Broad Agency Announcement
Wideband Adaptive RF Protection (WARP)
Microsystems Technology Office
HR001120S0027
January 30, 2020
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ATTACHMENT 2: Proposal Summary Slide Template
ATTACHMENT 3: Controlled Unclassified Information (CUI) Guide
PART I: OVERVIEW INFORMATION

- **Federal Agency Name**: Defense Advanced Research Projects Agency (DARPA), Microsystems Technology Office (MTO)
- **Funding Opportunity Title**: Wideband Adaptive RF Protection (WARP)
- **Announcement Type**: Initial Announcement
  - **Funding Opportunity Number**: HR001120S0027
- **Catalog of Federal Domestic Assistance Numbers (CFDA)**: 12.910 Research and Technology Development
- **Dates**: (All times listed herein are Eastern Time)
  - Posting Date: January 30, 2020
  - Proposers Day: February 11, 2020
  - Abstract Due Date: March 9, 2020
  - FAQ Submission Deadline: April 9, 2020
  - Proposal Due Date: April 23, 2020
  - Estimated period of performance start: September 2020
- **Concise description of the funding opportunity**: DARPA seeks innovative proposals to develop wideband, adaptive RF filters and cancellers that selectively attenuate interference and protect wideband digital radios from saturation. When exposed to interference/self-interference, the filters and cancellers will automatically sense and adapt to the electromagnetic environment through the intelligent control of its adaptive hardware. WARP will ultimately enable the use of wideband software defined radios in congested and contested environments.
- **Anticipated Funding Available for Award**: It is anticipated that $40M of total funding will be awarded across both technical areas, approximately partitioned as follows:
  - $20M for Technical Area 1 (TA1), 3 phases, 48 months, 6.2 funding;
  - $20M for Technical Area 2 (TA2), 3 phases, 48 months, 6.2 funding.
- **Anticipated individual awards**: Multiple awards are anticipated.
- **Anticipated funding type**: 6.2
- **Types of instruments that may be awarded**: Procurement contract, grant, cooperative agreement or other transaction.
- **Agency contact**:
  - Dr. Timothy Hancock, Program Manager
    BAA Coordinator: HR001120S0027@darpa.mil
    DARPA/MTO
    ATTN: HR001120S0027
    675 North Randolph Street
    Arlington, VA 22203-2114
PART II: FULL TEXT OF ANNOUNCEMENT

I. Funding Opportunity Description

The Defense Advanced Research Projects Agency (DARPA) often selects its research efforts through the Broad Agency Announcement (BAA) process. This BAA is being issued, and any resultant selection will be made, using the procedures under Federal Acquisition Regulation (FAR) 6.102(d)(2) and 35.016 and 2 C.F.R. § 200.203. Any negotiations and/or awards will use procedures under FAR 15.4, Contract Pricing. Proposals received as a result of this BAA shall be evaluated in accordance with evaluation criteria specified herein through a scientific review process.

DARPA BAAs are posted on the beta SAM website, under the Contract Opportunities (FBO) link, at https://beta.sam.gov/, and, as applicable, the grants.gov website at http://www.grants.gov/. The following information is for those wishing to respond to the BAA.

The Microsystems Technology Office at DARPA seeks innovative proposals to develop wideband adaptive filtering and self-interference cancellation circuits to enable the use of wideband software defined radios in spectrum-congested environments. When exposed to external interference or self-interference, WARP signal filters and cancellers will sense and adapt to the electromagnetic environment through the intelligent control of adaptive hardware.

A. Background

Historically, digital receivers have been narrowband because they have been limited by analog-to-digital converter (ADC) bandwidth. For these narrowband systems, pre-planned filtering has been used to prevent unwanted signals from reaching the ADC. In the last decade, however, ADC technology has achieved greater than 10 GHz of instantaneous bandwidth with 8-10 effective number of bits (ENOB). This performance is now sufficient for use in wideband digital receivers but poses two challenges with respect to dynamic range. Wideband ADCs typically have a smaller available input voltage swing and therefore reduced dynamic range when compared to their narrowband counterparts. Additionally, as the bandwidth increases, more signals are potentially observed which mean larger voltage swings into the ADC, further stressing the dynamic range. The Wideband Adaptive RF Protection (WARP) program seeks to protect these wideband receivers against both external and self-interference through adaptive equalization of the input spectrum to stay within the dynamic range of a wideband digital receiver.

Today, receivers are protected from external interference through static filtering, automatic gain control, or signal limiters. With static filtering, only a fraction of the digital receiver bandwidth is used, which gives good sensitivity but does not leverage the full available bandwidth of the receiver. The use of automatic gain control takes full advantage of the bandwidth of the system, but decreases the sensitivity to small signals. Finally, the use of signal limiters can cause cross-modulation distortion and may decrease the overall sensitivity of the system. The use of tunable filters is often the desired solution, but they rarely are able to tune over the bandwidth that is
achievable today in wideband receivers. To achieve wideband coverage, designers will often implement a mix of tuned and switched filter banks, but the inclusion of explicitly switched signal paths can incur additional loss and often precludes the creation of a multi-band filter response.

For the case of self-interference, receivers are protected through half-duplex operation, antenna isolation, or signal cancellation. Half-duplex operation disconnects the receiver when the transmitter is turned on, eliminating the possibility of full-duplex operation. Antenna isolation is implemented with circulators, electrically balanced duplexers (EBDs), or frequency duplexers which all have narrowband limitations and, in the case of frequency duplexing, does not support same-frequency full-duplex operation. Antenna isolation is also implemented with cross-polarized antenna feeds or physical antenna separation for good wideband operation but does not provide sufficient total system isolation and is frequently limited by antenna installation constraints. Finally, signal cancellation must be used in conjunction with one of the antenna isolation techniques, but because of the bandwidth limitations, there are virtually no signal cancellation solutions to pair with wideband antenna isolation techniques. While narrowband techniques have been implemented in the literature, they often use only a few frequency or time taps and can therefore only cancel signals over a narrow bandwidth with a short delay spread in the leakage path.

B. Program Description

The goal of the WARP program is to develop wideband, adaptive filters and analog signal cancellers that selectively attenuate or cancel external and self-interference to protect wideband digital radios from saturation, ultimately enabling the use of software-defined radios in congested and dynamic spectral environments.

For external interference, the ideal wideband receiver would continuously sense the electromagnetic environment and adaptively react in the presence of jammers or blockers to maintain dynamic range without decreasing sensitivity and bandwidth. WARP adaptive filters will automatically reconfigure their frequency response to include pass/stop bands with bandwidth and center frequency tuning and selectively attenuate large signals while passing small or desired signals. The challenge is to do this over a wide bandwidth with low insertion loss so that it may be used at the input of a receiver. Today, most chip-scale tunable filters are limited to a 2:1 tuning ratio or less without explicit band switching. The WARP program will demonstrate adaptive RF filtering of external interference with a 9:1 tuning ratio to provide full-band coverage across 2-18 GHz. It is expected that this will be achieved through innovative filter architectures supported by state-of-the-art components and packaging.

In same-frequency simultaneous transmit and receive (STAR), antenna isolation alone is not sufficient to attenuate the transmitter leakage from interfering with the receiver. Even with good antenna isolation (e.g., 30-40 dB), this problem is made more severe as the transmit power is increased above 1 Watt. For example, with 40-50 dBm of transmit power and 30 dB of antenna isolation, this is still 10-20 dBm at the input of the receiver, exceeding the dynamic range of the receiver by 30-40 dB. For wideband analog signal cancellation, the canceller must be able to match the transfer function of the leakage path between the two antenna ports. Depending on the band of operation and the geometry of the antennas, the variation in the time delay due to dispersion and
multi-path can be in the range of 5-50 ns. For wideband operation, this will require the canceller to have a time-bandwidth product of approximately 10, well beyond the state-of-the-art. This differs from early research in this field where narrowband solutions were implemented with simple vector modulation over a fixed delay window. Achieving long and controllable time delays with chip-scale (or even board-scale) solutions have been the limiting factor. The WARP program will demonstrate adaptive STAR signal cancellation across the full bandwidth of either 100-1000 MHz or 1-6 GHz. It is expected that this will require innovation in circuits and components that do not rely solely on electromagnetic delay lines to achieve the desired time-bandwidth product.

In these new approaches to wideband reconfigurable filtering and signal cancellation, it is expected that the number of tuning inputs could be in the range of 10-100. Controlling the hardware through pre-planned lookup tables alone would likely be ineffective because the system will need to adapt to the environment in real-time. Adaptation will likely require a combination of embedded sensing at multiple nodes within the hardware and control that mixes a priori look-up tables and adaptive light-weight algorithms. When exposed to external or self-interference, WARP signal filters and cancellers will sense and adapt through the intelligent control of the hardware, despite the many degrees of freedom.

![Figure 1: WARP Program Block Diagram](image1)

![Figure 2: WARP Program Structure](image2)
C. Program Structure

As shown in Figure 1, WARP will be executed across two technical areas (TAs): TA1 - Wideband Adaptive Filtering and TA2 - Wideband Signal Cancellation. The total program is expected to run 48 months, where Phase 1 and Phase 2 will each be 18 months long, while Phase 3 will last 12 months. An overall schedule for the program is shown in Figure 2. DARPA anticipates funding multiple performers with a variety of technical approaches in each technical area. It is expected that fewer performers will be funded in Phases 2 and 3 of the program. Options may be exercised, at the Government’s sole discretion, based on technical progress demonstrated against the metrics defined in this BAA and based on funding availability.

D. Technical Areas

Technical Area 1 (TA1): Wideband Adaptive Filtering, 48 Months

The goal of TA1 is to demonstrate adaptive RF filtering that ultimately provides a 9:1 tuning ratio for full-band coverage across 2-18 GHz. This will be achieved in steps throughout the program by exceeding 2:1 tuning ratio for Phase 1 and exceeding 3:1 tuning in Phase 2, before building a full-band solution in Phase 3. The focus of this TA is on the development of novel circuit architectures with state-of-the-art components that break the limitations of traditional tunable RF filters and simultaneously meet or exceed the program metrics for TA1 listed in Table 1. There are many metrics to guide the development with the top priority being broadband adaptive tunability. Filters may be configured as either bandpass or bandstop with a preference for supporting both modes such that the filter transfer function is fully tailorable to the situation. The filters can be either continuously or digitally tunable, in both center frequency and bandwidth, as long as they fully cover the entire frequency range specified in the metrics. Additional proposer-defined metrics may be included in the abstract and full proposal as long as they are consistent with the goals and metrics of the program and TA1.

Another key aspect of TA1 will be an embedded sensing approach that will be used for determining how the tunable filter should adapt to the environment in Phase 1. It is expected that this information will be used in Phase 2 to implement a control algorithm where the embedded sensing will provide the inputs to a closed-loop system control that will tune the adaptive filter in response to the environment and/or external stimulus. While the metrics in Table 1 do not explicitly contain a device size, the size of the tunable filter hardware and embedded sensing should be minimized and made consistent with current integrated microwave assembly packaging. The size and power consumption of the control electronics are not included in the metrics and commercial off-the-shelf (COTS) processing may be used for demonstration. The resulting hardware should be on an evaluation board with appropriate connectors to interface with test equipment, along with sufficient documentation in the event that the government chooses to perform independent testing.

Phase 1 (Base) – The goal of Phase 1 is to demonstrate open-loop tunable filtering meeting the Phase 1 metrics based on a technology that will readily scale in tuning ratio and be able to meet the metrics of subsequent phases. Only open-loop, off-line control is necessary for this phase (Matlab, Labview, etc.). There should also be a focus on embedded sensing to facilitate future closed-loop tuning. The embedded sensing may include techniques such as measurement of the
input or output port of the tunable filter or the measurement of internal nodes of the filter. The use
of test equipment, such as network analyzers, spectrum analyzers or oscilloscopes at the ports of
the filter is not considered embedded sensing and is prohibited. The choice of center frequency
within the 2-18 GHz band for Phase 1 is left to the performers, but the rationale for why the range
was chosen as a starting point in Phase 1 should be justified in the proposal.

**Phase 2 (Option)** – The goal of Phase 2 is to scale the tuning beyond an octave and implement
closed-loop adaptive tuning while simultaneously meeting the metrics of Phase 2 where linearity
and power handling metrics increase. As in Phase 1, the choice of center frequency, within the 2-
18 GHz band, is left to the performers, but that choice should be justified in the proposal. Closed-
loop control based on the embedded sensing and COTS processing hardware will sense changes
in the environment and intelligently reconfigure filter parameters to optimally suppress
interference. As the number of inputs could be large and the response function potentially not a
monotonic surface, solutions may require the development of a mix of *a priori* look-up tables and
adaptive algorithms or other innovative methods.

**Phase 3 (Option)** – The goal of Phase 3 is demonstrate tuning over the entire band of 2-18 GHz,
as well as simultaneously meeting or exceeding all Phase 3 metrics. As in Phase 2, adaptive real-
time control of the filter response will be an integral part of the demonstration.

<table>
<thead>
<tr>
<th>TA1 Metric</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating band of interest</td>
<td>2-18 GHz</td>
<td>2-18 GHz</td>
<td>2-18 GHz</td>
<td>1</td>
</tr>
<tr>
<td>Average insertion loss (passive circuits)</td>
<td>&lt;5 dB</td>
<td>&lt;3 dB</td>
<td>&lt;3 dB</td>
<td>2</td>
</tr>
<tr>
<td>Average noise figure (active circuits)</td>
<td>&lt;8 dB</td>
<td>&lt;6 dB</td>
<td>&lt;6 dB</td>
<td>2</td>
</tr>
<tr>
<td>Center frequency tuning ratio</td>
<td>&gt;2:1</td>
<td>&gt;3:1</td>
<td>Full-band solution</td>
<td>3</td>
</tr>
<tr>
<td>Bandwidth tuning ratio</td>
<td>&gt;3:1</td>
<td>&gt;5:1</td>
<td>&gt;5:1</td>
<td>4</td>
</tr>
<tr>
<td>In-band IIP3</td>
<td>&gt;15 dBm</td>
<td>&gt;20 dBm</td>
<td>&gt;20 dBm</td>
<td>5</td>
</tr>
<tr>
<td>Out-of-band IIP3</td>
<td>&gt;50 dBm</td>
<td>&gt;60 dBm</td>
<td>&gt;60 dBm</td>
<td>6</td>
</tr>
<tr>
<td>Out-of-band rejection</td>
<td>&gt;30 dB</td>
<td>&gt;40 dB</td>
<td>&gt;40 dB</td>
<td>7</td>
</tr>
<tr>
<td>Maximum out-of-band input signal</td>
<td>&gt;10 dBm</td>
<td>&gt;20 dBm</td>
<td>&gt;20 dBm</td>
<td>8</td>
</tr>
<tr>
<td>Maximum allowable output power</td>
<td>&lt;-20 dBm</td>
<td>&lt;-20 dBm</td>
<td>&lt;-20 dBm</td>
<td>9</td>
</tr>
<tr>
<td>Expected in-band input signal</td>
<td>&lt;-20 dBm</td>
<td>&lt;-20 dBm</td>
<td>&lt;-20 dBm</td>
<td>10</td>
</tr>
<tr>
<td>Built-in intelligence</td>
<td>Embedded sensing only</td>
<td>Closed-loop adaptivity</td>
<td>Closed-loop adaptivity</td>
<td>11</td>
</tr>
<tr>
<td>Reconfiguration speed</td>
<td>NA</td>
<td>&lt;100 µs</td>
<td>&lt;100 µs</td>
<td>12</td>
</tr>
<tr>
<td>Power consumption</td>
<td>&lt;250 mW</td>
<td>&lt;250 mW</td>
<td>&lt;250 mW</td>
<td>13</td>
</tr>
</tbody>
</table>

**Table 1: TA1 - Wideband Adaptive Filtering Metrics**

**Table 1 Notes:**
1) The frequency band in which the filter will operate. Only in Phase 3 will full band coverage
   be a goal. See center frequency tuning in note 3.
2) For passive circuits the average insertion loss shall be measured over the -3 dB bandwidth and
   shall include any loss due to embedded sensing. If the design has active embedded RF gain,
   then noise figure shall be used as the relevant metric to track the impact on receiver sensitivity.
3) Ratio of the highest to lowest center frequency of the pass/stop band over which the filter is tuned and there shall be no gaps over the tuning range.

4) Ratio of the highest to lowest bandwidth of the pass/stop band over which the filter is tuned. For bandpass, the bandwidth is defined as the -3 dB bandwidth and for bandstop, the bandwidth is defined by the out-of-band rejection metric.

5) The input third-order intercept point (IIP3) measured using two tones in the passband.

6) The input third-order intercept point (IIP3) measured using two tones in the stopband.

7) For both bandpass and bandstop performance, this is the rejection in the stopband and may be a tunable parameter between the metric and 0 dB. For bandpass, the transition bandwidth from passband to stopband may be performed defined based on the chosen resonator quality factor and filter order. For bandstop, the stopband will be self-consistent with the reported bandwidth tuning; see note 4.

8) The maximum input power level of a single tone in the stopband.

9) The total output power, in-band and out-of-band, at the output of the filter. This is the expected maximum signal allowed into a typical wideband receiver that would follow the WARP filter and the corresponding peak-to-peak voltage may be considered as the threshold for protecting the receiver against distortion.

10) The maximum input power level of a single tone in the passband.

11) In Phase 1, only embedded sensing will be implemented and filter control may be implemented off-line (Matlab, Labview, etc.) for characterization of the other metrics. In Phase 2 and 3, a real-time COTS controller may be used for closed-loop control, based on the embedded sensing and consistent with the reconfiguration speed metric.

12) Reconfiguration speed is the total delay from an environmental change or other external control stimulus until the observed change in the output of the RF signal. This time is expected to include any delay in the sensing, computation and hardware control.

13) Power consumption is the total power needed for the filter and any embedded sensing. The power of any COTs processing in Phase 2 and Phase 3 is not included because power reduction of an FPGA or microcontroller implementation is not a goal of this program and could be optimized in the future on a per application basis.

**Technical Area 2 (TA2): Wideband Signal Cancellation, 48 Months**

The goal of TA2 is to demonstrate adaptive RF self-interference cancellation that covers a wide instantaneous bandwidth in the presence of a multi-path, delay spread leakage channel between the transmitter and receiver. The delay spread between two wideband antennas will be dependent on the size of the antennas, and therefore the 0.1-6 GHz band of interest is broken into a low-band (100-1000 MHz) and a high-band (1-6 GHz). Performers may choose to implement a solution in the low-band, the high-band, or both. The instantaneous bandwidth and delay spread can be multiplied together for a time-bandwidth product (BT) that is one of the characteristic challenges of this TA. Exceeding a unity BT has proven difficult based on published results, so in Phase 1, the metrics will require a BT of approximately 2 and in Phase 2, this will need to improve to approximately 10 through scaling of both the instantaneous bandwidth and supported delay spread. An example of a leakage path between two wideband low-band antennas is shown in Figure 3. This TA seeks to develop new cancellation circuit architectures that break this BT limitation and meet or exceed the program metrics for TA2 listed in Table 2. There are many metrics to guide the development with the top priority being the instantaneous bandwidth and supported delay.
spread. Additional proposer-defined metrics may be included in the abstract and full proposal as long as they are consistent with the goals and metrics of the program and TA2.

Figure 3: Example antenna isolation in the low band (a) frequency and (b) time domain

Another key aspect of TA2 will be an embedded sensing approach that will be used for open-loop signal/channel sensing in Phase 1. It is expected that this information will be used in Phase 2 to implement a closed-loop control algorithm. While the metrics in Table 2 do not explicitly contain a device size as this is potentially dependent on the frequency band and implementation strategy, the size of the tunable canceller hardware and embedded sensing should be consistent with current integrated microwave assembly packaging with a preference toward chip-scale sizes where possible. The size and power consumption of the control electronics are not included in the metrics and COTS processing may be used for demonstration. The resulting hardware should be on an evaluation board with appropriate connectors to interface with test equipment, along with sufficient documentation in the event that the government chooses to perform independent testing.

It is well understood that over >130 dB of cancellation is potentially needed to completely suppress the self-interference of a transmitter to the noise floor of a receiver. Achieving such a large number will likely involve a tiered approach that uses a combination of antenna isolation, analog cancellation, and digital cancellation. **TA2 is specifically only about the analog cancelation needed to protect a wideband digital receiver from the large signal on the antenna receive port.** Research that seeks to improve antenna isolation or digital cancellation is beyond the scope of this program. **Responses that propose (1) to improve antenna isolation through antenna design, circulators, electrically balanced duplexers, or frequency duplexers, or (2) to develop digital cancellation approaches implemented after the ADC to remove residual leakage, will be considered non-responsive to the BAA.**
Phase 1 (Base) – The goal of Phase 1 is to demonstrate open-loop control of a self-interference RF canceller based on a technology that will readily scale in tuning and BT and be able to meet or exceed the metrics of subsequent phases. Only open-loop off-line control is necessary for this phase (Matlab, Labview, etc.). There should also be a focus on embedded sensing to facilitate future closed-loop control. The use of a baseline leakage channel estimate from an off-line factory calibration as a starting point is acceptable. The choice of frequency tuning range within the chosen band is left to the performers, but the rationale for why the range was chosen as a starting point in Phase 1 should be justified in the proposal.

Phase 2 (Option) – The goal of Phase 2 is to scale the BT by 5x and the tuning range to 3:1 while simultaneously meeting the metrics of Phase 2 where linearity and power handling metrics increase. Additionally, closed-loop adaptive tuning will be demonstrated to adapt to changes in the leakage channel after a baseline factory calibration. As in Phase 1, the choice of center frequency within the chosen band is left to the performers, but should be justified in the proposal. Closed-loop control based on the embedded sensing and COTS processing hardware will sense changes in the leakage channel and intelligently reconfigure canceller parameters to optimally cancel the transmitter leakage. As the number of inputs could be large and the response function potentially not a monotonic surface, solutions may require the development of a mix of *a priori* look-up tables and adaptive algorithms or other innovative methods.

Phase 3 (Option) – The goal of Phase 3 is to demonstrate full-band coverage (low-band, high-band, or both) as well as simultaneously meeting or exceeding all Phase 3 metrics. As in Phase 2, self-adaptive, real-time control of the canceller response will be an integral part of the demonstration.

<table>
<thead>
<tr>
<th>TA2 Metric</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating band of interest</td>
<td>0.1-1 GHz (low-band) and/or 1-6 GHz (high-band)</td>
<td>&gt;2:1</td>
<td>&gt;3:1</td>
<td>Full-band solution</td>
</tr>
<tr>
<td>Center frequency tuning</td>
<td>&gt;100 MHz / &gt;400 MHz</td>
<td>&gt;250 MHz / &gt;1000 MHz</td>
<td>&gt;250 MHz / &gt;1000 MHz</td>
<td>3</td>
</tr>
<tr>
<td>Low / high-band cancellation bandwidth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low / high-band delay spread</td>
<td>&gt;25 ns / &gt;5 ns</td>
<td>&gt;50 ns / &gt;10 ns</td>
<td>&gt;50 ns / &gt;10 ns</td>
<td>4</td>
</tr>
<tr>
<td>Tx signal cancellation</td>
<td>&gt;35 dB</td>
<td>&gt;45 dB</td>
<td>&gt;45 dB</td>
<td>5</td>
</tr>
<tr>
<td>Coupled power from Tx output</td>
<td>&gt;10 dBm</td>
<td>&gt;20 dBm</td>
<td>&gt;20 dBm</td>
<td>6</td>
</tr>
<tr>
<td>Maximum power to cancel at Rx input</td>
<td>&gt;10 dBm</td>
<td>&gt;20 dBm</td>
<td>&gt;20 dBm</td>
<td>7</td>
</tr>
<tr>
<td>Residual power after signal cancellation</td>
<td>&lt;25 dBm</td>
<td>&lt;25 dBm</td>
<td>&lt;25 dBm</td>
<td>8</td>
</tr>
<tr>
<td>C canceller OIP3</td>
<td>&gt;50 dBm</td>
<td>&gt;60 dBm</td>
<td>&gt;60 dBm</td>
<td>9</td>
</tr>
<tr>
<td>Residual noise figure impact</td>
<td>&lt;4 dB</td>
<td>&lt;2 dB</td>
<td>&lt;2 dB</td>
<td>10</td>
</tr>
<tr>
<td>Built-in intelligence</td>
<td>Embedded sensing only</td>
<td>Closed-loop adaptivity</td>
<td>Closed-loop adaptivity</td>
<td>11</td>
</tr>
<tr>
<td>Reconfiguration speed</td>
<td>NA</td>
<td>&lt;100 µs</td>
<td>&lt;100 µs</td>
<td>12</td>
</tr>
<tr>
<td>Power consumption</td>
<td>&lt;250 mW</td>
<td>&lt;250 mW</td>
<td>&lt;250 mW</td>
<td>13</td>
</tr>
</tbody>
</table>

Table 2: TA2 - Wideband Signal Cancellation Metrics
Table 2 Notes:

1) Performers must choose to operate either across the low-band (100-1000 MHz) or the high-band (1-6 GHz) or choose both, and this selection must be clearly stated in the proposal.
2) Ratio of the highest to lowest center frequency over which the canceller is tuned. If digital tuning is implemented, there shall be no gaps over the tuning range.
3) The minimum instantaneous bandwidth of the canceller.
4) The difference in time between the longest leakage path and the shortage leakage path.
5) Attenuation of the transmitter self-interference achieved by the RF canceller.
6) The hypothetical RF power coupled from a high-power amplifier. This is the input power to the RF canceller and indicates the desired power handling of the RF canceller.
7) The maximum RF power that appears at the receiver input due to transmitter self-interference. This is also the effective RF power internal to the RF canceller that will be subtracted from the canceller receive input.
8) The residual RF power after signal cancellation at the output of the WARP canceller and the input of a wideband digital receiver. This power and the corresponding peak-to-peak voltage may be considered as the threshold for protecting the receiver against distortion.
9) Output referenced third-order intercept point (OIP3) of the canceller measured before any signal subtraction (or with no leakage path present). This will indicate the residual third-order intermodulation (IM3) products introduced by the canceller and should be measured at the maximum power that is to be cancelled at the Rx input (note 7). For example, in Phase 3, a 20 dBm maximum power, would indicate 2 tones at 14 dBm. With an OIP3 of 60 dBm, this will result in IM3 products at -92 dBc or -78 dBm.
10) The degradation in receive signal-to-noise ratio due to the addition of the canceller. This may include physical loss from the summing junction, but is typically residual uncancelled noise introduced by the canceller electronics.
11) In Phase 1, only embedded sensing will be implemented and canceller control may be implemented off-line (Matlab, Labview, etc.) for characterization of the other metrics. In Phase 2 and 3, a real-time COTS controller may be used for closed-loop control, based on the embedded sensing and consistent with the reconfiguration speed metric.
12) Reconfiguration speed is the total delay from an environmental change or other external control stimulus until the observed change in the output of the RF signal. This time is expected to include any delay in the sensing, computation and hardware control.
13) Power consumption is the total power needed for the canceller and any embedded sensing. The power of any COTs processing in Phase 2 and Phase 3 is not included because power reduction of an FPGA or microcontroller implementation is not a goal of this program and could be optimized in the future on a per application basis.

E. Schedule/Milestones

WARP is a 48-month, three-phase program with an expected kick-off in September 2020. A mandatory program kickoff meeting will be held to present the technical approach, discuss technical and programmatic items of concern, and to interact with the government team and other program performers. The end of each phase represents a major technical milestone in the program and end-of-phase review meetings will be scheduled approximately one month before the end of each phase. These meetings will be used to communicate the technical progress made, particularly with respect to the metrics, during the entire phase. Technical progress towards the goals of the
program represent the major deciding factor in funding decisions for the subsequent phase and will be monitored through quarterly teleconference calls and occasional site visits by the DARPA program manager along with other members of the government team. A summary of the program schedule is presented in Figure 4.

![Figure 4: WARP Program Schedule](image)

**F. Deliverables**

Program deliverables include quarterly technical slide presentations and monthly financial reports. Prior to each end-of-phase meeting, performers in both technical areas will provide to the Government a written report covering, a) description of the implemented WARP system, b) component lab test results, and c) charts and explanations of how well the system meets, exceeds, or falls short of specified program metrics (as described in this BAA). Additionally, and in both technical areas, two copies of the hardware will be submitted for independent verification and validation (IV&V) by the government. Sufficient documentation and support for testing at a government lab (AFRL, etc.) is required. Additionally, all design files will be delivered to the government team at the end of each phase to include, but not limited to mechanical drawings, schematic and layout databases of chips, packages and circuit boards, as well as any firmware, software and source code. Templates will be provided for quarterly telecons and will include technical updates with simulated measured results to demonstrate progress toward the program metrics, as well as an up to date financial spend plan.

**G. Government Furnished Equipment/Property/Information**

No Government Furnished Equipment, Property, or Information will be provided.

**H. Intellectual Property**

Any use of proposer-defined intellectual property (patents, proprietary information, etc.) should be clearly marked as such within the proposal. Include all proprietary claims to the results, prototypes, intellectual property, or systems supporting the effort and/or necessary for the use of the research, results, and/or prototype. If there are no proprietary claims, this should be stated. For forms to be completed regarding intellectual property, see Section IV.B.11.
II. Award Information

A. General Award Information

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

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

Awards under this BAA will be made to proposers on the basis of the evaluation criteria listed below (see section labeled “Application Review Information,” Sec. V.), and program balance to provide overall value to the Government. The Government reserves the right to request any additional, necessary documentation once it makes the award instrument determination. Such additional information may include but is not limited to Representations and Certifications (see Section VI.B.4., “Representations and Certifications”). The Government reserves the right to remove proposers from award consideration should the parties fail to reach agreement on award terms, conditions and cost-price within a reasonable time or the proposer fails to timely provide requested additional information. Proposals identified for negotiation may result in a procurement contract, grant, cooperative agreement, or other transaction, depending upon the nature of the work proposed, the required degree of interaction between parties, whether or not the research is classified as Fundamental Research, and other factors.

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

In accordance with 10 U.S.C. § 2371b(f), the Government may award a follow-on production contract or Other Transaction (OT) for any OT awarded under this 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 program goals as described herein may be met by proposed efforts for fundamental research and 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.
III. Eligibility Information

A. Eligible Applicants

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

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.

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

   (2) For classified proposals, applicants will ensure all industrial, personnel, and information systems processing security requirements are in place and at the appropriate level (e.g., Facility Clearance Level (FCL), Automated Information Security (AIS),
Certification and Accreditation (C&A), and any Foreign Ownership Control and Influence (FOCI) issues are mitigated prior to submission. Additional information on these subjects can be found at http://www.dss.mil.

B. Organizational Conflicts of Interest

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

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

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

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

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

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

C. Cost Sharing/Matching

Cost sharing is not required; however, it will be carefully considered where there is an applicable statutory condition relating to the selected funding instrument. Cost sharing is encouraged where there is a reasonable probability of a potential commercial application related to the proposed research and development effort.

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

D. Other Eligibility Criteria

Collaborative efforts/teaming are strongly encouraged. After proposal selections, the Government reserves the right to seek contractual arrangements, such as Associate Contractor Agreements (ACAs), between separate performers if doing so benefits the overall program/project goals and objectives and mutual interests of the parties.

IV. Application and Submission Information

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

A. Address to Request Application Package

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

B. Content and Form of Application Submission

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

1. Abstract Format

Proposers are strongly encouraged to submit an abstract in advance of a full proposal. Abstracts should follow the format described below in this section. The cover sheet should be clearly marked “ABSTRACT” and the total length of Section II should not exceed 5 pages.
Section I. Administrative

A. Cover sheet to include:
   (1) BAA number (HR001120S0027);
   (2) Technical area(s);
   (3) Lead Organization submitting abstract;
   (4) Type of organization, selected among the following categories:
       Large Organization, Small Disadvantaged Organization, Other Small Organization, HBCU, MI, Other Educational, Other Nonprofit;
   (5) Proposer’s internal reference number (if any);
   (6) Other team members (if applicable) and type of organization for each;
   (7) Proposal title;
   (8) Technical point of contact to include:
       Salutation, last name, first name, street address, city, state, zip code (+4),
       telephone, fax (if available), electronic mail;
   (9) Administrative point of contact to include:
       Salutation, last name, first name, street address, city, state, zip code (+4),
       telephone, fax (if available), electronic mail;
   (10) Total funds requested from DARPA, and the amount of cost share (if any); AND
   (11) Date proposal abstract was submitted.

(Note: An official transmittal letter is not required when submitting a Proposal Abstract.)

Section II. Abstract Details

A. Innovative Claims
   Summary of innovative claims for the proposed research. This section is the centerpiece of the abstract and should succinctly describe the uniqueness and benefits of the proposed approach relative to the current state-of-art alternate approaches. The technical area of interest, the mode of operation for TA1 (passband, stopband, both), and the choice of operating band (Low/High/Both) for TA2, should be clearly indicated.

B. Technical Approach
   Technical rationale, technical approach, and constructive plan for accomplishment of technical goals in support of innovative claims and deliverable production. This section should clearly and succinctly describe the uniqueness and benefits of the proposed approach. Proposers must include adequate detail and justification for any performer-defined metrics and goals. The abstract must provide a detailed analysis of how the proposed approach will meet the WARP program metrics and goals.

C. Cost and Schedule
   Provide a high-level cost estimate for resources (e.g. labor, materials) and any subcontractors over the proposed timeline of the project, broken down by Government fiscal year.
D. Capabilities & Teaming

A clearly defined organization chart for the program team which includes, as applicable: (1) the programmatic relationship of team members; (2) expertise and unique capabilities of team members; (3) team member responsibilities.

2. Full Proposal Format

All full proposals must be in the format given below. Proposals shall consist of two volumes: Volume I – Technical and Management Proposal (3 sections), and Volume II – Cost Proposal (4 sections). The submission of other supporting materials along with the proposals is strongly discouraged and will not be considered for review. Section II of Volume I, Technical and Management Proposal, shall not exceed 20 pages. The page limitation for full proposals includes all figures, tables, and charts. There is no page limit for Volume II, Cost Proposal.

A summary slide of the proposed effort, in PowerPoint format, should be submitted with the proposal. A template slide is provided as Attachment 2 to the BAA. Submit this PowerPoint file in addition to Volumes I and II of your full proposal. This summary slide does not count towards the total page count.

Proposers should not propose to more than one Technical Area in a single proposal. Proposers who wish to propose to more than one Technical Area must submit a separate full proposal for each individual Technical Area. Proposals must include all phases described herein for the associated Technical Area.

a. Volume I, Technical and Management Proposal

Section I. Administrative

A. Cover sheet to include:
   (1) BAA number (HR001120S0027);
   (2) Technical area(s);
   (3) Lead Organization submitting proposal;
   (4) Type of organization, selected among the following categories:
       Large Organization, Small Disadvantaged Organization, Other Small Organization,
       HBCU, MI, Other Educational, Other Nonprofit;
   (5) Proposer’s internal reference number (if any);
   (6) Other team members (if applicable) and type of organization for each;
   (7) Proposal title;
   (8) Technical point of contact to include:
       Salutation, last name, first name, street address, city, state, zip code (+4),
       telephone, fax (if available), electronic mail;
   (9) Administrative point of contact to include:
       Salutation, last name, first name, street address, city, state, zip code (+4),
       telephone, fax (if available), electronic mail;
   (10) Total funds requested from DARPA, and the amount of cost share (if any); AND
   (11) Date proposal was submitted.
B. Official transmittal letter.

The transmittal letter should identify the BAA number, the proposal by name, and the proposal reference number (if any), and should be signed by an individual who is authorized to submit proposals to the Government.

Section II. Detailed Proposal Information

A. Executive Summary

Summarize the technical approach, anticipated performance, and expected outcomes of the proposed effort. The executive summary should be concise and to the point, describing the uniqueness and benefits of the proposed approach relative to the current state-of-art approaches. Tables, graphs, and diagrams can be used as supplemental material along with narrative to convey the information. For TA1, the mode of operation (passband, stopband, or both), and for TA2, the choice of operating band (low, high or both), should be clearly indicated.

B. Technical Approach

This section is the centerpiece of the proposal and should communicate the innovative claims for the proposed research and clearly describe the proposed approach. This section should demonstrate that the proposer has a clear understanding of the state-of-the-art and should provide sufficient justification for the feasibility of the proposed approach(es). This section should include a detailed technical rationale, technical approach, and constructive plan for accomplishment of technical goals and metrics. The proposal must provide a detailed analysis of how the proposed approach will meet the DARPA metrics and goals.

For TA1 proposals, the Technical Approach must:

- State the frequency range within 2-18 GHz that will be chosen for implementation in Phase 1 and Phase 2 along with rationale for why the ranges were chosen as a path to achieve full-band, 2-18 GHz coverage by the end of Phase 3.
- State the absolute bandwidth of the proposed bandpass and/or bandstop filtering and how this relates to resonator quality factor (Q), chosen filter order and the stated insertion loss and stopband rejection goals of the program.
- As part of the adaptive control, state what will be sensed (power, voltage, current), where in the circuit it will be sensed and how it will be sensed.
- State the expected algorithm approach and processing requirements in Phase 2/3 for closed loop adaptation.
- State the testing strategy in each phase, especially as it pertains to Phase 2/3 where closed-loop adaptation will be implemented.
- Clearly state and justify any proposer-defined metrics.

For TA2 proposals, the Technical Approach must:

- State the frequency range within the low band and/or high band that will be chosen for implementation in Phase 1 and Phase 2 along with rationale for why the ranges were chosen as a path to achieve full-band (low band and/or high band) coverage by the end of Phase 3.
• State the number of expected time/frequency taps and how they will be controlled (tuned, switched, etc.) to achieve the combination of bandwidth, delay spread and cancellation stated in the metrics.
• As part of the adaptive control, state what will be sensed (power, voltage, current), where in the circuit it will be sensed and how it will be sensed.
• State the expected algorithm approach and processing requirements in Phase 2/3 for closed loop adaptation.
• State the testing strategy in each phase, especially as it pertains to Phase 2/3 where closed-loop adaptation will be implemented. State whether any wideband antenna isolation measurements will be made to characterize specific leakage channels. State how the transmit-to-receive leakage path will be emulated and the type of leakage channel that will be used for testing (multipath, amplitude distribution, etc.) and what waveforms will be used to demonstrate the bandwidth of the canceller.
• Clearly state and justify any proposer-defined metrics.

C. Statement of Work (SOW)
In plain English, clearly define the technical tasks/subtasks to be performed, their durations, and dependencies among them. The page length for the SOW will be dependent on the amount of the effort. The SOW must not include proprietary information. For each task/subtask, provide:
  1. A general description of the objective (for each defined task/activity);
  2. A detailed description of the approach to be taken to accomplish each defined task/activity;
  3. Identification of the primary organization responsible for task execution (prime, sub, team member, by name, etc.);
  4. The completion criteria for each task/activity - a product, event or milestone that defines its completion.
  5. Define all deliverables (reporting, data, reports, software, etc.) to be provided to the Government in support of the proposed research tasks/activities; AND
  6. Clearly identify any tasks/subtasks (prime or subcontracted) that will be accomplished on-campus at a university, if applicable.

Note: Each phase of the program must be separately defined in the SOW. Include a SOW for each subcontractor and/or consultant in the Cost Proposal Volume. Do not include any proprietary information in the SOW(s).

D. Schedules and measurable milestones
Schedules and measurable milestones for the proposed research. (Note: Measurable milestones should capture key development points in tasks and should be clearly articulated and defined in time relative to start of effort.) The milestones must not include proprietary information.

E. Risk Analysis and Mitigation Plan
Identify the major technical and programmatic risks in the program. Include a risk matrix. For each risk, assign a probability of occurrence on a scale of 1-10, where 10 indicates a high likelihood that the risk will impact program success, as well as an assessment of impact, also on a scale of 1-10, where 10 indicates that this risk would maximally limit the program from
delivering prototypes on schedule or meeting performance objectives. For each item with total risk (likelihood × impact) exceeding 40, include a plan for mitigating the risk and assessing risk reduction.

F. Proposer Accomplishments
Discussion of proposer’s previous accomplishments and work in closely related research areas.

G. Technology Transition and National Security Impact Statement
Describe plans to mature and transition funded technologies for use beyond the conclusion of the program. DARPA anticipates WARP technologies to be relevant for both commercial and defense applications, and impact through successful technology transition is an important goal of the program. Within the Technology Transition and National Security Impact section, proposals shall describe:

- How the proposed work contributes to U.S. national security and U.S. technological capabilities. The proposer may also summarize previous work that contributed to U.S. national security and U.S. technological capabilities.
- Plans and capabilities to transition technologies developed under this effort to U.S. national security applications and/or to U.S. industry. The proposer may also discuss previous technology transitions to the benefit of U.S. interests.

To reduce the potential for unintended foreign access to critical U.S. national security technologies developed under this effort, proposals shall describe:

- Any plans to transition technologies developed under this effort to foreign governments or to companies that are foreign owned, controlled or influenced. The proposer may also discuss previous technology transition to these groups.
- How the proposer will assist its employees and agents performing work under this effort to be eligible to participate in the U.S. national security environment.

H. Facilities and Equipment
Description of the facilities and equipment that would be used for the proposed effort and how they will support meeting program metrics.

I. Teaming
Describe the formal teaming arrangements which will be used to execute this effort. Describe the programmatic relationship between investigators and the rationale for choosing this teaming strategy. Present a coherent organization chart and integrated management strategy for the program team. For each person, indicate: (1) name, (2) affiliation, (3) abbreviated listing of all technical area tasks they will work on with roles, responsibilities, and percent time indicated, (4) discussion of the proposers’ previous accomplishments, relevant expertise and/or unique capabilities.

J. DARPA Embedded Entrepreneur Initiative (optional sub-section; does not count toward page count)
To catalyze the conversion of scientific discovery to impact, the Microsystems Technology Office offers applicants the opportunity for additional funding and transition assistance through participation in the Embedded Entrepreneur Initiative. The DARPA Embedded Entrepreneur
Initiative will provide additional funding, up to $250,000, to employ one entrepreneur-in-residence or one corporate business development lead. The entrepreneurial lead's ultimate goal is to develop a robust go to market strategy for entering into defense and commercial markets. All commercialization and transition activities will be timed to suit the Performer's stage of maturity. Often, the Embedded Entrepreneurial work is most useful in year two or three of a Program. Activities conducted can include, but are not limited to; cost modeling, end user engagement, market analysis and mapping, competitive analysis, techno-economic analysis, manufacturing and scale-up strategy, IP securement strategy, and financial plan creation. Embedded Entrepreneur participants will work closely with DARPA's Commercial Strategy team and their extensive network of U.S. investors, strategic partners, and mentors.

Proposers wishing to participate in the Embedded Entrepreneur Initiative must:

- Include an initial hypothesis describing how the proposed technology will transition from its current state to future integration into a product or capability.
- Include separately costed tasks describing plans to build and refine a viable Go to Market Strategy over the course of the DARPA program. Tasks contributing to the build of a robust Go to Market Strategy can include, but are not limited to; cost modeling, end user engagement, market analysis and mapping, competitive analysis, techno-economic analysis, manufacturing and scale-up strategy, IP securement strategy, and financial plan creation.

Participation in the Embedded Entrepreneur Initiative is voluntary but highly recommended. Participants are not expected to form a new company or leave their current research positions to pursue transition, but are expected to, throughout the lifecycle of the proposed effort, identify appropriate partners for enabling transition. Embedded Entrepreneur Initiative funding requests should be consistent with the proposed work scope and proposed timeline, but are anticipated to be in the range of $250,000 per Performer.

**Section III. Additional Information**

Information in this section may include a brief bibliography of relevant technical papers and research notes (published and unpublished) which document the technical ideas upon which the proposal is based. Copies of not more than three (3) relevant prior papers may be included in the submission.


All proposers, including FFRDCs, must submit the following:

**Section I. Administrative**

Cover sheet to include:

1. BAA number (HR001120S0027);
2. Technical area(s);
3. Lead Organization submitting proposal;
4. Type of organization, selected among the following categories:
Large Organization, Small Disadvantaged Organization, Other Small Organization, HBCU, MI, Other Educational, Other Nonprofit;
(5) Proposer’s internal reference number (if any);
(6) Other team members (if applicable) and type of organization for each;
(7) Proposal title;
(8) Technical point of contact to include:
   Salutation, last name, first name, street address, city, state, zip code (+4),
   telephone, fax (if available), electronic mail (if available);
(9) Administrative point of contact to include:
   Salutation, last name, first name, street address, city, state, zip code (+4),
   telephone, fax (if available), and electronic mail (if available);
(10) Award instrument requested:
   Cost-Plus-Fixed Fee (CPFF), Cost-contract—no fee, cost sharing contract—no fee,
   or other type of procurement contract (specify), Grant, Cooperative Agreement, or
   Other Transaction;
(11) Place(s) and period(s) of performance;
(12) Total proposed cost separated by basic award and option(s), if any, by calendar year
   and by government fiscal year;
(13) Name, address, and telephone number of the proposer’s cognizant Defense Contract
   Management Agency (DCMA) administration office (if known);
(14) Name, address, and telephone number of the proposer’s cognizant Defense Contract
   Audit Agency (DCAA) audit office (if known);
(15) Date proposal was prepared;
(16) DUNS number;
(17) TIN number;
(18) CAGE Code;
(19) Subcontractor Information;
(20) Proposal validity period (120 days is recommended); AND
(21) Any Forward Pricing Rate Agreement, other such approved rate information, or such
   documentation that may assist in expediting negotiations (if available).

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

Section II. Detailed Cost Information (Prime and Subcontractors)

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

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

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

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

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

E. Material/Equipment
(i) For IT and equipment purchases, include a letter stating why the proposer cannot provide the requested resources from its own funding.
(ii) A priced Bill-of-Material (BOM) clearly identifying, for each item proposed, the quantity, unit price, the source of the unit price (i.e., vendor quote, engineering estimate, etc.), the type of property (i.e., material, equipment, special test equipment, information technology, etc.), and a cross-reference to the Statement of Work (SOW) task/s that require the item/s. At time of proposal submission, any item that exceeds $2,000 must be supported with basis-of-estimate (BOE) documentation such as a copy of catalog price lists, vendor quotes or a written engineering estimate (additional documentation may be required during negotiations, if selected).
(iii) If seeking a procurement contract and items of Contractor Acquired Property are proposed, exclusive of material, the proposer shall clearly demonstrate that the inclusion of such items as Government Property is in keeping with the requirements of FAR Part 45.102. In accordance with FAR 35.014, “Government property and title,” it is the Government’s intent that title to all equipment purchased with funds available for research under any resulting contract will vest in the acquiring nonprofit institution (e.g., Nonprofit Institutions of Higher Education and Nonprofit Organizations whose primary purpose is the conduct of scientific research) upon acquisition without further obligation to the Government. Any such equipment shall be used for the conduct of basic and applied scientific research. The above transfer of title to all equipment purchased with funds available for research under any resulting contract is not allowable when the acquiring entity is a for-profit organization; however, such organizations can, in accordance with FAR 52.245-1(j), be given priority to acquire such property at its full acquisition cost.

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

Itemization of all subcontracts. Additionally, the prime contractor is responsible for compiling and providing, as part of its proposal submission to the Government, subcontractor proposals prepared at the same level of detail as that required by the prime. Subcontractor proposals include Interdivisional Work Transfer Agreements (ITWA) or similar arrangements. If seeking a procurement contract, the prime contractor shall provide a cost reasonableness analysis of all proposed subcontractor costs/prices. Such analysis shall indicate the extent to which the prime contractor has negotiated subcontract costs/prices and whether any such subcontracts are to be placed on a sole-source basis.

All proprietary subcontractor proposal documentation, prepared at the same level of detail as that required of the prime, which cannot be uploaded to the DARPA BAA website (https://baa.darpa.mil, BAAT) or Grants.gov as part of the proposer’s submission, shall be made immediately available to the Government, upon request, under separate cover (i.e., mail, electronic/email, etc.), either by the proposer or by the subcontractor organization. This does not relieve the proposer from the requirement to include, as part of their submission (via BAAT or Grants.gov, as applicable), subcontract proposals that do not include proprietary pricing information (rates, factors, etc.).

A Rough Order of Magnitude (ROM), or similar budgetary estimate, is not considered a fully qualified subcontract cost proposal submission. Inclusion of a ROM, or similar budgetary estimate, may result in the full proposal being deemed non-compliant or evaluation ratings may be lowered;

H. Cost-Sharing

The amount of any industry cost-sharing (the source and nature of any proposed cost-sharing should be discussed in the narrative portion of the cost volume).

I. Fundamental Research

Written justification required per Section II.B, “Fundamental Research,” pertaining to prime and/or subcontracted effort being considered Contracted Fundamental Research.

Note 1:
(a) “Cost or Pricing Data” as defined in FAR 15.403-4 shall be required if the proposer is seeking a procurement contract per the referenced threshold, unless the proposer requests and is granted an exception from the requirement to submit cost or pricing data. Per DoD Class Deviation 2018-O0012, dated 13 April 2018, the threshold for obtaining certified cost and pricing data is $2,000,000. Per DFARS 215.408(5), DFARS 252.215-7009, Proposal Adequacy Checklist, applies to all proposers/proposals seeking a FAR-based award (contract).
(b) In accordance with DFARS 215.403-1(4)(D), DoD has waived cost or pricing data requirements for nonprofit organizations (including educational institutions) on cost-reimbursement-no-fee contracts. In such instances where the waiver stipulated at DFARS 215.403-1(4)(D) applies, proposers shall submit information other than cost or pricing data to the extent necessary for the Government to determine price reasonableness and cost realism; and cost or pricing data from subcontractors that are not nonprofit organizations when the subcontractor’s proposal exceeds the cost and pricing data threshold at FAR 15.403-4(a)(1).
(c) Per Section 873 of the FY2016 National Defense Authorization Act (Pub L. 114-92), “Pilot Program For Streamlining Awards For Innovative Technology Projects,” small businesses and nontraditional defense contractors (as defined therein) are alleviated from submission of certified cost and pricing data for new contract awards valued at less than $7,500,000. In such instances where this “waiver” applies, proposers seeking a FAR-based contract shall submit information other than certified cost or pricing data to the extent necessary for the Government to determine price reasonableness and cost realism; and certified cost or pricing data from subcontractors that are not small businesses or nontraditional defense contractors when such subcontract proposals exceed the cost and pricing data threshold at FAR 15.403-4(a)(1).

(d) “Cost or pricing data” are not required if the proposer proposes an award instrument other than a procurement contract (i.e., cooperative agreement, grant, or other transaction).

Note 2:
Proposers are required to provide the aforementioned cost breakdown as an editable MS Excel spreadsheet, inclusive of calculations formulae, with tabs (material, travel, ODC’s) provided as necessary. The Government also requests and recommends that the Cost Proposal include MS Excel file(s) that provide traceability between the Bases of Estimate (BOEs) and the proposed costs across all elements and phases. This includes the calculations and adjustments that are utilized to generate the Summary Costs from the source labor hours, labor costs, material costs, etc. input data. It is requested that the costs and Subcontractor proposals be readily traceable to the Prime Cost Proposal in the provided MS Excel file(s) – although this is not a requirement, providing information in this manner will assist the Government in understanding what is being proposed both technically and in terms of cost realism. NOTE: If the PDF submission differs from the Excel submission, the PDF will take precedence.

Section III. Other Transaction Request, if applicable

All proposers requesting an Other Transaction (OT) must include a detailed list of payment milestones (Milestone Plan). Each milestone must include the following:

- Milestone description
- Completion/Exit criteria (to include identifying all associated data deliverables excluding those specifically providing project status)
- Due date
- Payment/funding schedule (to include, if cost share is proposed, awardee and Government share amounts)
- For each data deliverable, identify the proposed Government data rights (keeping in mind the how each data deliverable will need to be used by the Government given the goals and objectives of the proposed project)

It is noted that, at a minimum, milestones should relate directly to accomplishment of program technical metrics as defined in the BAA and/or the proposer’s proposal. Agreement type, expenditure or fixed-price based, will be subject to negotiation by the Agreements Officer. Do not include proprietary data.
Section IV. Other Cost Information

Where the effort consists of multiple portions which could reasonably be partitioned for purposes of funding, these should be identified as options with separate cost estimates.

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

The proposer should include supporting cost and pricing information in sufficient detail to substantiate the summary cost estimates and should include a description of the method used to estimate costs and supporting documentation.

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

3. Proprietary Information

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

4. Security Information

a. Program Security Information

Proposers should include with their proposal any proposed solution(s) to program security requirements unique to this program. Common program security requirements include but are not limited to: operational security (OPSEC) contracting/sub-contracting plans; foreign participation or materials utilization plans; program protection plans (which may entail the following) manufacturing and integration plans; range utilization and support plans (air, sea, land, space, and cyber); data dissemination plans; asset transportation plans; classified test activity plans; disaster recovery plans; classified material / asset disposition plans and public affairs / communications plans.

b. Unclassified Submissions

DARPA anticipates that submissions received under this BAA will be unclassified. However, should a proposer wish to submit classified information, an unclassified email must be sent to the BAA mailbox notifying the Technical Office PSO of the submission and the below guidance must be followed.
Security classification guidance and direction via a Security Classification Guide (SCG) and/or DD Form 254, “DoD Contract Security Classification Specification,” will not be provided at this time. 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. Both Classified and Unclassified Submissions

For a proposal that includes both classified and unclassified information, the proposal may be separated into an unclassified portion and a classified portion. The proposal should include as much information as possible in the unclassified portion and use the classified portion ONLY for classified information. The unclassified portion can be submitted through the DARPA BAA Website, per the instructions in Section IV.C.3.b, below. The classified portion must be provided separately, according to the instructions outlined in the ‘Classified Submissions’ section below.

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

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

“CLASSIFICATION DETERMINATION PENDING. Protect as though classified (insert the recommended classification level, e.g., Top Secret, Secret or Confidential)”

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

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

Proposers choosing to submit classified information from other collateral classified sources (i.e., sources other than DARPA) must ensure (1) they have permission from an authorized individual at the cognizant Government agency (e.g., Contracting Officer, Program Manager); (2) the proposal is marked in accordance with the source Security Classification Guide (SCG) from which the material is derived; and (3) the source SCG is submitted along with the proposal.
When a proposal includes a classified portion, and when able according to security guidelines, we ask that proposers send an e-mail to HR001120S0027@darpa.mil as notification that there is a classified portion to the proposal. When sending the classified portion via mail according to the instructions, proposers should submit six (6) hard copies of the classified portion of their proposal and two (2) CD-ROMs containing the classified portion of the proposal as a single searchable Adobe PDF file. Please ensure that all CDs are well-marked. Each copy of the classified portion must be clearly labeled with HR001120S0027, proposer organization, proposal title (short title recommended), and Copy _ of _.

Confidential and Secret Information

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

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

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

  OR

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

The inner envelope shall be addressed to:

Defense Advanced Research Projects Agency  
ATTN: Program Security Officer, MTO  
Reference: HR001120S0027  
675 North Randolph Street  
Arlington, VA 22203-2114

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

Defense Advanced Research Projects Agency  
Security & Intelligence Directorate, Attn: CDR  
675 North Randolph Street  
Arlington, VA 22203-2114
Top Secret Information
Use classification, handling, and marking guidance provided by previously issued SCGs, the DoD Information Security Manual (DoDM 5200.01, Volumes 1 - 4), and the National Industrial Security Program Operating Manual, including the Supplement Revision 1, (DoD 5220.22-M and DoD 5200.22-M Sup. 1). Top Secret information must be hand-carried by an appropriately cleared and authorized courier to the DARPA CDR. Prior to traveling, the courier shall contact the DARPA CDR at 703-526-4052 to coordinate arrival and delivery.

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

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

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

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

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

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

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

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

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

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

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

9. Grant Abstract

Per Section 8123 of the Department of Defense Appropriations Act, 2015 (Pub. L. 113-235), all grant awards must be posted on a public website in a searchable format. To comply with this
requirement, proposers requesting grant awards 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 grant proposals that are not selected for award will not be publicly posted.

10. Small Business Subcontracting Plan

Pursuant to Section 8(d) of the Small Business Act (15 U.S.C. § 637(d)) and FAR 19.702(a)(1), each proposer who is a small business concern and seeking a procurement contract that has subcontracting possibilities is required to submit a subcontracting plan with their proposal. The plan format is outlined in FAR 19.704. As of the date of publication of this BAA, per FAR 19.702, the threshold for submission of a small business subcontracting plan is $700,000 (total contract amount including options).

11. Intellectual Property

All proposers must provide a good faith representation that the proposer either owns or possesses the appropriate licensing rights to all intellectual property that will be utilized under the proposed effort.

a. For Procurement Contracts

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

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

b. For All Non-Procurement Contracts

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

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

13. 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.

14. Funding Restrictions

Not applicable.

C. Submission Information

DARPA will acknowledge receipt of all submissions and assign an identifying control number that should be used in all further correspondence regarding the submission. DARPA intends to use electronic mail correspondence regarding HR001120S0027. Submissions may not be submitted by fax or e-mail; any so sent will be disregarded.

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

All administrative correspondence and questions on this solicitation, including requests for clarifying information on how to submit an abstract or full proposal to this BAA should be directed to HR001120S0027@darpa.mil. DARPA intends to use electronic mail for correspondence regarding HR001120S0027. Proposals and abstracts may not be submitted by fax or e-mail; any so sent will be disregarded. DARPA encourages use of the Internet for retrieving the BAA and any other related information that may subsequently be provided.
1. Submission Dates and Times

a. Abstract Due Date
Abstracts must be submitted to DARPA via the BAA Website (https://baa.darpa.mil) on or before 1:00 PM, Eastern Time, March 9, 2020. Abstracts received after this time and date will not be reviewed.

b. Full Proposal Date
The full proposal must be submitted via the DARPA BAA website on or before 1:00 PM, Eastern Time, April 23, 2020. If deemed compliant, the Government will evaluate all such proposals in the initial round of selections. Additionally, proposals may be submitted after the above due date until 1:00 PM, Eastern Time, May 21, 2020. If deemed compliant, such proposals will be reviewed at the Government’s discretion, contingent upon the availability of funds. Proposers are warned that the likelihood of available funding is greatly reduced for proposals submitted after the initial closing date deadline. Failure to comply with the submission procedures may result in the submission not being evaluated.

c. Frequently Asked Questions (FAQ)
DARPA will post a consolidated Question and Answer (FAQ) document on a regular basis. To access the posting go to: http://www.darpa.mil/work-with-us/opportunities. Under the HR001120S0027 summary will be a link to the FAQ. Submit your question(s) by e-mail to HR001120S0027@darpa.mil. In order to receive a response sufficiently in advance of the proposal due date, send your question(s) on or before 1:00 PM, Eastern Time, April 9, 2020.

2. Abstract Submission Information
Proposers are strongly encouraged to submit an abstract in advance of a full proposal in order to provide potential proposers with a rapid response and to minimize unnecessary effort in proposal preparation and review. DARPA will acknowledge receipt of the submission and assign a control number that should be used in all further correspondence regarding the abstract.

All abstracts sent in response to HR001120S0027 shall be submitted via DARPA's BAA Website (https://baa.darpa.mil). Visit the website to complete the two-step registration process. Submitters will need to register for an Extranet account (via the form at the URL listed above) and wait for two separate e-mails containing a username and temporary password. After accessing the Extranet, submitters may then create an account for the DARPA BAA website (via the "Register your Organization" link along the left side of the homepage), view submission instructions, and upload/finalize the abstract. Proposers using the DARPA BAA Website may encounter heavy traffic on the submission deadline date; it is highly advised that submission process be started as early as possible.

All abstracts submitted electronically through the DARPA BAA Submission website must be uploaded as zip files (.zip or .zipx extension). The final zip file should only contain the document(s) requested herein and must not exceed 50 MB in size. Only one zip file will be accepted per abstract; abstracts not uploaded as zip files will be rejected by DARPA.
NOTE: YOU MUST CLICK THE ‘FINALIZE PROPOSAL ABSTRACT’ BUTTON AT THE BOTTOM OF THE CREATE PROPOSAL ABSTRACT PAGE. FAILURE TO DO SO WILL RESULT IN YOUR ABSTRACT NOT BEING OFFICIALLY SUBMITTED TO THIS BAA AND THEREFORE NOT BEING REVIEWED.

Please note that the DoD-issued certificate associated with the BAA website is not recognized by all commercial certificate authorities, resulting in untrusted connection errors/messages. You can either bypass the warning (possibly by adding https://baa.darpa.mil to your list of trusted sites, or darpa.mil as a trusted domain), or visit DISA’s site to download the Root Certificate Authority (CA): https://public.cyber.mil/from-iase/.

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

Note: DO NOT SUBMIT ABSTRACTS TO GRANTS.GOV.

3. Proposal Submission Information

The typical proposal should express a consolidated effort in support of one or more related technical concepts or ideas. Disjointed efforts should not be included into a single proposal. Proposals not meeting the format described in the BAA may not be reviewed.

a. For Proposers Requesting Grants or Cooperative Agreements:

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

Submissions: Proposers must submit the three forms listed below.

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

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

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

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

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

Form 2: Research and Related Senior/Key Person Profile (Expanded), available on the Grants.gov website at https://apply07.grants.gov/apply/forms/sample/RR_KeyPersonExpanded_2_0-V2.0.pdf. This form must be completed and submitted.

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

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

Proposers electing to submit grant or cooperative agreement proposals as hard copies must complete the same forms as indicated above.

b. For Proposers Requesting Technology Investment Agreements

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

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

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

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

- Name and address of the agencies and/or other parties supporting the other research projects
- Period of performance for the other research projects.

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

c. For Proposers Requesting Contracts or Other Transaction Agreements

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

All unclassified full proposals submitted electronically through the DARPA BAA website must be uploaded as zip files (.zip or .zipx extension). The final zip file should not exceed 50 MB in size. Only one zip file will be accepted per submission and submissions not uploaded as zip files will be rejected by DARPA.

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

Classified submissions and proposals requesting assistance instruments (grants or cooperative agreements) should NOT be submitted through DARPA's BAA Website (https://baa.darpa.mil), though proposers will likely still need to visit https://baa.darpa.mil to register their organization (or verify an existing registration) to ensure the BAA office can verify and finalize their submission.
Please note that the DoD-issued certificate associated with the BAA website is not recognized by all commercial certificate authorities, resulting in untrusted connection errors/messages. You can either bypass the warning (possibly by adding https://baa.darpa.mil to your listed of trusted sites, or darpa.mil as a trusted domain), or visit DISA’s site to download the Root Certificate Authority (CA): https://public.cyber.mil/from-iase/.

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

d. Classified Submission Information


4. Other Submission Requirements

Not applicable.

V. Application Review Information

A. Evaluation Criteria

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

1. Overall Scientific and Technical Merit

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

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 technical team has the expertise and experience to accomplish the proposed tasks.

2. Potential Contribution and Relevance to the DARPA Mission

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

The proposer clearly demonstrates its plans and capabilities to contribute to U.S. national security and U.S. technological capabilities. The evaluation will consider the proposer’s plans and capabilities to transition proposed technologies to U.S. national security applications and to U.S. on-shore industry. The evaluation may consider the proposer’s history of transitioning or plans to transition technologies to foreign governments or to companies that are foreign owned, controlled,
or influenced. The evaluation will also consider the proposer’s plans and capabilities to assist its employees and agents to be eligible to participate in the U.S. national security environment.

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

3. Cost Realism

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

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

B. Review and Selection Process

1. Review Process

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

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

Award(s) will be made to proposers whose proposals are determined to be the most advantageous to the Government, all factors considered, including the potential contributions of the proposed work to the overall research program and the availability of funding for the effort.
It is the policy of DARPA to ensure impartial, equitable, comprehensive proposal evaluations based on the evaluation criteria listed above and to select the source (or sources) whose offer meets the Government's technical, policy, and programmatic goals. Pursuant to FAR 35.016, the primary basis for selecting proposals for acceptance shall be technical, importance to agency programs, and fund availability. In order to provide the desired evaluation, qualified Government personnel will conduct reviews and (if necessary) convene panels of experts in the appropriate areas.

2. Handling of Source Selection Information

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

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

3. Federal Awardee Performance and Integrity Information (FAPIIS)

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

VI. Award Administration Information

A. Selection Notices

1. Abstracts

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

2. Proposals

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

B. Administrative and National Policy Requirements

1. Meeting and Travel Requirements

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

2. FAR and DFARS Clauses

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

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

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

4. Representations and Certifications


5. Terms and Conditions


C. Reporting

The number and types of reports will be specified in the award document, but will include as a minimum quarterly technical and monthly financial status reports. The reports shall be prepared and submitted in accordance with the procedures contained in the award document and mutually agreed on before award. Reports and briefing material will also be required as appropriate to document progress in accomplishing program metrics. A Final Report that summarizes the project and tasks will be required at the conclusion of the performance period for the award, notwithstanding the fact that the research may be continued under a follow-on vehicle.
D. Electronic Systems

   1. Wide Area Work Flow (WAWF)

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

   2. i-Edison

   The award document for each proposal selected for funding will contain a mandatory requirement for invention disclosures (and associated elections, confirmatory instruments, etc.) and patent reports to be submitted electronically through i-Edison ([https://public.era.nih.gov/iedison](https://public.era.nih.gov/iedison)).

   3. TFIMS

   The award document for each proposal selected for funding will contain a mandatory requirement for technical and status reports to be submitted electronically through DARPA’s TFIMS (or similar) web-based tool.

VII. Agency Contacts

   Administrative, technical or contractual questions should be sent via e-mail to HR001120S0027@darpa.mil. All requests must include the name, email address, and phone number of a point of contact.

   The technical POC for this effort is:

   Dr. Timothy Hancock  
   DARPA/MTO  
   ATTN: HR001120S0027  
   675 North Randolph Street  
   Arlington, VA 22203-2114  
   Email: HR001120S0027@darpa.mil

VIII. Other Information

   A. Proposers Day

   The WARP Proposers Day will be held on February 11, 2020 in Arlington, VA. Advance registration is required for both the physical meeting and the webcast. See DARPA-SN-20-25 posted at [https://beta.sam.gov/](https://beta.sam.gov/) for all details. Attendance at the WARP Proposers Day is not required to propose to this solicitation.
B. Protesting

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