Broad Agency Announcement

Habitus

Defense Sciences Office

HR001120S0035

February 17, 2020

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PART I: OVERVIEW INFORMATION

- **Federal Agency Name:** Defense Advanced Research Projects Agency (DARPA), Defense Sciences Office (DSO)

- **Funding Opportunity Title:** Habitus

- **Announcement Type:** Initial Announcement

- **Funding Opportunity Number:** HR001120S0035

- **Catalog of Federal Domestic Assistance (CFDA) Number(s):** 12.910 Research and Technology Development

- **Dates** (All times listed herein are Eastern Time.)
  - Posting Date: February 17, 2020
  - Proposers Day: February 10, 2020. See Section VIII.B.
  - TA1/ TA2 Abstract Due Date: February 28, 2020, 4:00 p.m.
  - FAQ Submission Deadline for TA1/TA2: March 23, 2020, 4:00 p.m. See Section VIII.A.
  - FAQ Submission Deadline for CE: TBD
  - TA1/TA2 Full Proposal Due Date: April 23, 2020, 4:00 p.m.
  - CE Full Proposal Due Date: TBD
  - BAA closing date: August 17, 2020

- **Anticipated Individual Awards:** DARPA anticipates multiple awards.

- **Types of Instruments that May be Awarded:** Procurement contracts, cooperative agreements, or other transactions

- **Agency contacts**

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

- **Frequently Asked Questions (FAQ):** FAQs for this solicitation may be viewed on the DARPA/DSO Opportunities Website. See Section VIII.A for further information.

PART II: FULL TEXT OF ANNOUNCEMENT

I. Funding Opportunity Description

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

A. Introduction

The Defense Sciences Office (DSO) at the Defense Advanced Research Projects Agency (DARPA) is soliciting innovative research proposals to create self-sustaining, adaptive, generalizable, and scalable methods for generating causal system models based on local knowledge to aid operational decision making.

Understanding how to work with and influence local systems[1] to support stability operations is critical for operational decision making and is most challenging in undergoverned regions in which the systems themselves are often in flux or illegible.[2] Establishing stability in such regions requires we facilitate actions that are in line with local views, yet our current means for understanding local systems such as the political, socioeconomic, and/or those related to health and infrastructure are limited. Humans develop causal cognitive representations – or cognitive models – of systems of which they are a part. These models include factors (or variables), relationships among factors, and contexts that affect both. The knowledge behind these models is often hyper-localized, changing dramatically with regional and/or population dependent interactions of factors such as terrain, industries, population density (urban, rural), shared history, formal and informal power structures, religion, and ethnicity. These cognitive models, though often implicit, allow one to estimate which factors are most important for a given outcome and how those factors interact to anticipate future outcomes based on history, current events, and trends.

Unfortunately, the cognitive models locals have developed are largely inaccessible to outsiders and operational decision makers. This has led to operational challenges. Examples include:

- The failure to recognize the interaction of local burial practices with Ebola's virulence in West Africa led to a vast underprojection of the disease's spread in 2014. Efforts to treat it as a health and education issue misunderstood the local importance of these rituals; solutions that included local religious leadership were far more effective than education-

[1] By "systems" for the purposes of this BAA we mean an interconnecting network of factors that affect or contribute to a real-world outcome. An agricultural system might include, for instance, natural factors (e.g., rainfall, temperatures) and human factors (e.g., irrigation methods, planting practices, and formal or informal regulations, and even perceptions of events) that affect the outcome of seasonal agricultural yields and/or crop prices.
[2] We use "illegibility" here as James C. Scott has developed the concept to refer to ways in which states understand those they govern. Scott, J. C. (1998). *Seeing like a state: How certain schemes to improve the human condition have failed*. Yale University Press. Full text: https://libcom.org/files/Seeing%20Like%20a%20State%20-%20James%20C.%20Scott.pdf

only approaches.[3]

- The US's early Information Operations campaign in Iraq was largely ineffective because Iraqis had learned to distrust traditional media outlets (radio, television) after years of listening to Ba'athist propaganda.[4]
- Efforts to secure a small town from ISIS created local turmoil when US forces set up a perimeter that excluded the local glass factory and disrupted locals' ability to get to work.

Such cultural factors, when studied and described in a vacuum, provide little quantitative or predictive power for understanding real-world outcomes. Instead, Habitus is focused on creating explicit computational models of complex, real-world local systems based on collective cognitive models of local populations. These computational models will include all relevant factors that contribute to predicting a system outcome, whether concrete (e.g., employment rates, rain totals) or traditionally unquantifiable (e.g., religious beliefs, historical experience). Systems of interest include those relevant to stability operations - whether related to security, socioeconomics, politics, and/or those involved with health and wellbeing.

The program will make the computational models available, accessible, and understandable to operators, providing them with an "insider" view to support operational decision making. The resulting capability will be specific enough to anticipate system-level effects in response to events that are generalizable across regions and populations, adaptive as societies change over time, and self-sustaining for maintainability and persistence.

B. Background

Through lived experience, human cognition reduces the dimensionality of complex systems and derives causality among the most relevant factors, relationships among factors, and contexts that affect both to create an implicit cognitive model. These cognitive models form the basis of experience and "insider" knowledge. These cognitive models allow one to estimate which factors are most important for a given outcome and how those factors interact to anticipate future outcomes based on history, current events, and trends.

Unfortunately, the cognitive models locals have developed are mostly implicit and largely inaccessible to outsiders, and thus, cannot inform operational decision making. Most current approaches collect outputs of cognitive models among populations (e.g., polling, big data methods) but make very limited attempts to extract the causal reasoning by which locals derive those outputs. In many cases, existing tools were developed to support *strategic* forecasting and analysis rather than to provide the detailed understanding necessary to make projections and anticipate how a system and its factors will change over time. While Subject Matter Experts (SMEs) spend years developing similar cognitive models about a given region or domain topic,[5] rarely are there enough SMEs available to guide operational decision making, and often their

[3] Maxmen, A. (2015). How the fight against Ebola tested a culture's traditions. *National Geographic*, *30*.
[4] McFate, M. (2005). *The military utility of understanding adversary culture*. Office of Naval Research, Arlington VA.
[5] By "domain topic" we mean a particular type of system that exists in multiple regions globally. Examples include: agricultural practices, food insecurity, microfinance, infectious disease spread, informal governance structures, and others.

knowledge is not specific enough to understand the particularities of a given town or municipality. Likewise, big data methods often lack the ability to interpret data through a local lens and are not specific enough to a given Area of Operations (AO) to inform decision making. Exceptions that are highly tuned to a single city do not generalize to other areas or populations. Polling remains a common state of practice because the methods generalize widely; however, polling is not adaptive, and a poll must be completely rerun to account for changing views as a result of emerging events, which requires considerable labor.

Needed is a capability that is simultaneously:

- **Adaptive**, so system representations and projections update to maintain accuracy as non-ergodic human systems change over time;
- **Scalable & generalizable,** so that the methodology readily transfers to new regions, populations, and topics;
- **Self-sustaining**, meaning it requires few resources to maintain over time; and
- **Specific** and detailed enough to provide causal insight for a given region, system, and/or population.

While any one perspective – and any one individual's cognitive model – is unlikely to be complete and accurate for predicting regional system outcomes, recent advances in participatory science and modeling have demonstrated that building collective models based on the knowledge of populations who live, work, and interact with the system can provide more accurate estimations of future outcomes of that system than experts and other state of the art methods.[6] Broader indications that we can develop such a capability come from trends in ecological research, where the accuracy and efficacy of assessments and interventions have improved by involving locals not just in outcome estimation but also in knowledge discovery (i.e., identifying relevant factors) and model construction (i.e., establishing relationships among factors and the effect of contexts).[7,8] The level of agreement among respondents characterizes the collective uncertainty about the importance of each factor in the computational model, providing an estimate of error and community divergence. Though promising, these methods are limited in their ability to scale in a manner that makes them efficacious for operational needs.

Habitus will develop a method that, via engagement with locals, will construct computational models of the collective local view of political, economic, and/or social systems so decision makers can understand not only *what* factors are important but also *why* and *how* these systems work from an insider's view (Figure 1). Developing such computational models will not only provide operators with the ability to anticipate how the system will change as events unfold, but also specific insight as to how to affect the system to achieve desired results.

[6] Halbrendt, J., Gray, S. A., Crow, S., Radovich, T., Kimura, A. H., & Tamang, B. B. (2014). Differences in farmer and expert beliefs and the perceived impacts of conservation agriculture. *Global Environmental Change*, *28*, 50-62.
[7] Bélisle, A. C., Asselin, H., LeBlanc, P., & Gauthier, S. (2018). Local knowledge in ecological modeling. *Ecology and Society*, *23*(2).

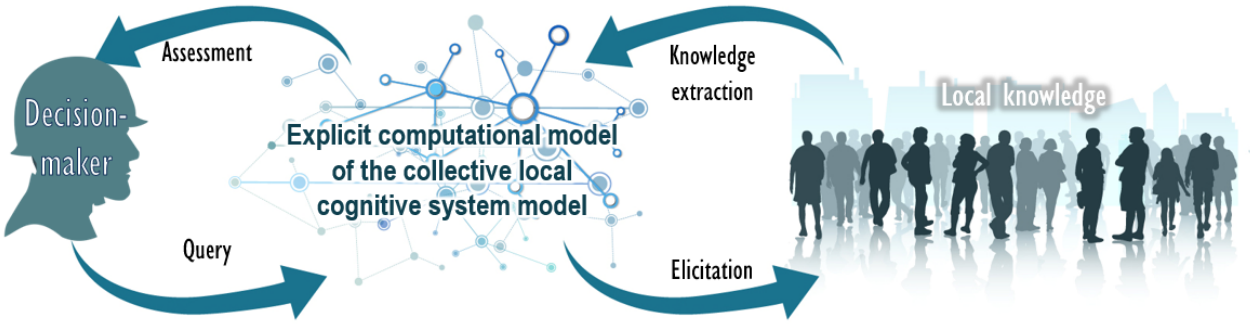

Figure 1. Habitus System Concept. Through engagement with local populations, Habitus creates an explicit computational model of the collective local cognitive model of a system in a (performer-specified) topic domain. A commander (decision maker) can view and query the computational model for assessments of system-level changes based on actual or hypothetical actions or events, providing the commander with an in-depth understanding of the system and its causal dynamics.

Developing an operational capability from these advances requires that we 1) develop automated methods for identifying factors and their relative importance, relationships among factors, and contexts that affect those relationships to create **specific** computational models and 2) create a **self-sustaining** engagement mechanism to elicit knowledge such that a model can **adapt** or maintain accuracy over time and as systems change. The goal is not to create a single computational model for all regions, but rather to develop a generalizable *methodology* that is **scalable** enough to create a customized computational model for each AO.

An example of Habitus' potential impact is in support of a US Marine Air-Ground Task Force (MAGTF) deployment to East Asian regions with high levels of geographic, ethnic, and linguistic diversity. Arriving forces would deploy Habitus operationally in each new region to provide immediate (within a few days), coarse understanding of the most critical system factors, such as major players, industries, populations, and their locations and affiliations. Habitus would then develop a more robust, detailed, quantitative, and causal computational model of collective cognitive system model in a few weeks. The commander would query the computational model with potential actions and observe the predicted changes to the actions/attitudes of the populace.

C. Program Description/Scope

The Habitus program will create a specific, generalizable/scalable, adaptive, and self-sustaining methodology for capturing and making local knowledge available to operational decision makers to support stability operations. This involves developing mechanisms of measurement and local engagement, identifying relevant factors, prioritizing and developing relationships among those factors, and testing and updating the model as systems change. Over the course of the program, performers will demonstrate, test, and validate the system by using the computational models generated by their systems to make predictions against real-world, externally verifiable outcomes.

Proposed research should investigate innovative approaches that enable revolutionary advances in science, methodologies, or systems to engage with and understand local populations to make their often implicit cognitive models of a local system explicit and available to operational

decision-makers. Specifically excluded is research that primarily results in evolutionary improvements to the existing state of practice.

D. Program Structure

Habitus consists of two Technical Areas (TAs) and a Comparative Evaluation (CE) team in support of a government Testing and Evaluation (T&E) team.

- TA1: Model Development
- TA2: Engagement Mechanism
- CE: Comparative Evaluation

This BAA comprises two proposal submission periods. The first submission period is for TAs 1 and 2. Because the engagement mechanisms will depend heavily on model development strategies, and vice versa, all proposals submitted during the first submission period must address both TA1 and TA2. The CE component is also being solicited under this BAA; however, additional technical detail regarding CE will be published in a subsequent BAA amendment. The amendment will also include requirements for submitting a proposal and due dates. The description of CE that follows is for informational purposes only in order to facilitate proposing to TA1/TA2. In order to ensure the impartiality of the evaluation of the TA1 and 2 technology, proposers selected for negotiation of an award for TA1/TA2 will not be eligible to propose to the CE BAA Amendment.

The program will consist of three Phases and a total of 42 months.

- For TA1/TA2:
  - Phase 1 (Base period, 24 months) will focus on building the initial capabilities and demonstrating efficacy in one region. Performers will be expected to work directly (i.e., on site) with local populations to develop, test, and validate methods.
  - Phase 2 (Option 1, 12 months) will challenge performers to generalize the capabilities in two new regions/populations. Performers will demonstrate scalability of the method by sustaining performance in new regions with substantially less development time.
  - Phase 3 (Option 2, 6 months) will be an extended demonstration of the capability in a DARPA-specified region, which will be selected in collaboration with performers and interested transition partners. Discussions and decisions on DARPA specified region will occur early in Phase 2 to allow time for any necessary IRB modifications and subsequent HRPO approvals prior to the start of Phase 3.
  - TA1/TA2 Proposals should address all three Phases. For costing purposes, proposers should base the Phase 3 portion of their proposal on a location that is comparable (in terms of travel costs and infrastructure needs) to those proposed for Phases 1 and 2.
- CE will begin roughly 12 months into Phase 1 and will run the duration of the rest of the program (30 months).

E. Technical Area Descriptions

TA1: Model Development. TA1 will develop scalable and generalizable knowledge elicitation methods to semi-automatically and rapidly derive computational model factors and system level relationships (the system model). The methods should:

- **Be specific and quantifiable**. The system model should quantify the relationships among factors and be able to generate quantifiable predictions based on changes in the system.
- **Capture implicit local knowledge**. Elicitation strategies should account for the fact that people are often not explicitly aware of the sources or indicators of their knowledge. This implicit knowledge will need to be gathered if it is to be used in the model.
- **Capture unanticipated factors.** The method should be able to elicit or discover factors the performer team or outside experts did not anticipate. This could involve identifying new terms or colloquialisms locals use to describe either the same factor outside experts use, or discovering new, previously unspecified factors. Performers are strongly encouraged to include methods that acknowledge and overcome challenges associated with education levels (e.g., literacy).
- **Incorporate local beliefs and/or practices.** Local populations may have beliefs and/or practices that may not be proven by empirical scientific evidence but nevertheless influence behavior and system outcomes. Outsiders often miss these elements, which can lead to miscalculations and misunderstandings. Proposed methods should be able to discover and incorporate these beliefs and practices into computational models.
- **Represent dynamic systems**. To achieve adaptivity, the computational model should be able to 1) update the relative importance of factors and their relationships to the predicted outcome and 2) be able to insert new factors, relationships, and contexts into the model as more information is gathered and as the system evolves.
- **Empower non-experts to anticipate real-world system outcomes.** The computational model should allow the non-expert user (i.e., assume no special training in data science, behavioral or social science, or local languages) to adjust factors to explore the potential outcomes of given actions and provide understanding behind the projected outcome.

The proposed methods must exhibit generalizability across four subject populations. Proposers will demonstrate efficacy by testing their ability to predict the outcomes of real-world, local events. The government T&E team will evaluate efficacy against current practices by comparting TA1/TA2 results to those from the CE.

TA2: Engagement Mechanism. TA2 will create a self-sustaining capability that continually provides information necessary to build and update TA1's computational models *by providing value to the local users*. The solution can be based on either passive observation or active engagement. Passive observations use natural behaviors that occur independent of Habitus, while active engagements are direct interactions with locals such as queries or probes. Each active engagement is considered a "touchpoint" with locals with respect to the Habitus metrics (Table 2). The solution should:

- **Be generalizable.** Proposers should address how the capability will be effective in more than one region and why it will be appealing/useful to multiple populations.
- **Align incentives of Habitus with the local population to support accuracy.** Methods that rely solely on monetary incentives encourage participation but not necessarily accuracy. Proposers should address how their engagement mechanism will provide value to locals in a way that aligns with existing motivations (e.g., intrinsic incentives) to encourage participation and accuracy in responses.
- **Identify and efficiently sample all relevant populations.** Proposers should consider how to identify populations relevant to the domain topic they propose and how to engage with those populations (i.e., how they will avoid oversampling or harassing local populations). The methods developed should identify the group to which the sampled people belong (including the possibility of multi-group membership). In addition, the methodology will need to address the challenges of obtaining representative samples from a small population.
- **Accommodate characteristics of the target population.** Each local population will have characteristics that will need to be considered when creating an effective engagement mechanism. Examples of these characteristics are literacy rates, likely frequency of use, collection platform, communication equipment, infrastructure, and applications.[9] The engagement mechanism must align with the local infrastructures of the subject populations. Rather than constrain performers to specific technologies (e.g., dumb phones or Facebook), the methods developed should be able to access the subject populations both with their current infrastructure or platform and with those that will be available in the near future.
- **Demonstrate self-sustainment.** In order to provide long-term transitionable value, the method will need to minimize impediments to self-sustainment. Such impediments include any recurring costs (e.g., labor) associated with creating computational models from collected data and ongoing payments for participation. Alternative incentives such as information exchange paradigms may be considered. To be self-sustaining, the mechanism should maximize the inherently limited opportunities for engagement. This is a particular problem for local populations where the total potential pool of respondents is limited, and the length of (intermittent) engagement is long. Proposers will need to describe their mechanisms for self-sustained use. We encourage performers to consider starting from existing points of departure (such as existing methods used by Non-Governmental Organizations (NGOs) or existing data collection platforms) to minimize development time and risk.
- **Passive engagement.** If TA2 includes passive engagement methods, proposers must 1) address *specifically* how they will know/test that they are interpreting the data correctly within the local context, 2) specify if informed consent is required, and if so, 3) how they plan to obtain informed consent required for Independent Review Board (IRB) approval.
- **Active engagement.** If TA2 includes active engagement methods, proposers must explain *specifically* how they will address interaction effects of the proposed engagement method.

[9] For instance, currently dumb phones are far more prevalent than any kind of smartphone in Africa, however "dumb smartphones" are on the rise. Likewise, Facebook messenger and WhatsApp are far more popular than SMS in South America, but SMS is still the dominant messaging mechanism certain regions of Africa.

This may vary across and between cultures. An example of "interaction effects" are perspective based biases that can be introduced by the investigator. Obtaining informed consent in line with IRB and HRPO requirements will be required for all active engagement methods.

TA2 solutions can be specific to a topic domain (e.g. political, economic, health related, etc.) although solutions that can be applied to multiple domains are preferred. Approaches to gathering data from populations lacking robust telecommunications infrastructure are of particular interest, but they will have to demonstrate that they can generate sufficient data necessary to support the needs of TA1.

Comparative Evaluation

The Comparative Evaluation (CE) team will generate parallel predictions to those specified by TA1/TA2 using current methods in order to generate a question-for-question comparative data set that the government T&E team will use to evaluate performance. This is because DARPA expects TA1 and 2 teams to tackle domain topics that are important to stability and defense, rather than those that are easy to predict. Since the capabilities required of any CE team will depend on the populations, regions, and topics being investigated by the TA1 and 2 teams, proposals for CE teams are not being solicited at the present time. DARPA intends to release an amendment to this BAA with additional technical area details, potentially including information on the specific populations, regions, and topics from the TA1 and 2 proposals selected for negotiation of an award, abstract details (if applicable), and proposal requirements and due dates after TA1/TA2 proposers have been notified of DARPA's selection decisions.

F. Additional Parameters

Proposers to the Habitus program will need to develop computational models from, and demonstrate their engagement mechanisms among, populations and under circumstances that will demonstrate specificity, adaptivity, generalizability and self-sustainability. Therefore, proposers must describe how they plan to address the following challenges:

- **Real world event predictions**. In order to enable validation, the proposed methods must generate predictions for *externally verifiable real-world events*. Proposers will need to specify the system that they will model and the events that will be predicted. The events targeted must have the following features:
    - Ground truth must be externally verifiable (unemployment rates, agricultural yields, crop prices, infection rates, etc.);
    - Events must occur with enough frequency so that there are sufficient instances of ground truth to evaluate progress on a quarterly basis.

- **Population size.** In order to balance the desire to probe local behavior with the need for statistical power, the target populations must be between 50,000 and 500,000 people in at least three distinct populations in regions Outside the Continental United States (OCONUS). Performers should seek populations that have significant heterogeneity, especially in the latter phases of the program.

- **Work with non-WEIRD populations**. In order to demonstrate the capability is widely generalizable, proposers should to work with populations that are not from Western Educated Industrialized Rich and Democratic (WEIRD)[10] regions. Regions selected may exhibit one or two of the WEIRD features. Working with college undergraduate participants in the United States is out of scope. Initial work in largely unacculturated immigrant or isolated populations in the Continental United States (CONUS) is acceptable, but the capability must be demonstrated within populations and regions OCONUS over the course of the program.
- **Language.** If the proposed methods will use linguistic data or language-based interactions, performers must do so in at least one language other than English. Proposers are encouraged to work in local dialects when possible. No new Natural Language Processing (NLP) libraries will be created under this program[11] therefore performers must either work in languages for which translation capability exists or use non-linguistic methods.

- **OCONUS human subjects research.** Performers are strongly encouraged to work with local partners, which may include universities or research institutions, to facilitate in-country human subjects research (HSR) approval and ensure research adheres to local HSR requirements.[12] If performers choose not to partner locally, they must demonstrate experience obtaining HSR approval in the proposed region.

Submissions must propose a topic domain of interest and geographically distinct populations to be studied and demonstrate existing relationships to facilitate work in those regions. The topic domain that a performer team chooses may include any area related to stability operations, such as supporting economic stability, anticipating and offsetting food insecurity, improving disease prevention, or another defense-related issue. The specific populations and the topics addressed are up to the proposer to define, as long as they meet the parameters above.

Out of scope are solutions that rely solely on social media and/or Mechanical Turk.

G. Schedule/Milestones

The Habitus performers will be evaluated using a number of milestones and metrics enumerated below. However, attainment of the milestones and metrics for a given phase does not guarantee transition into the next phase of the program. Individual efforts will also be judged on their expected ability to attain subsequent milestones. Options may be exercised, at the Government's sole discretion, based on technical progress measured against the metrics and milestones defined in the BAA as well as funding availability.

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[10] Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world?. *Behavioral and brain sciences*, *33*(2-3), 61-83.

[11] It is acceptable to add new colloquialisms to extant libraries as encountered/discovered.

[12] In addition to adhering to US and HRPO standards HSR, all protocols must adhere to the HSR requirements of the nation in which the work will occur. See the Health and Human Services website for guidance. https://www.hhs.gov/ohrp/international/compilation-human-research-standards/index.html Partnering with a local research institution that is already familiar with their national requirements and approval processes will facilitate protocol adherence to local, US, and HRPO requirements.

Phase 1	Month 6 PI meeting	Month 12 PDR	Month 18 PI meeting	Month 24 End of Phase
TA1 Model Dev.	• Review model development pipeline • Detailed HSR protocol for all proposed testing sites • Detailed description & quantified projection of 'touchpoints' needed for method to be reliable	• IRB approval all sites (includes international partners and HRPO) and all planned Phases (covering activities in both TAs) • Evidence of touchpoints needed for method to be reliable	• Can the method predict what the locals would predict? (Brier Skill Score)	• Demo in last 6 months to evaluate teams against end-of-phase performance requirements • Demonstrate improved prediction accuracy compared to current methods (Brier Skill Score)
TA2 Engage. Mech.	• Evidence of sustainability in population of interest for the proposed engagement method among the target populations for all phases (e.g., market research) • Proposed design adjustments based on findings	• Detailed system overview including evidence the proposed engagement method aligns with local infrastructure • Evidence TA2 can support the touchpoints required for TA1	• Initial demonstration with surrogate user (e.g., naive user with comparable education to target populations)	• Demonstration of 1:2000 touchpoint ratio • Evidence of onboarding & sustained use

Phase 2	Month 30: PI meeting	Month 36: End of Phase
	• Assess accuracy for 1 new application • Asses time to stand up new capability, 1 new application • Assess retention rate for 1 new application and Phase 1 application • Assess touchpoint ratio for 1 new application and Phase 1 application	• Maintain Phase 1 accuracy in 2 new applications (domains or regions) • Stand up in new region < 2 weeks and/or compared to poll • Retain better than 75% of users at 2 weeks in 2 applications in addition to Phase 1 application • 1:200 touchpoint ration in 2 applications in addition to Phase 1 application

Phase 3:	Month 42: End of Phase
	• Maintain performance on all Phase 2 metrics in a DARPA specified challenge. Ideally with a current event and/or transition partner defined question. • Initial accuracy at 3 months and sustained accuracy at the end of the Phase.

Table 1: Habitus program milestone schedule

DARPA will assess TA1 and TA2 components separately in Phase 1. This means teams can develop TA1 using approximated methods for TA2 function (e.g., mimicking the nature and frequency of engagement) and can test TA2 methods for usability and traction among locals without the TA1 modeling capability being fully implemented. In Phases 2 and 3, DARPA will evaluate performance of the integrated TA1/TA2 capability against metrics.

Notable milestones:

HSR protocol and approval timeline. The schedule allows for 12 months to obtain IRB and Human Research Protection Office (HRPO) approvals. However, this includes time for delays, so teams are highly encouraged to complete their protocol, obtain IRB determination and approval, *and submit the protocol to HRPO review by month 6 or earlier*. Approval delays beyond 12 months will significantly harm the performer's ability to move beyond Phase 1 in the program. Teams are encouraged to begin work with local populations as soon as they receive HRPO approval (i.e., prior to month 12).

Evidence TA2 can support TA1 needs at month 12. Performers will be required to demonstrate that the engagement methods employed in TA2 will provide enough information to support TA1 data needs. Likewise, TA1 must present evidence to quantify the amount of data they will need from TA2. Though a data-backed demonstration of this is not required until month 12, proposers should include projections or estimations of each in their proposals.

Predicting predictions by locals. Just as important as anticipating real-world outcomes is the ability to understand how the local population will respond to, or view, event outcomes. If the TA1 computational models are successful in providing an insider view, they should be able to anticipate and make predictions of *what the local population will predict will happen* as a result of a hypothetical event. Because this level of prediction does not rely on the event occurring and does not use external sources to provide ground truth, this evaluation can be performed earlier in the program and more frequently. Therefore, DARPA will first evaluate this prediction performance against the accuracy metric at month 18.

	Metrics	Phase 1: Build 24 mo, 1 region	Phase 2: Generalize 12 mo, + 2 regions	Phase 3: Test 6 mo, Government Selected region
TA1 Model Dev.	Accuracy: Brier Skill Score (BSS) compared to polling $Brier\ Skill\ Score = 1 - \frac{Brier\ Score_{Habitus}}{Brier\ Score_{SOA*}}$	> 0	Maintain accuracy > 0	Maintain accuracy > 0
	Time to establish in new region (State of the art: 2 weeks)	< 6 weeks with new population for Phase End Demo	< 2 weeks	< 1 week
TA2 Engage. Mech.	Retention	Evidence	> 75% @ 2 weeks	> 80% @ 1 month
	Efficiency Touchpoint Ratio (State of the Art: 1:2000)	1:2000	1:200	1:200

** SOA: The CE effort will generate predictions from current State of the Art (SOA) practices for a direct comparison to Habitus performance accuracy.*

Table 2 Habitus program metrics

Brier Skill Score for Accuracy: To evaluate accuracy DARPA will use a variation of the Brier Skill Score (BSS), which compares the relative accuracy of the performer's TA1 method against that of the State of the Art (SoA) methods the CE team will use. DARPA is using this comparative method rather than providing an absolute accuracy threshold to encourage performers to choose challenging topics and events for which there may be no current reliable methods for assessing the local view (the system outcome must still have externally verifiable ground truth, even if current methods are poor at predicting those outcomes). Note that a BSS of > 0 means TA1 is performing better than the CE team. Performers will need to establish this level of performance by the end of Phase 1 and demonstrate that they can maintain that performance in new regions and in shorter amounts of time across Phases 2 and 3.

Touchpoint Ratio for Efficiency: TA2 engagement methods will not be self-sustaining if they continually pester users/populations to provide information. DARPA will evaluate efficiency by comparing the number of "touchpoints" or number of times the engagement mechanism must request input from the participant – against the number of complete data points collected. All attempts to contact locals to participate (not just interactions with those who consent), and the process of obtaining consent as part of IRB compliance will count against the touchpoint ratio.

Other proposal properties

- Proposers should provide a technical and programmatic strategy that conforms to the entire program schedule and presents an aggressive plan to fully address all program goals, metrics, milestones and deliverables.
- The task structure must be consistent across the proposed schedule, Statement of Work, and cost volume.
- A target start date of 1 October 2020 may be assumed for planning purposes.
- Schedules will be synchronized across performers, as required, and monitored/revised as necessary throughout the program.
- All proposals must include the following meetings and travel in the proposed schedule and costs:
    - To continue integration and development between TAs, foster collaboration between teams, and disseminate program developments, a two-day Principal Investigator (PI) meeting will be held approximately every six months, with locations split between the East and West Coasts of the United States. For budgeting purposes, plan for eight two-day meetings over the course of 42 months: five meetings in the Washington, D.C. area and three meetings in the San Francisco, CA area.
    - Regular teleconference meetings will be scheduled with the Government team for progress reporting as well as problems identification and mitigation. Proposers should also anticipate at least one site visit per phase by the DARPA Program Manager during which they will have the opportunity to demonstrate progress towards agreed-upon milestones.

H. Deliverables

Performers will be expected to provide at a minimum the following deliverables:

- Comprehensive quarterly technical reports due within ten days of the end of the given quarter, describing progress made on the specific milestones as laid out in the SOW.
- Items specified in the Program Milestone Schedule (Table 1).
- Data and code necessary for the T&E team to evaluate performer progress against accuracy at least 90 days before the end of Phases 1 and 2.
- A phase completion report submitted within 30 days of the end of each phase, summarizing the research done.
- Other negotiated deliverables specific to the objectives of the individual efforts. These may include registered reports; experimental protocols; publications; data management plan; intermediate and final versions of software libraries, code, and Application Programming Interfaces (APIs), including documentation and user manuals and/or a comprehensive assemblage of design documents, models, modeling data and results; and model validation data.
- Reporting as outlined in Section VI.C.

I. Other Program Objectives and Considerations

1. Collaboration

TA 1, 2 and the CE Team will be required to work with the government T&E team who will evaluate performance against the metrics outlined in Table 2. TA1/TA2 performers will – at a

minimum – be required to provide the government T&E team with their predictions prior to the specified event's outcome. Collaboration may also include sharing all raw data, code for reproducing results, and output results.

II. Award Information

A. General Award Information

DARPA anticipates multiple awards for combined TA1/TA2 efforts and a single award for the CE team (subject of a future amendment to this BAA).

The level of funding for individual awards made under this BAA will depend on the quality of the proposals received and the availability of funds. Proposals that are determined selectable will not necessarily receive awards. Awards will be made to proposers[13] whose proposals are determined to be the most advantageous to the Government, all evaluation factors considered. See Section V for further information.

The Government reserves the right to:

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

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

Proposers looking for innovative, commercial-like contractual arrangements are encouraged to consider requesting Other Transactions. To understand the flexibility and options associated with

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

Other Transactions, consult http://www.darpa.mil/work-with-us/contract-management#OtherTransactions.

In accordance with 10 U.S.C. § 2371b(f), the Government may award a follow-on production contract or Other Transaction (OT) for any OT awarded under this BAA if: (1) that participant in the OT, or a recognized successor in interest to the OT, successfully completed the entire prototype project provided for in the OT, as modified; and (2) the OT provides for the award of a follow-on production contract or OT to the participant, or a recognized successor in interest to the OT.

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

B. Fundamental Research

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

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

As of the date of publication of this BAA, the Government expects that TA1 program goals as described herein may be met by proposed efforts for fundamental research, while TA2 program goals may be met by non-fundamental research. Some proposed research may present a high likelihood of disclosing performance characteristics of military systems or manufacturing technologies that are unique and critical to defense. Based on the anticipated type of proposer (e.g., university or industry) and the nature of the solicited work, the Government expects that some awards will include restrictions on the resultant research that will require the awardee to seek DARPA permission before publishing any information or results relative to the program.

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

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

To ensure high research standards and support reproducibility of work performed under this program, all publications will have to pre-register their hypotheses with either a journal or pre-registration service prior to data collection.

III. Eligibility Information

A. Eligible Applicants

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

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

a. FFRDCs

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

b. Government Entities

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

c. Authority and Eligibility

At the present time, DARPA does not consider 15 U.S.C. § 3710a to be sufficient legal authority to show eligibility. While 10 U.S.C.§ 2539b may be the appropriate statutory starting point for some entities, specific supporting regulatory guidance, together with evidence of agency approval, will still be required to fully establish eligibility. DARPA will consider FFRDC and

Government Entity eligibility submissions on a case-by-case basis; however, the burden to prove eligibility for all team members rests solely with the proposer.

2. Foreign Participation

Non-U.S. organizations and/or individuals may participate to the extent that such participants comply with any necessary nondisclosure agreements, security regulations, export control laws, and other governing statutes applicable under the circumstances. For classified submissions, this includes mitigating any Foreign Ownership Control and Influence (FOCI) issues prior to transmitting the submission to DARPA. Additional information on these subjects can be found at https://www.dcsa.mil/mc/ctp/foci/.

B. Organizational Conflicts of Interest

FAR 9.5 Requirements

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

Agency Supplemental OCI Policy

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

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

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

Government Procedures

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

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

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

Include any OCIs affirmations and disclosures in Attachment G Proposal Template Vol. 3-Admin and National Policy Requirements.

C. Cost Sharing/Matching

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

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

D. Other Eligibility Requirements

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

While proposers may submit proposals for both Technical Area 1 and 2 and the CE portion, TA1/TA2 awardees cannot be selected for the CE portion as a prime proposer, subawardee, or in any other capacity from an organizational to individual level. This is to avoid conflicts of interest between the Technical Areas and the CE portion and to ensure objective test and evaluation results. The decision as to which proposal(s) to consider for award is at the discretion of the Government.

IV. Application and Submission Information

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

- The proposed concept is applicable to the technical areas described herein.
- The proposed concept investigates an innovative approach that enables

revolutionary advances, i.e., will not primarily result in evolutionary improvements to the existing state of practice.
- The proposed work has not already been completed (i.e., the research element is complete but manufacturing/fabrication funds are required).
- The proposer has not already received funding or a positive funding decision for the proposed concept (whether from DARPA or another Government agency).

Abstracts and full proposals that are not found to be applicable to the Habitus BAA as defined above may be deemed non-conforming[14] and removed from consideration. All abstracts and full proposals must provide sufficient information to assess the validity/feasibility of their claims as well as comply with the requirements outlined herein for submission formatting, content and transmission to DARPA. Abstracts and full proposals that fail to do so may be deemed non-conforming and removed from consideration. Proposers will be notified of non-conforming determinations via letter.

A. Address to Request Application Package

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

B. Content and Form of Application Submission

1. TA1/TA2 Abstract Information

As stated above, proposers are strongly encouraged to submit an abstract in advance of a full proposal to minimize effort and reduce the potential expense of preparing an out of scope proposal. The abstract provides a synopsis of the proposed project by briefly answering the following questions:

- What is the proposed work attempting to accomplish or do?
- How is it done today, and what are the limitations?
- How will the proposed work overcome those limitations?
- Who will care and what will the impact be if the work is successful? This includes TA2 benefits to local populations.
- How much will it cost, and how long will it take?

DARPA will respond to abstracts with a statement as to whether DARPA is interested in the idea. If DARPA does not recommend the proposer submit a full proposal, DARPA will provide feedback to the proposer regarding the rationale for this decision. Regardless of DARPA's response to an abstract, proposers may submit a full proposal. DARPA will review all

[14] "Conforming" is defined as having been submitted in accordance with the requirements outlined herein.

conforming full proposals using the published evaluation criteria and without regard to any comments resulting from the review of an abstract.

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

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

- **TA1/TA2 Abstract Format**

All proposers are required to use Attachment A: Abstract Summary Slide Template and Attachment B: Abstract Template provided to this solicitation on http://beta.sam.gov and http://www.grants.gov. Attachment A Abstract Summary Slide Template described herein must be in .ppt or .pptx format and should be attached as a separate file to this document.

2. Full Proposal Information

Proposals consist of Volume 1: Technical and Management Volume, Volume 2: Cost Volume, and Volume 3: Administrative and National Policy Requirements Volume).

To assist in proposal development, various attachments have been provided along with the BAA posted on http:// beta.sam.gov (Attachment C: Proposal Summary Slide Template, Attachment D: Proposal Template Volume 1 Technical & Management Volume, Attachment E: Proposal Template Volume 2 Cost Volume, Attachment F: Cost Proposal Template and Attachment G: Proposal Template Volume 3 Administrative & National Policy Requirements Volume).

Full proposals requesting a procurement contract or other transaction (OT) must use the following attachments:

- Attachment C
- Attachment D
- Attachment E
- Attachment F
- Attachment G

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

- Attachment C
- Attachment D
- Attachment F
- Attachment G

*Note – Budget Justification should be provided as Section L of the SF 424 Research & Related Budget form provided via Grants.gov. The Budget Justification should include the following information for the recipient and all subawardees: (1) Direct

Labor: Detail the total number of persons and their level of commitment for each position listed (in sections A and B), as well as which specific tasks (as described in the SOW) they will support.(2) Equipment (section C) Provide an explanation for listed requested equipment exceeding $5,000, properly justifying their need to meet the objectives of the program. (3) Travel (section D) Provide the purpose of the trip, number of trips, number of days per trip, departure and arrival destinations, number of people, etc. (4) Other Direct Costs (section F). Provide a justification for the items requested and an explanation of how the estimates were obtained.

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

- **Full Proposal Format**

All proposers are required to use the templates provided as attachments to this solicitation on http://beta.sam.gov and http://www.grants.gov. Formatting instructions are provided therein.

3. Proprietary Information

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

Note that DARPA intends to release an amendment to this BAA with additional technical area details, potentially including information on the specific populations, regions, and topics from the TA1 and TA2 proposals selected for negotiation of an award in order to solicit CE proposals. Proposers selected for award will be required to work with DARPA to identify information appropriate to include in the amended BAA to solicit CE proposals and agree to its public release. Proposers that fail to expressly agree to this term within their proposal as outlined in Attachment D may be ineligible for an award.

4. Security Information

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

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

C. Submission Dates and Times

Proposers are warned that submission deadlines as outlined herein are in Eastern Time and will

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

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

1. Abstracts

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

2. Full Proposals

Full proposal packages – full proposal (Volume 1: Technical and Management Volume, Volume 2: Cost Volume, and Volume 3: Administrative and National Policy Requirements Volume) and, as applicable, proprietary subawardee cost proposals, classified appendices to unclassified proposals – must be submitted per the instructions outlined herein *and received by DARPA* no later than the due date and time listed in Part I: Overview Information. Proposals received after this time and date may not be reviewed.

D. Funding Restrictions

Not applicable.

E. Other Submission Requirements

Unclassified Submission Instructions

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

a. Abstracts

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

First time users of the DARPA BAA Submission website must complete a two-step account creation process. The first step consists of registering for an extranet account by going to the URL listed above and selecting the "Account Request" link. Upon completion of the online form, proposers will receive two separate emails; one will contain a user name and the second will provide a temporary password. Once both emails have been received, the second step

requires proposers to go back to the submission website and log in using that user name and password. After accessing the extranet, proposers may then create a user account for the DARPA BAA Submission website by selecting the "Register your Organization" link at the top of the page. Once the user account is created, proposers will be able to see a list of solicitations open for submissions, view submission instructions, and upload/finalize their abstract.

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

All abstracts submitted electronically through the DARPA BAA Submission website must meet the following requirements: (1) uploaded as a zip file (.zip or .zipx extension); (2) only contain the document(s) requested herein; (3) only contain unclassified information; and (4) must not exceed 100 MB in size. Only one zip file will be accepted per abstract and abstracts not uploaded as zip files will be rejected by DARPA.

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

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

b. Proposals Requesting a Procurement Contract or Other Transaction

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

i. Electronic Upload

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

First time users of the DARPA BAA Submission website must complete a two-step account creation process. The first step consists of registering for an extranet account by going to the URL listed above and selecting the "Account Request" link. Upon completion of the online form, proposers will receive two separate emails; one will contain a user name and the second will provide a temporary password. Once both emails have been received, the second step requires proposers to go back to the submission website and log in using that user name and password. After accessing the extranet, proposers may then create a user account for the DARPA

BAA Submission website by selecting the "Register your Organization" link at the top of the page. Once the user account is created, proposers will be able to see a list of solicitations open for submissions, view submission instructions, and upload/finalize their proposal.

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

All full proposals submitted electronically through the DARPA BAA Submission website must meet the following requirements: (1) uploaded as a zip file (.zip or .zipx extension); (2) only contain the document(s) requested herein; (3) only contain unclassified information; and (4) must not exceed 100 MB in size. Only one zip file will be accepted per full proposal and full proposals not uploaded as zip files will be rejected by DARPA.

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

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

ii. Direct Mail/Hand-carry

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

c. Proposals Requesting a Cooperative Agreement

Proposers requesting cooperative agreements may only submit proposals through ONE of the following methods: (1) electronic upload at Grants.gov (DARPA-preferred); or (2) direct mail/hand-carry to DARPA.

To evaluate compliance with Title IX of the Education Amendments of 1972 {20 U.S.C. A§ 1681 Et. Seq.), the Department of Defense is collecting certain demographic and career information to be able to assess the success rates of women who are proposed for key roles in applications in STEM disciplines. To enable this assessment, each application must include the two following forms completed as instructed: the Research and Related Senior/Key Person Profile (Expanded) form and the Research and Related Personal Data form. Both forms are provided with the application package in Grants.gov.

Proposers requesting cooperative agreements may only submit proposals through ONE of the following methods: (1) electronic upload at Grants.gov (DARPA-preferred); or (2) direct mail/hand-carry to DARPA.

i. Electronic Upload

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

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

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

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

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

ii. Direct Mail/Hand-carry

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

V. Application Review Information

A. Evaluation Criteria

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

- **Overall Scientific and Technical Merit**

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

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

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

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

- **Cost Realism**

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

B. Review and Selection Process

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

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

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

- **Handling of Source Selection Information**

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

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

C. Federal Awardee Performance and Integrity Information (FAPIIS)

Following the review and selection process described above, but prior to making an award above the simplified acquisition threshold (FAR 2.101), DARPA is required[15] to review and consider any information available through the designated integrity and performance system (currently FAPIIS). Selectees have the opportunity to comment on any information about themselves entered in the database. DARPA will consider any comments and other information in FAPIIS or other systems prior to making an award.

VI. Award Administration Information

A. Selection Notices

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

B. Administrative and National Policy Requirements

1. Solicitation Provisions and Award Clauses, Terms and Conditions

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

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

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

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

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

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

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

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

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

3. Representations and Certifications

In accordance with FAR 4.1102 and 4.1201, proposers requesting a procurement contract must complete electronic annual representations and certifications at https://www.sam.gov/. In addition, resultant procurement contracts will require supplementary DARPA-specific

representations and certifications. See http://www.darpa.mil/work-with-us/additional-baa for further information.

4. Intellectual Property

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

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

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

a. Intellectual Property Representations

All proposers must provide a good faith representation of either ownership or possession of appropriate licensing rights to all other intellectual property to be used for the proposed project. Proposers must provide a short summary for each item asserted with less than unlimited rights that describes the nature of the restriction and the intended use of the intellectual property in the conduct of the proposed research.

b. Patents

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

c. Procurement Contracts

- **Noncommercial Items (Technical Data and Computer Software):** Proposers requesting a procurement contract must list all noncommercial technical data and computer software that it plans to generate, develop, and/or deliver, in which the Government will acquire less than unlimited rights and to assert specific restrictions on those deliverables. In the event a proposer does not submit the list, the Government will assume that it has unlimited rights to all noncommercial technical data and computer software generated, developed, and/or delivered, unless it is substantiated that development of the noncommercial technical data and computer software occurred with mixed funding. If mixed funding is anticipated in the development of noncommercial technical data and computer software generated, developed, and/or delivered, proposers should identify the data and software in question as subject to GPR. In accordance with DFARS 252.227-7013, "Rights in Technical Data - Noncommercial Items," and DFARS 252.227-7014, "Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation," the Government will automatically assume that any such GPR restriction is limited to a period of 5 years, at which time the Government will acquire unlimited rights unless the parties agree otherwise. The Government may use the list during the evaluation process to evaluate the impact of any identified restrictions and may request additional information from the proposer, as may be necessary, to evaluate the proposer's assertions. Failure to provide full information may result in a determination that the proposal is non-conforming. A template for complying with this request is provided in Section IV.B.2.

- **Commercial Items (Technical Data and Computer Software):** Proposers requesting a procurement contract must list all commercial technical data and commercial computer software that may be included in any noncommercial deliverables contemplated under the research project, and assert any applicable restrictions on the Government's use of such commercial technical data and/or computer software. In the event a proposer does not submit the list, the Government will assume there are no restrictions on the Government's use of such commercial items. The Government may use the list during the evaluation process to evaluate the impact of any identified restrictions and may request additional information from the proposer to evaluate the proposer's assertions. Failure to provide full information may result in a determination that the proposal is non-conforming. A template for complying with this request is provided in Section IV.B.2.

d. Other Types of Awards

Proposers requesting an award instrument other than a procurement contract shall follow the applicable rules and regulations governing those award instruments, but in all cases should appropriately identify any potential restrictions on the Government's use of any intellectual property contemplated under those award instruments. This includes both noncommercial items and commercial items. The Government may use the list as part of the evaluation process to assess the impact of any identified restrictions, and may request additional information from the proposer, to evaluate the proposer's assertions. Failure to provide full

information may result in a determination that the proposal is non-conforming. A template for complying with this request is provided in Section IV.B.2.

5. Program-generated Data

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

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

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

6. Human Subjects Research (HSR)/Animal Use

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

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

Proposers and awardees may be subject to the DARPA requirements related to CUI or CTI on Non-DoD Information Systems as detailed at www.darpa.mil/work-with-us/additional-baa.

CUI and CTI guidance and/or a CUI/CTI guide may be required depending on system and/or the populations performers propose to study. DARPA will make a determination if a CUI/CTI guide is necessary during the selection process and selectees will be notified of CUI/CTI guidance during contract negotiations. Proposers should indicate if they believe their approach will include CUI or CTI in their proposal.

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

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

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

CTI is to be marked “DISTRIBUTION C. Distribution authorized to U.S. Government agencies and their contractor; Critical Technology; Current date. Other requests for this document shall be referred to DARPA, DSO” in accordance with Department of Defense Instruction 5230.24, "Distribution Statements on Technical Documents."

8. Electronic Invoicing and Payments

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

9. Electronic and Information Technology

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

10. Publication of Agreements

Per Section 8123 of the Department of Defense Appropriations Act, 2015 (Pub. L. 113-235), all Agreements must be posted on a public website in a searchable format. To comply with this requirement, proposers requesting Agreements must submit a maximum one (1) page abstract that may be publicly posted and explains the program or project to the public. 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 Agreement proposals that are not selected for award will not be publicly posted.

11. Disclosure of Information and Compliance with Safeguarding Covered Defense

Information Controls

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

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

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

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

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

C. Reporting

1. Technical and Financial Reports

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

2. Patent Reports and Notifications

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

VII. Agency Contacts

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

- **Technical POC**: Dr. Bart Russell, Program Manager, DARPA/DSO

- **BAA Email:** Habitus@darpa.mil

- **BAA Mailing Address:**

  DARPA/DSO
  ATTN: HR001120S0035
  675 North Randolph Street
  Arlington, VA 22203-2114

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

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

VIII. Other Information

A. Frequently Asked Questions (FAQs)

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

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

B. Proposers Day

The Habitus Proposers Day was held on February 10, 2020 at the Strategic Analysis Executive Conference Center, 4075 Wilson Blvd., Suite 300, Arlington, VA 22203. The Government's presentation is published under HR001120S0035 on the DARPA's Opportunity Page, https://www.darpa.mil/work-with-us/opportunities?tFilter=&oFilter=2&sort=date.