopsis of the proposed project by briefly answering the following questions:

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

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

Proposers should note that a favorable response to an abstract is not a guarantee that a proposal based on the abstract will ultimately be selected for award negotiation.

While it is DARPA policy to attempt to reply to abstracts within thirty calendar days, proposers to this solicitation may anticipate a response within approximately three weeks. These official notifications will be sent via email to the Technical POC and/or Administrative POC identified on the abstract coversheet.

2. Full Proposal Information and Formatting

a. Proposal Volumes

Full proposals must consist of all 3 volumes described below. To assist in proposal development, templates for these volumes are posted as attachments to this solicitation on https://beta.sam.gov/. The templates are specific to each volume, as outlined below.

Full proposals requesting a procurement contract or Other Transaction (OT) must use the following attachments in each volume:

- **Volume 1**
  - Attachment C: PROPOSAL SUMMARY SLIDE TEMPLATE
  - Attachment D: PROPOSAL TEMPLATE VOLUME 1: TECHNICAL & MANAGEMENT
- **Volume 2**
  - Attachment E: PROPOSAL TEMPLATE VOLUME 2: COST
  - Attachment F: MS Excel™ DARPA COST PROPOSAL SPREADSHEET
- **Volume 3**
  - Attachment G: PROPOSAL TEMPLATE VOLUME 3: ADMINISTRATIVE & NATIONAL POLICY REQUIREMENTS

Full proposals requesting a cooperative agreement must use the following attachments in addition to the Grants.gov application package:

- **Volume 1**

- Attachment C: PROPOSAL SUMMARY SLIDE TEMPLATE
- Attachment D: PROPOSAL TEMPALTE VOLUME 1: TECHNICAL & MANAGEMENT

- **Volume 2***
  - Attachment F: MS Excel™ DARPA COST PROPOSAL SPREADSHEET
- **Volume 3**
  - Attachment G: PROPOSAL TEMPLATE VOLUME 3: ADMINISTRATIVE & NATIONAL POLICY REQUIREMENTS

* Full proposals requesting a grant or cooperative agreement do not need to include Attachment E. Instead, Budget Justification should be provided as Section L of the SF 424 Research & Related Budget form provided via http://www.grants.gov (see section IV.E.1.c for additional details). The Budget Justification should include the following information for the recipient and all subawardees:

- **Direct Labor (sections A and B)** - Detail the total number of persons and their level of commitment for each position listed (as well as which specific tasks (as described in the SOW) they will support.
- **Equipment (section C)** - Provide an explanation for listed requested equipment exceeding $5,000, properly justifying why it is required to meet the objectives of the program.
- **Travel (section D)** - Provide the purpose of the trip, number of trips, number of days per trip, departure and arrival destinations, number of people, etc.
- **Other Direct Costs (section F)** - Provide a justification for the items requested and an explanation of how the estimates were obtained.
- **Participant/Trainee Support Costs section E -** Provide details on Tuition/ Fees/ Health Insurance, Stipends, Travel and Subsistence costs.

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

All proposers are required to use the appropriate templates based on the type of award requested.

Templates are provided as attachments to this solicitation on https://beta.sam.gov/ and http://www.grants.gov. Full Proposals that do not include the appropriate attachments as detailed here may be deemed non-conforming and may not be evaluated.

b. Technology Investment Agreements

Proposers requesting Technology Investment Agreements (TIA) awarded under 10 U.S.C. 2371 must include the completed form indicated below. This requirement only applies only to those who expect to receive a TIA as their ultimate award instrument.

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

The Research and Related Senior/Key Person Profile (Expanded) form, available on the Grants.gov website at https://apply07.grants.gov/apply/forms/sample/RR_KeyPersonExpanded_2_0-V2.0.pdf, will be used to collect the following information for all senior/key personnel, including Project Director/Principal Investigator and Co-Project Director/Co-Principal Investigator, whether or not the individuals' efforts under the project are funded by the DoD:

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

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

c. DARPA Embedded Entrepreneur Initiative (EEI)

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

There are three elements to DARPA's EEI: (1) A Senior Commercialization Advisor (SCA) from DARPA who works with the Program Manager (PM) to examine the business case for the awardee's technology and uses commercial methodologies to identify steps toward achieving a successful transition of technology to the Government and commercial markets; (2) Connections to potential industry and investor partners via EEI's Transition Working Groups; and (3) Additional funding for awardees to hire an embedded entrepreneur to achieve specific commercialization milestones and work towards the delivery of a robust transition plan for both defense and commercial markets. This embedded entrepreneur's qualifications should include business experience within the target industries of interest, experience in commercializing early stage technology, and the ability to communicate and interact with technical and non-technical stakeholders. Funding for EEI is typically no more than $250,000 per awardee over the duration of the award. An awardee may apportion EEI funding to hire more than one embedded entrepreneur, if achieving the milestones requires different expertise that can be obtained without exceeding the awardee's total EEI funding. The EEI effort is intended to be conducted concurrent with the research program without extending the period of performance.

EEI Application Process:

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

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

available funding.

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

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

3. Proprietary Information

Proposers are responsible for clearly identifying proprietary information. Submissions containing proprietary information must have the cover page and each page containing such information clearly marked with a label such as "Proprietary" or "Company Proprietary." NOTE: "Confidential" is a classification marking used to control the dissemination of U.S. Government National Security Information as dictated in Executive Order 13526 and should not be used to identify proprietary business information.

4. Controlled Unclassified Information (CUI) and Controlled Technical Information (CTI) on Non-DoD Information Systems

Proposers and awardees are subject to the DoD requirements related to protection of CUI and CTI IAW Executive Order 13556, *Controlled Unclassified Information*, DFARS 252.204-7000, *Disclosure of Information*, DFARS 252.204-7012, *Safeguarding Covered Defense Information and Cyber Incident Reporting*, DoD Instruction 5200.48, Controlled Unclassified Information, DoD Instruction 8582.01, *Security of Non-DoD Information Systems Processing Unclassified Nonpublic DoD Information*. See http://www.darpa.mil/work-with-us/additional-baa for additional guidance on protecting CUI on Non-DoD Information Systems.

CUI is defined as unclassified information that requires safeguarding or dissemination controls, pursuant to and consistent with applicable law, regulations, and Government-wide policies.

Controlled Technical Information (CTI) is defined as technical information with military or space application that is subject to controls on its access, use, reproduction, modification, performance, display, release, disclosure, or dissemination. The term CTI does not include information that is lawfully publicly available without restrictions.

DoD considers "technical information" to be technical data or computer software, as those terms are defined in Defense Federal Acquisition Regulation Supplement clause 252.227-7013, "Rights in Technical Data - Noncommercial Items" (48 CFR 252.227-7013). Examples of technical information include research and engineering data; engineering drawings and associated lists; specifications, standards, process sheets, manuals, technical reports, technical orders, catalog-item identifications, data sets, studies and analyses and related information; and computer software code. Note that such technical information may or may not be controlled (i.e., CTI), depending on whether it has military or space application.

As part of Attachment D: PROPOSAL TEMPLATE VOLUME 1: TECHNICAL & MANAGEMENT, the proposer should include a Statement of Work with a breakdown of all research tasks and subtasks and indicate the proposed classification for each. For all tasks and subtasks proposed to be unclassified, proposers should distinguish between work proposed to be Fundamental Research versus work proposed to be CUI. Proposers will provide a short explanation for why each subtask should be categorized as Fundamental Research or CUI.

If CUI tasks are proposed in the Statement of Work, proposers must provide a plan for protecting Controlled Unclassified Information as part of Attachment G: PROPOSAL TEMPLATE VOLUME 3: ADMINISTRATIVE & NATIONAL POLICY REQUIREMENTS.

CTI is to be marked "DISTRIBUTION C. Distribution authorized to U.S. Government agencies and their contractors; Critical Technology; [current date]. Other requests for this document shall be referred to DARPA, DSO" in accordance with Department of Defense Instruction 5203.24, "Distribution of Statements on Technical Documents."

5. Security Information

DARPA anticipates that submissions received under this BAA will be unclassified. However, should a proposer wish to submit classified information, an *unclassified* email must be sent to the BAA mailbox requesting submission instructions from the DARPA/DSO Program Security Officer (PSO).

a. Controlled Unclassified Information (CUI)

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

i. CUI Proposal Markings

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

ii. CUI Submission Requirements

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

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

Security classification guidance and direction via a Security Classification Guard (SCG) and/or DD Form 254, "DoD Contract Security Classification Specification," will not be provided at this time, since DARPA is soliciting ideas only. If a determination is made that the award instrument may result in access to classified information, a SCG and/or DD Form 254 will be issued by

DARPA and attached as part of the award.

C. Submission Dates and Times

Proposers are warned that submission deadlines as outlined herein are in Eastern Time and will be strictly enforced. When planning a response to this solicitation, proposers should take into account that some parts of the submission process may take from one business day to one month to complete (e.g., registering for a Data Universal Numbering System (DUNS) number or Taxpayer Identification Number (TIN)).

DARPA will acknowledge receipt of *complete* submissions via email and assign identifying numbers that should be used in all further correspondence regarding those submissions. If no confirmation is received within two business days, please contact the BAA Administrator at QuantumBenchmarking@darpa.mil to verify receipt.

1. Abstracts

Abstracts must be submitted per the instructions outlined herein *and received by DARPA* no later than the due date and time listed in Part One: Overview Information. Abstracts received after this time and date may not be reviewed.

2. Full Proposals

Full proposal packages as detailed in Section IV.B.2 above, and, as applicable, proprietary subawardee cost proposals and classified appendices to unclassified proposals, must be submitted per the instructions outlined herein *and received by DARPA* no later than the due date and time listed in Part One: Overview Information. Proposals received after this time and date may not be reviewed.

D. Funding Restrictions

Not applicable.

E. Other Submission Requirements

1. Unclassified Submission Instructions

Proposers must submit all parts of their submission package using the same method; submissions cannot be sent in part by one method and in part by another method nor should duplicate submissions be sent by multiple methods. Email submissions will not be accepted. Failure to comply with the submission procedures outlined herein may result in the submission being deemed non-conforming and withdrawn from consideration.

a. Abstracts

DARPA/DSO will employ an electronic upload submission system (https://baa.darpa.mil/) for all UNCLASSIFIED abstracts sent in response to this solicitation. *Abstracts must not be submitted via Grants.gov.*

First time users of the DARPA BAA Submission website must complete a two-step account creation process. The first step consists of registering for an extranet account by going to the

URL listed above 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, the second step requires proposers to go back to the submission website and log in using that user name and password. After accessing the extranet, proposers may then create a user account for the DARPA BAA Submission website by selecting the "Register your Organization" link at the top of the page. Once the user account is created, proposers will be able to see a list of solicitations open for submissions, view submission instructions, and upload/finalize 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 abstracts submitted electronically through the DARPA BAA Submission website must meet the following requirements: (1) uploaded as a zip file (.zip or .zipx extension); (2) only contain the document(s) requested herein; (3) only contain unclassified information; and (4) must not exceed 100 MB in size. Only one zip file will be accepted per abstract and abstracts not uploaded as zip files will be rejected by DARPA.

Technical support for the DARPA BAA Submission website is available during regular business hours, Monday – Friday, 9:00 a.m. – 5:00 p.m. Requests for technical support must be emailed to BAAT_Support@darpa.mil with a copy to QuantumBenchmarking@darpa.mil. Questions regarding submission contents, format, deadlines, etc. should be emailed to QuantumBenchmarking@darpa.mil. Questions/requests for support sent to any other email address may result in delayed/no response.

Since proposers may encounter heavy traffic on the web server, DARPA discourages waiting until the day abstracts are due to request an account and/or upload the submission.

NOTE: Proposers submitting an abstract via the DARPA BAA Submission site MUST (1) click the "Finalize" button in order for the submission to upload AND (2) do so with sufficient time for the upload to complete prior to the deadline. Failure to do so will result in a late submission.

b. Proposals Requesting a Procurement Contract or Other Transaction

Proposers requesting procurement contracts or Other Transactions may submit full proposals through ONE of the following methods: (1) electronic upload (DARPA-preferred); or (2) direct mail/hand-carry.

i. Electronic Upload

DARPA/DSO encourages proposers to submit UNCLASSIFIED proposals via the DARPA BAA Submission website at https://baa.darpa.mil.

First time users of the DARPA BAA Submission website must complete a two-step account creation process. The first step consists of registering for an extranet account by going to the URL listed above 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, the second step requires proposers to go back to the submission website and log in using that user name and password. After accessing the extranet, proposers may then create a user account for the DARPA BAA Submission website by selecting the "Register your Organization" link at the top of the page. Once the user account is created, proposers will be able to see a list of solicitations open for submissions, view submission instructions, and upload/finalize 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 full proposals submitted electronically through the DARPA BAA Submission website must meet the following requirements: (1) uploaded as a zip file (.zip or .zipx extension); (2) only contain the document(s) requested herein; (3) only contain unclassified information; and (4) must not exceed 100 MB in size. Only one zip file will be accepted per full proposal and full proposals not uploaded as zip files will be rejected by DARPA.

Technical support for the DARPA BAA Submission website is available during regular business hours, Monday – Friday, 9:00 a.m. – 5:00 p.m. Requests for technical support must be emailed to BAAT_Support@darpa.mil with a copy to QuantumBenchmarking@darpa.mil. Questions regarding submission contents, format, deadlines, etc. should be emailed to QuantumBenchmarking@darpa.mil. Questions/requests for support sent to any other email address may result in delayed/no response.

Since proposers may encounter heavy traffic on the web server, DARPA discourages waiting until the day proposals are due to request an account and/or upload the submission. NOTE: Proposers submitting a proposal via the DARPA BAA Submission site MUST (1) click the "Finalize" button in order for the submission to upload AND (2) do so with sufficient time for the upload to complete prior to the deadline. Failure to do so will result in a late submission.

ii. Direct Mail/Hand-carry

Proposers electing to submit procurement contract or Other Transaction proposals via direct mail or hand-carried must provide one paper copy and one electronic copy on CD or DVD of the full proposal package. All parts of the proposal package must be mailed or hand-carried in a single delivery to the address noted in Section VII below.

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 (DARPA-preferred); or (2) hard-copy mailed directly to DARPA. If proposers intend to use Grants.gov as their means of submission, then they must submit their entire proposal through Grants.gov; applications cannot be submitted in part to Grants.gov and in part as a hard-copy. Proposers using Grants.gov do not submit hard-copy proposals in addition to the Grants.gov electronic submission.

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

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

To evaluate compliance with Title IX of the Education Amendments of 1972 (20 U.S.C. § 1681 et.seq.), the Department of Defense (DoD) is collecting certain demographic and career information to be able to assess the success rates of women who are proposed for key roles in applications in science, technology, engineering or mathematics disciplines. In addition, the National Defense Authorization Act (NDAA) for FY 2019, Section 1286, directs the Secretary of Defense to protect intellectual property, controlled information, key personnel, and information about critical technologies relevant to national security and limit undue influence, including foreign talent programs by countries that desire to exploit United States' technology within the DoD research, science and technology, and innovation enterprise. This requirement is necessary for all research and research-related educational activities. The DoD is using the two forms below to collect the necessary information to satisfy these requirements. Detailed instructions for each form are available on Grants.gov.

Form 2: 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.*

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

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

Additional senior/key persons can be added by selecting the "Next Person" button at the bottom of the form. Note that, although applications without this information completed may pass Grants.gov edit checks, if DARPA receives an application without the required information, DARPA may determine that the application is incomplete and may cause your submission to be rejected and eliminated from further review and consideration under the solicitation. DARPA

reserves the right to request further details from the applicant before making a final determination on funding the effort.

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

i. Electronic Upload

DARPA encourages cooperative agreement proposers to submit their proposals via electronic upload at http://www.grants.gov/web/grants/applicants/apply-for-grants.html.Proposers electing to use this method must complete a one-time registration process on Grants.gov before a proposal can be electronically submitted. *If proposers have not previously registered, this process can take up to four weeks* so registration should be done in sufficient time to ensure it does not impact a proposer's ability to meet required submission deadlines. Registration requirements and instructions are outlined at http://www.grants.gov/web/grants/register.html.

Carefully follow the DARPA submission instructions provided with the solicitation application package on Grants.gov. Only the required forms listed therein (e.g., SF-424 and Attachments form) should be included in the submission. *NOTE: Grants.gov does not accept zipped or encrypted proposals.*

Once Grants.gov has received an uploaded proposal submission, Grants.gov will send two email messages to notify proposers that: (1) the proposal has been received by Grants.gov; and (2) the proposal has been either validated or rejected by the system. *It may take up to two business days to receive these emails.* If the proposal is validated, then the proposer has successfully submitted their proposal. If the proposal is rejected, the submission must be corrected, resubmitted and revalidated before DARPA can retrieve it. If the solicitation is no longer open, the rejected proposal cannot be resubmitted. Once the proposal is retrieved by DARPA, Grants.gov will send a third email to notify the proposer. DARPA will send a final confirmation email as described in Section IV.C.

To avoid missing deadlines, Grants.gov recommends that proposers submit their proposals to Grants.gov 24-48 hours in advance of the proposal due date to provide sufficient time to complete the registration and submission process, receive email notifications and correct errors, as applicable.

Technical support for Grants.gov submissions may be reached at 1-800-518-4726 or support@grants.gov.

ii. Direct Mail/Hand-carry

Proposers electing to submit grant or cooperative agreement proposals via direct mail or hand-carried must provide one paper copy and one electronic copy on CD or DVD of the full proposal package. Proposers must complete the SF 424 R&R form (Application for Federal Assistance, Research and Related) provided at Grants.gov as part of the opportunity application package for this BAA and include it in the proposal submission. All parts of the proposal package must be mailed or hand-carried to the address noted in Section VII below.

V. Application Review Information

A. Evaluation Criteria

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

- **Overall Scientific and Technical Merit**

The proposed technical approach is innovative, feasible, achievable, and complete.

The proposed technical team has the expertise and experience to accomplish the proposed tasks. Task descriptions and associated technical elements provided are complete and in a logical sequence with all proposed deliverables clearly defined such that a final outcome that achieves the goal can be expected as a result of award. The proposal identifies major technical risks, and planned mitigation efforts are clearly defined and feasible. The proposed schedule aggressively pursues performance metrics in an efficient time frame that accurately accounts for the anticipated workload.

- **Potential Contribution and Relevance to the DARPA Mission**

The potential contributions of the proposed effort bolster the national security technology base and support DARPA's mission to make pivotal early technology investments that create or prevent technological surprise. The proposed intellectual property restrictions (if any) will not significantly impact the Government's ability to transition the technology.

- **Cost Realism**

The proposed costs are realistic for the technical and management approach and accurately reflect the technical goals and objectives of the solicitation. 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

DARPA will conduct a scientific/technical review of each conforming proposal. Conforming proposals comply with all requirements detailed in this solicitation; proposals that fail to do so may be deemed non-conforming and may be removed from consideration. Proposals will not be evaluated against each other since they are not submitted in accordance with a common work statement. DARPA's intent is to review proposals as soon as possible after they arrive; however, proposals may be reviewed periodically for administrative reasons.

The review process identifies proposals that meet the evaluation criteria described above and are, therefore, selectable for negotiation of awards by the Government. DARPA policy is to ensure impartial, equitable, comprehensive proposal evaluations and to select proposals that meet

DARPA technical, policy, and programmatic goals. Proposals that are determined selectable will not necessarily receive awards (see Section II). Selections may be made at any time during the period of solicitation. For evaluation purposes, a proposal is defined to be the document and supporting materials as described in Section IV.

1. Handling of Source Selection Information

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

Submissions will not be returned. The original of each submission received will be retained at DARPA and all other non-required copies destroyed. A certification of destruction may be requested via email to the BAA mailbox, provided the formal request is received within 5 days after being notified of submission status.

C. Federal Awardee Performance and Integrity Information (FAPIIS)

Following the review and selection process described above, but prior to making an award above the simplified acquisition threshold (FAR 2.101), DARPA is required[5] to review and consider any information available through the designated integrity and performance system (currently FAPIIS). Selectees have the opportunity to comment on any information about themselves entered in the database. DARPA will consider any comments and other information in FAPIIS or other systems prior to making an award.

VI. Award Administration Information

A. Selection Notices

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

B. Administrative and National Policy Requirements

[5] Per 41 U.S.C. 2313, as implemented by FAR 9.103 and 2 CFR § 200.205.

1. Solicitation Provisions and Award Clauses, Terms and Conditions

Solicitation provisions relevant to DARPA BAAs are listed on the Additional BAA Content page on DARPA's website at www.darpa.mil/work-with-us/additional-baa. This page also lists award clauses that, depending on their applicability, may be included in the terms and conditions of awards resultant from DARPA solicitations. This list is not exhaustive and the clauses, terms and conditions included in a resultant award will depend on the nature of the research effort, the specific award instrument, the type of awardee, and any applicable security or publication restrictions.

For terms and conditions specific to grants and/or cooperative agreements, see the DoD General Research Terms and Conditions (latest version) at http://www.onr.navy.mil/Contracts-Grants/submit-proposal/grants-proposal/grants-terms-conditions and the supplemental DARPA-specific terms and conditions at http://www.darpa.mil/work-with-us/contract-management#GrantsCooperativeAgreements.

The above information serves to put potential proposers and awardees on notice of proposal requirements and award terms and conditions to which they may have to adhere.

2. System for Award Management (SAM) and Universal Identifier Requirements

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

International entities can register in SAM by following the instructions in this link: https://www.fsd.gov/fsd-gov/answer.do?sysparm_kbid=dbf8053adb119344d71272131f961946&sysparm_search=KB0013221.

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

- DUNS number
- TIN
- Commercial and Government Entity (CAGE) Code. If a proposer does not already have a CAGE code, one will be assigned during SAM registration.
- Electronic Funds Transfer information (e.g., proposer's bank account number, routing number, and bank phone or fax number).

3. Representations and Certifications

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

In addition, all proposers are required to submit for all award instrument types (i.e., procurement contract, cooperative agreement, grant, and Other Transaction for Prototype) supplementary DARPA-specific representations and certifications at the time of proposal submission. See

http://www.darpa.mil/work-with-us/reps-certs for further information on required representation and certification depending on your requested award instrument.

4. Intellectual Property

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

If proposers desire to use proprietary computer software or technical data or both as the basis of their proposed approach, in whole or in part, they should: (1) clearly identify such software/data and its proposed particular use(s); (2) explain how the Government will be able to reach its program goals (including transition) within the proprietary model offered; and (3) provide possible nonproprietary alternatives in any area that might present transition difficulties or increased risk or cost to the Government under the proposed proprietary solution. Proposers expecting to use, but not to deliver, commercial open source tools or other materials in implementing their approach may be required to indemnify the Government against legal liability arising from such use.

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) 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. See Attachment G: PROPOSAL TEMPLATE VOLUME 3: ADMINISTRATIVE & NATIONAL POLICY REQUIREMENTS, Section 4.

b. Patents

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

c. Procurement Contracts

i. 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 non-conforming. A template for complying with this request is provided in Attachment G: PROPOSAL TEMPLATE VOLUME 3: ADMINISTRATIVE & NATIONAL POLICY REQUIREMENTS, Section 4.

ii. 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 noncommercial 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 non-conforming. A template for complying with this request is provided in Attachment G: PROPOSAL TEMPLATE VOLUME 3: ADMINISTRATIVE & NATIONAL POLICY REQUIREMENTS, Section 4.

d. Other Types of Awards

Proposers 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. This includes both noncommercial items and commercial items. The Government may use the list as part of the evaluation process to assess the impact of any identified restrictions and may request additional information from the proposer, to evaluate the proposer's assertions. Failure to provide full information may result in a determination that the proposal is non-conforming. A template for complying with this request is provided in Attachment G: PROPOSAL TEMPLATE VOLUME 3: ADMINISTRATIVE &

NATIONAL POLICY REQUIREMENTS, Section 4.

5. Program-generated Data

Data are increasingly the key product of research and engineering endeavors. To ensure the reproducibility of results and access to source data for future research, awardees will be required to maintain and deliver any data generated during award performance ("program-generated data") that is needed to accomplish these goals. Awardees shall be expected to document both the proprietary and non-proprietary products of their research to ensure the retention and potential reusability of this information. This may include:

- Raw unprocessed data, software source code and executables, build scripts, process sequence, programmatic communication and other collaboration activities
- Data sets: rarified, experimental, test and measurement data
- Design of experiments and simulations
- Models or simulations (computational or mathematical)
- Recordings of various physical phenomena (including images, videos, sensor data, etc.)
- Access to and use of institutional, organizational or scientific community repositories and archives

When possible, DARPA may share some or all of the program-generated data with the broader research community as open data (with permission to access, reuse, and redistribute under appropriate licensing terms where required) to the extent permitted by applicable law and regulations (e.g., privacy, security, rights in data, and export control). DARPA plans to enable reproducibility of results through data sharing and to establish (or contribute to) digital collections that can advance this and other scientific fields.

6. Human Subjects Research (HSR)/Animal Use

Proposers that anticipate involving human subjects or animals in the proposed research must comply with the approval procedures detailed at http://www.darpa.mil/work-with-us/additional-baa, to include providing the information specified therein as required for proposal submission.

7. Electronic Invoicing and Payments

Awardees will be required to submit invoices for payment electronically via Wide Area Work Flow (WAWF), accessed through the Procurement Integrated Enterprise Environment at https://piee.eb.mil/, unless an exception applies. Registration in WAWF is required prior to any award under this BAA.

8. Electronic and Information Technology

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

9. 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) and DoDI 8582.01 that are in effect at the time the solicitation is issued.

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

C. Reporting

1. Technical and Financial Reports

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

2. Patent Reports and Notifications

All resultant awards will contain a mandatory requirement for patent reports and notifications to be submitted electronically through i-Edison (https://public.era.nih.gov/iedison).

VII. Agency Contacts

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

- **Technical POC**: Joseph Altepeter, Program Manager, DARPA/DSO
- **BAA Email:** QuantumBenchmarking@darpa.mil
- **BAA Mailing Address:**

  DARPA/DSO

ATTN: HR001121S0026
675 North Randolph Street
Arlington, VA 22203-2114

- **DARPA/DSO Opportunities Website:** http://www.darpa.mil/work-with-us/opportunities

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

VIII. Other Information

A. Proposers Day

The Quantum Benchmarking Proposers Day will be held on April 20, 2021 via webcast. Advance registration is required for this meeting. See the anticipated DARPA-SN-21-22 posted at https://beta.sam.gov/ for all details. Participation in the Quantum Benchmarking Proposers Day or viewing the webcast is voluntary and is not required to propose to this solicitation.

B. Frequently Asked Questions (FAQs)

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

DARPA will attempt to answer questions in a timely manner; however, questions submitted within 10 days of the proposal due date may not be answered. DARPA will post an FAQ list at: http://www.darpa.mil/work-with-us/opportunities. The list will be updated on an ongoing basis until the BAA expiration date as stated in Part I.

C. Collaborative Efforts/Teaming

DARPA highly encourages teaming before proposal submission and, as such, will facilitate the formation of teams with the necessary expertise. Interested parties should submit a one-page profile including the following information:

- Contact information to include name, organization, email, telephone number, mailing address, organization website (if applicable).
- A brief description of the proposer's technical competencies.
- Desired expertise from other teams, if applicable.

All profiles must be emailed to QuantumBenchmarking@darpa.mil no later than 12:00 p.m. April 26, 2021. Following the deadline, the consolidated teaming profiles will be sent via email to the proposers who submitted a valid profile. Specific content, communications, networking, and team formation are the sole responsibility of the participants. Neither DARPA nor the DoD endorses the information and organizations contained in the consolidated teaming profile document, nor does DARPA or the DoD exercise any responsibility for improper dissemination of the teaming profiles. Teams need not be finalized at the time of abstract submission.