Broad Agency Announcement

DARPA Subterranean (SubT) Challenge

Tactical Technology Office (TTO)

HR001118S0016

January 25, 2018

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

Table of Contents

PART I: OVERVIEW INFORMATION

- **Federal Agency Name** – Defense Advanced Research Projects Agency (DARPA), Tactical Technology Office (TTO)

- **Funding Opportunity Title –** DARPA Subterranean (SubT) Challenge

- **Announcement Type –** Initial Announcement

- **Funding Opportunity Number –** HR001118S0016

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

- **Dates**
    - Posting Date: January 25, 2018
    - Proposers Day: January 18, 2018, Arlington, VA
    - Abstracts Due: February 5, 2018, 1:00 p.m. (Eastern)
    - Questions Due: February 20, 2018, 5:00 p.m. (Eastern)
    - Proposals Due: March 23, 2018, 1:00 p.m. (Eastern)

- **Concise description of the funding opportunity –** The goal of the DARPA Subterranean Challenge is to discover innovations that enable integrated and rapid mapping, navigation, and search of complex environments.

- **Total amount anticipated to be awarded** – Approximately $40M total. It is anticipated that funding will be allocated as shown below:

Track A	Up to $30M
Track C	Up to $6M
Prizes	Approximately $4M

    (prize authority being sought under 10 U.S.C. § 2374a)

- **Anticipated individual awards** – DARPA intends to award multiple contracts as explained in Section I.C.

- **Types of instruments that may be awarded** – Procurement contract, cooperative agreement, or Other Transaction.

- **Agency contact**
    - Points of Contact
      The BAA Coordinator for this effort can be reached at:
      SubTChallenge@darpa.mil

PART II: FULL TEXT OF ANNOUNCEMENT

I.   Funding Opportunity Description

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

The Defense Advanced Research Projects Agency (DARPA) is soliciting innovative proposals to advance technologies through both a systems and virtual competition that will enhance the ability to rapidly map, navigate, and search subterranean environments. Proposed research should investigate innovative approaches that enable revolutionary advances in science, devices, or systems. Specifically excluded is research that primarily results in evolutionary improvements to the existing state of practice.

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

A.   Program Vision

A.1. Motivation for the DARPA Subterranean Challenge

Subterranean environments remain, in many ways, a hidden domain in spite of being broadly relevant across a range of military and civilian applications. The challenges presented by subterranean environments can vary drastically across subdomains (depicted in Figure 1), which can include human-made tunnel systems, urban and municipal underground infrastructure, and natural cave networks. Tunnels can extend many kilometers in length and can include highly constrained passages, multiple levels, and vertical shafts. Alternatively, urban underground environments are often more structured and constructed out of man-made materials, but can have complex layouts that cover multiple stories and/or span multiple city blocks. Natural cave networks often have irregular geological structures, with both constrained passages and large caverns, and unpredictable topologies often stretching large distances in extent and depth.

Figure 1: Representative examples of diverse subterranean subdomains: tunnel systems, urban underground, and cave networks

Even under ideal conditions, these complex environments present significant challenges for subterranean situational awareness. However, in time-sensitive scenarios, whether in active combat operations or disaster response settings, warfighters and first responders alike are faced with a range of increased technical challenges, including difficult and dynamic terrains, unstable

structures and obstacles, degraded environmental conditions, severe communication constraints, and expansive areas of operation. In many cases, these environments pose too great a risk to deploy personnel, and current technologies fail to provide the necessary rapid and remote mapping, navigation, and search capabilities.

The multi-faceted nature of these problems presents both a need and an opportunity for breakthrough innovations for public safety scenarios as well as a wide range of military, academic, and commercial applications, including infrastructure inspection, oil/gas/mining, construction, archeology, and scientific exploration. The DARPA Subterranean Challenge (a.k.a. the SubT Challenge) aims to bring together multi-disciplinary teams and industries across disparate fields to establish a broader research community and develop these innovative leap-ahead capabilities. Teams participating in the challenge will be tasked with designing and developing systems that address the challenges of subterranean environments across all three subdomains. DARPA is seeking authority under 10 U.S.C. § 2374a to simulate innovations using prize competitions.

A.2. Program Goals

The primary goal of the DARPA Subterranean Challenge is to discover innovative solutions that can rapidly and remotely map, navigate, and search complex environments, including human-made tunnel systems, urban and municipal underground infrastructure, and natural cave networks. Given the complex problem space presented by these environments, the DARPA Subterranean Challenge seeks to inspire and realize technological breakthroughs to offer key insights into:

- Disruptive concepts of operations that both enable and exploit the capability to conduct rapid and autonomous subterranean missions; and

- Composition of system capabilities to offer freedom of mobility at operationally relevant speeds in complex, unpredictable, and diverse subterranean environments.

The variety of built-in challenge elements and the competition structure itself are intended to address the secondary goal of increasing the diversity, versatility, cost-effectiveness, and robustness of relevant technologies and systems capable of addressing the myriad needs of a wide range of environments rather than serving single-purpose uses with specifically tailored solutions.

Another goal of the DARPA Subterranean Challenge is to establish a collaborative community by bringing together multi-disciplinary teams and cross-cutting approaches across disparate fields to tackle the autonomy, perception, networking, and mobility needs of the subterranean domain. To encourage a broader range of participants, the SubT Challenge includes both a physical Systems competition as well as a software-only Virtual competition. Teams in the Systems competition will develop and demonstrate physical systems in real-world environments, which will emphasize the interdisciplinary nature of fielding integrated solutions. Teams in the Virtual competition will use virtual models of systems, environments, and terrain to compete in simulation-based events that will focus effort on software-driven innovations.

To initiate such cross-cutting approaches, DARPA will develop the SubT Virtual Testbed comprising an extensible and validated simulation environment, automated testing and assessment tools, and associated software support infrastructure to be provided as government-furnished equipment (GFE). Teams in both the Systems and Virtual competitions will leverage this suite of GFE simulation tools to accelerate the development and evaluation of their proposed solutions. It

is anticipated that this testbed will have a dramatic and long-lasting positive impact on the broader military, academic, and commercial communities by providing a way to explore the unique challenges of the subterranean domain and evaluate potential solutions in a scalable and extensible simulation environment.

A.3. Illustrative Scenario

The primary scenario of interest for the SubT Challenge is providing rapid situational awareness for a team of warfighters or first responders operating in unknown and dynamic environments. The layout of the environment is unknown, could degrade or change over time (i.e., dynamic terrain), and is too high-risk to send in personnel. Potential representative scenarios involve rescue efforts in collapsed mines, post-earthquake search and rescue in urban underground settings, and/or cave rescue operations for injured or lost spelunkers. Additional scenarios include a range of military missions in which teams of systems could be sent in advance of warfighters to perform rapid search and mapping in support of follow-on operations. These scenarios present significant dangers that would preclude employing a human team, such as collapsed and unstable structures or debris, presence of hazardous materials, lack of ventilation, and potential for smoke and/or fire.

To effectively respond in these situations, teams will need to rapidly and remotely explore and exploit complex and unknown environments at large scales. The proposed systems will need to be capable of navigating the challenging terrains and obstacles found across the three subdomains. As the systems build a context-dependent map of the environment, they will also need to search for objects of interest, which could vary in size, quantity, and detection signatures (e.g., visual, thermal, chemical).

Such complex environments are expected to present diverse morphologies, ranging from, e.g., crawl spaces, branches and dead ends, vertical shafts, larger open expanses to densely cluttered environments. The courses could vary in length from hundreds to thousands of meters, resulting in mission durations ranging from tens of minutes to several hours. Further, given the scenario's need for urgency, it is not expected that manual and time-consuming teleoperation of individual systems is viable due to both severe communications constraints and large spatial scales of these settings.

B.   Program Description

The goal of the DARPA Subterranean Challenge is to advance innovative solutions to map, navigate, and search complex subterranean environments at high operational tempos. The challenge elements and scoring objectives are designed to drive innovation in developing integrated solutions that address gaps in autonomy, perception, networking, and mobility required to operate in widely varying subterranean settings. This section provides an overview of the Challenge and describes how the technical elements relate to the DARPA Subterranean Challenge vision. Further details regarding the rules and scoring of the Challenge are to be provided at a later date.

B.1. Competition Overview

The DARPA Subterranean Challenge is organized into two competitions (Systems and Virtual), each with two tracks (DARPA-funded and self-funded). Teams in the Systems tracks will develop and demonstrate physical systems to compete in live competitions on physical, representative subterranean courses. Teams in the Virtual tracks will develop software and

algorithms using virtual models of systems, environments, and terrain to compete in simulation-based events.

The two competitions are designed to cross-fertilize and accelerate development across both Systems and Virtual track participants. The objectives, rules, and events for the two competitions are closely related, but provide different avenues for development of innovative approaches and technologies. The Systems competition focuses on advancing and evaluating novel physical solutions in realistic field environments, while the Virtual competition explores larger-scale runs in virtual environments that explore significantly expanded scenario sizes and durations.

The Systems and Virtual competitions will each hold concurrent and coordinated Challenge events to include three Circuit Events and a Final Event, each motivated by an illustrative vignette that will provide context and constraints for the map, navigate, and search mission. The three Circuit events (a.k.a. the Tunnel Circuit, Urban Circuit, and Cave Circuit) will each focus on one of the three subdomains, and are intended to promote frequent "build-test-compete" iterations within and among all participating teams. For Systems teams, Circuit events will be held at selected sites based on the relevant subdomain's distinguishing characteristics. Virtual teams will have similar virtual Circuit Events, presented with synthetic test courses also focused on a specific subdomain, but at larger spatial and temporal scales. The Final Event will combine elements of all three subdomains into a single integrated challenge course (as notionally illustrated in Figure 2) to demonstrate the versatility of solutions developed.
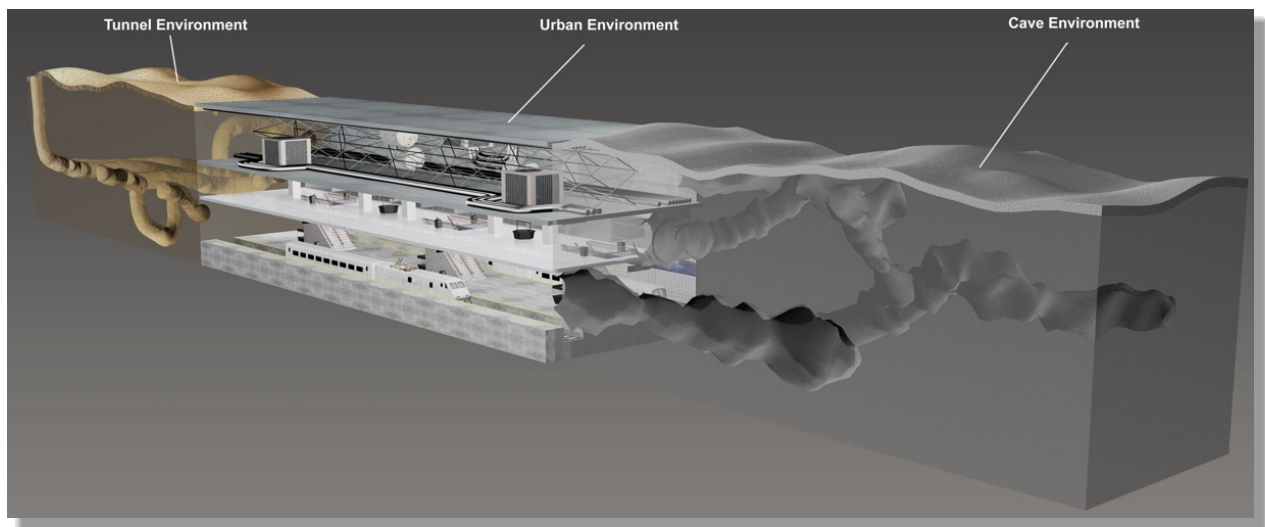
Figure 2: Notional concept for an integrated subterranean competition course, illustrating elements of tunnel systems, urban underground, and cave networks

Teams are charged with pursuing high-risk, high-reward approaches to meet and exceed the objectives of the Circuits and Final Events, and are motivated by the potential for winning monetary prizes and/or incentivized by possible continued funding. Those teams selected to receive DARPA contract awards must continue to excel, as continued funding is based, in part, by their performance in these events. Such DARPA-funded teams also have the opportunity to

compete for the prizes in the Final Events. Self-funded teams are competing for prize money rewarding high performance at each of the Circuits, in addition to the prizes in the Final Events.

To support the efforts in both competitions, DARPA will develop the SubT Virtual Testbed, an extensible and validated Gazebo-based simulation environment, automated testing and assessment tools, and associated software support infrastructure to be provided as government-furnished equipment (GFE). The SubT Virtual Testbed will be developed to emulate as many of the same subterranean environments and characteristics that will be presented in the physical competition and as realistically as possible. Upon initial release of its core elements ahead of the Challenge Kickoff, continuous integration and deployment of updates and features to the SubT Virtual Testbed are expected through frequent stable releases. DARPA intends to make the SubT Virtual Testbed available to all SubT Challenge competitors across both Systems and Virtual competitions. Competitors will leverage this DARPA-provided simulation environment for development and assessment of their proposed solutions.

As part of their interim deliverables, DARPA-funded Systems teams must provide virtual models of their developmental systems. DARPA will work with each of the Systems teams to perform physical validation of the virtual models and ensure that these models reflect sufficient fidelity (e.g., geometry, kinematics, performance) for integration and use in the SubT Virtual Testbed. For any unconventional approaches that may be proposed, DARPA will work with those teams to determine an appropriate virtual model on a case-by-case basis. These verified virtual models (and any revisions) will help populate the "SubT Tech Repo" – an online catalog of subterranean technologies – alongside other candidate virtual models of Government-developed and/or commercial off-the-shelf (COTS) systems.

The Virtual track competitors will then be able to "mix and match" using one or more models selected from the SubT Tech Repo, load their own respective software-based innovations, and compete against a field of other capability mixes. As such, Virtual track teams will not only aim to compose the best combination of available capabilities, but will also seek to optimize their software (e.g., algorithms for mapping, navigation, and search in subterranean environments) to best take advantage of those capabilities. Relevant mission constraints (e.g., total cost, packed volume, power budget), as presented in the event vignettes, will further influence this optimization. Virtual competitors must use existing models from the SubT Tech Repo. Development and use of custom mobility or sensor hardware models by Virtual teams is not permitted.

The program is organized into three phases as illustrated in Figure 3:

- **Phase 1**: Systems track teams will have approximately 12 months to complete their baseline design, development, integration, and testing of their proposed solutions. As part of this effort, the Systems teams will develop and provide DARPA with a virtual model of their systems for inclusion in the SubT Tech Repo. Virtual track teams will have approximately 12 months to develop, integrate, and test their software-based solutions using an initial release of the SubT Tech Repo.
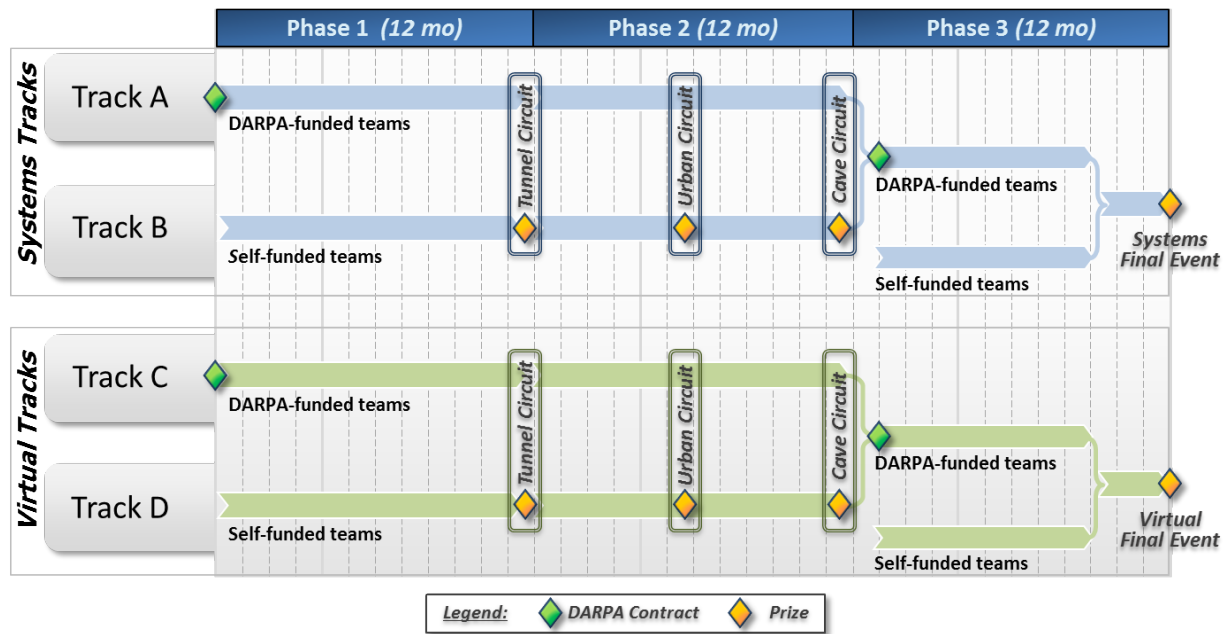
Figure 3: Notional program structure and schedule for the DARPA Subterranean Challenge

Phase 1 will culminate with the Tunnel Circuit events for both Systems and Virtual tracks. The Systems Tunnel Circuit is anticipated to be approximately a week-long event with teams deploying their systems in a physical competition course. The Virtual Tunnel Circuit will be conducted at approximately the same time via online (remote) participation, competing in synthetic courses that share similar characteristics as their physical counterparts, but at greater spatial and temporal scales.

- **Phase 2**: Systems track teams will participate in two additional Circuit Events – the Urban Circuit and Cave Circuit – to be held at sites relevant to their respective subdomains. The Virtual track teams will again have similar Virtual Circuits with synthetic competition courses that include similar course elements at greater spatial and temporal scales. In Phase 2, Virtual competitors will have access to newly validated system models included in the SubT Tech Repo, which were generated and provided by the DARPA-funded Systems teams during Phase 1 development.

- **Phase 3**: Teams in both Systems and Virtual Track competitions will continue development, refinement, and testing, culminating with their respective Final Events. The Final Event courses will combine elements from each of the three subdomains into a single integrated competition course as notionally illustrated in Figure 2. Systems teams that are selected for Phase 3 will provide updated virtual models of their systems, which will again be validated by DARPA, added to the SubT Tech Repo, and promptly released to the Virtual Teams ahead of the Final Event.

B.2. Technical Challenge Elements

The Circuits and the Finals competition courses will be designed to assess performance across various challenge elements, including: austere navigation, degraded sensing, severe communication constraints, terrain obstacles, dynamic terrain, and endurance limits. These

challenge elements will also be encoded into the SubT Virtual Testbed to the fullest extent possible.

1. Austere Navigation: The challenge courses are expected to include features such as multiple levels, inclines, loops, dead-ends, slip-inducing terrain interfaces, and sharp turns. Such environments with limited visibility, difficult terrain, and/or sparse features can lead to significant localization error and drift over the duration of an extended run. Proposed systems will need to be capable of navigating in complex environments without the use of GPS. Considerations should be made for geological and physical content of the subterranean environment that impact such navigation methods.

2. Degraded Sensing: The courses are expected to include elements that range from constrained passages to large openings, lighted areas to complete darkness, and wet to dusty conditions. Perception and proprioceptive sensors will need to reliably operate in these low-light, obscured, and/or scattering environments while having the dynamic range to accommodate such varying conditions. Dust, fog, mist, water, and smoke are within scope of this challenge element. Extreme temperatures, fire, and hazardous materials are not expected to be within scope. Various sensor modalities and combinations will be allowed, including but not limited to: LIDAR, acoustic, visual, RF, tactile, RADAR, gravity, compass/magnetic, wind, and chemical. The SubT Virtual Testbed will incorporate as many of these sensing challenge elements and modalities as possible, with priority given to those that are more readily observed in real-world subterranean environments and/or more aligned with operational needs.

3. Severe Comms: Limited line-of-sight, RF propagation challenges, and effects of varying geology in subterranean environments impose significant impediments to reliable networking and communications links. The physical competition courses as well as the SubT Virtual Testbed environments will be designed to include these severe communications constraints to the extent possible. Proposers are encouraged to consider innovative approaches to overcome these constraints, including novel combinations of hardware, software, waveforms, protocols, distributed or dispersed concepts, and/or deployment methods.

4. Terrain Obstacles: Proposed systems will be required to demonstrate robustness in navigating a range of mobility-stressing terrain features and obstacles. Terrain elements and obstacles may include constrained passages, sharp turns, large drops/climbs, inclines, steps, ladders, and mud, sand, and/or water. The environments may include organic or human-made materials; structured or unstructured clutter; and intact or collapsed structures and debris.

5. Dynamic Terrain: Terrain features and obstacles may also include dynamic elements, which could include, e.g., mobile obstacles, moving walls and barriers, falling debris, and/or other physical changes to the environment that test the agility of the system autonomy to reason, react, and potentially recover from the possibility of a changing map.

6. Endurance Limits: While the physical course designs may be constrained by practical limits in their spatial scales, it is expected that proposed systems will need to be capable of a team-aggregated endurance between 30–180 minutes to be mission-relevant. Virtual

teams are likely to be tasked with mapping, navigating, and searching courses with potentially much longer durations. These requirements are driven by the desire to explore operationally relevant spatial and temporal scales within the context of time and logistics constraints of executing the competition events. This aggregate endurance requirement may require novel deployment concepts, energy-aware planning, heterogeneous agents of varying endurance, energy harvesting or transfer technologies, and/or a combination of various approaches to overcome the various challenge elements.

Combined, these technical challenge elements highlight some of the unique challenges presented to systems that operate in subterranean environments. DARPA is interested in proposals that offer holistic approaches to addressing these challenge elements.

Competing teams will be assessed based on technological progress to be evaluated at each of the three (Tunnel, Urban, Cave) Circuit Events as well as the Final Events. DARPA seeks breakthrough capabilities beyond the current state-of-the-art.

B.3. Scoring Criteria and Competition Rules

The scoring criteria and competition rules are anticipated to be released by Challenge Kickoff. DARPA expects to apply the following context in their formulation.

The primary scenario of interest for the SubT Challenge is providing rapid situational awareness for a team of warfighters or first responders operating in unknown and dynamic environments. The layout of the environment is unknown, could degrade or change over time (i.e., dynamic terrain), and is too high-risk to send in personnel. The proposed systems would be deployed to provide rapid situational awareness through mapping of the unknown environment and localization of objects of interest (e.g., electrical boxes, leaking valves). As the systems explore and map the environment, it will be crucial to provide these situational awareness updates via reach-back to human emergency personnel in as close to real-time as possible. The urgency in completing the course objectives and providing near-real-time situational awareness updates will be a consistent focus of the competition.

Given the large-scale nature and complexity of subterranean environments, it is anticipated that "systems of systems" could provide a distributed approach to rapid exploration and mapping as well as a heterogeneous approach to navigating and searching the competition course in a way that may not be feasible with a single mobility approach. The courses might include small passages, sharp turns, large drops/climbs, mud, water, and other mobility-stressing terrain features and obstacles. Challenge participants should expect, for example, both constrained areas with human-crawlable cross sections as well as larger underground open spaces that could include large ledges or vertical shafts. No breaching, burrowing, or use of explosives will be permitted.

Additionally, there may be a variety of objects of interests relevant to each of the three subdomains. Competition objectives will include the need to search for, detect, and provide georeferenced locations of these objects of interest, which could vary in their size, quantity, and detection signatures (e.g., visual, thermal, chemical). Examples of possible objects of interest include electrical boxes, leaking valves, smoke sources, exposed wires, doors or panels, and hand tools. Such detection and/or recognition tasks may benefit from in-situ data-gathering capabilities by physical systems maneuvering through the course.

The operational scenario suggests that approaches should be highly autonomous without need for substantive human interventions; capable of remotely mapping and/or navigating complex and dynamic terrain; and able to operate with degraded and unreliable communication links. Systems teams are envisioned to have a single human supervisor at a "command post" external to the course; however, teams should expect to provide only high-level interactions due to the degraded communications network. DARPA may intentionally degrade communications fidelity by reducing link availability, increasing latency, and/or limiting quality of service. The scoring objectives anticipate inclusion of penalties based on the amount of data transmitted from the command station to their systems. Teams are encouraged to utilize interfaces that enable effective human monitoring despite degraded communication. It is not expected that manual teleoperation of individual systems will be a viable strategy. No manual physical intervention or entry by (human) team members on the course will be permitted.

Virtual teams will be required to develop solutions that map, navigate, and search entirely autonomously with no human operator interactions; however, proposed solutions should account for the need to present relevant information to a virtual "command post" to provide near-real-time situational awareness updates.

As the proposed system maps, navigates, and searches for objects of interest, teams should expect and plan for some level of failures and/or attrition. Such incapacitation could occur due to, e.g., inability to overcome obstacles, failed interactions with dynamic terrain (e.g., moving walls), loss in communications, or reaching of endurance limits. Proposed approaches should address such possibilities in their system design and/or contingency planning so as to enable continued operations and execution of the competition run.

DARPA is interested in proposed solutions that are cost-effective, attrition-tolerant, and capable of addressing the spatial and temporal challenges of rapidly mapping and navigating complex environments. Due to the likely broader impact of more cost-effective solutions, proposals that minimize component and systems costs, that is, those that emphasize system affordability, will be seen as positively aligning with evaluation criteria (i.e., "Potential Contribution and Relevance to the DARPA Mission"). As appropriate, DARPA may introduce explicit cost constraints to the fielded systems, e.g., limits on unit and/or aggregate systems costs.

Candidate scoring criteria include the following (not in priority order, and not an exhaustive enumeration):

- Successful maneuver through course elements

- Course completion time

- Map fidelity, registration accuracy, or completeness

- Location accuracy and identification of objects of interest

DARPA may tune the various competition design elements to drive innovation and investment. Anticipated "tuning knobs" include course terrain difficulty, course length and/or duration, and communications constraints. Proposals offering robust, versatile approaches that can adapt to and overcome such variable adjustments are of high interest to DARPA.

C. Program Structure

This section describes the programmatic details as a funded performer in the DARPA Subterranean Challenge.

C.1. Challenge Tracks

Competitors may enter the DARPA Subterranean Challenge via one of the following four distinct tracks outlined in Table 1. The Challenge is organized into two competitions (Systems and Virtual), each with two tracks for DARPA-funded and self-funded competitors.

	Track	Description
Systems Competition	Track A DARPA-funded	Must submit a proposal to this BAA to be considered. Selected Systems teams will receive a contract award. They must participate in Systems Circuit Events to be considered for the next phase of funding.
	Track B Self-funded	Should not submit a proposal to this BAA. Systems teams that are self-funded will be required to qualify (per below) to compete in any of the Systems Circuits and Final Event.
Virtual Competition	Track C DARPA-funded	Must submit a proposal to this BAA to be considered. Selected Virtual teams will receive a contract award. They must participate in Virtual Circuit Events to be considered for the next phases of funding.
	Track D Self-funded	Should not submit a proposal to this BAA. Virtual teams that are self-funded will be required to qualify (per below) to compete in any of the three Virtual Circuits and Final Event.

Table 1: Descriptions of the DARPA Subterranean Challenge Tracks

Teams that intend to follow Track B or Track D should not respond to this BAA and instead will be required to qualify prior to each Circuit Event and Final Event per posted guidelines. The qualification process is anticipated to include a short abstract providing details on technical approach and safety features. It is also possible that certain aspects of a Track B or Track D performer's systems would need to be demonstrated to DARPA to verify safety and operator competency. Track B and Track D performers should also be prepared to host DARPA personnel who will conduct site visits to verify competition level of readiness.

If submitting a proposal for both Track A and Track C, proposers must submit separate proposals. Note that although proposals may be submitted for consideration for Track A and Track C, it is anticipated that a team may only be awarded a contract for either Track A or Track C.

Proposers whose proposals to Track A or Track C are not selected for funding will still be eligible to participate as self-funded teams in Track B or Track D, provided that they complete the associated qualification guidelines.

C.2. Program Scope
C.2.a. Track A Scope

<u>Phase 1</u>: During the 12-month Phase 1, Track A teams will complete the baseline design, development, integration, and testing of their proposed solutions. The main development effort in

this phase will culminate in a Critical Design Review (CDR) no later than month eight (8), during which the performer will present as deliverables a Technical Data Package and a Simulation Package.

The Technical Data Package will include (as appropriate) the following items:

- Mechanical and electrical performance specifications

- Computer-aided design (CAD) models of system(s) with all components (hardware, actuators, sensors, electronics)

- Other design files (e.g., wiring diagrams, electrical board schematics)

- Bill of materials, quotes, lead times of all major components, build plan and schedule

- Mechanical, electrical, and data architecture design, including diagrams of architectures, interfaces, protocols, etc.

The Simulation Package will provide virtual models of the system(s) for inclusion in the SubT Tech Repo and will include (as appropriate) the following items:

- CAD model of the system(s) for visualization in a Gazebo-compatible format. Models are not required to reveal proprietary design features. A relatively low-resolution model is often preferred for accelerated rendering purposes as long as it faithfully represents the system's external appearance.

- Faithful representation of system mobility, kinematics, and actuation in a Gazebo-compatible format. Teams should describe, reference, and/or include low-level interfaces (e.g., drivers) necessary for basic mobility.

- Sensor models that faithfully represent sensing modality and performance as a Gazebo-compatible plugin.

- Note: Track A Teams are not required to include perception, navigation, or advanced locomotion algorithms, but may include as much as they are willing to share to encourage teams in Track C and Track D to use their model submissions in the SubT Tech Repo.

Phase 1 culminates with the Tunnel Circuit event, which is expected to be approximately a week-long event with teams deploying their system(s) in the competition course. The results from the Tunnel Circuit will be used by DARPA, in part, to inform the decision to fund contract options for Phase 2.

Phase 2: During the 12-month Phase 2, Track A teams will continue their development efforts and participate in two additional Circuit Events – the Urban Circuit and Cave Circuit – to be held at sites relevant to their respective subdomains. In Phase 2, teams will need to demonstrate that their proposed systems provide holistic and versatile solutions to all of the challenge elements presented by the varied environments across all three subdomains. Team performance in the Urban Circuit and Cave Circuit will be used by DARPA, in part, to inform the decision to fund contract options for Phase 3.

One (1) month before the Cave Circuit, Track A teams must provide an updated Simulation Package that reflects any newly introduced systems models; updates to previous designs; or revisions of performance characteristics to be added to the SubT Tech Repo and released to the Virtual Teams before the Final Event.

Phase 3: During the 12-month Phase 3, Track A teams will continue their development, refinement, and testing efforts and participate in the Final Event. The Final Event course will combine elements from each of the three subdomains into a single integrated Final course as notionally illustrated in Figure 2. Upon completing the Final Event, Track A teams must provide a Final Technical Data Package, Final Report, and other deliverables as listed in Section I.E.1.

C.2.b. Track C Scope

Phase 1: During the 12-month Phase 1, Track C performers will focus on integration within the SubT Virtual Testbed and will compete in the Tunnel Circuit in month twelve (12).

Track C teams will begin Phase 1 with an initial release of the SubT Tech Repo populated with Government-developed and/or commercial off-the-shelf (COTS) systems models, highlighting a variety of mobility methods (e.g., aerial, ground) and a range of common sensor modalities. Teams will compose their own combination of systems models and develop the necessary algorithms and software solutions to address the challenge elements in the Tunnel Circuit.

Phase 1 culminates with the Tunnel Circuit, which is expected to occur at approximately the same time as the Systems Tunnel Circuit, and will include similar course characteristics, but at larger spatial and temporal scales. The results from the Tunnel Circuit will be used by DARPA, in part, to inform contract award decisions for Phase 2.

Phase 2: During the 12-month Phase 2, Track C teams will continue their development efforts and participate in two additional Circuit Events, i.e., the Urban Circuit and Cave Circuit.

Early in Phase 2, DARPA will release a major update to the SubT Tech Repo, which will contain additional validated system models generated and provided by the DARPA-funded Systems teams during Phase 1. Track C teams will have access to the expanded SubT Tech Repo, which may offer additional capabilities with which they may improve their respective solutions in addressing the challenge elements presented in the Urban Circuit and Cave Circuit. The Urban Circuit and Cave Circuit will again include similar course characteristics as their respective Systems Circuit courses, but at larger spatial and temporal scales. Team performance in the Urban Circuit and Cave Circuit will be used by DARPA, in part, to inform contract award decisions for Phase 3.

Phase 3: During the 12-month Phase 3, Track C teams will continue their development, refinement, and testing efforts and participate in the Final Event.

Early in Phase 3, DARPA will release another major update to the SubT Tech Repo, which will contain additional validated system models generated and provided by the DARPA-funded Systems teams during Phase 2.

The Final Event course will combine elements from each of the three subdomains into a single integrated Final course as notionally illustrated in Figure 2. After the Final Event, Track C teams must provide a Final Report and other deliverables as listed in Section I.E.2.

C.3. Funding

The program has planned the following funding for Track A and Track C performer teams. This plan is subject to changes based on the number of qualified teams and available resources.

Track		Phase 1	Phase 2	Phase 3
A	# Teams	Up to Six (6)	Up to Six (6)	Up to Six (6)
	Funding	≤$1.5M per team	≤$1.5M per team	≤$1.5M per team
C	# Teams	Up to Eight (8)	Up to Eight (8)	Up to Six (6)
	Funding	≤$250K per team	≤$250K per team	≤$250K per team

Table 2: Funding Table for DARPA-funded teams

Track A and Track C funding will be split into a Phase 1 base (Tunnel Circuit) with costed options for Phase 2 (Urban Circuit, Cave Circuit) and Phase 3 (Final Event), as illustrated in Figure 3. Decisions to exercise contract options will be based on performance in the Circuit Events and DARPA's assessment of progress towards achieving the technical goals of the program.

C.4. Prizes

- **Circuit Events**: Self-funded teams in Track B and Track D will compete for monetary prizes to be announced at the Challenge Kickoff. DARPA-funded teams from Track A and Track C are not be eligible for these prizes.

- **Systems Final Event**: Teams in Track A and Track B will compete for monetary prizes, anticipated to be approximately $2M.

- **Virtual Final Event**: Teams in Track C and Track D will compete for monetary prizes, anticipated to be approximately $750K.

Note: DARPA is seeking prize authority under 10 U.S.C. § 2374a.

D. Challenge Infrastructure

D.1. Program Initiation Meeting

DARPA will hold a workshop for contracted Track A and Track C teams to discuss technical approaches and execution plans, anticipated to occur in early Fall of 2018 upon contract award.

D.2. Challenge Kickoff

DARPA will hold a public event shortly after the Program Initiation Meeting to mark the official kickoff of the DARPA Subterranean Challenge and announce the structure, rules, important dates, and prizes of the Circuits and Final Event. These details will apply to both

DARPA-funded and self-funded teams across both Systems and Virtual competitions. Further details of the Challenge Kickoff event will be provided at a later date.

D.3. Technical Interchange Meetings

DARPA encourages vibrant information exchange and collaborative interactions among all SubT Challenge participants, to include DARPA technical staff, representatives from Challenge teams, infrastructure developers, and other Government partners. To that end, DARPA will host several Technical Interchange Meetings, which will offer a forum for community building and cross-pollination of technical ideas and approaches:

- Technical Interchange Meeting in preparation for Tunnel Circuit

- Technical Interchange Meeting in preparation for Cave Circuit

- Technical Interchange Meeting in preparation for the Final Event

- DARPA Subterranean Challenge "Lessons Learned" Workshop

D.4. Circuits and Final Evaluations

The program will host a series of evaluations, namely the three Circuit Events and the Final Events, which will assess each competing team's approaches in representative subterranean environments.

1. **Systems Competition:** Systems track teams in Track A and Track B will bring their systems to a physical site, which will be identified no later than six months before each event. Systems teams can expect that these evaluations will take approximately one week and will be based in the continental United States. In their proposals, Systems competitors should plan for their team to travel in support of the four (4) Challenge events, and for key team members to travel to the four (4) Technical Interchange Meetings.

2. **Virtual Competition**: Virtual track teams in Track C and Track D will compete remotely via online submissions for each Circuit Event. Details on submitting software and competition execution will be provided at a later date; teams can expect to submit software products for execution and evaluation by DARPA. The Final Event for the Virtual competitors will be co-located and concurrent with the Systems Final Event. As such, Virtual teams should plan in their proposals for travel to attend and support their effort at the Final Event venue, in addition to travel of key team members to the four (4) in-person Technical Interchange Meetings.

D.5. SubT Virtual Testbed

The SubT Virtual Testbed, to be provided as GFE, is planned to be released by the Program Initiation Meeting and is anticipated to be based on the Gazebo simulator. The SubT Virtual Testbed can be expected to include the following:

- Support for variety of mobility methods, including but not limited to, air- and ground-based mobility platforms

- Support for wide range of commonly used sensors, potentially including LIDAR, acoustic, visual, RF, RADAR, gravity, compass/magnetic, and logical/fiducials

- Variety of subterranean test environments across all three subdomains with varying degrees of complexity and spatial scales

- Ability to emulate some level of networking and communications constraints approaching those experienced in subterranean environments

- Ability to run simulations both locally and through approved cloud service providers

- Access to automated testing and assessment tools

- Documentation and technical support forums

Anticipating continuous integration and improvement of features and capabilities, DARPA intends to provide an initial release by the Program Initiation Meeting, followed by stable releases of updates and enhancements. Limited allocations of cloud-computing resources will be provided by DARPA for the execution of the Virtual Circuits and Final Events. Further details will be provided with release of the SubT Virtual Testbed software and accompanying documentation.

E.   DARPA Subterranean Challenge Deliverables

SubT Challenge deliverables, separated by track, are detailed below.

E.1. Systems Track A Deliverables

Deliverable: Phase 1 Technical Data Package
  Frequency: At Critical Design Review
  Format: Competitor-defined formats
  Description: Provide a full design technical data package (refer to Section I.C.2 for more details)

Deliverable: Phase 1 Simulation Package
  Frequency: At Critical Design Review
  Format: Gazebo-compatible models (SDF/URDF); driver/plugin software
  Description: Develop a simulation package of the system(s) in the SubT Virtual Testbed for inclusion in the SubT Tech Repo (refer to Section I.C.2 for more details)

Deliverable: Phase 2 Simulation Package
  Frequency: 1 month before Cave Circuit
  Format: Gazebo-compatible models (SDF/URDF); driver/plugin software
  Description: Update to the simulation package incorporating any updates or additions made to the systems and models in Phase 2

Deliverable: Phase 3 Simulation Package

Frequency: 1 month before Final Event
Format: Gazebo-compatible models (SDF/URDF); driver/plugin software
Description: Final revision to the simulation package incorporating any updates or additions made to the systems and models in Phase 3

Deliverable: Model Validation Sessions
Frequency: Within 3 months of submitting updated Simulation Packages
Format: N/A
Description: Access to hardware provided to DARPA for the purpose of validating the mobility and sensor models of the virtual system models. This may be performed on-site at a performer location or possibly as part of the check-in process at the Challenge events

Deliverable: Progress Report
Frequency: Monthly
Format: Microsoft PowerPoint
Description: Summary of technical accomplishments, planned actions for the next reporting period, graphical representations of work being completed, and relevant financial information

Deliverable: Circuit Report
Frequency: 1 month after each Circuit Event
Format: Microsoft Word; supporting videos
Description: A technical report on the team's performance at the Circuit, including details on success, failures, analyses of causes, and video highlights of the event

Deliverable: Project Documentation
Frequency: As required
Format: Contractor-defined formats
Description: Relevant documentation developed over the course of the program, e.g., registration materials, qualification packages, briefings, technical papers and presentations, posters, multimedia, graphics

Deliverable: Final Report
Frequency: Prior to contract completion
Format: Microsoft Word; supporting videos
Description: Detailed description of the project effort, tasks, technical approach, testing and event results, analysis of results, and lessons learned. Include revised Technical Data Package incorporating any updates or additions since Phase 1

E.2. Virtual Track C Deliverables

Deliverable: Software
  Frequency: As required, to be specified in Challenge rules
  Format: Software package (e.g., Docker container)
  Description: Teams will submit their software (e.g., source code and/or binaries via Docker containers) for the three Circuit Events and the Final Event by associated qualification deadlines and submission deadlines

Deliverable: Progress Report
  Frequency: Monthly
  Format: Microsoft PowerPoint
  Description: Summary of technical accomplishments, planned actions for the next reporting period, graphical representations of work being completed, and relevant financial information

Deliverable: Circuit Report
  Frequency: 1 month after each Circuit Event
  Format: Microsoft Word; supporting videos
  Description: A technical report on the team's performance at the Circuit, including details on success, failures, analyses of causes, and highlights of the event

Deliverable: Project Documentation
  Frequency: As required
  Format: Contractor-defined formats
  Description: Relevant documentation developed over the course of the program, e.g., registration materials, qualification packages, briefings, technical papers and presentations, posters, multimedia, graphics

Deliverable: Final Report
  Frequency: Prior to contract completion
  Format: Microsoft Word; supporting videos
  Description: Detailed description of the project effort, tasks, technical approach, testing and event results, analysis of results, and lessons learned

II.   Award Information

A.   General Award Information

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

The Government reserves the right to select for negotiation all, some, one, or none of the proposals received in response to this solicitation and to make awards without discussions with proposers.

The Government also reserves the right to conduct discussions if it is later determined to be necessary. If warranted, portions of resulting awards may be segregated into pre-priced options. Additionally, DARPA reserves the right to accept proposals in their entirety or to select only portions of proposals for award. In the event that DARPA desires to award only portions of a proposal, negotiations may be opened with that proposer. The Government reserves the right to fund proposals in phases with options for continued work, as applicable.

The Government reserves the right to request any additional necessary documentation once it makes the award instrument determination. The Government reserves the right to remove proposals from award consideration, should the parties fail to reach agreement on award terms, conditions, and/or cost/price 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, depending upon the nature of the work proposed, the required degree of interaction between parties, whether or not the research is classified as Fundamental Research, and other factors.

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

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

B.   Fundamental Research

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

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

As of the date of publication of this BAA, the Government expects that program goals as described herein may be met by proposers intending to perform fundamental research and does not anticipate applying publication restrictions of any kind to individual awards for fundamental research that may result from this BAA. Notwithstanding this statement of expectation, the Government is not

prohibited from considering and selecting research proposals that, while perhaps not qualifying as fundamental research under the foregoing definition, still meet the BAA criteria for submissions. If proposals are selected for award that offer other than a fundamental research solution, the Government will either work with the proposer to modify the proposed statement of work to bring the research back into line with fundamental research or else the proposer will agree to restrictions in order to receive an award.

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

For certain research projects, it may be possible that although the research being performed by the awardee is restricted research, a subawardee may be conducting fundamental research. In those cases, it is the awardee's responsibility to explain in their proposal why its subawardee's effort is fundamental research

III.   Eligibility Information

A.   Eligible Applicants

All responsible sources capable of satisfying the Government's needs may submit a proposal that shall be considered by DARPA. Please note that FFRDC, Government entity, and foreign participation is welcomed; however, some limitations may apply. Please see below.

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

FFRDCs are subject to applicable direct competition limitations and cannot propose to this BAA in any capacity unless they meet the following conditions: (1) FFRDCs must clearly demonstrate that the proposed work is not otherwise available from the private sector. (2) FFRDCs must provide a letter on official letterhead from their sponsoring organization citing the specific authority establishing their eligibility to propose to Government solicitations and compete with industry, and their compliance with the associated FFRDC sponsor agreement's terms and conditions. This information is required for FFRDCs proposing to be awardees or subawardees.

All proposers are expected to address transition; transition is part of the evaluation criteria in Section V.A. However, given their special status, FFRDCs should describe how and when a proposed technology/system will transition to which Non-FFRDC organization(s).

A.1.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.

A.1.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.

(1)   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.

(2)   Classified proposals are not anticipated, as they would be unable to be accommodated into the Challenge events.

B.   Organizational Conflicts of Interest

FAR 9.5 Requirements

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

Agency Supplemental OCI Policy

In addition, DARPA has a supplemental OCI policy that prohibits contractors/performers from concurrently providing Scientific Engineering Technical Assistance (SETA), Advisory and Assistance Services (A&AS) or similar support services and being a technical performer. Therefore, as part of the FAR 9.5 disclosure requirement above, a proposer must affirm whether the proposer or *any* proposed team member (subawardee, consultant) is providing SETA, A&AS,

or similar support to any DARPA office(s) under: (a) a current award or subaward; or (b) a past award or subaward that ended within one calendar year prior to the proposal's submission date.

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

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

Government Procedures

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

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

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

C. Cost Sharing/Matching

Cost sharing is not required; however, it will be carefully considered where there is an applicable statutory condition relating to the selected funding instrument. 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.

IV.   Application and Submission Information

A.   Address to Request Application Package

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

B.   Content and Form of Application Submission

All submissions, including abstracts and proposals, must be written in English with formatting specifications detailed below. Copies of all documents submitted must be clearly labeled with the DARPA BAA number, proposer organization, and proposal title/proposal short title.

B.1.   Abstracts

Proposers are strongly encouraged to submit an abstract in advance of a proposal to minimize effort and reduce the potential expense of preparing an out-of-scope proposal. The abstract provides a synopsis of the proposed project.

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 the abstract, proposers may submit a full proposal. DARPA will review all full proposals submitted using the evaluation criteria without regard to any comments resulting from an abstract.

Abstract Format: Abstracts shall not exceed a maximum of four (4) pages, inclusive of figures, tables, and charts, to include a coversheet and three (3) pages for description of the technical approach. Additionally, all abstracts should provide one (1) "elevator pitch" slide as detailed below.

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

Abstracts must include the following components:

- **Cover Sheet:** Provide the following information:
  - (1) Label: "Abstract"
  - (2) BAA number: (HR001118S0016)
  - (3) Abstract title
  - (4) Lead organization name
  - (5) Technical point of contact (POC) including name, mailing address, telephone number, and e-mail address

- o (6) Administrative POC including name, mailing address, telephone number, and e-mail address
- o (7) Estimated total cost
- o (8) Estimated period of performance
- o (9) Primary subcontractors (if known/applicable)
- **Technical Plan:** Outline and address technical challenges inherent in the approach and possible solutions for overcoming potential problems. It is strongly encouraged to frame responses in the context of the Heilmeier Catechism questions. Provide appropriate specific milestones (quantitative, if possible) at intermediate stages of the project to demonstrate progress.
- **Capabilities/Management Plan:** Provide a brief summary of expertise of the team, including subcontractors and key personnel. Teaming arrangements do not need to be finalized at the time of abstract submission; however, mention of potential teaming/collaboration arrangements is encouraged. Identify a principal investigator for the project and include a description of the team's organization, including roles and responsibilities. Describe any existing intellectual property required to complete the project and any specialized facilities to be used as part of the project. List Government-furnished materials or data assumed to be available.
- **Cost and Schedule:** Provide a cost estimate for resources (e.g., labor, materials) and any subcontractors over the proposed timeline of the project, broken down by Government fiscal year.
- **Bibliography {Optional, exclusive of page count}:** If desired, include a brief bibliography with links to relevant papers, presentations, and/or reports.
- **"Elevator Pitch" Slide:** Using the template provided as slide 1 of Attachment 3 to the BAA posted at www.fbo.gov and www.grants.gov, provide a visually compelling single slide in PowerPoint that effectively and succinctly conveys the key innovations and unique aspects of the proposed approach.

B.2. Proposals

All complete proposal packages must include the parts listed below. The following templates, which contain proposal content descriptions and instructions, have been provided as attachments to the BAA posted at www.fbo.gov and www.grants.gov. Use of these templates is mandatory for all proposal submissions to this BAA.

- Attachment 1 – Cover Sheet and Proposal Templates
- Attachment 2 – Cost Summary Templates
- Attachment 3 – "Elevator Pitch" and Summary Slide Templates
- Attachment 4 – Administrative and National Policy Requirements

The proposal shall be delivered in two volumes, Volume I – Technical and Management Proposal and Volume II – Cost Proposal.

The proposal shall include the following sections. The total page count for Volume I is **10 pages**, where a "page" is 8-1/2 by 11 inches with type not smaller than 12-point (figures, tables, and charts may use 8- or 10-point font), margins not smaller than 1 inch, and line spacing not smaller than single spaced. Fold-outs up to 11 by 17 inches may be used, but will be counted as two pages.

Page Limit Includes:	Page Limit Does NOT include:
Executive Summary	Cover Sheet
Innovative Claims	Official Transmittal Letter
Technical Approach	Table of Contents
Management Plan	"Elevator Pitch" Slide
	Summary Slide
	Milestones and Deliverables Summary Table (limited to 3 pages)
	Schedule (limited to 2 pages)
	Cost Summary Sheet
	Statement of Work (limited to 3 pages)
	Intellectual Property
	Resume(s)

Ensure that each section provides a detailed discussion of proposed work to enable an in-depth review of specific technical and managerial issues relevant to that section. Specific attention must be given to addressing both risk and payoff of the proposed work that make it desirable to DARPA.

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

B.2.a. Volume I, Technical and Management Proposal

Section I: Administrative

    i.   **Cover Sheet:** should follow the format provided and include all information requested in Attachment 1

Section II: Summary of Proposal

    i.   **Table of Contents**

    ii.   **Executive Summary:**

Provide an executive-level description of key elements and unique features of the proposed DARPA Subterranean Challenge effort. The Executive Summary should also include a top-level schedule that outlines the proposer's overall vision and approach to executing the entire duration of the Challenge.

    iii.   **Innovative Claims:**

Describe the innovative aspects of the DARPA Subterranean Challenge effort in the context of existing capabilities and approaches, clearly delineating the uniqueness and benefits of this project in the context of the state-of-the-art, alternative approaches and other projects from the past and present. Describe how the proposed DARPA Subterranean Challenge effort is revolutionary and how it significantly rises above the current state-of-the-art.

iv. **Technical Approach:**

Provide a detailed description of the technical approach. This section will serve as the primary expression of the proposer's scientific and technical ideas. It should also include the proposer's understanding of the state-of-the-art approaches and the limitations that relate to each topic addressed by the proposal. Describe and analyze state-of-the-art results, approaches, and limitations within the context of the problem area addressed by this research. Demonstrating problem understanding requires not just the enumeration of related efforts; rather, related work must be compared and contrasted to the proposed approach.

Track A proposals must address the following aspects of system development:

- **Hardware**: What form will the proposed system take and how will that form enable it to perform each of the events in the scenario? Is this an evolution of an existing design or a "clean sheet" design? Describe all major design features, including mechanical (e.g., structures, actuation), electrical (e.g., energy source, computing), sensing (e.g., environmental), and operator interface. Describe the design methodology and the approach to high-risk elements of the design.
- **Software**: What is the high-level architecture of the software? Is this an evolution of an existing design or a "clean sheet" design?
- **Integration**: What process will the team use to integrate hardware and software? What is the likely set of components to be integrated?
- **Testing**: How will the team test the hardware, software, and integrated system, to include associated validation efforts? What laboratory and outdoor facilities will the test processes utilize?

Track C proposals must address the following aspects:

- **Algorithms**: What is the overall technical approach to performing the mapping, navigation, and search functions described in the challenge scenario?
- **Software**: What is the high-level architecture of the software? Is this an evolution of an existing design or a "clean sheet" design?
- **Development and Testing**: What is the software development workflow? How will the team perform automated evaluation and testing of the software? What laboratory and/or computing resources will be utilized?

v. **Management Plan:**

Describe formal teaming agreements that are required to execute this program, a brief synopsis of all key personnel, and a clearly defined organization chart for the program team (prime contractor and subcontractors, if any). Provide the percentage of time

committed for each of these key personnel in the program. DARPA requires key personnel identified in the proposal to be assigned as proposed, and the resulting contract/agreement will indicate no substitution shall be made without prior approval of the Government. Provide an argument that the team size and composition are both necessary and sufficient to meet the program objectives. Provide detailed task descriptions, costs, and interdependencies for each individual effort and/or subcontractor. To the extent that graduate students and postdocs are involved in individual efforts, describe their role and contribution. Information in this section must cover the following information:

- Programmatic relationship of team members;

- Unique capabilities of team members;

- Task responsibilities of team members;

- Teaming strategy among the team members;

- Government role in project, if any.

vi.   **Intellectual Property {no page limit}:**

DARPA requires sufficient Government rights to intellectual property developed to enable the Government to: 1) allow media coverage of the Circuit Events and Final Event at DARPA's discretion, 2) allow validation of technical performance, capabilities, and accomplishments by independent technical (potentially non-Government) experts, 3) facilitate discussion of technical challenges and applications with the broader technical community, and 4) support transition opportunities, including design and performance data required. It is anticipated that these activities will require the Government to conduct independent analyses, development, and assessments. DARPA anticipates needing Government Purpose Rights (GPR) and expects that much of the development will leverage free/open source resources. (Refer to Section IV.B.4.e for definitions of IP terms used herein.)

For any items for which the proposer asserts data rights less than unlimited rights, the proposer shall describe the impact of the GPR or limited rights assertion. In other words, the proposer should describe what data the Government will get, how the Government will be able to use it, and describe the impact of this data rights assertion on the Government's ability to transition the program. Inclusion of the table in Attachment 4 is sufficient.

The Government will assume unlimited rights if proposers fail to identify any intellectual property restrictions in their proposals. Include in this section all proprietary claims to results, demonstration systems, deliverables or systems supporting and/or necessary for the use of the research, results, demonstration systems and/or deliverables. If no restrictions are intended, then the proposer should

state "NONE." It is noted an assertion of "NONE" indicates that the Government has "unlimited rights" to all data delivered.

vii. **Statement of Work (SOW) {Limited to 3 pages, not counted against the 10-page Technical Volume limit}:**

In plain English, the SOW should clearly define the technical tasks/subtasks to be performed throughout the life of this program. The SOW should be detailed to work breakdown structure (WBS) level 2. For each task/subtask, the SOW should include:

- A general description of the objective (for each defined task/activity);

- A detailed description of the approach to be taken to accomplish each defined task/activity;

- Identification of the primary organization responsible for task execution (prime, subcontractor, by name, etc.);

- The completion criteria for each task/activity, such as a product, event, or milestone that defines its completion; and

- A definition of all deliverables (reports, data, software, documentation, hardware, demonstration system element, multimedia, etc.) to be provided to the Government in support of the proposed research tasks/activities. Include expected delivery date for each deliverable.

Do not include any proprietary information in the SOW or include any markings placing limitations on distribution on pages containing the SOW.

viii. **Schedule {Limited to 2 pages, not counted against the 10-page Technical Volume limit}:**

Include a schedule that graphically provides details all of the proposed program activities, including but not limited to Challenge events (Circuits, Finals); technical interchange meetings; and qualification efforts. For planning purposes, proposers may anticipate the Program Initiation Meeting to occur in Fall 2018. This section should include a detailed schedule showing tasks (including task name, duration, WBS elements), milestones and the interrelationships among tasks. The task structure must be consistent with that in the SOW. Measureable milestones should be clearly articulated and defined in time relative to the start of the project.

ix. **Milestone and Deliverable Summary Table {Limited to 3 pages, not counted against the 10-page Technical Volume limit}:**

The Milestone and Deliverable Summary table should break down all proposed major reviews and test events for completing the DARPA Subterranean Challenge events and the deliverables associated with the events. At a minimum, this section must include the deliverables outlined in Section I.E.

B.2.b. Volume II, Cost Proposal

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

The cost proposal should include a working spreadsheet file (.xls or equivalent format) that provides formula traceability among all components of the cost proposal. The spreadsheet file should be included as a separate component of the full proposal package. Costs must be traceable between the prime and subcontractors/consultants, as well as between the cost proposal and the SOW. The proposal should include a Phase 1 base period (which includes performance through the Tunnel Circuit) in addition to costed options for Phase 2 (i.e., execution through Urban and Cave Circuit Events) and Phase 3 (Final Event). For pricing purposes, proposers may assume an anticipated contract date in the beginning of Fall 2018. Also, proposers to Track A should account for travel to the Circuit Events and Final Event in their proposal; proposers to Track C should account for travel to the Final Event in their proposal.

i. Cover Sheet:

All proposers must submit a cover sheet that follows the format provided in Attachment 1 – Cover Sheet Template.

ii. Cost Summaries Table:

Provide a single-page summary table for the base and two options proposed, listing totals for labor, materials, other direct costs (ODCs), indirect costs (overhead, fringe, general and administrative (G&A)), and any proposed fee for the project. Include costs for each task in each fiscal year of the project by prime and major subcontractors, total cost and proposed cost share, if applicable. In addition, proposers should populate and submit the completed template provided in Attachment 2 – Cost Summary, providing all information therein, including Material and Travel break-out as shown on the separate tabs of the spreadsheet.

iii. Cost Details:

(a) Supporting Cost and Pricing Data:

The proposer should include supporting cost and pricing information in sufficient detail to substantiate the summary cost estimates and should include a description of the method used to estimate costs and supporting documentation. The Government strongly encourages that tables included in the cost proposal also be provided in an editable (e.g., MS Excel) format with calculation formulas intact to allow traceability of the cost proposal numbers across the prime and subcontractors.

i. The awardee is responsible for compiling and providing all subawardee proposals for the Procuring Contracting Officer (PCO).
ii. Subawardee proposals should include Interdivisional Work Transfer Agreements (ITWA) or similar arrangements.
iii. All proprietary subawardee proposal documentation, prepared at the same level of detail as that required of the awardee's proposal and that cannot be uploaded with the proposed awardee's proposal, shall be provided to the Government either by the

awardee or by the subawardee organization by e-mail (SubTChallenge@darpa.mil) when the proposal is submitted.

    iv. The proposed effort should be partitioned into a Phase 1 base period covering from Program Initiation Meeting to Tunnel Circuit; a Phase 2 option with separate cost estimates covering the Urban and Cave Circuit events; and a Phase 3 option with separate cost estimates covering the lead-up and participation in the Final Event and close-out activities.

    v. Each copy of the submitted proposal must be clearly labeled with the DARPA BAA number, proposer organization, and proposal title (short title recommended).

(b) **Cost Breakdown Information and Format:** Detailed cost breakdown to include the following.

    i. Provide the total program cost and costs broken down by initial phase and options.

    ii. Provide costs broken down for the initial phase, including at a minimum:

        1. Direct labor, including labor categories and man-hours, and labor rates;

        2. Cost by the prime and major subcontractors;

        3. Cost by major risk/activity;

        4. Materials;

        5. Other Direct Costs (ODCs) (e.g., travel, equipment, etc.);

        6. Overhead/Indirect charges, and rates used to calculate overhead/indirect costs;

        7. Provide the source, nature, and amount of any industry cost-sharing.

    iii. Identify the pricing assumptions that may require incorporation into the resulting award instrument (e.g., use of Government Furnished Property/facilities/Information, access to Government Subject Matter Expert/s, etc.).

    iv. Supporting Cost Data**.**

        1. Provide sufficient detail to substantiate the summary cost estimates above.

        2. Include a description of the method used to estimate costs and supporting documentation.

        3. All proprietary subcontractor proposal documentation, prepared at the same level of detail as that required of the prime and which cannot be uploaded with the proposed prime contractor's proposal, shall be provided to the Government either by the prime contractor or by the subcontractor organization by e-mail (SubTChallenge@darpa.mil) when the proposal is submitted. The subject line of the e-mail shall contain the lead organization's proposal title and/or proposal reference number, lead organization name, lead organization proposal submission date, and subcontractor name.

        4. Cost Notes:

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

            B. The Government may award either a Federal Acquisition

Regulation (FAR) based contract or an Other Transaction for Prototype (OT) agreement for prototype system development.

All proposers requesting an Other Transaction (OT) for Prototypes must include a detailed list of milestones. Each milestone must include the following: milestone description, completion criteria, due date, and payment/funding schedule (to include, if cost share is proposed, contractor and Government share amounts). It is noted that, at a minimum, milestones should relate directly to accomplishment of program technical metrics as defined in the BAA and/or the proposer's proposal. Agreement type, fixed price or expenditure based, will be subject to negotiation by the Agreements Officer. Do not include proprietary data. If the proposer requests award of an OT for Prototype as a non-traditional contractor, information must be included in the cost proposal to support the claim. The term non-traditional defense contractor, with respect to a transaction authorized under section 2371b, means an entity that is not currently performing and has not performed for at least the one-year period preceding the solicitation of sources by the Department of Defense for the procurement or transaction, any contract or subcontract for the Department of Defense that is subject to full coverage under the cost accounting standards prescribed pursuant to section 1502 of title 41 and the regulations implementing such section.

B.3. Proprietary and Security Information

B.3.a. Proprietary Markings

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

B.3.b. Security Information

i. Program Security Information

Proposers should include with their proposal any proposed solution(s) to program security requirements unique to this program. Common program security requirements include but are not limited to: operational security (OPSEC) contracting/sub-contracting plans; foreign participation or materials utilization plans; program protection plans (which may entail the following) manufacturing and integration plans; range utilization and support plans (air, sea, land, space, and cyber); data dissemination plans; asset transportation plans; test activity plans; disaster recovery plans; material/asset disposition plans and public affairs/communications plans. DARPA does not anticipate this will apply to SubT Challenge (Track A or Track C) proposals, but has included these details for completeness if they are needed.

ii. Unclassified Submissions

DARPA anticipates that submissions received under this BAA will be unclassified. Proposals including classified information will not be accepted.

Controlled Unclassified Information (CUI), to include For Official Use Only (FOUO) Information, generated and/or provided under this BAA shall be safeguarded and marked as specified in DoD Manual 5200.01 Volume 4, DoD Information Security Program.

When information is controlled by the United States Munitions List (USML), the contractor must abide by the International Traffic Arms Regulation (ITAR) requirements.

B.3.c.   Disclosure of Information and Compliance with Safeguarding Covered Defense Information Controls

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

DFARS 252.204-7000, "Disclosure of Information"

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

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

The full text of the above solicitation provision and contract clauses can be found at http://www.darpa.mil/work-with-us/additional-baa#NPRPAC.

Compliance with the above requirements includes the mandate for proposers to implement the security requirements specified by National Institute of Standards and Technology (NIST) Special Publication (SP) 800-171, "Protecting Controlled Unclassified Information in Nonfederal Information Systems and Organizations" (see https://doi.org/10.6028/NIST.SP.800-171r1) that are in effect at the time the BAA is issued, or as authorized by the Contracting Officer, not later than December 31, 2017.

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.

B.4. Additional Proposal Information
B.4.a.   Human Research Subjects/Animal Use

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

B.4.b.   Approved Cost Accounting System Documentation

Proposers that do not have a Cost Accounting Standards (CAS) compliant accounting system considered adequate for determining accurate costs that are negotiating a cost-type procurement contract must complete an SF 1408.   For more information on CAS compliance, see http://www.dcaa.mil/. To facilitate this process, proposers should complete the SF 1408 found at http://www.gsa.gov/portal/forms/download/115778 and submit the completed form with the proposal.

B.4.c.   Small Business Subcontracting Plan

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

B.4.d.   Section 508 of the Rehabilitation Act (29 U.S.C. § 749d)/FAR 39.2

All electronic and information technology acquired or created through this BAA must satisfy the accessibility requirements of Section 508 of the Rehabilitation Act (29 U.S.C § 794d)/FAR 39.2.

B.4.e.   Intellectual Property

All proposers must provide a good faith representation that the proposer either owns or possesses the appropriate licensing rights to all intellectual property that will be utilized under the proposed effort. The Government desires unlimited data rights for all software source code developed at taxpayer expense so that it can release the software as open-source software (OSS) to implement a software maintenance philosophy of OSS community development (per DFARS 227.7203-2(b)(1)).

For the purposes of this solicitation, the following definitions for contracting apply:
1) "Unlimited rights" means rights to use, modify, reproduce, perform, display, release, or disclose data in whole or in part, in any manner, and for any purpose whatsoever, and to have or authorize others to do so.
2) "Government purpose rights" means the rights to use, duplicate, or disclose Data, in whole or in part and in any manner, for Government purposes only, and to have or permit others to do so for Government purposes only.
3) "Limited rights" means the rights to use, modify, reproduce, release, perform, display, or disclose data, in whole or in part, within the Government. The Government may not, without the written permission of the party asserting limited rights, release or disclose the data outside the Government, use the data for manufacture, or authorize the data to be used by another party, except that the Government may reproduce, release, or disclose such data or authorize the use or reproduction of the data by persons outside the Government if—
    i)   The reproduction, release, disclosure, or use is—
        (1) Necessary for emergency repair and overhaul; or

(2) A release or disclosure to—
  (a) A covered Government support contractor in performance of its covered Government support contract for use, modification, reproduction, performance, display, or release or disclosure to a person authorized to receive limited rights data; or
  (b) A foreign government, of data other than detailed manufacturing or process data, when use of such data by the foreign government is in the interest of the Government and is required for evaluation or informational purposes;

ii) The recipient of the data is subject to a prohibition on the further reproduction, release, disclosure, or use of the data; and

iii) The contractor or subcontractor asserting the restriction is notified of such reproduction, release, disclosure, or use.

4) "Data" means recorded information, regardless of form or method of recording, which includes but is not limited to, technical data, software (including executable code), maskworks and trade secrets. The term does not include financial, administrative, cost, pricing or management information and does not include subject inventions.

5) "Covered Government Support Contractor" means a contractor under a contract, the primary purpose of which is to furnish independent and impartial advice or technical assistance directly to the Government in support of the Government's management and oversight of a program or effort (rather than to directly furnish an end item or service to accomplish a program or effort), provided that the contractor:

i) Is not affiliated with the prime contractor or a first-tier subcontractor on the program or effort, or with any direct competitor of such prime contractor or any such first-tier subcontractor in furnishing end items or services of the type developed or produced on the program or effort; and

ii) Receives access to Data for performance of a Government contract.

iii) Enters into a nondisclosure agreement with the Performer, if required.

i. For Procurement Contracts

Proposers responding to this BAA requesting procurement contracts will need to complete the certifications at DFARS 252.227-7017. See http://www.darpa.mil/work-with-us/additional-baa for further information. If no restrictions are intended, the proposer should state "NONE." The table below captures the requested information:

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

ii. **For All Non-Procurement Contracts**

Proposers responding to this BAA requesting a cooperative agreement, or Other Transaction for Prototypes shall follow the applicable rules and regulations governing these various award instruments, but, in all cases, should appropriately identify any potential restrictions on the Government's use of any Intellectual Property contemplated under the award instrument in question. This includes both Noncommercial Items and Commercial Items. Proposers are encouraged use a format similar to that described in the paragraph above. If no restrictions are intended, then the proposer should state "NONE."

B.4.f. System for Award Management (SAM) and Universal Identifier Requirements

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

B.5. Submission Information

All times listed herein are in Eastern Time. Proposers are warned that submission deadlines as outlined herein are strictly enforced. When planning their 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 DUNS number or TIN).

When utilizing the DARPA BAA Submission website (https://baa.darpa.mil), as described below, a control number will be provided at the conclusion of the submission process. This control number should be used in all further correspondence regarding your proposal submission. DARPA will acknowledge receipt of all submissions. If no confirmation is received within two business days, please contact the BAA Administrator at SubTChallenge@darpa.mil to verify receipt. DARPA intends to use electronic mail correspondence regarding this Broad Agency Announcement. Submissions may not be submitted by fax or e-mail; any so sent will be disregarded.

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

Note: Proposers submitting an abstract or full proposal via the DARPA BAA Submission site MUST click the "Finalize" button with sufficient time for the upload to complete prior to the deadline. Failure to do so will result in a late submission.

For abstract and proposal submission dates, see Part I – Overview Information as well as information stated below. Submissions received after these dates and times may not be reviewed. Failure to comply with the submission procedures outlined herein may result in the submission not being evaluated.

The proposal must be received at DARPA/TTO, 675 North Randolph Street, Arlington, VA 22203-2114 (Attn.: DARPA Subterranean Challenge BAA) on or before the date and time listed in Part I., Overview Information and stated below in order to be considered during the initial round of selections; however, proposals received after this deadline may be received and evaluated up to 12 months (365 days) from the date of posting (1/25/2018) of the original BAA# HR001118S0016 on FedBizOpps.gov (www.fbo.gov) and/or Grants.gov (http://www.grants.gov). The ability to review and select proposals submitted after the initial round deadline specified in the BAA or due date otherwise specified by DARPA will be contingent on availability of funds. Proposers are warned that the likelihood of available funding is greatly reduced for proposals submitted after the initial closing date deadline.

B.5.a.   Abstracts Submission

Abstracts must be submitted per the instructions outlined herein and received by DARPA no later than 1:00 p.m. (Eastern time) on February 5, 2018. Abstracts received after this time and date may not be reviewed.

Unclassified abstracts sent in response to this BAA may be submitted via DARPA's BAA Website (https://baa.darpa.mil). Please refer to the Proposal Submission section below for additional details. All abstracts submitted electronically through the DARPA BAA Submission website must be uploaded as zip files (.zip or .zipx extension). The final zip file should only contain the document(s) requested herein and must not exceed 50 MB in size. Only one zip file will be accepted per abstract; abstracts not uploaded as zip files will be rejected by DARPA.

B.5.b.   Proposal Submission

The full proposal package, including all applicable attachments and any proprietary subcontractor cost proposals, must be submitted per the instructions outlined herein and received by DARPA no later than 1:00 pm (Eastern Time) on March 23, 2018.

i.   For Proposers Requesting Cooperative Agreements

Proposers requesting cooperative agreements may submit proposals through one of the following methods: (1) hard copy mailed directly to DARPA; or (2) electronic upload per the instructions at http://www.grants.gov/applicants/apply-for-grants.html. Cooperative agreement proposals may not be submitted through any other means. 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 the Grants.gov do not submit paper proposals in addition to the Grants.gov electronic submission.

> (1) Grants.gov Submissions: Grants.gov requires proposers to complete a one-time registration process before a proposal can be electronically submitted. First time registration can take between three business days and four weeks. For more information about registering for Grants.gov, see http://www.darpa.mil/work-with-us/additional-baa.

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

ii. **For Proposers Requesting Procurement Contracts or OTs and Submitting to a DARPA-approved Proposal Submissions Website**

Unclassified proposals sent in response to this BAA may be submitted via DARPA's BAA Website (https://baa.darpa.mil). Note: If an account has already been created for the DARPA BAA Website, this account may be reused. If no account currently exists for the DARPA BAA Website, visit the website to complete the two-step registration process. Submitters will need to register for an Extranet account (via the form at the URL listed above) and wait for two separate e-mails containing a username and temporary password. After accessing the Extranet, submitters may then create an account for the DARPA BAA website (via the "Register your Organization" link along the left side of the homepage), view submission instructions, and upload/finalize the proposal. Proposers using the DARPA BAA Website may encounter heavy traffic on the submission deadline date; proposers should start this process as early as possible.

All unclassified concepts submitted electronically through DARPA's BAA Website must be uploaded as zip files (.zip or .zipx extension). The final zip file should be no greater than 50 MB in size. Only one zip file will be accepted per submission, and submissions not uploaded as zip files will be rejected by DARPA.

Proposals requesting cooperative agreements should NOT be submitted through DARPA's BAA Website (https://baa.darpa.mil), though proposers will likely still need to visit https://baa.darpa.mil to register their organization (or verify an existing registration) to ensure the BAA office can verify and finalize their submission.

Technical support for DARPA's BAA Website may be reached at BAAT_Support@darpa.mil, and is typically available during regular business hours, Eastern Time.

B.5.c. Abstract Submission Responses

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

B.5.d. Proposal Submission Responses

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

C. Funding Restrictions

Not Applicable.

D.   Other Submission Requirements

Not Applicable.

V.   Application Review Information

A.   Evaluation Criteria

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

A.1. Overall Scientific and Technical Merit

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

The proposed technical team has the expertise and experience to accomplish the proposed tasks. Task descriptions and associated technical elements provided are complete and in a logical sequence with all proposed deliverables clearly defined such that a final outcome that achieves the goal can be expected as a result of award. The proposal identifies major technical risks and planned mitigation efforts are clearly defined and feasible.

A.2. Potential Contribution and Relevance to the DARPA Mission

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

In addition, this evaluation will take into consideration the extent to which the proposed intellectual property (IP) rights will potentially impact the Government's ability to transition the technology to the research, industrial, and operational military communities.

A.3. Cost and Schedule 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).

It is expected that the effort will leverage all available relevant prior research in order to obtain the maximum benefit from the available funding. For efforts with a likelihood of commercial application, appropriate direct cost sharing may be a positive factor in the evaluation. DARPA recognizes that undue emphasis on cost may motivate proposers to offer low-risk ideas with minimum uncertainty and to staff the effort with junior personnel in order to be in a more competitive posture. DARPA discourages such cost strategies.

The proposed schedule aggressively pursues performance metrics in an efficient time frame that accurately accounts for the anticipated workload. The proposed schedule identifies and mitigates any potential schedule risk.

A.4. Proposer's Capabilities and/or Related Experience

The proposer's prior experience in similar efforts clearly demonstrates an ability to deliver products that meet the proposed technical performance within the proposed budget and schedule. The proposal identifies the key personnel that will work on the effort. The proposed team has the expertise to manage the cost and schedule. Similar efforts completed/ongoing by the proposer in this area are fully described including identification of other Government sponsors.

B. Review of Proposals

B.1. Review Process

It is the policy of DARPA to ensure impartial, equitable, comprehensive proposal evaluations based on the evaluation criteria listed in Sections V.A.1-V.A.4 and to select the source (or sources) whose offer meets the Government's technical, policy, and programmatic goals.

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

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

B.2. Handling of Source Selection Information

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

Subject to the restrictions set forth in FAR 37.203(d), input on technical aspects of the proposals may be solicited by DARPA from non-Government consultants/experts who are strictly bound by the appropriate nondisclosure requirements.

B.3. Federal Awardee Performance and Integrity Information (FAPIIS)

Per 41 U.S.C. 2313, as implemented by FAR 9.103 and 2 CFR § 200.205, prior to making an award above the simplified acquisition threshold, DARPA is required to review and consider any information available through the designated integrity and performance system (currently FAPIIS). Awardees have the opportunity to comment on any information about themselves

entered in the database, and DARPA will consider any comments, along with other information in FAPIIS or other systems prior to making an award.

VI.   Award Administration Information

A.   Selection Notices and Notifications

A.1. Abstracts

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

A.2. Proposals

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

B.   Administrative and National Policy Requirements

B.1. Meeting and Travel Requirements

There will be a DARPA Subterranean Challenge Program Initiation Meeting, and all key participants are required to attend. Non-key participants may attend via teleconference. Performers should also plan for key team members to travel to the four (4) Technical Interchange Meetings in their proposals (c.f. Section I.D.3). Proposers to Track A should plan for their team to travel in support of the four (4) Challenge events; proposers to Track C should plan for travel to attend and support their effort at the Final Event venue (c.f. Section I.D.4). Additionally, periodic site visits may be required at the Program Manager's discretion.

B.2. FAR and DFARS Clauses

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

B.3. Controlled Unclassified Information (CUI) on Non-DoD Information Systems

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

B.4. Representations and Certifications

If a procurement contract is contemplated, prospective awardees will need to be registered in the SAM database prior to award and complete electronic annual representations and certifications consistent with FAR guidance at 4.1102 and 4.1201; the representations and certifications can be

found at www.sam.gov. Supplementary representations and certifications can be found at http://www.darpa.mil/work-with-us/additional-baa.

.

B.5. Terms and Conditions (cooperative agreements only)

A link to the DoD General Research Terms and Conditions for Grants and Cooperative Agreements and supplemental agency terms and conditions can be found at http://www.darpa.mil/work-with-us/contract-management#GrantsCooperativeAgreements.

C. Reporting

The number and types of reports will be specified in the award document, but will include as a minimum monthly technical and financial status. The reports shall be prepared and submitted in accordance with the procedures contained in the award document and mutually agreed on before award. Reports and briefing material, to include Circuit Reports and monthly Progress Reports, will also be required as appropriate to document progress in accomplishing program metrics. A Final Report that summarizes the project and tasks will be required at the conclusion of the performance period for the award, notwithstanding the fact that the research may be continued under a follow-on vehicle. At least one copy of each report will be delivered to DARPA and not merely placed on a SharePoint site. For additional details on these deliverables, please refer to Section I.E).

D. Electronic Systems

D.1. Wide Area Work Flow (WAWF)

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

D.2. i-Edison

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

VII. Agency Contacts

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

DARPA will use e-mail for all technical and administrative correspondence regarding this solicitation.

- Technical POC: Dr. Timothy H. Chung, Program Manager, DARPA/TTO

- Solicitation E-mail: SubTChallenge@darpa.mil

- Solicitation Mailing Address:
  DARPA/TTO

ATTN: HR001118S0016
675 North Randolph Street
Arlington, VA 22203-2114

VIII. Other Information

A. Proposers Day

The DARPA Subterranean Challenge Proposers Day was held on January 18, 2018 in Arlington, VA. The event was webcast for those who wanted to participate remotely. Advance registration was required for both the physical and webcast meeting. The registration deadline was January 10, 2018 and January 16, 2018, respectively.

See DARPA-SN-18-11 posted at https://www.fbo.gov/spg/ODA/DARPA/CMO/DARPA-SN-18-11/listing.html for further details. Attendance at the Proposers Day was voluntary and was not required to propose to this solicitation. Materials presented at the Proposers Day may have been posted at http://www.darpa.mil/work-with-us/opportunities/.

B. Frequently Asked Questions (FAQs)

Administrative, technical, and contractual questions should be e-mailed to SubTChallenge@darpa.mil. All questions must be in English and must include the name, e-mail address, and the telephone number of a point of contact.

DARPA will attempt to answer questions in a timely manner; however, questions submitted after the submission date as stated in Part I may not be answered. DARPA will post a consolidated FAQ list at: https://www.fbo.gov. The list will be updated on an ongoing basis until the BAA expiration date.

C. List of Attachments

- Attachment 1 – Cover Sheet and Proposal Templates

- Attachment 2 – Cost Summary Templates

- Attachment 3 – Elevator Pitch and Summary Slide Templates

- Attachment 4 – Administrative and National Policy Requirements