Broad Agency Announcement
Reconfigurable Imaging (ReImagine)
Microsystems Technology Office
DARPA-BAA-16-56

SEPTEMBER 19, 2016

Table of Contents

PART I: OVERVIEW INFORMATION

- **Federal Agency Name** – Defense Advanced Research Projects Agency (DARPA), Microsystems Technology Office (MTO)
- **Funding Opportunity Title –** Reconfigurable Imaging (ReImagine)
- **Announcement Type –** Initial Announcement
- **Funding Opportunity Number –** DARPA-BAA-16-56
- **Catalog of Federal Domestic Assistance Numbers (CFDA)** – 12.910 Research and Technology Development
- **Dates**
  - Posting Date: September 19, 2016
  - Proposal Due Date: November 10, 2016
  - Estimated period of performance start date: 1 April 2017
- **Concise description of the funding opportunity:** DARPA is soliciting research proposals to demonstrate multi-functional imaging sensors that are reconfigurable through software. Proposers will build around a common digital framework that can be customized for specific applications. Both passive and active modes are desired. Also of interest are proposals that develop adaptive algorithms that optimize the operation of a reconfigurable sensor in real time to optimize information collection.
- **Total amount of money available to be awarded:** Approximately $20M in awards are anticipated.
- **Anticipated individual awards** – Multiple awards are anticipated.
- **Anticipated funding type** - 6.2 and/or 6.3
- **Types of instruments that may be awarded** – Procurement contract, grant (TA3 Only), cooperative agreement (TA3 Only) or other transaction
- **Any cost sharing requirements –** None
- **Agency contact**
  - Dr. Jay Lewis, Program Manager
    BAA Coordinator: DARPA-BAA-16-56@darpa.mil
    DARPA/MTO

    ATTN: DARPA-BAA-16-56
    675 North Randolph Street
    Arlington, VA 22203-2114

    FAX: 703-248-8008
    EMAIL: DARPA-BAA-16-56@darpa.mil

PROPOSERS ARE CAUTIONED THAT EVALUATION RATINGS MAY BE LOWERED AND/OR PROPOSALS REJECTED IF PROPOSAL PREPARATION (PROPOSAL FORMAT, CONTENT, ETC.) AND/OR SUBMITTAL INSTRUCTIONS ARE NOT FOLLOWED.

THOSE INTENDING TO SUBMIT A PROPOSAL FOR AN ASSISTANCE INSTRUMENT (GRANT OR COOPERATIVE AGREEMENT) ARE STRONGLY ENCOURAGED TO READ THE INSTRUCTIONS PROVIDED AT SECTION IV(B)(4) REGARDING THE TIME

REQUIRED TO RECEIVE VALIDATION OF SUBMISSIONS MADE THROUGH GRANTS.GOV. PROPOSALS THAT ARE VALIDATED AFTER THE PROPOSAL DUE DATE/TIME WILL BE CONSIDERED LATE AND, AS SUCH, WILL NOT BE REVIEWED.

PART II: FULL TEXT OF ANNOUNCEMENT

I. Funding Opportunity Description

The Defense Advanced Research Projects Agency (DARPA) often selects its research efforts through the Broad Agency Announcement (BAA) process. This BAA is being issued, and any resultant selection will be made, using the procedures under Federal Acquisition Regulation (FAR) 6.102(d)(2) and 35.016, and 2 C.F.R. § 200, as applicable. Any negotiations and/or awards will use procedures under FAR 15.4 (Contract Pricing) or 2 CFR 200, Subpart E (Cost Principles), as applicable. Proposals received as a result of this BAA shall be evaluated in accordance with evaluation criteria specified herein through a scientific review process.

DARPA BAAs are posted on the Federal Business Opportunities (FedBizOpps) website, http://www.fbo.gov/, and, as applicable, the Grants.gov website at http://www.grants.gov/. The following information is for those wishing to respond to the BAA.

DARPA is soliciting innovative research proposals to develop concepts and demonstrate an architecture for a software-reconfigurable, multi-mode imaging system. The resulting camera technology will incorporate functions that are normally not accessible within a single focal plane array (FPA) by configuring regions-of-interest (ROIs) that operate independently of other regions of the array, and by reconfiguring the measurements being made in the imaging array in response to the scene. Proposed research should investigate innovative approaches that enable revolutionary advances in science, devices, or systems. Specifically excluded is research that primarily results in evolutionary improvements to the existing state of practice.

A. Introduction and Background

The objectives for most camera designers include maximizing spatial resolution and signal-to-noise (SNR). Yet a wealth of information in the optical domain is lost under these constraints. Specialty cameras exist to capture other types of information, for example in the frequency domain, the spectral domain, or the resolution of depth. But these cameras are not normally able to provide high SNR imagery at high spatial resolution from a single focal plane, and are used relatively infrequently due to the system demands of adding camera systems. Today's imaging systems primarily perform only a single or limited set of measurements due in part to the underlying readout integrated circuits (ROICs), which sample the signal of interest and transfer these values off of the chip. ROICs are typically designed for a very specific mode of operation, and in essence are application specific integrated circuits (ASICs).

An imaging system that autonomously extracts the most relevant information, using a single sensor, and based only on the context in the scene would revolutionize a wide variety of military and commercial applications. This requires the development of a software-configurable array that enables *simultaneous* and *distinct* imaging modes in different ROIs. This would provide capabilities that previously required multiple sensors. It also requires algorithms that adapt the sensor configuration in real time based on context, and creates a consistent marketplace for information that seeks to maximize the value of making one measurement relative to the cost of missing others.

Over the last decade, the emergence of imaging arrays with in-pixel analog-to-digital conversion (ADC) has enabled innovative concepts for FPAs with wide dynamic range and in-pixel processing[1]. Similar pixel architectures have been used for high performance light detection and ranging (LIDAR) measurements with both framed and asynchronous operation. However, pixel pitches for arrays that both digitize and accumulate signals in the pixel remain at 20 μm or larger, and these designs are typically fixed-logic ASICs. Using an advanced node complementary metal-oxide semiconductor (CMOS) process provides an opportunity to both reduce pixel pitch and also insert sufficient programmable logic to enable a software definable platform. In addition, separating the analog components that interface with the detector into a separate layer with per-pixel interconnects introduces the ability to customize an application agnostic all-digital layer for a wide range of applications.

B. Program Objective

The objectives of the ReImagine program are to demonstrate that a software-reconfigurable imaging system can enable revolutionary capabilities, present a new approach to application development that is more similar to field programmable gate array (FPGA) based design than to ASIC design, and to develop the underlying theory and algorithms that learn to collect the most valuable information when the sensor can be configured for a variety of measurements. The ReImagine program aims to demonstrate that a single ROIC architecture can be configured to accommodate multiple modes of imaging operations that may be defined after the chip has been designed. With the use of 3-D integration, it will be possible to customize the sensor to interface with virtually any type of imaging sensor (e.g. photodiode, photoconductor, avalanche photodiode, or bolometer) and to optimize it for any spectral band (e.g. ultraviolet (UV) through very long-wave infrared (VLWIR)). More importantly, it will be possible to adapt the mode of operation either through manual user control, through preset routines that can change many times per second, or in response to context derived from the scene being observed. For example, a single imager could present simultaneous ROIs that can run at high resolution (i.e. foveated imaging), or at high frame rate. ReImagine ROICs will also demonstrate that efficient computation within an ROI can enable real-time analysis on much more complex scenes than traditional systems. ReImagine will build on this architecture to develop a concept of operation, the application requirements, the modes of operation, and the algorithms that will be used. The result will be more actionable information to the warfighter (or the warfighter's automatic response system) than has ever been possible from a single imaging sensor.

In addition to multiple passive imaging functions, the ability to incorporate range detection into a high resolution, low noise imaging system offers a potential revolutionary capability. LIDAR systems today are predominantly scanning devices that contain large moving components and do not provide high quality context imagery. 2-D imaging LIDAR systems have been demonstrated and are able to acquire 3-D imagery in framing or asynchronous modes. Both direct detect and coherent receiver arrays have been demonstrated, each with distinct advantages for different applications. However, in all cases, high data rates limit the spatial resolution of the sensor, and the demonstration of both passive imaging and active LIDAR modes in a large (> 1 MPixel)

[1] K.I. Schulz et al., "Digital-Pixel Focal Plane Array Technology," *Lincoln Laboratory Journal,* vol. 20 (2), 36-51 (2014).

array has not been demonstrated. A ReImagine dual-mode sensor would provide the ability to collect high data rate LIDAR measurements within a configurable ROI, while continuing to measure passive context imagery.

DARPA seeks innovative proposals in the following Technical Areas. Proposers may propose to more than one technical area, but must fulfill all the requirements defined for each, the tasks and costs associated with each Technical Area must be clearly delineated and easily separable, and any technical and/or cost interdependencies clearly identified (and minimized to the maximum extent possible):

1. **Technical Area 1 (TA1): Single or multi-color passive imager architecture and algorithms**

TA1 aims to design and develop a single or multi-color passive camera architecture and supporting algorithms, which can support a variety of technical objectives that are not currently possible from a single FPA. Spectral bands of interest span from UV to the very long-wave infrared (VLWIR), or wavelengths approximately 0.25 μm – 14 μm, and should be driven by the proposed application. Multi-color imagers may be designed to integrate the signal from different spectral bands either simultaneously or consecutively.

2. **Technical Area 2 (TA2): Hybrid active/passive imager architecture and algorithms**

TA2 aims to design and develop a hybrid active/passive imager architecture, where passive mode operation is based on traditional intensity measurements across an image array, and active mode is based on time-of-flight (TOF) measurements for 3-D range information (e.g. LIDAR mode). Moreover, the array can be configured to perform active mode measurements in specific ROIs, while simultaneously operating in passive mode in the remainder of the array. While TA2 efforts should demonstrate 3-D mode operation with integrated laser sub-systems, TA2 proposals should leverage existing laser sources and pointing systems. Proposals for other types of active mode imaging are of interest and should apply to TA2.

3. **Technical Area 3 (TA3): Innovative concepts for imaging systems with internal feedback**

TA3 will explore adaptive algorithms for reconfigurable imaging systems. The flow of information in today's imaging systems is exclusively from the sensor to image processing and/or the user, and object, gesture, or activity recognition algorithms use data with parameters that do not change over time. The ReImagine architecture endeavors to provide an imaging system that can change the nature of data being measured, either spatially, temporally, or spectrally; either as intensity or time; and either frame-, change-, or event-driven. TA3 proposals should explore new concepts in active learning that can determine the type of data that should be collected, both as a function of location and time. The algorithms should maximize information content and enable decisions, based on the context of the scene and the predicted value of various types of data.

C. Program Structure, Milestones, Schedule, and Deliverables

1. Technical Areas 1 and 2

Use of either a procurement contract or other transaction (OT) award instrument is permitted for TA1 and TA2.

The central objective of TA1 and TA2 is to use a Government-furnished reconfigurable IC and development platform to experimentally demonstrate an imaging architecture in which reconfigurability provides a revolutionary capability. ReImagine proposals should consider revolutionary designs and applications previously unattainable from a single FPA by exploiting the reconfigurable functionality of the envisioned FPA architecture. Proposals suggesting incremental improvements to state of the art ROIC technologies are discouraged.

Figure 1 shows a notional drawing of the 3-layer ReImagine architecture. The foundation for ReImagine will be the Government-provided common digital hardware layer, Tier 1, with associated software for configuring the chip. While ReImagine performers will provide input to the design process for the common digital layer, proposals to develop the Tier 1 layer are not of interest. Common digital ROICs with per-pixel ADCs can be considered to have five primary components, as depicted in Figure 1. Each item is described briefly below:

1. The detector, where each pixelated detector is connected to the circuitry below it;
2. Mixed signal front end circuitry, in which analog signals from the photodetector are converted to digital pulses;
3. The digital registers that are typically used to count or measure the timing of pulses that represent photocurrent packets;
4. Pixel level signal processing and routing that is used for basic computation and routing of data out of the array;
5. Peripheral processing and multiplexing, which can include general or specific signal processing and logic, as well as multiplexing and input/output (I/O) resources.

In the ReImagine configuration, the detectors reside in Tier 3. Proposals to develop novel detector technology are not of interest. The mixed signal layer resides in Tier 2. The separation of the mixed signal and digital components into separate layers enables a common digital architecture to be adapted for a variety of photodetector technologies using a custom Tier 2 design. It also enables the use of the optimum CMOS feature size and voltage for the analog components. Components 3 – 5 from the list above will reside in Tier 1. Note that Figure 1 is notional and other configurations that achieve the same functionality are acceptable. However this BAA will used terminology consistent with Figure 1 to describe the functions of the imaging architecture.

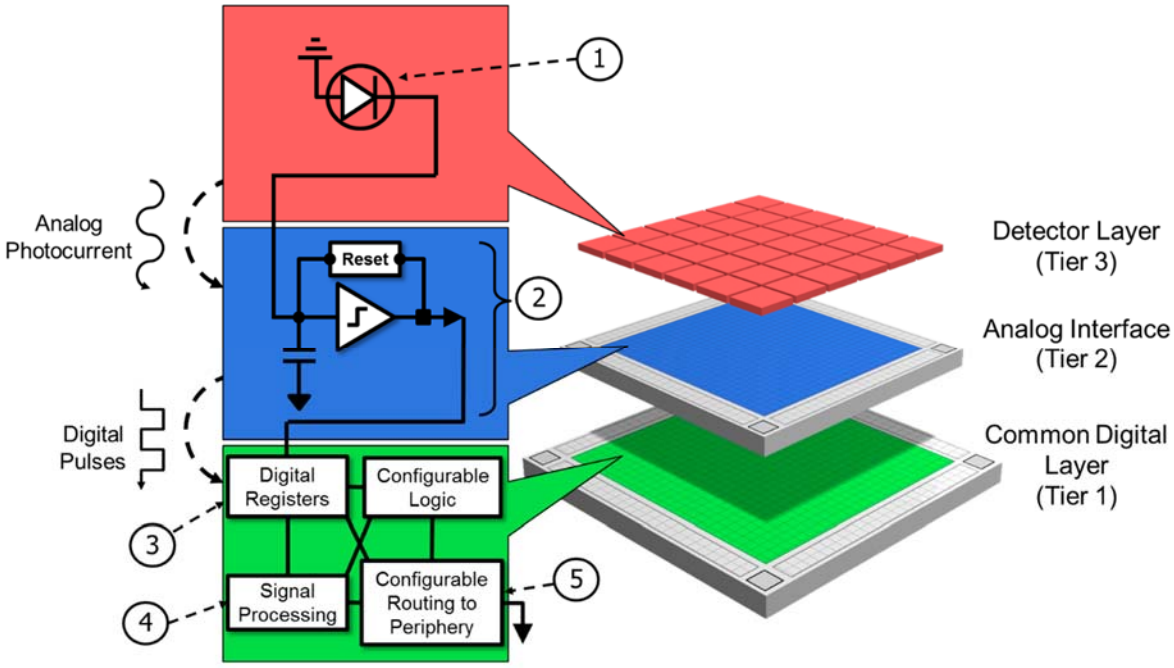

Figure 1. Illustration showing the three layers of the notional ReImagine architecture and the baseline circuit functionality in each layer. The circled numbers refer to the components described in the text above.

TA1 and TA2 performers should design and fabricate Tiers 2 and 3, integrate them with the Government-provided Tier 1, and develop any necessary firmware to operate the resulting camera. In contrast to Tier 1, the front end analog layer (Tier 2) and the detector layer (Tier 3) are expected to be application dependent. Tier 2 and Tier 3 should contain arrays of sensors and front end circuitry, respectively, with one-to-one correspondence. Tier 2 will provide CMOS-compatible digital pulses that may be in response to photocurrent or other signal triggers. Tier 3 will consist of a detector layer suitable for the operational purpose of the imager.

As part of the ReImagine program, the Government plans to develop and provide two generations of reconfigurable integrated circuits (ICs) (Gen-1 and Gen-2) and their associated configuration software development tools, as Government Furnished Property (GFP). A detailed list and approximate dates for transfer of GFP are provided below (See "Government Furnished Property/Information").

The resources in digital ROICs with per-pixel ADCs have historically been defined at the time of chip design to include an analog front end that serves as an interface between the detector and the digital circuitry and a fixed number of digital registers. The number of counters and the bit depth per pixel are limited by the feature size of the CMOS process and the detector pitch. Control signals for these digital resources are typically global and shared by all pixels. The reconfigurable ICs that will be developed under this program seek to break this paradigm of fixed resources per pixel and instead provide banks of digital logic resources and reconfigurable routing channels that can be allocated to pixels, as needed, using the same programming techniques as FPGAs.

Signal inputs from the detector array to the Gen-1 IC will be composed of 4x4 arrays of digital I/O pins addressable by Tier 2, with reconfigurable routing channels to an array of (32) 8-bit registers. The registers can be independently configured to perform operations that include count up/down, timestamp, parallel orthogonal shift, or serial shift left/right. This level of configuration will allow for connectivity to pixel arrays of varying pitch, and enable the number of counters per detector pixel to be dynamically selectable. This reconfigurability will also provide more per-pixel resources when they are aggregated into larger pixels. Proposals should note where a pixel pitch larger than 10 μm will be demonstrated, and whether this is due to a constraint in the optics or detectors, or whether it is to make use of more per-pixel resources. Reconfigurable routing resources will also be provided for the distribution of control signals, and for moving data through the array. Surrounding the array of pixel circuitry will be peripheral banks of memory, digital signal processing (DSP) blocks, and reconfigurable logic to enable output formatting and on-chip processing.

Table 1 includes a description of the Gen-1 common digital layer hardware that should be assumed for ReImagine proposals, noting that the actual parameters may differ. It should be assumed that the digital layer will be fabricated using a commercial 14 nm CMOS process. Proposals should explicitly state where additional features or resources would be needed to implement their proposed modes of operation, and whether those resources may increase the pixel pitch and/or power consumption.

Table 1. Notional characteristics for the Gen-1 Tier 1 IC.

Criterion	Gen 1
Pixel Format	640 x 512
Pixel Pitch	≥ 10 μm
Operating Temperature	77 – 300 K
Minimum Tier 1-2 Interconnect Pitch	5 μm
Digital Registers/Pixel	≥ 16 bits
Pixel Configuration	• 8 bits per counter, independently configurable o Count up/down or timing • Serial shift left/right • Orthogonal data shift/route • Resource configuration per 4x4 pixel sub-array
Tier 2 Interface	• ≥ 1 bidirectional I/Os per 4x4 pixel sub-array
Routing	• 4 reconfigurable routing channels per 4x4 pixel sub-array
Peripheral Logic	• ≥ 10k look up tables • ≥ 64 DSP blocks • ≥ 1 MB memory

It is anticipated that the Gen-2 IC will expand on Gen-1 concepts to move towards an architecture that resembles an array of distributed processors, and may include more complex digital blocks similar to those surrounding the array in Gen-1 (e.g. memory, adders, multipliers,

etc.). As discussed below, the Gen 2 design will ultimately be defined by incorporating input from TA1 and TA2 performers.

These reconfigurable ICs will be programmed though a combination of Government-furnished and open source FPGA computer-aided design (CAD) tools. Users will write a Verilog description of their desired ROIC configuration. Combining this Verilog description with provided Verilog models of the ReImagine digital resources, users will simulate their design to perform functional verification. Users will iterate through synthesis, optimization, and place and route implementation steps. Government-furnished software will generate a bitstream to program the IC through a standard Joint Test Action Group (JTAG) interface.

TA1 and TA2 proposals should place an emphasis on developing novel operating modes and algorithms which can significantly impact the application of interest. While TA3, discussed in more detail later, will focus on new control theory based on techniques that actively learn and adapt, control algorithms that enable appropriate mode-switching for TA1 and TA2 applications are within scope and should be included in TA1 and TA2 efforts. Successful proposals will:

- Clearly describe an application, notional system-level platform, and mission of interest;
- Quantitatively demonstrate the benefits of the ReImagine architecture to the application and mission;
- Describe the proposed modes of operation in the context of pixel-level, FPA-level, and system-level operations;
- Describe the principles or algorithms that control the modes of operation at a given time and location;
- Provide a detailed description of the pixel-level design and features in Tier 2;
- Provide a detailed description of the integration strategy, the prototype, and the final imaging demonstrations and test/validation strategy;
- Define the challenges and associated risk mitigation strategies.

The ability to decouple the analog interface from the digital tier provides an opportunity for innovative or multi-mode front end designs. However, the objectives for the interface layer should be driven by the application requirements. Proposals to develop front end designs with lower noise and smaller values for the least significant bit (LSB) than the state of the art are of interest when this is relevant to the application, for example in low photon flux applications.

TA1 and TA2 efforts will have a three phase period of performance with a total duration of 45 months. Both TAs will have a 9-month Phase 0 base period, a 9-month Phase 1 Option, a 9-month Extended Phase 1 Option, and an 18-month Phase 2 Option, subject to the availability of funds and technical progress during the preceding phase(s). A schedule including all of the phases for each Technical Area is shown in Figure 2.

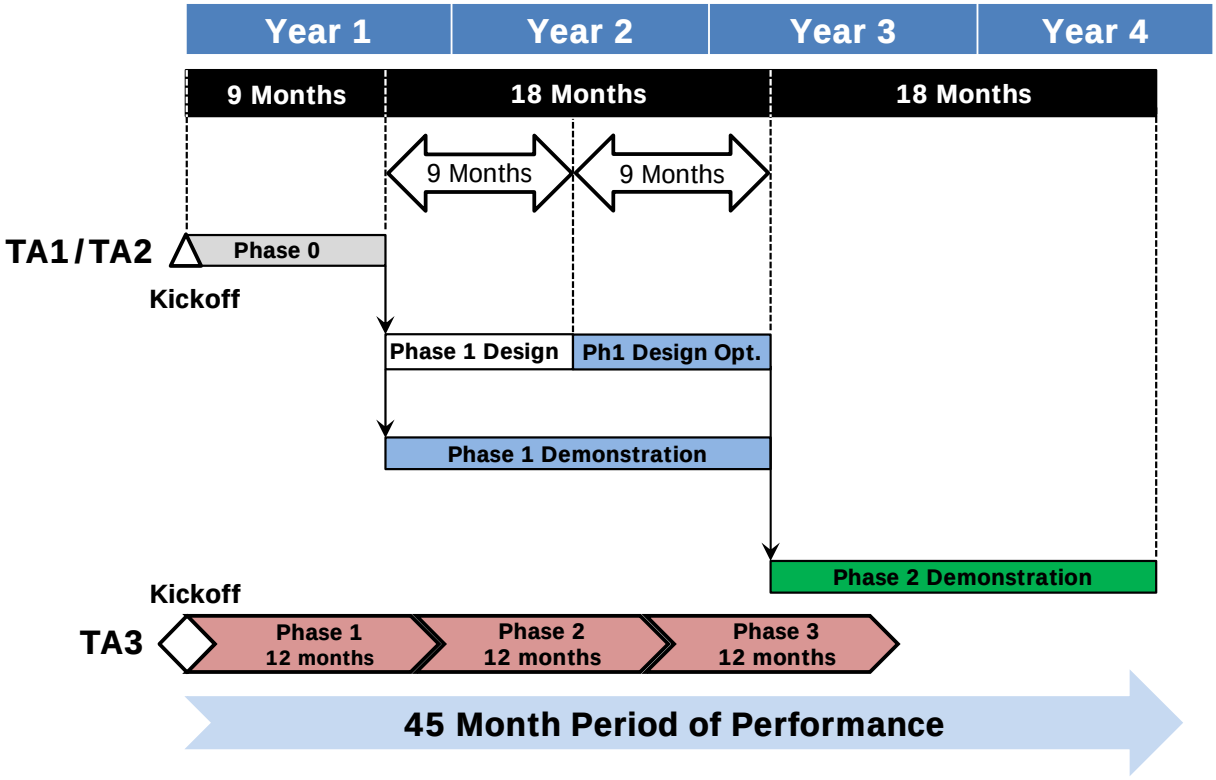

Figure 2. Program timeline for each phase of TA1-3.

Phase 0 – *Base Period*

In Phase 0, performers will be provided with Gen-1 programming tools and associated documentation. These will should be used during Phase 0 to verify the operation and reconfigurability of the Tier 1 processor running the proposer-developed configuration. The CAD flow software and documentation will be provided as a combination of GFE and open source tools.

The overarching objectives of Phase 0 are to, a) develop and demonstrate the proposed ROIC configurations in software, b) define the operating parameters and requirements for a reconfigurable imaging system in the framework of the proposed application, c) identify shortcomings or desirable modifications to the Gen-1 Tier 1 design, and provide this as input for the Gen-2 design, and d) refine the approach and detailed plan for a Phase 1 demonstration.

Proposals should describe the activities that will be performed during Phase 0. Examples include elucidating the modes of operation specific to applications of interest, refining the detailed requirements for the digital layer, developing a framework for mode control, quantifying the impact of the multi-mode imager on the application of interest through simulation, and developing a detailed plan for development of a Phase 1 and/or Phase 2 demonstration camera. Preliminary concepts, though not a full design, for the Tier 2 interface layer should be developed, and co-simulation of Tier 2 with the Tier 1 model is encouraged. Proposers should also develop a power consumption framework to evaluate the system-level tradeoffs between computation within the array, on the periphery of the ROIC, and off-board for the application of interest. This

should be done within a framework of total system power that accounts for required detector cooling, and include a preliminary thermal analysis of the 3-D ROIC.

Phase 1 – *Option and Extended Option*

There are two parallel activities anticipated during Phase 1 for both TA1 and TA2: Phase 1 Demonstration and Phase 1 Design. Whether proposers should address one activity or both is discussed below. The parallel efforts should be clearly distinguishable and separable both in terms of technical scope and cost.

Phase I Demonstrations

The objective of the 18 month Phase 1 Demonstration task is to demonstrate multi-functional imaging based on the Gen-1 reconfigurable IC. It is anticipated that Phase 1 efforts will deliver a multi-function prototype imager including a demonstration in a laboratory environment at the end of Phase 1. The Phase 1 demonstration must clearly show programmable functionality, unprecedented capability, and a path toward implementing further improvements in the Phase 2 demonstration. If proposers believe that the Gen-1 ROIC will not support their application, but that a Gen-2 ROIC could, they may elect not to propose to the Phase 1 Demonstration task, but this rationale should be clearly explained.

Proposals should provide a description of the following:

- Application and principles of operation. This is the heart of ReImagine proposals. Proposals should clearly describe innovative multi-functional modes of operation, embedded algorithms and/or autonomous control of functionality, and compare each mode of operation with the state of the art for a dedicated FPA designed specifically for that mode. These should be put in the context of relevant applications of interest to the DARPA mission. Priority should be given to concepts that demonstrate unprecedented capabilities based on reconfigurability.
- Tier 2 design. The fundamental function of the Tier 2 layer is to convert sensor data into a digital pulse stream. An independent Tier 2 layer is an opportunity to customize the 3-D ROIC for the relevant detector technology and application, and to integrate novel designs not typically used in current digital ROIC technologies. For example, TA2 proposers may require multi-function capability for dual active/passive operation, and may leverage pixel-level control lines from Tier 1 to Tier 2. Proposals should describe the operation and design strategy for Tier 2. This should include a preliminary estimate of power consumption in representative conditions for Tier 2 and the anticipated CMOS production node.
- 3-D integration. Phase 1 demonstrations are expected to include pixel-level integration of the Tier 1 and Tier 2 layers, and one or more interconnects per pixel. Tier 1 die should be assumed to be available in wafer form and will be provided as GFE. Demonstrations will also require hybridization of the Tier 3 detector layer with the ROIC layers. A technical approach and rationale for both processes should be provided. The 3-D integration scheme should be repeatable and able to meet the thermal cycle requirements for a military EO/IR system.
- Validation and testing. A clear strategy should be provided to validate operation of the Phase 1 prototype and test the multi-function imaging capability, include all traditional metrics for imaging systems in each mode of operation (spectral band coverage,

responsivity, noise, NETD, noise equivalent power or irradiance, etc.). Specific objectives of interest for Phase 1 proposals are given in Table 3, and additional metrics relevant to the specific application should be provided.

Proposers should describe each mode of operation in detail. For each mode of operation, proposals should include the following, as well as any other details relevant to the application:

- Detector type
- Spectral response
- Pixel circuit configuration and features in the analog front end
- Pixel format (e.g. single pixel, sub-array, or full frame operating mode)
- Frame rate
- Data type (intensity, event, time, etc.)
- Maximum required bandwidth on the Tier 1 – Tier 2 data I/O interface
- In pixel processing
- Perimeter processing
- Optics configuration (if variable)

Phase 1 Design

Phase 1 Design is a nine month activity, with a second nine month option period. All proposals are expected to include Phase 1 Design activity. The objective is to continue the work described in Phase 0, but now focus on developing a detailed operational description and simulation for the Gen-2 digital layer. Proposers should describe specific enhancements to Table 1 that would be required for Gen-2 applications, if there are any.

Phase 1 Design performers can expect iterative distribution of software from the government incorporating updated Gen-2 framework models. The generalized power consumption framework developed during Phase 0 should be developed into a detailed power analysis specific to the Phase 2 design and include a detailed thermal analysis. During the Extended Option period, performers should begin design and layout of the Tier 2 layer, including the fabrication of test chips, if appropriate, for the proposed technology. During the Extended Option period, performers will develop a detailed plan for the Gen-2 prototype that includes optics, detector, electronics, and a detailed test plan.

Phase 2 - *Option*

The objective of Phase 2 is the demonstration of significant improvement over the state of the art in terms of reconfigurability, functionality, and the ability to provide move valuable information from a single FPA. While Gen-1 applications may be restricted by the existing resources in the digital layer, proposals will have the opportunity to recommend specific features and capabilities in the Gen-2 ROIC. New and unique features that are necessary for Phase 2 should be highlighted in the proposal, but should be justified in terms of real estate, power consumption, and the ability to generalize these resources for multiple applications. Proposers should also describe the anticipated limitations of the Gen-1 layer for their proposed application, and quantify the benefits of a more advanced design.

With respect to operating modes, performance objectives, and technical approach, Gen-2 Demonstration proposals should address the same topics as Gen 1 Demonstration proposals, and

should highlight advances made between Phases 1 and 2 demonstrations. While Gen 1 demonstrations can be laboratory based, Gen 2 demonstrations should be portable and suitable for testing outdoors. However, extensive custom electronics and packaging of the camera should not be included in Phase 2 proposals.

Government Furnished Property (GFP) and Information: The following items and data can be anticipated to be furnished by the Government to teams selected for Phase 1 demonstrations. Dates are counted from the beginning of the program. These dates are approximate but should be used for planning purposes:

- Phase 0 (Month 1):
  - Specification sheet for the Gen-1 Tier 1 IC
  - Interface control document (ICD) for Tier 1 to Tier 2, and Tier 1 to electronics
  - CAD flow software and supporting documentation for the Gen-1 IC
  - Benchmark models for simulation, bitstream generation, and configuration
- Phase 1 Demonstration (Month 18)
  - Tier 1 die, in the form of (2) 300 mm wafers
  - Development kit. Performers will receive a physical development kit that will provide an electronic interface to the Tier 1 IC. A development board will be included with a cable interconnect to the FPA. Performers will be responsible for the design and fabrication of a daughter board to house the FPA that is appropriate for their test environment. The development kit will enable prototyping and demonstration of the proposed operational models in hardware.
- Phase 1 Design (Month 10)
  - Specification sheet for the Gen-2 Tier 1 IC
  - ICD for Tier 1 to Tier 2, and Tier 1 to electronics
  - Tier 1 (Gen 2) simulation software and supporting documentation
  - Benchmark models for simulation, bitstream generation, and configuration
- Phase 2 (Month 33)
  - Tier 1 die, in the form of (2) 300 mm wafers
  - Gen 2 development kit, similar to the Gen 1 kit described above

Technical Interchange Meetings: Performers will be expected to spend a minimum of one and a maximum of three days at a Government site for quarterly technical interchange meetings (TIMs) with the Tier 1 hardware and software design team. Kickoff and end of phase program reviews will supplant these TIMs. The objectives of the TIMs will include providing an update to performers on hardware designs and software, and for performers to update the Government team with concepts, simulation results, plans, and application requirements.

Performance Objectives: The ReImagine platform endeavors to enable revolutionary capabilities across a wide range of applications. As such, proposers must provide application-relevant performance metrics. It is required that proposals describe measurable, quantitative milestones at the conclusion of each phase. The templates given below for performance objectives are provided as guidelines, but following them exactly is not required for proposal compliance, due to the variation in expected proposals. All proposals should provide a technical rationale for the approach and program milestones, as well as a clear trajectory to achieving the end of program goals.

Table 3 gives objectives that should be met or defined for the Phase 1 and Phase 2 demonstrations. Note that additional information is requested for TA2 proposals. Specifically, TA2 proposals are of interest that incorporate passive imaging together with one or more of Geiger mode direct detection, high gain linear mode detection with near single photon noise levels, or high bandwidth AC coupled linear mode coherent operations. Proposals that use active functionality for measurements other than distance, e.g. laser vibrometry, are also of interest and should apply to TA2. Modes should allow for high data rate active ROIs, including burst mode operation. The potential for streamed processing and data compression on chip is also of interest.

Based on each mode of operation, proposers should benchmark the state of the art (SOA), and compare the implementation in ReImagine to the most relevant figures of merit (FOM) for that application. An example template is given in Table 4. If a particular FOM will fall short of the SOA, proposers should explain why this will not impact the overall capabilities for that application. The information provided in response to Table 4 is key to a successful proposal, as it embodies the impact that ReImagine will have on capabilities. Of particular interest to ReImagine are proposals that either a) combine SOA capabilities to achieve a mission objective that was previously not possible with a single focal plane, or b) demonstrate new methods for collecting and processing data that leverage the reconfigurability and/or embedded processing of the ReImagine digital layer.

Table 3. TA2 camera configuration and performance objectives.

	Phase 1	**Phase 2**
Spectral Band(s) (μm)	Proposer Defined	Proposer Defined
Pixel Pitch (μm)	≥ 10 μm	≥ 8 μm
Array Format	640 × 512	1280 × 1024
Imaging mode (TA1 and TA2)		
Distinct imaging modes of operation	≥ 3 (TA1) ≥ 2 (TA2)	≥ 4 (TA1) ≥ 3 (TA2)
LSB (e^-)	Proposer Defined	Proposer Defined
Front end noise (e^-)	Proposer Defined	Proposer Defined
Range mode (TA2 only)		
Front end bandwidth (GHz)	Proposer Defined	Proposer Defined
Range Precision (m)	Proposer Defined	Proposer Defined
Crosstalk (%)	Proposer Defined	Proposer Defined
Photon collection efficiency	Proposer Defined	Proposer Defined
Noise equivalent photons	Proposer Defined	Proposer Defined
Minimum time between events (μs)	Proposer Defined	Proposer Defined

Table 4. Objectives for TA1.

Distinct modes of operation	**SOA capability**	**Gen 1**	**Gen 2**
Mode 1	FOM 1: FOM 2: Etc.	FOM 1: FOM 2: Etc.	FOM 1: FOM 2: Etc.
Mode 2	FOM 1:	FOM 1:	FOM 1:

	FOM 2: Etc.	FOM 2: Etc.	FOM 2: Etc.
Etc.	Etc.	Etc.	Etc.

Deliverables: All Technical Area 1 and Technical Area 2 performers shall be required to provide the following deliverables:

- Technical reports for all kickoff and program review meetings
- Technical reports from quarterly TIMs
- Monthly financial reports
- Phase 0
  - Detailed report on reconfigurable applications and Phase 1 plans
  - Verilog files for Gen-1 configurations
- Phase 1 Demonstrations
  - Gen-1 Tier 2 Preliminary Design Review (PDR) and Critical Design Review (CDR) documents
  - Gen-1 camera PDR and CDR documents
  - Verilog files for Gen-1 configurations
  - One prototype camera, delivered to a government facility, meeting the final Phase 1 objectives
- Phase 1 Design
  - Detailed report on reconfigurable applications and plans for Phase 1 prototype
  - Verilog files for Gen-2 configurations
- Phase 1 Design Option
  - Gen-2 Tier 2 PDR documents
  - Gen-2 camera PDR documents
- Phase 2
  - Gen-2 Tier 2 CDR documents
  - Gen-2 camera CDR documents
  - Verilog files for Gen-2 configurations
  - One prototype camera, delivered to a government facility, meeting the final Phase 2 objectives

2. Technical Area 3

Use of either a procurement contract, grant, cooperative agreement or other transaction (OT) award instrument is permitted for TA3.

It will be possible for the ReImagine architecture to change modes through user control, or through preset routines. However it is also possible to envision an autonomous system that configures the sensor to collect the most relevant data based on context in the scene. The goal of TA3 is to develop adaptive learning algorithms that guide the sensor, through the real-time adaptation of sensor control parameters, to collecting the data with the highest content of useful information.

TA1 and TA2 will provide only a small number of instantiations of a reconfigurable image sensor, and many others could be conceived. Therefore TA3 will not use ReImagine hardware or software provided as GFP/Information, or developed in TA1 or TA2. Instead, TA3 efforts are expected to develop camera models in software that can explore design parameters that may guide the development of future reconfigurable sensors. Proposers should assume the availability of only input data that comes from the reconfigurable image sensor, and will be responsible for generating that data during the program. In contrast to sensor fusion, models must consider not only the relative value of data, but also the opportunity cost of data not being collected at a given location and time.

Proposals to TA3 must exhibit two strengths: *capability advancement* and *implementability*.

Capability advancement must be defined by proposers in terms of objectively observable, numerical metrics. Proposers should specify their own metrics. Proposers must specify baseline values for these metrics using one or multiple fixed sensors, and values that they propose to achieve at each ReImagine phase boundary. Proposers must specify how these metrics will be measured on their final, and in-development, algorithms. The test data sets that are proposed for use in these measurements shall be specified. Measurable milestones must be proposed by phase.

Implementability measures the degree to which the proposed algorithms can be used in realistic systems. TA3 performers are not limited to the functions that can be anticipated from the TA1-2 Technical Areas. Real-time parametric control over spatial resolution, temporal resolution, spectral response, and polarization response may be considered, as well as the use of distance measurements. Other configurable parameters may be proposed. However the capabilities of the sensor must be bounded and specified. Requirements for the algorithms must be constrained within reasonable bounds; for example, if machine learning algorithms are proposed, then the required amount of labeled and unlabeled training data must be estimated.

TA3 will consist of three 12-month phases (Base and two options), with a start date coincident with Phase 0 of TA1-2, as shown in Figure 2. TA3 performers will not receive Government Furnished Property or Information during the program. It is anticipated that the scope of TA3 efforts will be fundamental research and, as such, publication of the results developed under TA3 will be encouraged. Dissemination of results at program-wide meetings will be required. See the "Fundamental Research" section below for more information.

Phase 1 – *Base Period*

Phases 1 and 2 should focus primarily on the Capability Advancement criteria. In Phase 1, proposers are expected to develop a detailed framework and begin implementation of the proposed algorithms. This may consist of a reduced complexity model in terms of configurable parameters relative to the ultimate capability of the proposed sensor model. Proposers should provide specific quantitative milestones for the algorithms, as well as a clear description of the methodology for their evaluation. At the end of Phase 1, performers must demonstrate streaming operation of the algorithm with a 1000x slowdown in real time.

Phase 2 - *Option*
In Phase 2 proposers should develop a complete model for the reconfigurable sensor and explore variations on the fundamental algorithm. Performers must develop a complete test data set that covers the full parameter space to evaluate the performance of the algorithms against the proposed criteria. At the end of Phase 2 performers must demonstrate streaming operation of the algorithm with a 10x slowdown in real time.

Phase 3 - *Option*
In Phase 3 performers should focus on Implementability. Feedback learning algorithms should inherently provide real-time decisions to the sensor. Considering this proposers should propose objectives that reduce the size, weight, and power of the computation resources required to run their algorithms in real time. Operation should be demonstrated in a real-time camera model that responds to feedback from their algorithms and demonstrates the full Capabilities Advancement demonstrated in Phases 1-2.

Deliverables
All Technical Area 3 performers shall be required to provide the following deliverables:

- Technical reports for all kickoff and program review meetings
- Quarterly technical reports
- Monthly financial reports

II. Award Information

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

The Government reserves the right to select for negotiation all, some, one, or none of the proposals received in response to this solicitation, and to make awards without discussions with proposers. The Government also reserves the right to conduct discussions if it is later determined to be necessary. If warranted, portions of resulting awards may be segregated into pre-priced options. Additionally, DARPA reserves the right to accept proposals in their entirety or to select only portions of proposals for award. In the event that DARPA desires to award only portions of a proposal, negotiations may be opened with that proposer. The Government reserves the right to fund proposals in phases with options for continued work at the end of one or more of the phases.

Awards under this BAA will be made to proposers on the basis of the evaluation criteria listed below (see section labeled "Application Review Information," Sec. V.), and program balance to provide overall value to 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. The Government reserves the right to remove proposers from award consideration should the parties fail to reach agreement on award terms, conditions and cost/price within a reasonable time or the proposer fails to timely provide requested additional information. Proposals identified for negotiation may result in a procurement contract, grant, 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.

In all cases, the Government contracting officer shall have sole discretion to select award instrument type and to negotiate all instrument terms and conditions with selectees. Proposers are advised that regardless of the instrument type proposed, DARPA personnel, in consultation with the Government contracting officer, may select other award instruments, as they deem appropriate. 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.

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 established the national policy for controlling the flow of scientific, technical, and engineering information produced in federally funded fundamental research at colleges, universities, and laboratories. The Directive 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. The Government does not anticipate applying publication restrictions of any kind to individual awards for fundamental research that may result from this BAA. Notwithstanding this statement of expectation, the Government is not prohibited from considering and selecting research proposals that, while perhaps not qualifying as fundamental research under the foregoing definition, still meet the BAA criteria for submissions. If proposals are selected for award that offer other than a fundamental research solution, the Government will either work with the proposer to modify the proposed statement of work to bring the research back into line with fundamental research or else the proposer will agree to restrictions in order to receive an award.

Proposers should indicate in their proposal whether they believe the scope of the research included in their proposal is fundamental or not. While proposers should clearly explain the intended results of their research, the Government shall have sole discretion to select award instrument type and to negotiate all instrument terms and conditions with selectees. Appropriate clauses will be included in resultant awards for non-fundamental research to prescribe publication requirements and other restrictions, as appropriate.

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

The following statement or similar provision will be incorporated into any resultant non-fundamental research procurement contract or other transaction:

> There shall be no dissemination or publication, except within and between the contractor and any subawardees, of information developed under this contract or contained in the reports to be furnished pursuant to this contract without prior written approval of DARPA's Public Release Center (DARPA/PRC). All technical reports will be given proper review by appropriate authority to determine which Distribution Statement is to be applied prior to the initial distribution of these reports by the contractor. With regard to subawardee proposals for Fundamental Research, papers resulting from unclassified fundamental research are exempt from prepublication controls and this review requirement, pursuant to DoD Instruction 5230.27 dated October 6, 1987.
>
> When submitting material for written approval for open publication, the contractor/awardee must submit a request for public release to the DARPA/PRC and include the following information: (1) Document Information: document title, document author, short plain-language description of technology discussed in the material (approx. 30 words), number of pages (or minutes of video) and document type (e.g., briefing, report, abstract, article, or paper); (2) Event Information: event type (conference, principal investigator meeting, article or paper), event date, desired date for DARPA's approval; (3) DARPA Sponsor: DARPA Program Manager, DARPA office, and contract number; and (4) Contractor/Awardee's Information: POC name, email and phone. Allow four weeks for processing; due dates under four weeks require a justification. Unusual electronic file formats may require additional processing time. Requests may be sent either via email to public_release_center@darpa.mil or by mail at 675 North Randolph Street, Arlington VA 22203-2114, telephone (571) 218-4235. Refer to the following for link for information about DARPA's public release process: http://www.darpa.mil/work-with-us/contract-management/public-release."

III. Eligibility Information

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

A. Eligible Applicants

Federally Funded Research and Development Centers (FFRDCs) and Government entities (e.g., Government/National laboratories, military educational institutions, etc.) 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; and (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 prime contractors or subawardees. 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. 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.

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

B. Procurement Integrity, Standards of Conduct, Ethical Considerations, and Organizational Conflicts of Interest

Current federal employees are prohibited from participating in particular matters involving conflicting financial, employment, and representational interests (18 U.S.C. §§ 203, 205, and 208). Once the proposals have been received, and prior to the start of proposal evaluations, the Government will assess potential conflicts of interest and will promptly notify the proposer if any appear to exist. The Government assessment does NOT affect, offset, or mitigate the proposer's responsibility to give full notice and planned mitigation for all potential organizational conflicts, as discussed below.

Without prior approval or a waiver from the DARPA Director, in accordance with FAR 9.503, a contractor cannot simultaneously provide scientific, engineering, technical assistance (SETA) or similar support and also be a technical performer. As part of the proposal submission, all members of the proposed team (prime proposers, proposed subawardees, and consultants) must affirm whether they (their organizations and individual team members) are providing SETA or similar support to any DARPA technical office(s) through an active contract or subcontract. All affirmations must state which office(s) the proposer, subawardees, consultant, or individual supports and identify the prime contract number(s). All facts relevant to the existence or potential existence of organizational conflicts of interest (FAR 9.5) must be disclosed. The disclosure must include a description of the action the proposer has taken or proposes to take to avoid, neutralize, or mitigate such conflict. If in the sole opinion of the Government after full consideration of the circumstances, a proposal fails to fully disclose potential conflicts of interest and/or any identified conflict situation cannot be effectively mitigated, the proposal will be rejected without technical evaluation and withdrawn from further consideration for award.

If a prospective proposer believes a conflict of interest exists or may exist (whether organizational or otherwise) or has questions on what constitutes a conflict of interest, the proposer should send his/her contact information and a summary of the potential conflict via email to the BAA email address before time and effort are expended in preparing a proposal and mitigation plan.

C. Cost Sharing/Matching

Cost sharing is not required; however, it will be carefully considered where there is an applicable statutory condition relating to the selected funding instrument (e.g., for any Other Transactions under the authority of 10 U.S.C. § 2371). Cost sharing is encouraged where there is a reasonable probability of a potential commercial application related to the proposed research and development effort.

D. Other Eligibility Criteria

1. Collaborative Efforts

Collaborative efforts/teaming are encouraged.

IV. Application and Submission Information

A. Address to Request Application Package

This solicitation contains all information required to submit a proposal. No additional forms, kits, or other materials are needed. This notice constitutes the total BAA solicitation. No additional information is available, except as provided at FBO.gov or Grants.gov, nor will a formal Request for Proposal (RFP) or additional solicitation regarding this announcement be issued. Requests for the same will be disregarded.

B. Content and Form of Application Submission

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.

Submissions will not be returned. The original of each submission received will be retained at DARPA and all other non-required copies destroyed. A certification of destruction may be requested, provided the formal request is received at this office within 5 days after unsuccessful notification.

1. Security Information

Proposals that address specific military applications may contain classified information. If the classification level of submissions is not covered by an existing Security Classification Guide (SCG), proposers may contact the Technical Office Program Security Officer (PSO) for additional guidance via the BAA mailbox.

Classified submissions shall be transmitted in accordance with the following guidance. Additional information on the subjects discussed in this section may be found at http://www.dss.mil/.

If a submission contains Classified National Security Information as defined by Executive Order 13526, the information must be appropriately and conspicuously marked with the proposed classification level and declassification date. Similarly, when the classification of a submission is in question, the submission must be appropriately and conspicuously marked with the proposed classification level and declassification date. Submissions requiring DARPA to make a final classification determination shall be marked as follows:

> "CLASSIFICATION DETERMINATION PENDING. Protect as though classified_____ (insert the recommended classification level, e.g., Top Secret, Secret or Confidential)"

NOTE: Classified submissions must indicate the classification level of not only the submitted materials, but also the classification level of the anticipated award.

Proposers submitting classified information must have, or be able to obtain prior to contract award, cognizant security agency approved facilities, information systems, and appropriately cleared/eligible personnel to perform at the classification level proposed. All proposer personnel performing Information Assurance (IA)/Cybersecurity related duties on classified Information Systems shall meet the requirements set forth in DoD Manual 8570.01-M (Information Assurance Workforce Improvement Program).

Proposers choosing to submit classified information from other collateral classified sources (i.e., sources other than DARPA) must ensure (1) they have permission from an authorized individual at the cognizant Government agency (e.g., Contracting Officer, Program Manager); (2) the proposal is marked in accordance with the source SCG from which the material is derived; and (3) the source SCG is submitted along with the proposal.

Confidential and Secret Information
Use transmission, classification, handling, and marking guidance provided by previously issued SCGs, the DoD Information Security Manual (DoDM 5200.01, Volumes 1 - 4), and the National Industrial Security Program Operating Manual, including the Supplement Revision 1, (DoD 5220.22-M and DoD 5200.22-M Sup. 1) when submitting Confidential and/or Secret classified information.

Confidential and Secret classified information may be submitted via ONE of the two following methods:

- Hand-carried by an appropriately cleared and authorized courier to the DARPA CDR. Prior to traveling, the courier shall contact the DARPA Classified Document Registry (CDR) at 703-526-4052 to coordinate arrival and delivery.

  OR

- Mailed via U.S. Postal Service (USPS) Registered Mail or USPS Express Mail. All classified information will be enclosed in opaque inner and outer covers and double-wrapped. The inner envelope shall be sealed and plainly marked with the assigned classification and addresses of both sender and addressee.

  The inner envelope shall be addressed to:

  Defense Advanced Research Projects Agency
  ATTN: Program Security Office, MTO
  Reference: DARPA-BAA-16-56
  675 North Randolph Street
  Arlington, VA 22203-2114

  The outer envelope shall be sealed with no identification as to the classification of its contents and addressed to:

  Defense Advanced Research Projects Agency
  Security & Intelligence Directorate, Attn: CDR
  675 North Randolph Street
  Arlington, VA 22203-2114

Top Secret Information
Use classification, handling, and marking guidance provided by previously issued SCGs, the DoD Information Security Manual (DoDM 5200.01, Volumes 1 - 4), and the National Industrial Security Program Operating Manual, including the Supplement Revision 1, (DoD 5220.22-M and DoD 5200.22-M Sup. 1). Top Secret information must be hand-carried by an appropriately cleared and authorized courier to the DARPA CDR. Prior to traveling, the courier shall contact the DARPA CDR at 703-526-4052 to coordinate arrival and delivery.

Sensitive Compartmented Information (SCI)
SCI must be marked, managed and transmitted in accordance with DoDM 5105.21 Volumes 1 - 3. Questions regarding the transmission of SCI may be sent to the DARPA Technical Office PSO via the BAA mailbox or by contacting the DARPA Special Security Officer (SSO) at 703-812-1970.

Successful proposers may be sponsored by DARPA for access to SCI. Sponsorship must be aligned to an existing DD Form 254 where SCI has been authorized. Questions regarding SCI sponsorship should be directed to the DARPA Personnel Security Office at 703-526-4543.

Special Access Program (SAP) Information
SAP information must be marked in accordance with DoDM 5205.07 Volume 4 and transmitted by specifically approved methods which will be provided by the Technical Office PSO or their staff.

Proposers choosing to submit SAP information from an agency other than DARPA are required to provide the DARPA Technical Office PSO written permission from the source material's cognizant Special Access Program Control Officer (SAPCO) or designated representative. For clarification regarding this process, contact the DARPA Technical Office PSO via the BAA mailbox or the DARPA SAPCO at 703-526-4102.

Additional SAP security requirements regarding facility accreditations, information security, personnel security, physical security, operations security, test security, classified transportation plans, and program protection planning may be specified in the DD Form 254.

NOTE: prior to drafting the submission, if use of SAP Information Systems is to be proposed, proposers must first obtain an Authorization-to-Operate from the DARPA Technical Office PSO (or other applicable DARPA Authorization Official) using the Risk Management Framework (RMF) process outlined in the Joint Special Access Program (SAP) Implementation Guide (JSIG), Revision 3, dated October 9, 2013 (or successor document).

2. Proprietary Information

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

3. Full Proposal Format

All full proposals must be in the format given below. Nonconforming proposals may be rejected without review. Proposals shall consist of two volumes: Volume I – Technical and Management Proposal, and Volume II – Cost Proposal. The submission of other supporting materials along with the proposals is strongly discouraged and will not be considered for review. 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.

Section II of Volume I, Technical and Management Proposal, shall not exceed, 1) 25 pages for proposals that address one of Technical Areas 1 or 2, 2) 15 pages for proposals that address only

TA3, 3) 35 pages for proposals that address two Technical Areas, and 3) 40 pages for proposals that address three Technical Areas. All full proposals must be written in English.

One PowerPoint slide summarizing the proposed effort should be submitted with the proposal. A template slide is provided on the FBO website (Attachment 2). Submit this PowerPoint file in addition to Volumes I and II of your full proposal. This summary slide does not count towards the total page count.

a. Volume I, Technical and Management Proposal

Section I. Administrative

A. Cover sheet to include:

(1) BAA number (DARPA-BAA-16-56);
(2) Technical area(s);
(3) Lead Organization submitting proposal;
(4) Type of organization, selected among the following categories:
Large Organization, Small Disadvantaged Organization, Other Small Organization, HBCU, MI, Other Education, or Other Nonprofit;
(5) Proposer's internal reference number (if any);
(6) Other team members (if applicable) and type of organization for each;
(7) Proposal title;
(8) Technical point of contact to include:
Salutation, last name, first name, street address, city, state, zip code (+4), telephone, fax (if available), electronic mail;
(9) Administrative point of contact to include:
Salutation, last name, first name, street address, city, state, zip code (+4), telephone, fax (if available), electronic mail;
(10) Total funds requested from DARPA, and the amount of cost share (if any); AND
(11) Date proposal was submitted.

B. Official transmittal letter.

Section II. Detailed Proposal Information

A. Executive Summary

A one-page executive summary outlining the proposed effort. The executive summary must contain:

1. A high-level overview of the proposed work;
2. Metrics used to define success;
3. Milestones (both DARPA-mandated and proposed-defined);
4. Operational scenarios relevant to the proposed approach;
5. Innovations made by the proposed work; AND
6. The cost and duration of each phase.

B. Statement of Work (SOW)

In plain English, clearly define the technical tasks/subtasks to be performed, their durations, and dependencies among them. The page length for the SOW will be dependent on the amount of the effort. The SOW must not include proprietary information. For each task/subtask, provide:

1. A general description of the objective (for each defined task/activity);
2. A detailed description of the approach to be taken to accomplish each defined task/activity;
3. Identification of the primary organization responsible for task execution (prime, sub, team member, by name, etc.);
4. The completion criteria for each task/activity - a product, event or milestone that defines its completion.
5. Define all deliverables (reporting, data, reports, software, etc.) to be provided to the Government in support of the proposed research tasks/activities; AND
6. Clearly identify any tasks/subtasks (prime or subcontracted) that will be accomplished on-campus at a university.

Note: It is recommended that the SOW should be developed so that each Phase and Technical Area of the program is separately defined. Activities proposed to Phase 1 Demonstration and Phase 1 Design tasks should also be separately defined.

C. Innovative Claims and Comparison with Existing Technology

Description of the applications being addressed by the proposed research, and the state of the art. Summary of the innovative concepts being proposed, and the measurable impact of the proposed research, and advantages and disadvantages with respect to the state of the art. Explanation of performance requirements necessary for the proposed application.

D. Technical Approach

A detailed description of the technical approach, technical rationale, and constructive plan for accomplishment of technical goals in support of the innovative claims and deliverables. This section is the centerpiece of the proposal and should succinctly describe the uniqueness and benefits of the proposed approach. Proposers must include adequate detail and justification for any performer defined metrics and goals. In addition, a detailed analysis of how the proposed approach will meet both the DARPA and performer defined metrics must be provided. See Part II, Section I (A through C) for discussion of specific topics that should be addressed in the technical/management proposal.

E. Proposer Accomplishments

Discussion of proposer's previous accomplishments and work in closely related research areas. This section should be no more than 1 page in length.

F. Results and Technology Transfer

Description of the results, products, transferable technology, and expected technology transfer path. This should also address mitigation of life-cycle and sustainment risks associated with transitioning intellectual property for U.S. military applications, if applicable. See also Section VIII. "Intellectual Property."

G. **Facilities**

Description of the facilities that would be used for the proposed effort.

H. Management Plan

Management plan and key personnel - Include teaming arrangements and organization chart for the proposed effort. Identify key personnel who will contribute to the proposed effort and the level of effort expected for each. Include brief biographies of key personnel.

I. Schedule and Measurable Milestones

Schedule and measurable milestones for the proposed research. (Note: Measurable milestones should capture key development points in tasks and should be clearly articulated and defined in time relative to start of effort.) Additionally, proposals should clearly explain the technical approach(es) that will be employed to meet or exceed each program metric and provide ample justification as to why the approach(es) is/are feasible. The milestones must not include proprietary information. Where the effort consists of multiple portions which could reasonably be partitioned for purposes of funding, these should be identified as options.

Section II. Additional Information

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 two (2) relevant papers may be included in the submission.

b. Volume II, Cost Proposal – {No Page Limit}

All proposers, including FFRDCs, must submit the following:

Section I. Administrative

Cover sheet to include:

(1) BAA number (DARPA-BAA-16-56);
(2) Lead Organization submitting proposal;
(3) Type of organization, selected among the following categories:
Large Organization, Small Disadvantaged Organization, Other Small Organization, HBCU, MI, Other Education, or Other Nonprofit;
(4) Proposer's internal reference number (if any);
(5) Other team members (if applicable) and type of organization for each;
(6) Proposal title;
(7) Technical point of contact to include:
Salutation, last name, first name, street address, city, state, zip code (+4), telephone, fax (if available), electronic mail (if available);
(8) Administrative point of contact to include:
Salutation, last name, first name, street address, city, state, zip code (+4), telephone, fax (if available), and electronic mail (if available);
(9) Award instrument requested: cost-plus-fixed fee (CPFF), cost-contract—no fee, cost sharing contract – no fee, or other type of procurement contract (*specify*), grant, cooperative agreement, or other transaction;
(10) Place(s) and period(s) of performance;

(11) Total proposed cost separated by basic award and option(s) (if any) broken down by calendar year and by government fiscal year;
(12) Name, address, and telephone number of the proposer's cognizant Defense Contract Management Agency (DCMA) administration office (*if known)*;
(13) Name, address, and telephone number of the proposer's cognizant Defense Contract Audit Agency (DCAA) audit office (*if known*);
(14) Date proposal was prepared;
(15) DUNS number;
(16) TIN number;
(17) CAGE Code;
(18) Subcontractor Information;
(19) Proposal validity period; AND
(20) Any Forward Pricing Rate Agreement, other such approved rate information, or such documentation that may assist in expediting negotiations (if available).

Attachment 1, the Cost Volume Proposer Checklist, must be included with the coversheet of the Cost Proposal.

Section III. Detailed Cost Information

The proposers,' to include eligible FFRDCs,' cost volume shall provide certified cost and pricing information (See Note 1), or other than certified cost or pricing information if the total price is under the referenced threshold, in sufficient detail to substantiate the program price proposed (e.g., realism and reasonableness). In doing so, the proposer shall provide, for both the prime and each subcontractor, a summary cost breakdown and a detailed cost breakdown by phase (if multiple phases are proposed), technical task/sub-task, and month for each technical area proposed to (Government fiscal year). The breakdown/s shall include, at a minimum, the following major cost items along with associated backup documentation:

Total program cost broken down by major cost items:

A. Direct Labor
A breakout clearly identifying the individual labor categories with associated labor hours and direct labor rates, as well as a detailed Basis-of-Estimate (BOE) narrative description of the methods used to estimate labor costs;

B. Indirect Costs
Including Fringe Benefits, Overhead, General and Administrative Expense, Cost of Money, Fee, etc. (must show base amount and rate);

C. Travel
Provide the purpose of the trip, number of trips, number of days per trip, departure and arrival destinations, number of people, etc.;

D. **Other Direct Costs**
Itemized with costs; back-up documentation is to be submitted to support proposed costs;

E. Material/Equipment
(i) A priced Bill-of-Material (BOM) clearly identifying, for each item proposed, the quantity, unit price, the source of the unit price (i.e., vendor quote, engineering estimate, etc.), the type of property (i.e., material, equipment, special test equipment, information

technology, etc.), and a cross-reference to the Statement of Work (SOW) task/s that require the item/s. At time of proposal submission, any item that exceeds $1,000 must be supported with basis-of-estimate (BOE) documentation such as a copy of catalog price lists, vendor quotes or a written engineering estimate (additional documentation may be required during negotiations, if selected).

(ii) If seeking a procurement contract and items of Contractor Acquired Property are proposed, exclusive of material, the proposer shall clearly demonstrate that the inclusion of such items as Government Property is in keeping with the requirements of FAR Part 45.102. In accordance with FAR 35.014, "Government property and title," it is the Government's intent that title to all equipment purchased with funds available for research under any resulting contract will vest in the acquiring nonprofit institution (e.g., Nonprofit Institutions of Higher Education and Nonprofit Organizations whose primary purpose is the conduct of scientific research) upon acquisition without further obligation to the Government. Any such equipment shall be used for the conduct of basic and applied scientific research. The above transfer of title to all equipment purchased with funds available for research under any resulting contract is not allowable when the acquiring entity is a for-profit organization; however, such organizations can, in accordance with FAR 52.245-1(j), be given priority to acquire such property at its full acquisition cost.

F. **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 and any other proposed consultant costs (e.g. travel);

G. **Subcontracts**

Itemization of all subcontracts. Additionally, the prime contractor is responsible for compiling and providing, as part of its proposal submission to the Government, subcontractor proposals prepared at the same level of detail as that required by the prime. Subcontractor proposals include Interdivisional Work Transfer Agreements (ITWA) or similar arrangements. If seeking a procurement contract, the prime contractor shall provide a cost reasonableness analysis of all proposed subcontractor costs/prices. Such analysis shall indicate the extent to which the prime contractor has negotiated subcontract costs/prices and whether any such subcontracts are to be placed on a sole-source basis. All proprietary subcontractor proposal documentation, prepared at the same level of detail as that required of the prime, which cannot be uploaded to the DARPA BAA website (https://baa.darpa.mil, BAAT) or Grants.gov as part of the proposer's submission, shall be made immediately available to the Government, upon request, under separate cover (i.e., mail, electronic/email, etc.), either by the proposer or by the subcontractor organization. This does not relieve the proposer from the requirement to include, as part of their submission (via BAAT or Grants.gov, as applicable), subcontract proposals that do not include proprietary pricing information (rates, factors, etc.). A Rough Order of Magnitude (ROM), or similar budgetary estimate, is not considered a fully qualified subcontract cost proposal submission. Inclusion of a ROM, or similar budgetary estimate, may result in the full proposal being deemed non-compliant or evaluation ratings may be lowered.

H. Cost-Sharing

The source, nature, and amount of any industry cost-sharing;

I. Fundamental Research

Written justification required per Part II, "Fundamental Research," pertaining to prime and/or subcontracted effort being considered Contracted Fundamental Research; AND

J. **Small Business Subcontracting Plan**
If applicable. See Section VI(B)(6) "Subcontracting" below.

Note 1:
(a) "Cost or Pricing Data" as defined in FAR 15.403-4 shall be required if the proposer is seeking a procurement contract per the referenced threshold, unless the proposer requests and is granted an exception from the requirement to submit cost or pricing data. Per DFARS 215.408(5), DFARS 252.215-7009, Proposal Adequacy Checklist, applies to all proposers/proposals seeking a FAR-based award (contract).
(b) In accordance with DFARS 15.403-1(4)(D), DoD has waived cost or pricing data requirements for nonprofit organizations (including educational institutions) on cost-reimbursement-no-fee contracts. In such instances where the waiver stipulated at DFARs 15.403-1(4)(D) applies, proposers shall submit information other than cost or pricing data to the extent necessary for the Government to determine price reasonableness and cost realism; and cost or pricing data from subcontractors that are not nonprofit organizations when the subcontractor's proposal exceeds the cost and pricing data threshold at FAR 15.403-4(a)(1).
(c) Per Section 873 of the FY2016 National Defense Authorization Act (Pub L. 114-92), "Pilot Program For Streamlining Awards For Innovative Technology Projects," small businesses and nontraditional defense contractors (as defined therein) are alleviated from submission of certified cost and pricing data for new contract awards valued at less than $7,500,000. In such instances where this "waiver" applies, proposers seeking a FAR-based contract shall submit information other than certified cost or pricing data to the extent necessary for the Government to determine price reasonableness and cost realism; and certified cost or pricing data from subcontractors that are not small businesses or nontraditional defense contractors when such subcontract proposals exceed the cost and pricing data threshold at FAR 15.403-4(a)(1).
(d) "Cost or pricing data" are not required if the proposer proposes an award instrument other than a procurement contract (i.e., cooperative agreement, grant, or other transaction agreement).

Section III. Other Cost Information

Proposers are required to provide the aforementioned cost breakdown as an editable MS Excel spreadsheet, inclusive of calculations formulae, with tabs (material, travel, ODC's) provided as necessary. The Government also requests and recommends that the Cost Proposal include MS Excel file(s) that provide traceability between the Bases of Estimate (BOEs) and the proposed costs across all elements and phases. This includes the calculations and adjustments that are utilized to generate the Summary Costs from the source labor hours, labor costs, material costs, etc. input data. It is requested that the costs and Subcontractor proposals be readily traceable to the Prime Cost Proposal in the provided MS Excel file(s) – although this is not a requirement, providing information in this manner will assist the Government in understanding what is being proposed both technically and in terms of cost realism.

If proposals are for more than one Technical Area, or 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 IT and equipment purchases, include a letter stating why the proposer cannot provide the requested resources from its own funding.

The cost proposal should include identification of pricing assumptions of which may require incorporation into the resulting award instrument (i.e., use of Government Furnished Property/Facilities/Information, access to Government Subject Matter Experts, etc.).

Supporting cost and pricing information in sufficient detail to substantiate the summary cost estimates in B. above. Include a description of the method used to estimate costs and supporting documentation.

Cost proposals submitted by FFRDC's (prime or subcontractor) will be forwarded, if selected for negotiation, to their sponsoring organization contracting officer for review to confirm that all required forward pricing rates and factors have been used.

Proposers, other than universities, without an accounting system considered adequate for determining accurate costs must complete an SF 1408 if a cost type contract is to be negotiated. To facilitate this process, proposers should complete the SF 1408 found at http://www.gsa.gov/portal/forms/download/115778 and submit the completed form with the proposal. To complete the form, check the boxes on the second page, then provide a narrative explanation of your accounting system to supplement the checklist on page one. For more information, please see http://www.dcaa.mil/preaward_accounting_system_adequacy_checklist.html.

Per Section 8123 of the Department of Defense Appropriations Act, 2015 (Division C of the Consolidated and Further Continuing Appropriations Act, 2015, Pub. L. 113-235), all grant awards must be posted on a public website in a searchable format. To facilitate this task, proposers requesting grant awards must submit a maximum one (1) page abstract that may be publicly posted to comply with the requirement of Section 8123. This abstract should explain the project or program to the public and should only contain information that the proposer confirms is releasable to the public; DO NOT INCLUDE ANY PROPRIETARY INFORMATION OR INFORMATION THAT CANNOT BE DISPLAYED ON A PUBLIC WEBSITE. The proposer should sign the bottom of the abstract confirming the information in the abstract is approved for public release. Proposers are advised to provide both a signed PDF copy, as well as an editable (e.g., Microsoft word) copy. Abstracts contained in grant proposals that are not selected for award will not be publicly posted.

PLEASE NOTE, PROPOSERS ARE CAUTIONED THAT EVALUATION RATINGS MAY BE LOWERED AND/OR PROPOSALS REJECTED IF PROPOSAL PREPARATION (PROPOSAL FORMAT, CONTENT, ETC.) AND/OR SUBMITTAL INSTRUCTIONS ARE NOT FOLLOWED.

4. Proposal Submission Information

The typical proposal should express a consolidated effort in support of one or more related technical concepts or ideas. Disjointed efforts should not be included into a single proposal.

Proposals and abstracts may not be submitted by fax or e-mail; any so sent will be disregarded.

For Proposers Requesting Grants or Cooperative Agreements:

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

Grants.gov requires proposers to complete a one-time registration process before a proposal can be electronically submitted. If proposers have not previously registered, this process can take between three business days and four weeks. See the Grants.gov registration checklist at http://www.grants.gov/web/grants/register.html for registration requirements and instructions.

Once Grants.gov has received a proposal submission, Grants.gov will send two email messages to advise proposers as to whether or not their proposals have been validated or rejected by the system; IT MAY TAKE UP TO TWO DAYS TO RECEIVE THESE EMAILS. The first email will confirm receipt of the proposal by the Grants.gov system; this email only confirms receipt, not acceptance, of the proposal. The second will indicate that the application has been successfully validated by the system prior to transmission to the grantor agency or has been rejected due to errors. If the proposal is validated, then the proposer has successfully submitted their proposal. If the proposal is rejected, the proposed must be corrected and resubmitted before DARPA can retrieve it. If the solicitation is no longer open, the rejected proposal cannot be resubmitted. Once the proposal is retrieved by DARPA, the proposer will receive a third email from Grants.gov. To avoid missing deadlines, proposers should submit their proposals in advance of the final proposal due date with sufficient time to receive confirmations and correct any errors in the submission process through Grants.gov. For more information on submitting proposals to Grants.gov, visit the Grants.gov submissions page at: http://www.grants.gov/web/grants/applicants/apply-for-grants.html.

Proposers electing to submit grant or cooperative agreement proposals as hard copies must complete the SF 424 R&R form (Application for Federal Assistance, Research and Related) available on the Grants.gov website http://apply07.grants.gov/apply/forms/sample/RR_SF424_2_0-V2.0.pdf Technical support for Grants.gov submissions may be reached at 1-800-518-4726 or support@grants.gov.

For Proposers Requesting Contracts or Other Transaction Agreements

Proposers requesting contracts or other transaction agreements must submit proposals via DARPA's BAA Website (https://baa.darpa.mil). Note: If an account has already been created for the DARPA BAA Website, this account may be reused. If no account currently exists for the

DARPA BAA Website, visit the website to complete the two-step registration process. Submitters will need to register for an Extranet account (via the form at the URL listed above) and wait for two separate e-mails containing a username and temporary password. After accessing the Extranet, submitters may then create an account for the DARPA BAA website (via the "Register your Organization" link along the left side of the homepage), view submission instructions, and upload/finalize the proposal. Proposers using the DARPA BAA Website may encounter heavy traffic on the submission deadline date; it is highly advised that submission process be started as early as possible.

Technical support for DARPA's BAA Website may be reached at action@darpa.mil, and is typically available during regular business hours (9:00 AM - 5:00 PM EST, Monday - Friday).

NOTE: YOU MUST CLICK THE 'FINALIZE FULL PROPOSAL' BUTTON AT THE BOTTOM OF THE CREATE FULL PROPOSAL PAGE. FAILURE TO DO SO WILL RESULT IN YOUR PROPOSAL NOT BEING OFFICIALLY SUBMITTED TO THIS BAA AND THEREFORE NOT BEING REVIEWED.

For All Proposers:

All administrative correspondence and questions on this solicitation, including requests for information on how to submit an abstract or full proposal to this BAA should be directed to DARPA-BAA-16-56@darpa.mil. DARPA intends to use electronic mail for correspondence regarding DARPA-BAA-16-56. DARPA encourages use of the Internet for retrieving the BAA and any other related information that may subsequently be provided.

5. Submission Dates and Times

a. Full Proposal Due Date

The full proposal must be submitted to DARPA/MTO on or before 5:00 PM., Eastern Time, 10 November 2016, in order to be considered during the single round of selections. Proposals received after this deadline will not be reviewed.

b. Question and Answer Deadline

DARPA will post a consolidated Question and Answer (FAQ) document on a regular basis. To access the posting go to: http://www.darpa.mil/work-with-us/opportunities. Under the DARPA-BAA-16-56 summary will be a link to the FAQ. Submit your question/s by e-mail to DARPA-BAA-16-56@darpa.mil. In order to receive a response sufficiently in advance of the proposal due date, send your question/s on or before 1:00 PM, Eastern Time, 27 October 2016.

DARPA will acknowledge receipt of complete submissions via email and assign control numbers that should be used in all further correspondence regarding proposals.

6. Funding Restrictions

There will be limitations on direct costs such as foreign travel or equipment purchases. Travel budgets should be limited to domestic travel for relevant key personnel to attend the kickoff meeting and one program review meeting annually. TA3 proposals may include travel for up to two people per organization, not to exceed a total of four people per proposal, to present technical results at one relevant domestic conference per Phase.

Laboratory equipment and machinery budgets should include only necessary specialized equipment and tooling. Standard laboratory equipment, necessary for distinguishing oneself as a qualified performer, shall not be included in the proposal. Where equipment purchases are proposed, the proposal must include a narrative description of the application requirements, the selection process, and the disposition plan for the proposed equipment (see Section IV(B)(4)(b) regarding compliance with FAR Part 45.102).

Preaward costs will not be reimbursed unless a preaward cost agreement is negotiated prior to award.

7. Other Submission Requirements

Not applicable.

V. Application Review Information

A. Evaluation Criteria

Proposals will be evaluated using the following criteria, listed in descending order of importance: (a) Overall Scientific and Technical Merit; (b) Potential Contribution and Relevance to the DARPA Mission; (c) Proposer's Capabilities and/or Related Experience; and (d) Cost Realism.

(a) Overall Scientific and Technical Merit

The proposed technical approach is feasible, achievable, complete and supported by a proposed technical team that 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.

(b) 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 maintain the technological superiority of the U.S. military and prevent technological surprise from harming our national security by sponsoring

revolutionary, high-payoff research that bridges the gap between fundamental discoveries and their application.

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

(c) Proposer's Capabilities and/or Related Experience

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

(d) 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).

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.

B. Review and Selection Process

DARPA will conduct a scientific/technical review of each conforming proposal. 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, all factors considered, including the potential contributions of the proposed work to the overall research program and the availability of funding for the effort.

It is the policy of DARPA to ensure impartial, equitable, comprehensive proposal evaluations and to select the source (or sources) whose offer meets the Government's technical, policy, and programmatic goals. Pursuant to FAR 35.016, the primary basis for selecting proposals for acceptance shall be technical, importance to agency programs, and fund availability. In order to

provide the desired evaluation, qualified Government personnel will conduct reviews and (if necessary) convene panels of experts in the appropriate areas.

For evaluation purposes, a proposal is the document described in "Full Proposal Format," Section IV.B.3. Other supporting or background materials submitted with the proposal will be considered for the reviewer's convenience only and not considered as part of the proposal.

Restrictive notices notwithstanding, support contractors may handle proposals for administrative purposes. These support contractors are prohibited from competition in DARPA technical research and are bound by appropriate non-disclosure requirements.

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.

VI. Award Administration Information

A. Selection Notices

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 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.

B. Administrative and National Policy Requirements

1. Meeting and Travel Requirements

All key participants are required to attend the program kickoff meeting. Performers should also anticipate regular program-wide PI Meetings and periodic site visits at the Program Manager's discretion.

2. Human Subjects Research

All research selected for funding involving human subjects, to include use of human biological specimens and human data, must comply with the federal regulations for human subjects protection. Further, research involving human subjects that is conducted or supported by the DoD must comply with 32 CFR 219, Protection of Human Subjects (and DoD Instruction 3216.02, Protection of Human Subjects and Adherence to Ethical Standards in DoD-Supported Research (http://www.dtic.mil/whs/directives/corres/pdf/321602p.pdf).

Institutions awarded funding for research involving human subjects must provide documentation of a current Assurance of Compliance with Federal regulations for human subjects protection, such as a Department of Health and Human Services, Office of Human Research Protection Federal Wide Assurance (http://www.hhs.gov/ohrp). All institutions engaged in human subjects research, to include subawardees, must also hold a valid Assurance. In addition, all personnel

involved in human subjects research must provide documentation of completion of human subjects research training.

For all proposed research that will involve human subjects in the first year or phase of the project, the institution must provide evidence of or a plan for review by an Institutional Review Board (IRB) upon final proposal submission to DARPA as part of their proposal, prior to being selected for funding. The IRB conducting the review must be the IRB identified on the institution's Assurance of Compliance with human subjects protection regulations. The protocol, separate from the proposal, must include a detailed description of the research plan, study population, risks and benefits of study participation, recruitment and consent process, data collection, and data analysis. It is recommended that you consult the designated IRB for guidance on writing the protocol. The informed consent document must comply with federal regulations (32 CFR 219.116). A valid Assurance of Compliance with human subjects protection regulations along with evidence of completion of appropriate human subjects research training by all investigators and personnel involved with human subjects research should accompany the protocol for review by the IRB.

In addition to a local IRB approval, a headquarters-level human subjects administrative review and approval is required for all research conducted or supported by the DoD. The Army, Navy, or Air Force office responsible for managing the award can provide guidance and information about their component's headquarters-level review process. Note that confirmation of a current Assurance of Compliance with human subjects protection regulations and appropriate human subjects research training is required before headquarters-level approval can be issued.

The time required to complete the IRB review/approval process varies depending on the complexity of the research and the level of risk involved with the study. The IRB approval process can last between one and three months, followed by a DoD review that could last between three and six months. Ample time should be allotted to complete the approval process. DoD/DARPA funding cannot be used towards human subjects research until ALL approvals are granted.

3. Animal Use

Award recipients performing research, experimentation, or testing involving the use of animals shall comply with the rules on animal acquisition, transport, care, handling, and use as outlined in: (i) 9 CFR parts 1-4, Department of Agriculture rules that implement the Animal Welfare Act of 1966, as amended, (7 U.S.C. § 2131-2159); (ii) National Institutes of Health Publication No. 86-23, "Guide for the Care and Use of Laboratory Animals" (8th Edition); and (iii) DoD Instruction 3216.01, "Use of Animals in DoD Programs."

For projects anticipating animal use, proposals should briefly describe plans for Institutional Animal Care and Use Committee (IACUC) review and approval. Animal studies in the program will be expected to comply with the Public Health Service (PHS) Policy on Humane Care and Use of Laboratory Animals, available at http://grants.nih.gov/grants/olaw/olaw.htm.

All award recipients must receive approval by a DoD-certified veterinarian, in addition to an IACUC approval. No animal studies may be conducted using DoD/DARPA funding until the United States Army Medical Research and Materiel Command (USAMRMC) Animal Care and Use Review Office (ACURO) or other appropriate DoD veterinary office(s) grant approval. As a part of this secondary review process, the award recipient will be required to complete and submit an ACURO Animal Use Appendix, which may be found at https://mrmc-www.army.mil/index.cfm?pageid=Research_Protections.acuro&rn=1.

4. Export Control

Per DFARS 225.7901-4, all procurement contracts, other transactions and other awards, as deemed appropriate, resultant from this solicitation will include the DFARS Export Control clause (252.225-7048).

5. Subcontracting

Pursuant to Section 8(d) of the Small Business Act (15 U.S.C. § 637(d)), it is the policy of the Government to enable small business and small disadvantaged business concerns to be considered fairly as subcontractors to contractors performing work or rendering services as prime contractors or subcontractors under Government contracts, and to assure that prime contractors and subcontractors carry out this policy. Each proposer who submits a contract proposal and includes subcontractors is required to submit a subcontracting plan in accordance with FAR 19.702(a)(1) should do so with their proposal. The plan format is outlined in FAR 19.704.

6. Electronic and Information Technology

All electronic and information technology acquired through this solicitation must satisfy the accessibility requirements of Section 508 of the Rehabilitation Act (29 U.S.C. § 794d) and FAR 39.2. Each proposer who submits a proposal involving the creation or inclusion of electronic and information technology must ensure that federal employees with disabilities will have access to and use of information that is comparable to the access and use by Federal employees who are not individuals with disabilities and members of the public with disabilities seeking information or services from DARPA will have access to and use of information and data that is comparable to the access and use of information and data by members of the public who are not individuals with disabilities.

7. Employment Eligibility Verification

As per FAR 22.1802, recipients of FAR-based procurement contracts must enroll as federal contractors in E-verify and use the system to verify employment eligibility of all employees assigned to the award. All resultant contracts from this solicitation will include FAR 52.222-54, "Employment Eligibility Verification." This clause will not be included in grants, cooperative agreements, or Other Transactions.

8. Reserved

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

Unless the proposer is exempt from this requirement, as per FAR 4.1102 or 2 CFR 25.110 as applicable, all proposers must be registered in the System for Award Management (SAM) and have a valid Data Universal Numbering System (DUNS) number prior to submitting a proposal. All proposers must maintain an active registration in SAM with current information at all times during which they have an active Federal award or proposal under consideration by DARPA. All proposers must provide the DUNS number in each proposal they submit.

Information on SAM registration is available at www.sam.gov.

10. Reporting Executive Compensation and First-Tier Subcontract Awards

FAR clause 52.204-10, "Reporting Executive Compensation and First-Tier Subcontract Awards," will be used in all procurement contracts valued at $25,000 or more. A similar award term will be used in all grants and cooperative agreements.

11. Updates of Information Regarding Responsibility Matters

Per FAR 9.104-7(c), FAR clause 52.209-9, Updates of Publicly Available Information Regarding Responsibility Matters, will be included in all contracts valued at $500,000 or more where the contractor has current active Federal contracts and grants with total value greater than $10,000,000.

12. Representations by Corporations Regarding an Unpaid Delinquent Tax Liability or a Felony Conviction under any Federal Law

The following representation will be included in all awards:

(a) In accordance with section 101(a) of the Continuing Appropriations Act, 2016 (Pub. L. 114-53) and any subsequent FY 2016 appropriations act that extends to FY 2016 funds the same restrictions as are contained in sections 744 and 745 of division E, title VII, of the Consolidated and Further Continuing Appropriations Act, 2015 (Pub. L. 113-235), none of the funds made available by this or any other Act may be used to enter into a contract with any corporation that —

(1) Has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability, where the awarding agency is aware of the unpaid tax liability, unless the agency has considered suspension or debarment of the corporation and made a determination that this further action is not necessary to protect the interests of the Government; or

(2) Was convicted of a felony criminal violation under any Federal law within the preceding 24 months, where the awarding agency is aware of the conviction, unless the agency has considered suspension or debarment of the corporation and made a determination that this action is not necessary to protect the interests of the Government.

(b) The Offeror represents that –

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

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

13. Cost Accounting Standards (CAS) Notices and Certification

As per FAR 52.230-2, any procurement contract in excess of the referenced threshold resulting from this solicitation will be subject to the requirements of the Cost Accounting Standards Board (48 CFR 99), except those contracts which are exempt as specified in 48 CFR 9903.201-1. Any proposer submitting a proposal which, if accepted, will result in a CAS compliant contract, must submit representations and a Disclosure Statement as required by 48 CFR 9903.202 detailed in FAR 52.230-2. The disclosure forms may be found at http://www.whitehouse.gov/omb/procurement_casb.

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

Controlled Unclassified Information (CUI) refers to unclassified information that does not meet the standards for National Security Classification but is pertinent to the national interests of the United States or to the important interests of entities outside the Federal Government and under law or policy requires protection from unauthorized disclosure, special handling safeguards, or prescribed limits on exchange or dissemination. All non-DoD entities doing business with DARPA are expected to adhere to the following procedural safeguards, in addition to any other relevant Federal or DoD specific procedures, for submission of any proposals to DARPA and any potential business with DARPA:

- Do not process DARPA CUI on publicly available computers or post DARPA CUI to publicly available webpages or websites that have access limited only by domain or Internet protocol restriction.
- Ensure that all DARPA CUI is protected by a physical or electronic barrier when not under direct individual control of an authorized user and limit the transfer of DARPA CUI to subawardees or teaming partners with a need to know and commitment to this level of protection.

- Ensure that DARPA CUI on mobile computing devices is identified and encrypted and all communications on mobile devices or through wireless connections are protected and encrypted.
- Overwrite media that has been used to process DARPA CUI before external release or disposal.

15. Safeguarding of Covered Defense Information and Cyber Incident Reporting

Per DFARS 204.7304, DFARS 252.204-7012, "Safeguarding of Covered Defense Information and Cyber Incident Reporting," applies to this solicitation and all FAR-based awards resulting from this solicitation.

16. Prohibition on Contracting with Entities that Require Certain Internal Confidentiality Agreements

(a) In accordance with section 101(a) of the Continuing Appropriations Act, 2016 (Pub. L. 114-53) and any subsequent FY 2016 appropriations act that extends to FY 2016 funds the same restrictions as are contained in section 743 of division E, title VII, of the Consolidated and Further Continuing Appropriations Act, 2015 (Pub. L. 113-235), none of the funds appropriated (or otherwise made available) by this or any other Act may be used for a contract with an entity that requires employees or subcontractors of such entity seeking to report fraud, waste, or abuse to sign internal confidentiality agreements or statements prohibiting or otherwise restricting such employees or contactors from lawfully reporting such waste, fraud, or abuse to a designated investigative or law enforcement representative of a Federal department or agency authorized to receive such information.

(b) The prohibition in paragraph (a) of this provision does not contravene requirements applicable to Standard Form 312, Form 4414, or any other form issued by a Federal department or agency governing the nondisclosure of classified information.

(c) *Representation*. By submission of its offer, the Offeror represents that it does not require employees or subcontractors of such entity seeking to report fraud, waste, or abuse to sign or comply with internal confidentiality agreements or statements prohibiting or otherwise restricting such employees or contactors from lawfully reporting such waste, fraud, or abuse to a designated investigative or law enforcement representative of a Federal department or agency authorized to receive such information.

C. Reporting

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

D. Electronic Systems

1. Representations and Certifications

In accordance with FAR 4.1201, prospective proposers shall complete electronic annual representations and certifications at www.sam.gov.

2. Wide Area Work Flow (WAWF)

Unless using another means of invoicing, performers will be required to submit invoices for payment directly via to http://wawf.eb.mil. Registration in WAWF will be required prior to any award under this BAA.

3. 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://s-edison.info.nih.gov/iEdison.

VII. Agency Contacts

Administrative, technical or contractual questions should be sent via e-mail to DARPA-BAA-16-56@darpa.mil. All requests must include the name, email address, and phone number of a point of contact.

The technical POC for this effort is:

Dr. Jay Lewis
DARPA/MTO
ATTN: DARPA-BAA-16-56
675 North Randolph Street
Arlington, VA 22203-2114

Email: DARPA-BAA-16-56@darpa.mil

VIII. Other Information

A. Intellectual Property Procurement Contract Proposers

1. Noncommercial Items (Technical Data and Computer Software)

Proposers responding to this BAA requesting a procurement contract to be issued under the FAR/DFARS shall identify all noncommercial technical data and noncommercial computer

software that it plans to generate, develop, and/or deliver under any proposed award instrument in which the Government will acquire less than unlimited rights, and to assert specific restrictions on those deliverables. Proposers shall follow the format under DFARS 252.227-7017 for this stated purpose. In the event that proposers do not submit the list, the Government will assume that it automatically has "unlimited rights" to all noncommercial technical data and noncommercial computer software generated, developed, and/or delivered under any award instrument, unless it is substantiated that development of the noncommercial technical data and noncommercial computer software occurred with mixed funding. If mixed funding is anticipated in the development of noncommercial technical data and noncommercial computer software generated, developed, and/or delivered under any award instrument, then proposers should identify the data and software in question, as subject to Government Purpose Rights (GPR). In accordance with DFARS 252.227-7013 Rights in Technical Data - Noncommercial Items, and DFARS 252.227-7014 Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation, the Government will automatically assume that any such GPR restriction is limited to a period of five (5) years in accordance with the applicable DFARS clauses, at which time the Government will acquire "unlimited rights" unless the parties agree otherwise. Proposers are advised that the Government will use the list during the evaluation process to evaluate the impact of any identified restrictions and may request additional information from the proposer, as may be necessary, to evaluate the proposer's assertions. If no restrictions are intended, then the proposer should state "NONE." It is noted an assertion of "NONE" indicates that the Government has "unlimited rights" to all noncommercial technical data and noncommercial computer software delivered under the award instrument, in accordance with the DFARS provisions cited above. Failure to provide full information may result in a determination that the proposal is not compliant with the BAA – resulting in nonselectability of the proposal.

A sample list for complying with this request is as follows:

NONCOMMERCIAL				
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)

2. Commercial Items (Technical Data and Computer Software)

Proposers responding to this BAA requesting a procurement contract to be issued under the FAR/DFARS shall identify all commercial technical data and commercial computer software that may be embedded in any noncommercial deliverables contemplated under the research effort, along with any applicable restrictions on the Government's use of such commercial technical data and/or commercial computer software. In the event that proposers do not submit the list, the Government will assume that there are no restrictions on the Government's use of such commercial items. The Government may use the list during the evaluation process to evaluate the impact of any identified restrictions and may request additional information from the proposer, as may be necessary, to evaluate the proposer's assertions. If no restrictions are

intended, then the proposer should state "NONE." Failure to provide full information may result in a determination that the proposal is not compliant with the BAA – resulting in nonselectability of the proposal.

A sample list for complying with this request is as follows:

COMMERCIAL				
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)

B. Non-Procurement Contract Proposers – Noncommercial and Commercial Items (Technical Data and Computer Software)

Proposers responding to this BAA requesting a Grant, Cooperative Agreement, Technology Investment Agreement, or Other Transaction for Prototype 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 those award instruments in question. This includes both Noncommercial Items and Commercial Items. Although not required, proposers may use a format similar to that described in Paragraphs 1.a and 1.b above. The Government may use the list during the evaluation process to evaluate the impact of any identified restrictions, and may request additional information from the proposer, as may be necessary, to evaluate the proposer's assertions. If no restrictions are intended, then the proposer should state "NONE." Failure to provide full information may result in a determination that the proposal is not compliant with the BAA – resulting in nonselectability of the proposal.

C. All Proposers – Patents

Include documentation proving your ownership of or possession of appropriate licensing rights to all patented inventions (or inventions for which a patent application has been filed) that will be utilized under your proposal for the DARPA program. If a patent application has been filed for an invention that your proposal utilizes, but the application has not yet been made publicly available and contains proprietary information, you may provide only the patent number, inventor name(s), assignee names (if any), filing date, filing date of any related provisional application, and a summary of the patent title, together with either: (1) a representation that you own the invention, or (2) proof of possession of appropriate licensing rights in the invention.

D. All Proposers – Intellectual Property Representations

Provide a good faith representation that you either own or possess appropriate licensing rights to all other intellectual property that will be utilized under your proposal for the DARPA program. Additionally, proposers shall provide a short summary for each item asserted with less than

unlimited rights that describes the nature of the restriction and the intended use of the intellectual property in the conduct of the proposed research.

E. Other Transactions (OTs):

DARPA is able to obtain its research support through a variety of legal instruments and flexible arrangements, to include use of Other Transaction Agreements (OTAs). OTAs are potentially applicable to a wide variety of DARPA programs. They are likely to be particularly applicable to support dual-use technologies (those with commercial nonmilitary potential as well as potential military applications), consortia or multi-party agreements, and work supported by multiple funding sources. Because OTAs are not traditional procurement contracts, DARPA is not required to include the traditional FAR and DFARS clauses in these agreements, but is free to negotiate provisions that are mutually agreeable to both the Government and the consortium of companies entering into the agreement. Proposals may, but need not, state that an OTA rather than a contract or grant is desired. Furthermore, DARPA does not enter into OTAs when a contract or grant is feasible or appropriate. See FAR 35.003 for Government-wide policy on use of contracts for research and development. Potential proposers are encouraged to visit the DARPA Contracts Management page (http://www.darpa.mil/work-with-us/contractmanagement) for more information regarding the use of OTAs.

Transactions for Research and Other Transactions for Prototype Projects. Of these two types of OTAs, the one most pertinent to this BAA is referred to as a Technology Investment Agreement (TIA) and is issued in accordance with Part 37 of the Department of Defense Grant and Agreement Regulations (DODGARs) (http://www.gpo.gov/fdsys/granule/CFR-2008-title32-vol1/CFR-2008-title32-vol1-part21/content-detail.html). TIAs are assistance instruments used to stimulate or support research designed to: (a) reduce barriers to commercial firm's participation in defense research, to give the Department of Defense (DoD) access to the broadest possible technology and industrial base; (b) promote new relationships among performers in both the defense and commercial sectors of that technology and industrial base; and (c) stimulate performers to develop, use, and disseminate improved practices. As a matter of DoD policy, a TIA may be awarded only when one or more for-profit firms are to be involved either in the (1) performance of the research project; or (2) the commercial application of the research results (e.g. commercial transition partner). Also of importance is the requirement that, to the maximum extent practicable, the non-Federal parties carrying out a research project under a TIA are to provide at least half of the costs of the project – this being a statutory condition for any TIA, or Other Transaction Agreement in general, issued under the authority of 10 U.S.C. 2371b. Such instruments can involve a single performer or multiple performers participating as a consortium (which are not required to operate as a separate legal entity) and the Generally Accepted Accounting Principle (GAAP) applies rather than the FAR or DFARS cost principles.

For information on Other Transaction Authority for Prototypes (OTA) agreements, refer to http://www.darpa.mil/work-with-us/contract-management. All proposers requesting an Other Transaction Authority for Prototypes agreement (OTA) must include a detailed list of milestones. Each such milestone must include the following: milestone description, completion criteria, due date, payment/funding schedule (to include, if cost share is proposed, contractor and Government share amounts). It is noted that, at a minimum, such milestones should relate directly to

accomplishment of program technical metrics as defined in the BAA and/or the proposer's proposal. Agreement type, fixed price or expenditure based, will be subject to negotiation by the Agreements Officer; however, it is noted that the Government prefers use of fixed price milestones with a payment/funding schedule to the maximum extent possible. Do not include proprietary data. If the proposer requests award of an OTA agreement as a nontraditional defense contractor, as so defined in the OSD guide entitled "Other Transactions (OT) Guide For Prototype Projects" dated August 2002 (as amended) (http://www.acq.osd.mil/dpap/Docs/otguide.doc), information must be included in the cost proposal to support the claim. Additionally, if the proposer plans requests award of an OTA agreement, without the required one-third (1/3) cost share, information must be included in the cost proposal supporting that there is at least one non-traditional defense contractor participating to a significant extent in the proposed prototype project.