Broad Agency Announcement

Next-Generation Non-Surgical Neurotechnology (N^3)

BIOLOGICAL TECHNOLOGIES OFFICE

HR001118S0029

March 23, 2018

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PART I: OVERVIEW INFORMATION

- **Federal Agency Name** – Defense Advanced Research Projects Agency (DARPA), Biological Technologies Office
- **Funding Opportunity Title –** Next-Generation Non-Surgical Neurotechnology
- **Announcement Type –** Initial announcement
- **Funding Opportunity Number –** HR001118S0029
- **Catalog of Federal Domestic Assistance Numbers (CFDA) – 12.910 Research and Technology Development**
- **Dates**
  - Posting Date – March 23, 2018
  - Proposal Abstract Due Date and Time – April 24, 2018, 4:00 PM ET
  - Proposal Due Date and Time – June 5, 2018, 4:00 PM ET
  - BAA Closing Date – June 5, 2018
  - Proposers Day – April 3, 2018

  https://www.fbo.gov/spg/ODA/DARPA/CMO/DARPA-SN-18-38/listing.html

- **Concise description of the funding opportunity –** DARPA seeks proposals to design, build, demonstrate, and validate a nonsurgical neural interface system to broaden the applicability of neural interfaces to the able-bodied warfighter. The final technology aims to enable neural recording and stimulation with sub-millimeter spatial resolution.
- **Anticipated individual awards** - Multiple awards are anticipated.
- **Types of instruments that may be awarded** - Procurement contract, cooperative agreement or Other Transaction.
- **Any cost sharing requirements – None**
- **Agency contact**

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PART II: FULL TEXT OF ANNOUNCEMENT

1. 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) often selects its research efforts through the BAA process. The BAA will appear first on the FedBizOpps website, http://www.fbo.gov, and the Grants.gov website http://www.grants.gov. The following information is for those wishing to respond to the BAA. Proposals received as a result of this BAA shall be evaluated in accordance with evaluation criteria specified herein through a scientific review process.

DARPA is soliciting innovative proposals to revolutionize the nonsurgical bidirectional neural interface. State-of-the-art high-resolution (single neuron or neural ensemble) neural interfaces are invasive, requiring surgical implantation of metal or silicon-based electrodes into brain tissue or on the surface of the brain. Current high-resolution neural interfaces are not a feasible solution for the able-bodied warfighter, nor are they ideal for therapy and restoration of function. However, given recent advances in biomedical engineering, neuroscience, and nanotechnology, there is now an opportunity to develop a neural interface that is either completely external to the body or that includes a nonsurgically delivered nanotransducer that will serve as a signal transducing intermediary between neurons and the external recording and stimulating device. The current major technological challenge is to interact with neural tissue through the skull while maintaining high spatial and temporal resolution; this is important for both recording and stimulating neurons. It is also imperative that candidate technologies are safe and biocompatible.

Proposed research should investigate innovative approaches that enable revolutionary advances in science, devices, and systems. Specifically excluded is research that primarily results in evolutionary improvements to the existing state of practice. Incremental advances in electroencephalography (EEG) and magnetic resonance imaging (MRI) may not be considered responsive to this BAA and may not be evaluated.

1.1. PROGRAM OVERVIEW

The Next-Generation Non-Surgical Neurotechnology (N^3) program aims to develop a high-resolution neural interface that does not require surgery. While previous DARPA programs have developed neural interfaces intended to restore function to the wounded warrior, the N^3 program will broaden the applicability of neural interfaces to the able-bodied warfighter.

A neural interface that enables fast, effective, and intuitive hands-free interaction with military systems by able-bodied warfighters is the ultimate program goal. The promise of efficient warfighter multitasking and intuitive interaction with autonomous and semi-autonomous systems point to the need to develop technologies targeted at enriching human-machine interaction. In addition, it is imperative that warfighters be able to interact regularly and intuitively with artificially intelligent (AI), semi-autonomous and autonomous systems in a manner currently not

possible with conventional interfaces. The N^3 program will develop the interface technology required for current and future systems.

The high-resolution neural interfaces available today require a craniotomy for direct placement into the brain. The burden of surgery and associated risks are currently too high for this approach to be considered for use by able-bodied individuals. The N^3 program aims to overcome these issues by developing a nonsurgical neural interface that is safe for human use, and that has high spatiotemporal resolution and low latency to enable function on par with current microelectrode technology. The interface must be bidirectional and will integrate technology for both neural recording (read out) and neural stimulation (write in). The developed technology must be agnostic to the interfaced DoD-relevant system.

To reach high temporal and spatial resolution, N^3 will focus on two approaches: noninvasive (Technical Area 1 –TA1) and "minutely" invasive (Technical Area 2 – TA2) neural interfaces. Noninvasive interfaces will include the development of sensors and stimulators that do not breach the skin and will achieve neural ensemble resolution ($<1mm^3$). Minutely invasive approaches will permit nonsurgical delivery of a nanotransducer: this could include a self-assembly approach, viral vectors, molecular, chemical and/or biomolecular technology delivered to neurons of interest to reach single neuron resolution ($<50\mu m^3$). In this application, the developed technology will serve as an interface between targeted neurons and the sensor/stimulator. They should be sufficiently small to not cause tissue damage or impede the natural neuronal circuit. The sensors and stimulators developed under the minutely invasive approach will be external to the skull and will interact with the nanotransducers to enable high resolution neural recording and stimulation.

Both noninvasive and minutely invasive approaches will be required to overcome issues with signal scattering, attenuation, and signal-to-noise ratio typically seen with state of the art noninvasive neural interfaces. Systems that are larger or requiring a highly controlled environment – such as magnetoencephalography (MEG), or magnetic resonance imaging (MRI) – and proposals describing incremental improvements upon current technologies, such as electroencephalography (EEG), may not be considered responsive to this BAA and may not be evaluated.

Final N^3 deliverables will include a complete integrated bidirectional brain-machine interface system. Non-invasive approaches will include sensor (read) and stimulator (write) subcomponents integrated into a device (or devices) external to the body (Figure 1B). Minutely invasive approaches will develop the nanotransducers for use inside the brain to facilitate read out and write in (Figure 1A). Minutely invasive approaches will also develop the external subcomponents and integrated devices that interact with the internal nanotransducers. N^3 developed technologies may move beyond the traditional voltage recordings associated with action potentials, and include different types of signals, such as light, magnetic/electric fields, radiofrequency, and neurotransmitter/ion concentrations. These atypical signals may require the development of new algorithms to enable accurate decoding and encoding of neural activity. To that end, the N^3 program will include a computational and processing unit that must provide task-relevant decoded neural signals for control in a DoD-relevant application. It must also provide the capability to encode signals from a DoD-relevant application and deliver sensory feedback to

the brain. The processing unit must decode/encode in real time with minimal system latency (Figure 1C). A block diagram of the expected final prototype is shown in Figure 2.

To prove the capabilities of the N^3 system, four major demonstrations will show progress from a benchtop proof-of-concept, to validation in animal models, to a final demonstration of a DoD-relevant application in human subjects. In order to transition the developed technology to clinical readiness, N^3 performers will actively collaborate with the Food and Drug Administration (FDA) throughout the program.

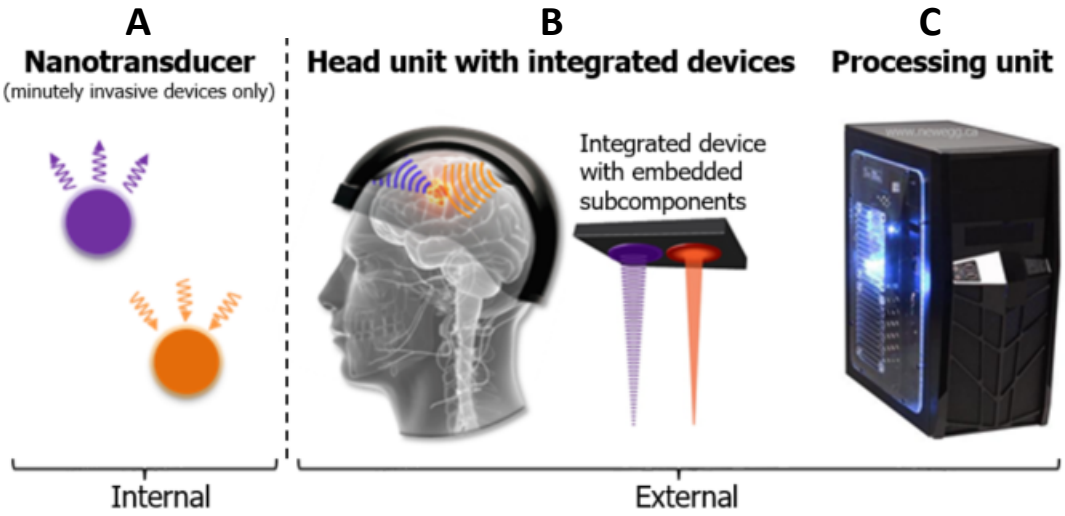


Figure 1. Notional N^3 prototype. 1A - Nanotransducers supporting read and write functions (for TA2 devices only). 1B right - Notional concept of at least two subcomponents integrated into one device. 1B left – notional diagram of multiple devices used to achieve multi-focal interaction with the brain. 1C - Processing unit for decoding and encoding computation between the N^3 system and relevant DoD application.

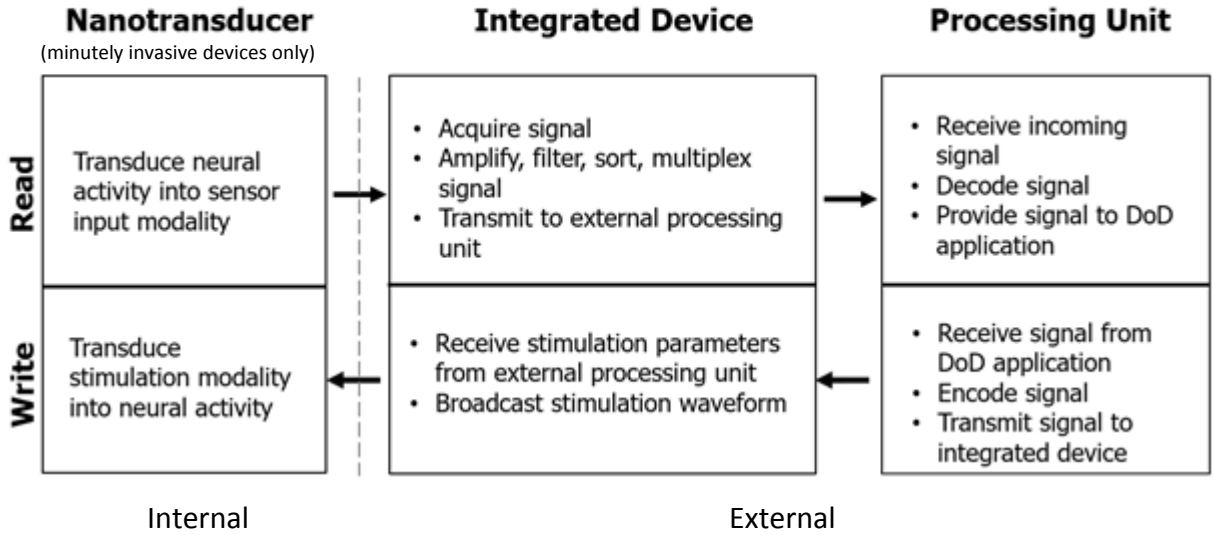


Figure 2. Block diagram of N^3 technology

1.2. TECHNICAL AREAS

The N^3 program will provide up to four years of funding to deliver a nonsurgical neural interface system and is divided into three sequential Phases: Phase I (base effort)– 12 months, Phase II (option) – 18 months, and Phase III (option) – 18 months. N^3 anticipates that each proposal will involve multiple integrated teams (from the same or different institutions) collectively developing the technological approaches for read out and write in. Teams must structure proposals as a single, unified effort with a system integrator that address all the program goals of the specified Technical Area (TA). Proposals that do not address all of the technical objectives may be considered non-responsive. Proposals must address a complete bidirectional neural interface system based on at least one of the following TAs:

Technical Area 1. Noninvasive neural interface

Technical Area 2. Minutely invasive neural interface

System Integration
Due to the complexity and performance objectives of the N^3 system, proposals must identify a lead integrator with a proven track record of managing and integrating disparate technologies. Starting as early as Phase I, system integration should be a consideration throughout the program.

Security Measures
Proposers must use approaches that ensure confidentiality, integrity, and availability (also known as the CIA triad) to prevent spoofing, tampering, or denial of service. It will be necessary to adequately secure the connection between the integrated device, the processing unit, and the system user's brain. Proposers must incorporate inherently safe techniques into any wireless and electronic portions of their system, and proposals must describe the specific protocols and techniques to be used.

Ethical, Legal, and Societal Implications (ELSI)
DARPA maintains its commitment to ensuring that efforts funded under this BAA adhere to ethical and legal regulations currently in place for federally and DoD-funded research. Program developments will be discussed with a panel of expert external advisors with expertise in bioethical issues that may emerge as a consequence of advances in neurotechnology. Proposers to this BAA must address potential ethical, legal, and societal implications of their proposed technology.

TECHNICAL AREA 1: NONINVASIVE NEURAL INTERFACE

TA1 focuses on the ability to noninvasively record neural activity and stimulate neurons with high spatiotemporal resolution. The technologies in TA1 must only use external sensors and stimulators that do not breach the skin. Example technologies for TA1 may include ultrasound, photoacoustics, magnetic fields, electric fields, or radiofrequency. The final solution could also involve a combination of technologies.

In addition to developing the fundamental technology, teams must demonstrate the viability of their neural interface to operate as part of a closed-loop system. Teams will be required to develop decoding and encoding algorithms tailored to the new acquisition of N^3 signals that will both enable multi-degree-of-freedom neural control and provide sensory feedback to the brain. The final system must also include a processing unit that can receive the incoming signal, decode, encode, and transmit signals to the integrated device at a 50ms latency. Proposals that do not directly link and justify the decoding and encoding methodology directly to the N^3 system may be considered non-responsive to this BAA and may not be evaluated.

Phase I (Base - 12 months): Develop subcomponent technology

In Phase I, teams will work on developing the subcomponents required for neural recording and stimulation. Proposals must fully describe the complete system design of their proposed bidirectional system. It must include a description of the individual subcomponents for read out and write in as well as their intended operational parameters. The system design must include the theory of operation of the read and write subcomponents. The system design must detail how the subcomponents will meet the performance metrics (Table 1) and overcome challenges with scattering and attenuation. Proposals must also describe data transmission to/from an external processing unit, and how they will implement decoding and encoding algorithms. Proposers must also describe their plan for fabrication of the read out and write in subcomponents. This description should include a detailed timeline for developing the sensor and stimulator subcomponents during this phase of the program. It should discuss microfabrication or nanofabrication processes as are relevant and must name the fabrication facilities. Proposals must also identify risks in the fabrication process.

At the end of Phase I, teams will be required to demonstrate the ability of their subcomponent technology to meet program metrics (Table 1) in a bench top demo. Proposals must describe what and how the technology will be demonstrated. It is expected the read out and write in subcomponents will continuously operate over the course of at least two hours, while adhering to the performance metrics defined in Table 1. The demonstration must be through a skull or skull-like medium, and must include a comparison to ground truth. Ground truth will provide empirical evidence that the technology can directly read out and write in the neural signal. Proposals must describe the intended method for acquiring ground truth (e.g., electrode recordings, calcium indicators). While teams must demonstrate the ability to read from and write to the brain, they are strongly encouraged to demonstrate the ability to operate at least two read or write channels within a $16mm^3$ volume or less of brain tissue, in order to demonstrate early feasibility of multichannel capabilities.

Teams must plan their subcomponent development in a manner that includes proof-of-concept checkpoints throughout the phase. These tests should demonstrate forward progress by characterizing the viability of system elements as they are being developed. Demos, data, and analysis outputs are all required to determine if the checkpoints have been achieved. Proposals should outline how teams will demonstrate the proof of concept checkpoints throughout Phase 1.

Teams will be required to perform a preliminary design review no later than six (6) months post contract award and a critical design review (CDR) no later than nine (9) months post contract

award. The CDR must be included in the statement of work. Performers that do not pass the CDR may not continue to Phase II.

Phase II (Option - 18 months): Integrate and validate *in vivo*

In Phase II, teams must integrate the read out and write in subcomponents and validate the integrated device *in vivo*. Proposals must discuss their device design and how and what quantity of individual read and write subcomponent will be integrated into a device. The proposal should address plans for fabrication of the integrated device and minimization and evaluation of crosstalk and interference issues between the subcomponents. Both interchannel and intermodality (read/write) crosstalk and interference issues must be addressed in the proposal. Proposals should also describe how responsibility for system integration will be handled, providing justification of previous accomplishments and past successful device integration. The proposal must describe how the overall system will meet latency metrics. It must also describe how at least 16-channel read out and write in capability will be integrated into the device.

In Phase II, teams must also begin algorithm development for decoding motor signals and for encoding sensory feedback. Decoding algorithms must be able to translate the neural signal recorded by the N^3 device into a control signal that facilitates multiple degree-of-freedom control, demonstrated either in a virtual reality or physical environment (see metrics in Table 1). Encoding algorithms must be able to interpret information from the task environment and translate the information into a pattern of stimulation that would deliver sensory feedback to the user about the task. The pattern of stimulation would then be delivered by the N^3 device. Proposals must describe unique N^3 specific decoder/encoder methodology, justification for the chosen algorithm(s), justification for how the algorithms will decode/encode within latency metrics, and an explanation of how these algorithms will meet system metrics (Table 1). The safety and histology strategy may involve histology with brain slices but must also include chronic *in vivo* mammalian histology demonstrations. It may also address sterility and biocompatibility where the device may come in direct contact with human skin as well as electrical and electromagnetic compatibility.

Teams must submit an Investigational Device Exemption (IDE) to the FDA. Pre-IDE submissions are required. The proposal must address safety and histology and describe how to evaluate safety and biocompatibility in large animal models (e.g., sheep and non-human primates) to provide the necessary documentation to the FDA. Good Lab Practices (GLP) conditions are recommended for animal studies conducted in Phase II. Testing will be required that shows the device is going to function as intended. An overall Device Evaluation Strategy (DES) will be a required deliverable at the end of Phase II. The DES will describe the device attributes as they relate to its intended function. Teams should refer to the FDA for full instructions for the DES. In cases where an IDE is not necessary for the proposed technology, human studies may begin in this phase instead of Phase III. If so, proposals must justify why they will not require an IDE and why they can transition to humans in Phase II. Proposals must describe a plan for recruiting human subjects.

Phase II will include two capability demonstrations. The first will occur 21 months into the program and will demonstrate open-loop read and write capabilities in either an animal or a

human subject, as appropriate. The second demonstration will occur at 30 months and will demonstrate closed-loop read and write capabilities of the integrated system in a higher-order mammal (e.g., non-human primate) or human subject. The design of the demonstrations will be up to the discretion of the teams but should be described in the proposal. For example, an acceptable demonstration could include a subject controlling multiple degrees of freedom on a virtual limb and receiving appropriate sensory feedback when the limb collides with objects in the workspace. The demonstration must concretely demonstrate that the sensory feedback is useful for the task. Demonstrations that include stimulation to elicit sensory percepts but no method to validate the effect are not acceptable. Other innovative demonstration ideas are encouraged. The program goal is to meet or exceed Phase II metrics for the 30-month demo, described in Table 1. Proposals must provide a Phase II demonstration description of both capability demonstrations, which should discuss how to incorporate both control and sensory signals and meet the Table 1 metrics. Proposals must describe the brain region(s) they intend to target for the demonstration and provide justification for selection of this region.

Teams are encouraged, but not required, to implement wireless data transmission between devices and the processing unit.

Phase III (Option - 18 months): Refine and demonstrate

In Phase III, teams will focus on refining their system algorithms in order to reduce system latency to 50ms, increase the degrees of freedom DOFs for control, and increase the number of encoded sensory signals as laid out in the metrics (Table 1). Proposals must address these program objectives and describe a strategy to scale up the number of devices to allow for multifocal read out and write in capabilities within different brain regions. During this phase, teams will receive their IDE approval and begin experiments in human subjects.

At the end of the program, teams will perform a DoD-relevant demonstration of their choosing in a human subject. For example, the final demonstration could include a human subject controlling multiple drones in a virtual reality setup, while receiving sensory feedback to portray the status of each drone. Proposals must include plans for the Phase III demonstration. This description should include a justification of the targeted brain region(s), a discussion of how the program metrics will be met (Table 1), and a rationale for why the demonstration is DoD-relevant.

TECHNICAL AREA 2: MINUTELY INVASIVE NEURAL INTERFACE

TA2 involves the development of a system that includes a nanotransducer placed on or near neurons of interest and an integrated sensor/stimulator device that sits outside the skin. The nanotransducer may include technologies such as, but not limited to, self-assembled/molecular/biomolecular/chemical nanoparticles, or viral vectors. These nanotransducers must be delivered in a minutely invasive (nonsurgical) manner, which may include ingestion, injection, or nasal administration, and involve technology that includes self-assembly inside the body. While the major TA2 goals of developing neural read out and write in capabilities are similar to the goals from TA1, creating a nanotransducer with an optimal delivery route to the brain is a major additional component. Another major component of TA2 is achieving cell-type specificity. Proposers may choose which cell types they plan to target but

must justify their decision. Furthermore, due to the proximity of the nanotransducer to the neuron, the metrics for TA2 are stricter, requiring single neuron spatial resolution and a higher number of control and sensory signals as outlined in Table 2.

Similar to TA1, TA2 proposals must include a system design description of the technology for read out and write in. The description should include the technical objectives delineated in TA1 and must provide a detailed description of the proposed nanotransducer. Teams must describe a viable delivery plan that allows the nanotransducer to be placed into the periphery and obtain proximity to its intended target in the brain. Proposals must also technically address how neural interfaces will achieve spatial control and stability. Proposals must describe the intended efficiency of the transducer (e.g., the percent of recorded neural activity compared to a state-of-the-art recording method). Proposals must also describe the expected nanotransducer response properties (e.g., rise, decay, refractory period) that should support program temporal resolution metrics (Table 2) and capture and/or drive neuronal activity.

Technical objectives set forth in TA1 apply here. Additional objectives specific to TA2 are described below. TA2 metrics are outlined in Table 2.

Phase I (Base - 12 months): Develop subcomponents and nanotransducers

In Phase I, the proposal must describe fabrication approach for the read and write subcomponents and nanotransducer. Discussion of the system design for the subcomponents is described in TA1 and proposers should include the theory of operation of the nanotransducer, the external subcomponent, and the interaction between the two in their proposal. The nanotransducer should be thoroughly described, including encapsulation material if relevant, antibodies or promoters for cell type specificity, and a protocol for fabrication. Teams will work toward an *in vitro* proof of concept demonstration at the end of Phase I for both neural read out and write in. *In vitro* demonstration must be tested using live cell cultures, organoids, or brain slices with a skull or skull simulant. Proposals must also describe a strategy for demonstrating viable interaction between the subcomponents and the nanotransducer, including a strategy for the *in vitro* proof of concept demonstration.

Phase II (Option - 18 months): Integrate and validate *in vivo*

Teams selected to move on to Phase II will work on transitioning the technology from the *in vitro* setup to mammalian animal models. During this Phase, the teams will focus on nanotransducer delivery to the brain and validate in animal models. Proposals must technically describe how to ensure the transducer works through the skull in the appropriate animal model. Animal models of interest include any typical mammalian models such as rodents, pigs, sheep, and non-human primates. The delivery method and a method to inactivate the nanotransducer in case of an adverse event must also be detailed in the proposal. The system integration, safety and histology, and Phase II demonstration described in TA1 apply here.

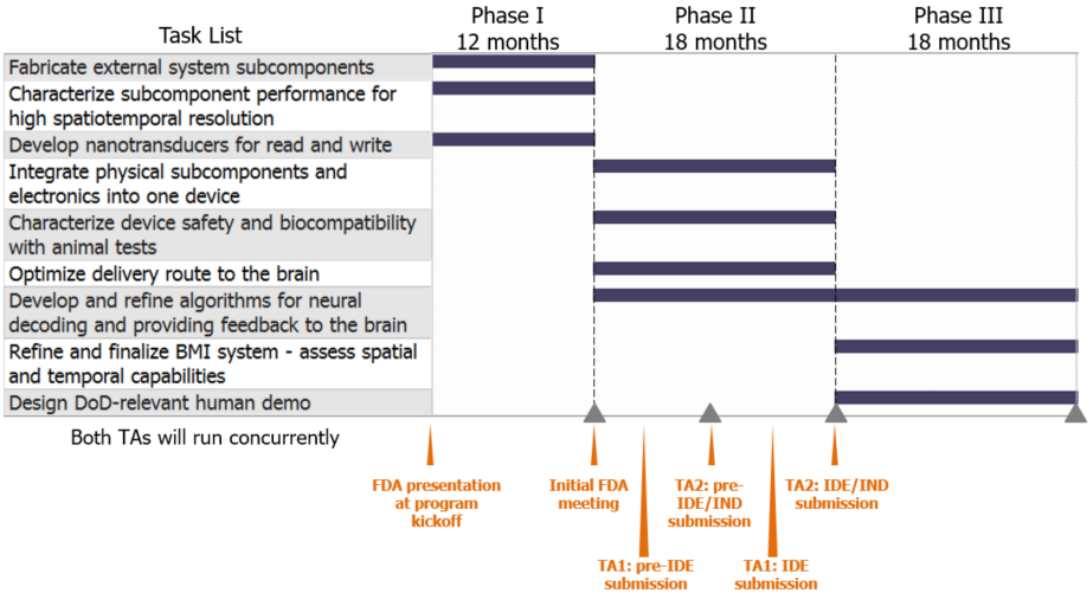
By the end of Phase II, teams must submit an Investigational Device Exemption (IDE) and/or Investigational New Drug (IND) to the FDA. Pre-IDE and pre-IND submissions are required. Timelines for FDA submission are different for the two TAs (see Figure 3). The nanotransducer

may be categorized by the FDA as a device, drug, or biologic. During Phase II, the chosen applicant will work closely with the FDA Office of Combination Product to identify the appropriate designation for their nanotransducer.

Phase III (Option - 18 months): Refine and demonstrate

In Phase III, teams must characterize their system and refine system parameters to meet program metrics. Teams will focus on refining their system algorithms in order to reduce system latency to 50ms, increase the DOFs for control, and increase the number of encoded sensory signals to meet what is listed in Table 2. Proposals must address these objectives and describe a strategy to scale up the number of devices to allow for multifocal read out and write in capabilities within different brain regions.

TA2 will also conclude a final demonstration in a human patient population. The human patient population must be defined in the proposal along with a justification for the choice. Proposals must include a full description of the final demonstration, along with a justification of the design choice (see Phase III demonstration description details put forth in the TA1-Phase III section), potential patient population, and why the demonstration is DoD relevant. For example, the final demonstration could include a patient using the N^3 device to control multiple devices in a virtual DoD setting with multiple degrees-of-freedom. At the same time, the patient would receive relevant sensory information from the virtual environment via neural stimulation. This sensory feedback would serve to guide action of the devices in the DoD setting. Other innovative demonstration ideas are encouraged.



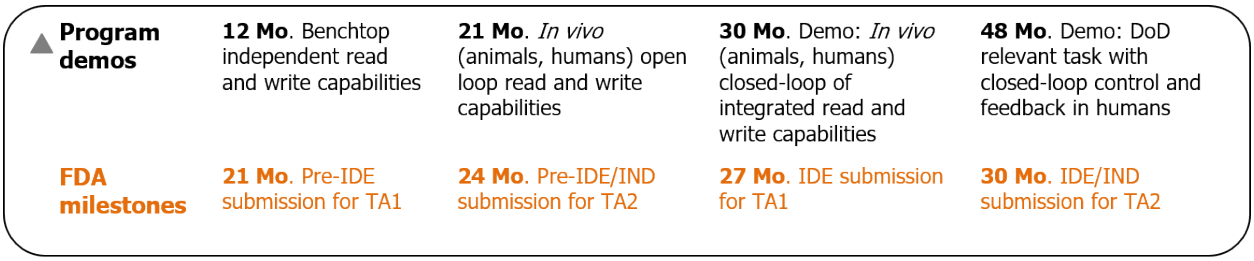


Figure 3. Program timeline

1.3. PROGRAM METRICS

In order for the Government to evaluate the effectiveness of a proposed solution in achieving the stated program objectives, proposers should note that the Government hereby promulgates the following program metrics that may serve as the basis for determining whether satisfactory progress is being made to warrant continued funding of the program. Although the following program metrics are specified, proposers should note that the Government has identified these goals with the intention of bounding the scope of effort, while affording the maximum flexibility, creativity, and innovation in proposing solutions to the stated problem.

Proposals must cite the quantitative and qualitative success criteria that the proposed effort will achieve by the time of each Phase's program metric measurement.

Performer progress will be assessed against end-of-phase metrics (see TA1 and TA2 metrics in Tables 1 and 2, respectively). Phase I metrics should hold for subsequent program phases. Funding for Phase II and II is contingent on satisfactory progress during the preceding phase and funding availability. Metrics that are not self-explanatory are further described below:

Accuracy
In order to meet the Accuracy metric for the read capability, teams must establish a "ground truth" method of recording (i.e., conventional electrodes) and compare the recording capability to their new technology. For technologies where the signal is no longer voltage-related, teams must include an explanation for how to interpret the new kind of signal (e.g., light). To meet the Accuracy metric for the write capability, a state-of-the-art "ground truth" for stimulation (i.e. optogenetics) must be used as a comparison with the new technology.

Channel count
A channel is a single read or a single write capability. The channel count is the number of individual read channels or individual write channels within a defined brain volume ($16mm^3$).

Device size
A single device contains integrated read out and write in subcomponents. These subcomponents must include ≥ 32 independent channels in a $16mm^3$ volume, with at least 16 channels per modality (refer to Table 1).

Sensory signals
Proposals must include methods for recording and interpreting sensory signals. Sensory signals are methods of perception that may include the ability to see, touch, hear, taste, speak or smell.

Multifocal capability
Teams must develop multiple bidirectional devices that they will situate around the subject's head in order to achieve multifocal neural recording and stimulation. In this context, multifocal refers to the ability to interact with different brain regions (ex: motor cortex and sensory cortex).

Cognitive indicators
While not an official metric, proposals may include methods for recording and interpreting cognitive indicators. Cognitive indicators may include the ability to detect decision making, error, certainty, cognitive load, et cetera. Proposals should also include a description of how these indicators will be identified and evaluated for accuracy.

The full list of metrics is shown below.

Table 1. TA1 metrics

Phase I Read and Write Subcomponents	**Phase II** Integrated Device	**Phase III** Final System
Spatial resolution <1 mm^3 **Temporal resolution** <10 ms **Stability** continuous operation for ≥ 2 hrs **Accuracy (read/write)** correlation to ground truth accuracy ≥ 95%	**Safety** ≤ 1° rise in tissue volume being read from/written to **Closed loop system latency** < 100 ms **Control signals** ≥ 3 DOF **Somatosensory signals** ≥ 3 categories (ex: detection, alarm) **Integrated device size** ≤ 125 cm^3 **Channel count** read channels/volume (≥16/16mm^3) write channels/volume (≥16/16mm^3)	**Closed loop system latency** < 50 ms **Control signals** ≥ 6 DOF **Somatosensory signals** ≥ 6 categories **Multifocal capability** ≥ 4 read/write locations without crosstalk

Table 2. TA2 metrics

Phase I Subcomponents and Transducers	**Phase II** Integrated Device	**Phase III** Final System
Spatial resolution <50 μm^3 **Temporal resolution** <10 ms **Stability** Continuous operation for ≥ 2 hrs **Accuracy (read/write)** Correlation to ground truth accuracy ≥ 95% **Cell type specificity** Excitatory and inhibitory control for stimulation **Delivery** Viable strategy identified	**Safety** ≤ 1° rise in tissue volume being read from/written to **Closed loop system latency** < 100 ms **Control signals** ≥ 5 DOF **Somatosensory signals** ≥ 5 categories (ex: detection, alarm) **Integrated device size** ≤ 125 cm^3 **Channel count** read channels/volume (≥16/16mm^3) write channels/volume (≥16/16mm^3)	**Closed loop system latency** < 50 ms **Control signals** ≥ 10 DOF **Somatosensory signals** ≥ 10 categories **Multifocal capability** ≥ 4 read/write locations without crosstalk

Progress will be assessed via regular teleconferences, program review meetings, and quarterly written reports. All key performer personnel are expected to participate in the teleconferences and attend review meetings.

Program review meetings will be held once a year. These meetings will permit the researchers to provide updates of their technical progress. Site visits will be conducted at the Program Manager's discretion.

2. Award Information

2.1. GENERAL AWARD INFORMATION

Multiple awards are possible. 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 fund a Phase option based on funding availability, an assessment of the research results, and a determination that awarding the option is in the best interest of the Government.

The Government reserves the right to request any additional, necessary documentation once it makes the award instrument determination. Such additional information may include but is not limited to Representations and Certifications (see Section VI.B.2., "Representations and Certifications"). The Government reserves the right to remove proposers from award consideration should the parties fail to reach agreement on award terms, conditions, and/or cost/price within a reasonable time, and the proposer fails to timely provide requested additional information. 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.

2.2. FUNDAMENTAL RESEARCH

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

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

As of the date of publication of this BAA, the Government expects that program goals as described herein may be met by proposers intending to perform fundamental research and proposers not intending to perform fundamental research or the proposed research may present a

high likelihood of disclosing performance characteristics of military systems or manufacturing technologies that are unique and critical to defense. Based on the nature of the performer and the nature of the work, the Government anticipates that some awards will include restrictions on the resultant research that will require the awardee to seek DARPA permission before publishing any information or results relative to the program.

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

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

3. Eligibility Information

3.1. ELIGIBLE APPLICANTS

All responsible sources capable of satisfying the Government's needs may submit a proposal that shall be considered by DARPA.

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

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.

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.

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.

3.1.2. Non-U.S. Organizations

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.

3.2. 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.

3.3. 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

4. Application and Submission Information

4.1. ADDRESS TO REQUEST APPLICATION PACKAGE

This announcement, any attachments, and any references to external websites herein constitute the total solicitation. If proposers cannot access the referenced material posted in the announcement found at http://www.darpa.mil, contact the administrative contact listed herein.

4.2. CONTENT AND FORM OF APPLICATION SUBMISSION

All submissions, including abstracts and proposals must be written in English with type not smaller than 12 point font. Smaller font may be used for figures, tables, and charts. Copies of all documents submitted must be clearly labeled with the DARPA BAA number, proposer organization, and proposal title/proposal short title.

4.2.1. Proposal Abstract Format

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 is a concise version of the proposal comprising a maximum of 6 pages including all figures, tables, and charts. The (optional) submission letter is not included in the page count. All pages shall be formatted for printing on 8-1/2 by 11-inch paper with font size not smaller than 12 point. Smaller font sizes may be used for figures, tables, and charts.

Submissions must be written in English.

Abstracts must include the following components:

A. Cover Sheet (does not count towards page limit): Include the administrative and technical points of contact (name, address, phone, fax, email, lead organization). Also include the BAA number, title of the proposed project, primary subcontractors, estimated cost, duration of the project, and the label "ABSTRACT."

B. Goals and Impact: Clearly describe what is being proposed and what difference it will make (qualitatively and quantitatively), including brief answers to the following questions:

1. What is the proposed work attempting to accomplish or do?
2. How is it done today? And what are the limitations?
3. What is innovative in your approach and how does it compare to the current state-of-the-art (SOA)?
4. What are the key technical challenges in your approach and how do you plan to overcome these?
5. Who will care and what will the impact be if you are successful?
6. How much will it cost and how long will it take?

C. Technical Plan: Outline and address all technical challenges inherent in the approach and possible solutions for overcoming potential problems. This section should provide appropriate specific milestones (quantitative, if possible) at intermediate stages of the project to demonstrate progress, and a brief plan for accomplishment of the milestones.

D. Capabilities: Provide a brief summary of expertise of the team, including subcontractors and key personnel. A principal investigator for the project must be identified, and a description of the team's organization. No more than two resumes should be included as part of the abstract. Include a description of the team's organization including roles and responsibilities. Describe the organizational experience in this area, existing intellectual property required to complete the project, and any specialized facilities to be used as part of the project. List Government-furnished materials or data assumed to be available. If desired, include a brief bibliography with links to relevant papers, reports, or resumes of key performers. Do not include more than two resumes as part of the abstract. Resumes count against the abstract page limit.

4.2.2. Proposal Format

All full proposals must be in the format given below. Proposals shall consist of two volumes: 1) **Volume I, Technical and Management Proposal**, and 2) **Volume II, Cost Proposal.** All pages shall be printed on 8-1/2 by 11-inch paper with type not smaller than 12 point. Smaller font may be used for figures, tables, and charts. The page limitation for full proposals includes all figures, tables, and charts. Volume I, Technical and Management Proposal, may include an attached bibliography of relevant technical papers or research notes (published and unpublished) which document the technical ideas and approach upon which the proposal is based. Copies of not more than three (3) relevant papers may be included with the submission. The bibliography and attached papers are not included in the page counts given below. The submission of other

supporting materials along with the proposals is strongly discouraged and will not be considered for review. **The maximum page count for Volume 1 is 30 pages.** A submission letter is optional and is not included in the page count. Volume I should include the following components:

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

a. Volume I, Technical and Management Proposal

Section I. Administrative

A. Cover Sheet (LABELED "PROPOSAL: VOLUME I"):

1. BAA number (HR001118S0029);
2. Technical area;
3. Lead organization submitting proposal (prime contractor);
4. Type of organization, selected from among the following categories: "LARGE BUSINESS," "SMALL DISADVANTAGED BUSINESS," "OTHER SMALL BUSINESS," "HBCU," "MI," "OTHER EDUCATIONAL," OR "OTHER NONPROFIT";
5. Proposer's reference number (if any);
6. Other team members (if applicable) and type of business for each;
7. Proposal title;
8. Technical point of contact (Program Manager or Principle Investigator) to include: salutation, last name, first name, street address, city, state, zip code, telephone, fax, e-mail;
9. Administrative point of contact (Contracting Officer or Grant Officer) to include: salutation, last name, first name, street address, city, state, zip code, telephone, fax, e-mail;
10. Award instrument requested: cost-plus-fixed-free (CPFF), cost-contract—no fee, firm-fixed-price, cooperative agreement, other transaction, or other type (specify);
11. Place(s) and period(s) of performance ;
12. Proposal validity period;
13. Total funds requested from DARPA, and the amount of cost share (if any); AND
14. Date proposal was submitted.

Information on award instruments is available at http://www.darpa.mil/work-with-us/contract-management

B. Official Transmittal Letter.

Section II. Detailed Proposal Information

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

- What is the proposed work attempting to accomplish or do?
- How is it done today, and what are the limitations?
- What is innovative in your approach?
- What are the key technical challenges in your approach and how do you plan to overcome these?
- Who or what will be affected and what will be the impact if the work is successful?
- How much will it cost, and how long will it take?

B. Goals and Impact: Clearly describe what the team is trying to achieve and the difference it will make (qualitatively and quantitatively) if successful. Describe the innovative aspects of the project in the context of existing capabilities and approaches, clearly delineating the uniqueness and benefits of this project in the context of the state of the art, alternative approaches, and other projects from the past and present. Describe how the proposed project is revolutionary and how it significantly rises above the current state of the art. Describe the deliverables associated with the proposed project and any plans to commercialize the technology, transition it to a customer, or further the work. This section should address all applicable proposal content instructions in Sections 1.1- 1.3 as required.

C. Technical Plan: Outline and address technical challenges inherent in the approach and possible solutions for overcoming potential problems. Provide appropriate measurable milestones (qualitative and quantitative) and program metrics (see Section 1.3) at each phase of the program to demonstrate progress, and a plan for achieving the milestones and metrics. The technical plan should demonstrate a deep understanding of the technical challenges and present a credible (even if risky) plan to achieve the program goal. Discuss mitigation of technical risk. The technical plan should address all applicable proposal content instructions in Sections 1.1- 1.3 as required.

D. Management Plan: Provide a summary of expertise of the team, including any subcontractors, and key personnel who will be doing the work. Resumes count against the proposal page count. Identify a principal investigator for the project. Provide a clear description of the team's organization including an organization chart that includes, as applicable: the programmatic relationship of team members; the unique capabilities of team members; the task responsibilities of team members, the teaming strategy among the team members; and key personnel with the amount of effort to be

expended by each person during each year. Provide a detailed plan for coordination including explicit guidelines for interaction among collaborators/subcontractors of the proposed effort. Include risk management approaches. Describe any formal teaming agreements that are required to execute this program.

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

F. Statement of Work (SOW): The SOW should provide a detailed task breakdown, citing specific tasks and their connection to the interim milestones and program metrics. Each phase of the program (Phase I through Phase III) should be separately defined. The SOW should provide a detailed task breakdown, citing specific tasks and their connection to the interim milestones and program metrics. The SOW must not include proprietary information.

   For each task/subtask, provide:

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

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

Section III. Additional Information (Note: Does not count towards page limit)

A brief bibliography of relevant technical papers and research notes (published and unpublished) which document the technical ideas upon which the proposal is based. Copies of not more than three (3) relevant papers can be included in the submission.

b. Volume II, Cost Management Proposal

Cover Sheet (LABELED "PROPOSAL: VOLUME II") and Appendix 1:

1. BAA number (HR001118S0029);
2. Technical area;
3. Lead Organization Submitting proposal;
4. Type of organization, selected among the following categories: "LARGE BUSINESS", "SMALL DISADVANTAGED BUSINESS", "OTHER SMALL BUSINESS", "HBCU", "MI", "OTHER EDUCATIONAL", OR "OTHER NONPROFIT";
5. Proposer's reference number (if any);
6. Other team members (if applicable) and type of business for each;
7. Proposal title;
8. Technical point of contact (Program Manager or Principal Investigator) to include: salutation, last name, first name, street address, city, state, zip code, telephone, fax (if available), electronic mail (if available);
9. Administrative point of contact (Contracting Officer or Grant Officer) to include: salutation, last name, first name, street address, city, state, zip code, telephone, fax (if available), and electronic mail (if available);
10. Award instrument requested: cost-plus-fixed-free (CPFF), cost-contract—no fee, cost sharing contract – no fee, or other type of procurement contract (*specify*), cooperative agreement, or other transaction;
11. Place(s) and period(s) of performance;
12. Total proposed cost separated by basic award and option(s) (if any);
13. Name, address, and telephone number of the proposer's cognizant Defense Contract Management Agency (DCMA) administration office (*if known)*;
14. Name, address, and telephone number of the proposer's cognizant Defense Contract Audit Agency (DCAA) audit office (*if known*);
15. Date proposal was prepared;
16. DUNS number (http://www.dnb.com/get-a-duns-number.html) ;
17. Taxpayer ID number (https://www.irs.gov/Individuals/International-Taxpayers/Taxpayer-Identification-Numbers-TIN);
18. CAGE code (https://cage.dla.mil/Home/UsageAgree);
19. Proposal validity period

Note that nonconforming proposals may be rejected without review.

Proposers that do not have a Cost Accounting Standards (CAS) complaint 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/cas.html. To facilitate this process, proposers should complete the SF 1408 found at http://www.gsa.gov/portal/forms/download/115778 and submit the completed form with the proposal. To complete the form, check the boxes on the second page, then provide a narrative explanation of your accounting system to supplement the checklist on page one. For more information, see (http://www.dcaa.mil/Home/Preaward).

The Government encourages proposers to complete an editable MS excel budget template that covers many of the items discussed below. This template document is provided as **Attachment 1** to this BAA. If proposers choose to use **Attachment 1**, submit the MS Excel template in addition to Volume I and II of their proposal. Volume II must include all other items discussed below that are not covered by the editable MS excel budget template. Proposers are welcome to utilize an alternative format, provided the information requested below is clearly and effectively communicated.

The Government strongly encourages that the proposer provide a detailed cost breakdown to include:

(1) Total program costs broken down by phase (Phase I base, Phase II option, and Phase III option) in Contractor Fiscal Year to include:

i. Direct Labor – Including individual labor categories with associated labor hours and direct labor rates. If selected for award, be prepared to submit supporting documentation to justify labor rates. (i.e., screenshots of HR databases, comparison to NIH or other web-based salary database);

ii. Consultants – If consultants are to be used, proposer must provide a copy of the consultant's proposed SOW as well as a signed consultant agreement or other document which verifies the proposed loaded daily / hourly rate, hours and any other proposed consultant costs (e.g., travel);

iii. Indirect Costs – Including Fringe Benefits, Overhead, General and Administrative Expense, Cost of Money, Fee, etc. (must show base amount and rate), if available, provide current Forward Pricing Rate Agreement or Forward Pricing Rate Proposal. If not available, provide 2 years historical data to include pool and expense costs used to generate the rates. For academia, provide DHHS or ONR negotiated rate package or, if calculated by other than a rate, provide University documentation identifying G&A and fringe costs by position;

iv. Travel – Provide the purpose of the trip, number of trips, number of days per trip, departure and arrival destinations, number of people, estimated rental car and airfare costs, and prevailing per diem rates as determined by gsa.gov, etc.; Quotes must be supported by screenshots from travel websites;

v. Other Direct Costs – Itemized with costs including tuition remission, animal per diem rates, health insurance/fee; back-up documentation is to be submitted to support proposed costs;

vi. Equipment Purchases – Itemization with individual and total costs, including quantities, unit prices, proposed vendors (if known), and the basis of estimate (e.g., quotes, prior purchases, catalog price lists, etc.); any item that exceeds $5,000 must be supported with back-up documentation such as a copy of catalog price lists or quotes prior to purchase (NOTE: For equipment purchases, include a letter stating why the proposer cannot provide the requested resources from its own funding), and;

vii. Materials – Itemization with costs, including quantities, unit prices, proposed vendors (if known), and the basis of estimate (e.g., quotes, prior purchases, catalog price

lists, etc.); any item that exceeds $5,000 must be supported with back-up documentation such as a copy of catalog price lists or quotes prior to purchase.

(2) A summary of program costs broken out by major tasks by Government Fiscal Year (GFY = Oct 1 – Sep 30)
(3) A summary of projected funding requirements by month;
(4) An itemization of any information technology (IT) purchase (including a letter stating why the proposer cannot provide the requested resources from its own funding), as defined in FAR Part 2.101;
(5) An itemization of Subcontracts. **All subcontractor cost proposal documentation must be prepared at the same level of detail as that required of the prime.** Subcontractor proposals should include Interdivisional Work Transfer Agreements (IWTA) or evidence of similar arrangements (an IWTA is an agreement between multiple divisions of the same organization);
(6) The source, nature, and amount of any industry cost-sharing. Where the effort consists of multiple portions which could reasonably be partitioned for purposes of funding, these should be identified as options with separate cost estimates for each;
(7) Identification of pricing assumptions of which 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.);
(8) Any Forward Pricing Rate Agreement, DHHS rate agreement, other such approved rate information, or such documentation that may assist in expediting negotiations (if available); and
(9) Proposers with a Government acceptable accounting system who are proposing a cost-type contract, must submit the DCAA document approving the cost accounting system.

4.2.3. Additional Proposal Information

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" or "Company Proprietary." NOTE: "Confidential" is a classification marking used to control the dissemination of U.S. Government National Security Information as dictated in Executive Order 13526 and should not be used to identify proprietary business information.

Unclassified Submissions

DARPA anticipates that submissions received under this BAA will be unclassified. However, should a proposer wish to submit classified information, an *unclassified* email must be sent to the BAA mailbox requesting submission instructions from the Technical Office PSO. If a determination is made that the award instrument may result in access to classified information, a SCG and/or DD Form 254 will be issued by DARPA and attached as part of the award.

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.

Approved Cost Accounting System Documentation

Proposers that do not have a Cost Accounting Standards (CAS) complaint 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/cas.html. To facilitate this process, proposers should complete the SF 1408 found at http://www.gsa.gov/portal/forms/download/115778 and submit the completed form with the proposal. To complete the form, check the boxes on the second page, then provide a narrative explanation of your accounting system to supplement the checklist on page one. For more information, see (http://www.dcaa.mil/preaward_accounting_system_adequacy_checklist.html).

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.

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. § 749d)/FAR 39.2.

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.

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)

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 to use a format similar to that described in the section above. If no restrictions are intended, then the proposer should state "NONE."

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.

4.2.4. Submission Information

DARPA will acknowledge receipt of all submissions and assign an identifying control number that should be used in all further correspondence regarding the submission. DARPA intends to use electronic mail correspondence regarding HR001118S0029. 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.

For proposal abstract and full proposal submission dates, see Part I., Overview Information. Submissions received after these dates and times may not be reviewed.

For Proposers Submitting Proposal Abstracts or Full Proposals Requesting Procurement Contracts or OTs through DARPA's BAA Submission Portal:

Abstracts and Full Proposals sent in response to HR001118S0029 may be submitted via DARPA's BAA Website (https://baa.darpa.mil). 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 abstract. Proposers using the DARPA BAA Website may encounter heavy traffic on the submission deadline date; it is highly advised that submission process be started 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. Classified submissions and proposals requesting assistance instruments (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 BAA Website may be reached at BAAT_Support@darpa.mil, and is typically available during regular business hours, (9:00 AM- 5:00 PM EST Monday – Friday).

Proposers using the DARPA BAA Website may encounter heavy traffic on the submission deadline date; it is highly advised that submission process be started as early as possible.

For Full Proposals Requesting Cooperative Agreements:

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

Submissions: Proposers must submit the three forms listed below.

> SF 424 Research and Related (R&R) Application for Federal Assistance, available on the Grants.gov website at https://apply07.grants.gov/apply/forms/sample/RR_SF424_2_0-V2.0.pdf. *This form must be completed and submitted.*
>
> To evaluate compliance with Title IX of the Education Amendments of 1972 (20 U.S.C. A§ 1681 Et. Seq.), the Department of Defense is using the two forms below to collect certain demographic and career information to be able to assess the success rates of women who are proposed for key roles in applications in science, technology, engineering, or mathematics disciplines. Detailed instructions for each form are available on Grants.gov.
>
> Research and Related Senior/Key Person Profile (Expanded), available on the Grants.gov website at https://apply07.grants.gov/apply/forms/sample/RR_KeyPersonExpanded_2_0-V2.0.pdf. *This form must be completed and submitted.*
>
> Research and Related Personal Data, available on the Grants.gov website at https://apply07.grants.gov/apply/forms/sample/RR_PersonalData_1_2-V1.2.pdf. *Each applicant must complete the name field of this form, however, provision of the demographic information is voluntary. Regardless of whether the demographic fields are completed or not, this form must be submitted with at least the applicant's name completed.*

Grants.gov 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.

Hard-copy Submissions: 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.

Failure to comply with the submission procedures may result in the submission not being evaluated. DARPA will acknowledge receipt of complete submissions via email and assign control numbers that should be used in all further correspondence regarding proposals.

4.2.5. Disclosure of Information and Compliance with Safeguarding Covered Defense Information Controls

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

DFARS 252.204-7000, "Disclosure of Information"
DFARS 252.204-7008, "Compliance with Safeguarding Covered Defense Information Controls"
DFARS 252.204-7012, "Safeguarding Covered Defense Information and Cyber Incident Reporting"

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

Compliance with the above requirements includes the mandate for proposers to implement the security requirements specified by National Institute of Standards and Technology (NIST) Special Publication (SP) 800-171, "Protecting Controlled Unclassified Information in Nonfederal Information Systems and Organizations" (see https://doi.org/10.6028/NIST.SP.800-171r1) that are in effect at the time the BAA is issued.

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

4.3. FUNDING RESTRICTIONS

Not Applicable.

4.4. OTHER SUBMISSION REQUIREMENTS

Not Applicable.

5. Application Review Information

5.1. EVALUATION CRITERIA

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

5.1.1 Overall Scientific and Technical Merit; 5.1.2 Potential Contribution and Relevance to the DARPA Mission; and 5.1.3 Cost Realism.

5.1.1. 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.

5.1.2. 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.

5.1.3. Cost Realism

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

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.

5.2. REVIEW OF PROPOSALS

Review Process

It is the policy of DARPA to ensure impartial, equitable, comprehensive proposal evaluations based on the evaluation criteria listed in Section V.A. 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.

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 non-disclosure requirements.

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.

6. Award Administration Information

6.1. SELECTION NOTICES

As soon as the evaluation of a proposal is complete, the proposers will be notified that 1) the proposal has been selected for funding pending contract negotiations, or 2) the proposal has not been selected. These official notifications will be sent via email to the Technical POC identified on the proposal coversheet.

6.1.1. Proposal 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.

6.1.2. Full 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.

6.2. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS

6.2.1. Meeting and Travel Requirements

There will be a program kickoff meeting in the Arlington, VA vicinity and all key participants are required to attend. Performers should also anticipate regular program-wide PI meetings and periodic site visits at the Program Manager's discretion to the Arlington, VA vicinity. Proposers shall include within the content of their proposal details and costs of any travel or meetings they deem to be necessary throughout the course of the effort, to include periodic status reviews by the government.

6.2.1. 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.

6.2.2. 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.

6.2.3. 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.

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6.2.4. Terms and Conditions

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

6.3. REPORTING

The number and types of reports will be specified in the award document, but will include as a minimum monthly financial status reports and quarterly technical status reports. 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 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.

6.4. ELECTRONIC SYSTEMS

6.4.1. 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.

6.4.2. 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 (http://public.era.nih.gov/iedison).

7. Agency Contacts

Administrative, technical or contractual questions should be sent via e-mail to N3@darpa.mil.

Points of Contact
The BAA Coordinator for this effort may be reached at:
N3@darpa.mil
DARPA/BTO
ATTN: HR001118S0029
675 North Randolph Street
Arlington, VA 22203-2114

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

8. Other Information

DARPA will host a Proposers Day in support of the N^3 program on **April 3, 2018** at the DARPA Conference Center in Arlington, VA. The purpose is to provide potential proposers with information on the N^3 program, promote additional discussion on this topic, address questions, provide a forum to present their capabilities, and to encourage team formation.

Interested proposers are not required to attend to respond to the N^3 BAA, and relevant information and materials discussed at Proposers Day will be made available to all potential proposers in the form of a Frequently Asked Questions (FAQ) posted on the DARPA Opportunities Page. The event will be webcast for those who would like to participate remotely.

DARPA will not provide cost reimbursement for interested proposers in attendance.

An online registration form and various other meeting details can be found at the registration website, http://events.sa-meetings.com/N3ProposersDay

To encourage team formation, interested proposers are encouraged to submit information to be shared with all potential proposers through the Proposers Day website and the DARPA Opportunities Page. This information may include contact information, relevant publications, and a slide or poster to summarize the proposer's interests.

Participants are required to register no later than **March 28, 2018 12:00 PM ET.** This event is not open to the Press. The Proposers Day will be open to members of the public who have registered in advance for the event; **there will be no onsite registration**.

All foreign nationals, including permanent residents, must complete and submit a DARPA Form 60 "Foreign National Visit Request," which will be provided in the registration confirmation email.

Proposers Day Point of Contact:

DARPA-SN-18-38@darpa.mil
ATTN: DARPA-SN-18-38
675 North Randolph Street
Arlington, VA 22203-2114

9. APPENDIX 1 – Volume II checklist

Volume II, Cost Proposal
Checklist and Sample Templates

The following checklist and sample templates are provided to assist the proposer in developing a complete and responsive cost volume. Full instructions appear in Section 4.2.2 beginning on Page 24 of HR001118S0029. This worksheet must be included with the coversheet of the Cost Proposal.

1. Are all items from Section 4.2.2 (Volume II, Cost Proposal) of **HR001118S0029** included on your Cost Proposal cover sheet?
   ○ **YES** ○ **NO** **Appears on Page(s)** [Type text]
   If reply is "No", please explain:

2. Does your Cost Proposal include (1) a summary cost buildup by Phase, (2) a summary cost buildup by Year, and (3) a detailed cost buildup of for each Phase that breaks out each task and shows the cost per month?
   ○ **YES** ○ **NO** **Appears on Page(s)** [Type text]

   If reply is "No", please explain:

3. Does your cost proposal (detailed cost buildup #3 above in item 2) show a breakdown of the major cost items listed below:
   Direct Labor (Labor Categories, Hours, Rates)
   ○ **YES** ○ **NO** **Appears on Page(s)** [Type text]

   Indirect Costs/Rates (i.e., overhead charges, fringe benefits, G&A)
   ○ **YES** ○ **NO** **Appears on Page(s)** [Type text]

   Materials and/or Equipment
   ○ **YES** ○ **NO** **Appears on Page(s)** [Type text]

   Subcontracts/Consultants
   ○ **YES** ○ **NO** **Appears on Page(s)** [Type text]

   Other Direct Costs
   ○ **YES** ○ **NO** **Appears on Page(s)** [Type text]

   Travel
   ○ **YES** ○ **NO** **Appears on Page(s)** [Type text]

   If reply is "No", please explain:

4. Have you provided documentation for proposed costs related to travel, to include purpose of trips, departure and arrival destinations and sample airfare?
   ○ **YES** ○ **NO** **Appears on Page(s)** [Type text]

If reply is "No", please explain:

5. Does your cost proposal include a complete itemized list of <u>all</u> material and equipment items to be purchased (a priced bill-of-materials (BOM))?
   ○ **YES** ○ **NO** **Appears on Page(s)** [Type text]

   If reply is "No", please explain:

6. Does your cost proposal include vendor quotes or written engineering estimates (basis of estimate) for <u>all</u> material and equipment with a unit price exceeding $5000?
   ○ **YES** ○ **NO** **Appears on Page(s)** [Type text]

   If reply is "No", please explain:

7. Does your cost proposal include a clear justification for the cost of labor (written labor basis-of-estimate (BOE)) providing rationale for the labor categories and hours proposed for each task?
   ○ **YES** ○ **NO** **Appears on Page(s)** [Type text]

   If reply is "No", please explain:

8. Do you have subcontractors/consultants? If YES, continue to question 9. If NO, skip to question 13.
   ○ **YES** ○ **NO** **Appears on Page(s)** [Type text]

9. Does your cost proposal include copies of all subcontractor/consultant technical (to include Statement of Work) and cost proposals?
   ○ **YES** ○ **NO** **Appears on Page(s)** [Type text]

   If reply is "No", please explain:

10. Do all subcontract proposals include the required summary buildup, detailed cost buildup, and supporting documentation (SOW, Bill-of-Materials, Basis-of-Estimate, Vendor Quotes, etc.)?
    ○ **YES** ○ **NO** **Appears on Page(s)** [Type text]

    If reply is "No", please explain:

11. Does your cost proposal include copies of consultant agreements, if available?
    ○ **YES** ○ **NO** **Appears on Page(s)** [Type text]

    If reply is "No", please explain:

12. If requesting a FAR-based contract, does your cost proposal include a tech/cost analysis for all proposed subcontractors?
    ○ **YES** ○ **NO** **Appears on Page(s)** [Type text]

    If reply is "No", please explain:

13. Have all team members (prime and subcontractors) who are considered a Federally Funded Research & Development Center (FFRDC), included documentation that clearly demonstrates work is not otherwise available from the private sector AND provided a letter on letterhead from the sponsoring organization citing the specific authority establishing their eligibility to propose to government solicitations and compete with industry, and compliance with the associated FFRDC sponsor agreement and terms and conditions.

○ **YES** ○ **NO** **Appears on Page(s)** [Type text]

If reply is "No", please explain:

14. Does your proposal include a response regarding Organizational Conflicts of Interest?

○ **YES** ○ **NO** **Appears on Page(s)** [Type text]

If reply is "No", please explain:

15. Does your proposal include a completed Data Rights Assertions table/certification?

○ **YES** ○ **NO** **Appears on Page(s)** [Type text]

If reply is "No", please explain: