18 Oct 2022

SPECIAL OPERATIONS FORCES ACQUISITION, TECHNOLOGY, AND LOGISTICS DIRECTORATE OF SCIENCE AND TECHNOLOGY (SOF AT&L-ST)

BROAD AGENCY ANNOUNCEMENT
USSOCOM-BAAST-2020, Amendment 2
FOR
TECHNOLOGY DEVELOPMENT AND ADVANCED TECHNOLOGY DEVELOPMENT

1.0 Introduction:

United States Special Operations Command (USSOCOM), Special Operations Forces Acquisition, Technology, and Logistics (SOF AT&L), Directorate of Science and Technology (S&T), transformed the BAA infrastructure to better align with the USSOCOM Commander's strategic priorities and vision. As such, the S&T Directorate will continue to evolve its investment strategy by focusing on SOF modernization development efforts that include more encompassing, disruptive technology[1] efforts that are larger in scope and meet the demands of the strategic vision and Future Operating Environment (FOE). USSOCOM will continue making some investments in Special Operations Forces (SOF) enhancements in the programs of record.

2.0 General:

2.1 Agency: United States Special Operations Command (USSOCOM)
2.2 Program Office: Science and Technology Directorate (SOF AT&L-ST)
2.3 BAA Number: USSOCOM-BAAST-2020
2.4 BAA Title: SOF AT&L-ST
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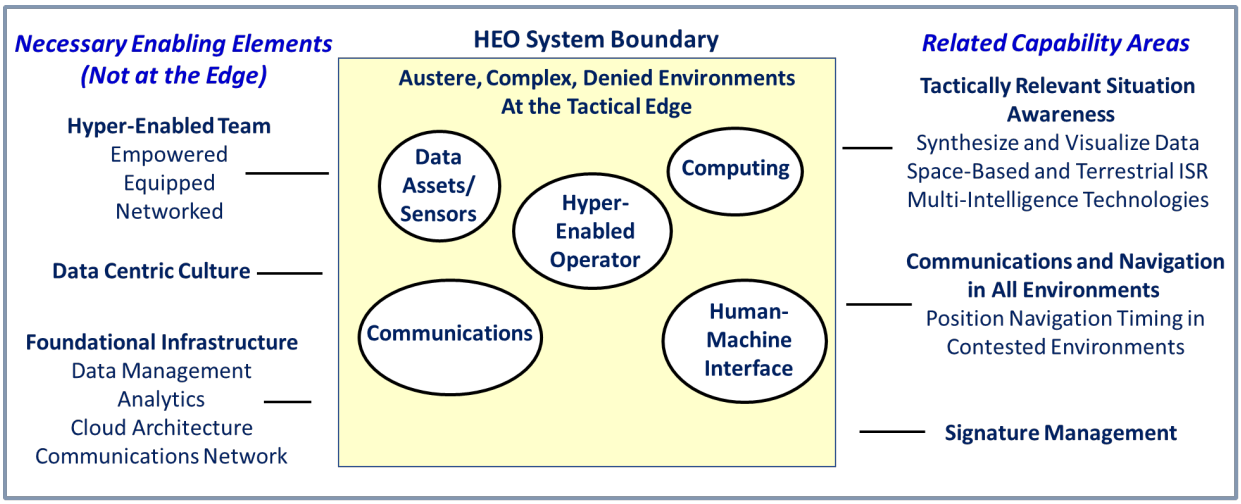
[1] Advanced technologies tend to be significant "game improvers," disruptive technologies tend to be "game changers".

3.0 Closing Date: Unless amended, this opportunity will remain as an open-ended announcement from the date of posting through 31 December 2025. White papers may be submitted at any time during this 5-year period subject to the submission process described in this BAA.

The Government may amend or update the technical focus areas and request a separate call for white papers at any time during the active period for this announcement.

4.0 Technology Areas of Interest:
SOF are designed to operate across the continuum of campaigning, crisis, and conflict. SOF operations will occur across all domains to include space and cyber to be in the forefront of the United States efforts confronting an emerging reality where our opponent possesses potential for overmatching capabilities. The new "normal" for SOF will be to operate in communication contested environments, under threat of targeting by high-end military capabilities, including Weapons of Mass Destruction, and where ubiquitous surveillance is routine, and information is weaponized. The FOE is a world of "Convergence": the point where the gap between non-state and state actor capabilities diminishes and the threat to force and mission success increases significantly. Core SOF missions such as Unconventional/Irregular Warfare, Military Information Support Operations, Direct Action, Counterterrorism, Security Force Assistance, Counter Proliferation of Weapons of Mass Destruction, and more are expected to remain key to SOF operations; however, the operational environment in which these missions will be executed is changing in accordance with global themes and trends. SOF missions will not significantly change, but how they are executed in the future and environment in which they are conducted is, and will continue, to change significantly. SOF will be empowered by technologies that enable Tactics, Techniques and Procedures to retain access and placement, as well as enable partner forces.

To permit SOF success in such a complex and dynamic environment, S&T seeks to gain Information Advantage to hyper enable SOF Operators across all mission sets. The Hyper Enabled Operator (HEO) is SOF empowered by technologies and information systems that accelerate tactical decision making by increasing situational awareness, reducing cognitive workload, and simplifying mission-appropriate information sharing. No single technology will independently make Operators hyper enabled. Instead, Operators will become hyper enabled through the integration of information and technologies. More specifically, the HEO will have technologies that permit the persistent, near-real-time collection of data; the rapid, automated distillation of that data into mission relevant information; the dissemination of that information to the personnel who require or can best use it; the presentation of that information in easily understandable formats and user-friendly modalities; the ability to use that information to select, direct, and implement tailorable, non-lethal and lethal effects to best meet mission objectives; all the while maintaining freedom of movement and tactical invisibility. Thus, S&T seeks white papers in the areas of Next Generation Intelligence Surveillance and Reconnaissance Networking and Data Management, Human Interface, Next Generation Effects, and Next Generation Mobility and Signature Management to build the HEO (see diagram below for a depiction of the HEO concept.



USSOCOM is interested in receiving white papers from all responsible sources (reference FAR 9.1) from industry, academia, individuals, Federally Funded Research and Development Centers, National Laboratories, and Government laboratories capable of pursuing, developing, and evolving disruptive capabilities that must be made available to the SOF Operator within the next five to seven years in order to achieve mission success in the FOE.

USSOCOM employs capabilities in all domains: terrestrial, maritime, air, space, and cyber. SOF personnel place a premium on technologies that are small, lightweight, rugged, modular, multi-use, easy to use, have low power consumption, require minimum maintenance, open architectures, and designed for operation in extreme environments at the edge of operations. Technology designs should consider comprehensive signature management approaches enabling low visibility and clandestine capabilities.

This BAA will sub-divide each technology focus area into two parts (disruptive technologies and SOF enhancements). The request for disruptive technologies is focused on peer/near-peer adversary technologies, new technologies that displace existing technology, and modernization of the SOF capabilities in all domains. These topics are contained within Sections 4.1 thru 4.6. Secondly, this BAA includes a request for technology insertion and SOF enhancements (also referred to as incremental improvements) aimed at supporting the SOF AT&L Program Executive Offices (PEOs) with advanced technology that addresses areas within their programs of record. These SOF enhancements are found in each technology focus area Section 4.1 thru 4.5. SOF enhancement technologies will be identified during initial proposal screening and subsequently evaluated separately by the requisite PEO and program office. More specifics on the evaluation of disruptive technologies and SOF enhancements are found in Section 6.0.

4.1 Next Generation Intelligence, Surveillance, and Reconnaissance (ISR) Capability Focus Area: USSOCOM S&T's Next Gen ISR capability focus area is focused on automated and persistent near-real-time data/information collection, processing, exploitation, and dissemination solutions, systems, and capabilities to include up and down cross-domain functionality enabling predictive analysis to augment SOF Operators and analysts. Focus is on increasing and enhancing SOF's ability

to manage and understand threats and the environment, process multiple data and communications inputs for optimized decision making, and support rapid, on-the-move ability to learn and communicate knowledge across a mission stakeholder team to search, locate and process High Value Targets.

SOF are interested in technologies that measure the physical characteristics of a given field of view, day and night, and in all weather conditions. Mission elements that could be enhanced include situational awareness, general planning, route planning, terrain mapping (including subterranean/urban/interior), change detection, event forensics, facial recognition, and locating objects under vegetation as a few examples.

4.1.1 Next Generation ISR Disruptive Technology Areas Include:

4.1.1.1 Autonomy-Enabled ISR/Battlefield Situational Awareness (SA): It is difficult to achieve persistent ISR without substantial manning and networking, computing, and software resources. SOF are interested in automated detection, identification, and localization capabilities to support SA of dismounted personnel. SOF require the ability to edge process, disseminate and query information in operating environments unfavorable to the utilization of traditional networks and computer servers. Bandwidth for information backhaul to computational centers and infrastructures is not regularly available to small teams. SOF small teams lack sufficient personnel to manually process, exploit and disseminate the amount of information generated by sensors deployed throughout the world. SOF desire software applications optimized for computing at the edge that automate the organization and fusion of data collected from multiple sources and multiple intelligence disciplines with neural networks and machine learning to recognize patterns and anomalies from various sensor types. SOF desire Augmented Reality (AR) enabling capabilities that provide warfighters with visual cues to identify and discern targets, foes, and friendly forces. SOF are also interested in reducing the cost of persistent AISR coverage by leveraging long endurance platforms capable of staying in undersea, surface, air and space layers for weeks or months at a time, as well as use of commercial capable ISR.

4.1.1.2 Stand-off Sensor Detection and identification: SOF are in search of tactical physical, behavioral, physiological, and/or electromagnetic signatures matching capability. System(s) should quickly conduct tactical biometrics matching worldwide from a distance of 1 Km or more. The system(s) need the ability to both store and upload data, operate both while stationary or moving, and be capable of supporting both overt and clandestine operations. The systems should employ advanced analytical software and sensor fusion designs to ingest multiple data inputs including but not limited to iris, facial, anatomical measures, gestures, gait, heartbeat, electromagnetic signals, deoxyribonucleic acid, and microbiome recognition. Software designs should consider counter-countermeasures intended to mask one's identity from automated mechanisms. Software applications should have the ability to operate on smart phones. Other options for stand-off biometrics include a distance up to 8 Ft with the ability to quickly ingest physical, behavioral, physiological, and/or electromagnetic signatures the Operator can use to measure response rates, provide a confidence factor, and assist in determining overall campaign effectiveness. Software designs should consider non-intrusive, innovative concepts with

visualization capabilities. Downloaded and saved data should come with further enrichment capabilities such as data tagging, user comments, and synchronization of similar biometrics.

4.1.1.3 Non-Radio Frequency Tagging, Tracking and Locating (TTL): Across the spectrum of conflict SOF require the ability to track a person or vehicle without the use of traditional electronic emitters, or other means that can be detected, to continue monitoring after losing contact with the subject. The tag on a person or vehicle must be undetectable by electromagnetic sensing devices, but accessible for near-real-time updates. The tag must not emit an RF signature while in use. The user should be able to retrieve or remotely interrogate the tag. The tag must be adaptable to fit numerous Concept of Operations (CONOPs) requirements for power and concealment. Conversely, SOF needs awareness and means to counter adversarial TTL systems.

4.1.2 Next Generation ISR SOF Enhancement Technology Areas Include:

4.1.2.1 SIGINT: These areas concentrate on RF communications intercept and location. Technologies of interest should provide or improve the capability to Detect, Intercept and Locate RF Signals of Interest of all types at frequencies ranging from HF to C-Band. Platforms and operational environments can be on land, air, sea, or space, manned or unmanned, and manpack based. Technologies of interest are:

- Detect:
    - Improved reception sensitivity
    - Improved filtering to reject out of band emitters Signal Classifiers (Artificial Intelligence/Machine Learning (AI/ML) of unknown signals in unregulated RF environments
    - Detection of electronic devices in room, vehicle, etc. with handheld device
- Intercept:
    - Improved analytical tools that automate steps in the SIGINT workflow
    - Advanced signal recording, bandwidth and capacity
    - Improved cellular exploitation middleware, cellular pin code bypass/cracking
- Locate:
    - Improved Direction-Finding (DF) accuracy and ability to separate emitters in a cochannel environment
    - DF in GPS-denied space
    - Provide Geolocation data to the user via the Android Tactical Assault Kit (ATAK) Common Operational Picture

4.1.2.2 Technical Support Systems: This area concentrates on items critical to mission success but is often not part of the initial design. Technologies of interest should provide improved performance; Size, Weight and Power (SWaP); and ease of use. Technologies of interest are:

- Unmanned/robotic/collaborative autonomous emplacement of unattended sensors in denied areas
- Emplacement of sensors via air, land, and water
- Avoid detection by adversaries
- Orientation of sensor, if required

Data Exfil: Technologies that provide additional data transfer capabilities/speed/bandwidths, reduce SWaP, increase flexibility in aerial, ground, underground, and maritime/riparian communication environments.

- Multiband, micro-sized devices capable of transmitting and receiving RF over distances greater than currently achieved
- New technologies that provide long distance data transfers in miniature packages, low signature, and are multipath resilient
- Data transport devices designed to perform in restricted propagation environments
- Data transport technologies to maximize limited bandwidth (e.g., compression, transmission technologies)
- Quantum and laser communications technologies

4.1.2.3 Biometrics: This area covers technologies used to collect, analyze and distribute various physical parameters that can be used to identify personnel. There is particular interest in technologies with a small form factor that provides the capability to rapidly (< 2 min) identify personnel, reduce false alarm rates and/or offer novel approaches at short to long distances in all environmental conditions. Technologies of interest are:

- Touchless fingerprint capture at near and extended distances for matching against authoritative databases and on-board watch lists
- Facial and/or iris capture for matching against authoritative databases and on-board watch lists
- Rapid, portable handheld DNA collection and processing for matching against authoritative databases and on-board watch lists
- Multi-modal biometric enrollment and matching device; must include a combination of an iris scanner, facial recognition, DNA, and fingerprint capture and processing

4.1.2.4 Forensics: This area covers the collection and processing of both physical and electronic information obtained from target locations either forward or within a deployed, controlled-environment shelter. In the short term, there is a need to process media devices on or near target locations and enable rapid analysis and target development. There is also a focus on updating equipment that can provide greater fidelity of chemicals of interest forward including but not limited to illicit narcotics, explosives and pre-cursors.

- Media and cell phone exploitation capability:
    - Exploit multiple cellular or operating systems without limitations
    - Conduct cable less exploitation of devices such as cell phones, tablets, laptops, computers, IoT devices, etc.
    - Simultaneously collect (image) multiple target devices
    - Conduct a simultaneous automated search and triage to extract data and metadata based on multiple user-defined parameters, including, but not restricted to, text, still image and video, time, location, and hashtag value, and compare to on-board watch lists
    - Conduct Optical character recognition (OCR), Optical word recognition (OWR), intelligent character recognition (ICR), intelligent word recognition (IWR), and

Convolutional Neural Networks and Image Classification of exploited data.
    - Create an Operator-configurable output that is interoperable with standard open-source Application Programming Interfaces (API) and integrate into current Intelligence Community analytical and mission command APIs
    - The device should save all captured data in the event of interruption (rapid disconnect)
    - Innovative transmission or transfer of large images and data pages over the internet
- Document exploitation capability:
    - Document exploitation, to include rapid scan and translation of foreign language via on-board disconnected OCR and OWR; small form factor devices such as a tablet, or mobile device
- Chemical exploitation capability:
    - Chemical analysis capabilities that are deployable to austere and power constrained environments
    - Operated in a shelter and semi temperature-controlled environment
    - Detect and provide fidelity for organic and inorganic materials
    - Trace evidence collection, identification, and processing
    - Small form-factor devices such as a tablet, or mobile device

4.1.2.5 TTL Systems, Sensors, or Tags: This area covers Tagging, Tracking and Locating (TTL) technologies that can be discreetly concealed in objects and/or vehicles. Technologies of interest should be optimized to operate on extremely low SWaP constraints, have reliable and redundant geolocation capabilities, survive exploitation attempts, support waveform diversity, and support long duration missions. Additional features and or capabilities in support of TTL mission to include:

- TTL sensors/systems/tags capable of employing Micro-Electro-Mechanical systems (MEMS) Inertial Navigation Systems (INS) dynamically for periods when Radio-Frequency-dependent geolocation is degraded, denied or non-existent
- Capabilities that exploit personal electronic devices for TTL without risk of discovery and compromise
- Capabilities that exploit organic vehicle/vessel electronic systems for TTL that provide persistent and reliable geolocation
- Small form factor (AA battery size) energy harvesting technologies for trickle charge of sensors
- Hight density small size and weight new energy sources to enable longer mission durations
- Broadband directional and omni-directional micro-size antenna solutions capable of a wide useable bandwidth, to include tunable antennas, in the Ultra High Frequencies (UHF) range and beyond
- Frequency agile tags/sensors able to operate at various frequency ranges while maintaining comparable SWaP
- Tag on a chip (IC) solution capable of sticker applications
- Sensors/Tags capable of employing signals of opportunity dynamically for periods when

GPS is degraded, denied, or non-existent in a low SWaP form factor
  - Systems/Sensors/Tags that make use of various Global Navigation Satellite Systems (GNSS) constellations simultaneously in low SWaP form factor
- TTL systems/sensors/tags that have robotic characteristics to enable automation of emplacement and repositioning mid operation
- TTL systems/sensors/tags with undetectable electromagnetic radiation signatures
- Capabilities to discretely leverage existing close-circuit television security systems, public safety systems, SmartCity technologies, or other ubiquitous sensors or systems for TTL
- New and Novel non-traditional TTL capabilities not limited to the RF spectrum such as optical taggant, big data analytics, cyber surveillance capabilities, or other means of tracking a person, vehicle, vessel, or activity

4.1.2.6 Sensors: This area covers various persistent surveillance systems and sub-systems also referred to as unattended ground sensor (UGS) systems, Reconnaissance, Surveillance, Target Acquisition (RSTA) tactical still and video surveillance systems, and indication and warning systems. Technologies that provide additional capabilities, reduce SWaP, increase flexibility in aerial, ground, underground, and maritime/riparian environments of the following:

- Capabilities that easily integrate with existing SOF systems/architectures and based on pen architectures
- Intelligent sensors that alert, highlight, communicate, and process at the tactical edge
- Man-portable discrete intrusion detection systems
- Systems that accommodate multiple wavelengths in small COTS applications (still imagery focus)
- Swappable/modular capabilities (still imagery focus)
- Sensor algorithms for fusing data from multiple sensors, data sources, networks, to reduce false alarms
- Sensor algorithms for location, classification, characterization, and identification of items of interest
- Detection via handheld and/or hands-free (cell phone size) electronic scan of small devices, such as sim cards, SD cards, or similar items on a person
- Detection of laser energy while carrying/using weapons
- Utilizing LIDAR and LADAR technology systems capable of significant resolution at high altitude while simultaneously providing real-time processing capability fused into mapping and video.

4.1.2.7 Enhanced Color Night Vision: SOF is in need of a head-worn and/or weapon mounted and small modular cameras for color night vision capability. This capability will aid Operators in rapid and efficient target identification, discrimination of targets and host nation partners, and differentiation of various laser colors/wavelengths for command and control. This capability would provide SOF Operators and Aviators greater clarity during transition to NVG's during EENT giving them the tactical advantage over our enemies and provide the ability to detect and classify activity (personnel, animal, vehicle, etc.) at range in a ground ISR mission during a moonless night. The selective colorization of image intensifiers will enhance visual acuity in extreme lighting

conditions, differentiate laser emissions, and improve identification/recognition of persons, signals, and modern LED lights. Proposed specifications per optical channel may include:

- FOV: 40 degrees (+ - 2 degrees)
- Latency: Below 4ms
- Refresh rate: Faster than 240 Hz frame rate
- Power consumption: No more than 150 milliwatts at peak power, generally 120 or less (no more than 40 milliamps at 3v)
- Depth of field: Improve over currently fielded equipment by 15%
- Starlight sensitivity: Equal to or better than the current fielded Generation 3 image intensifiers. Operational threshold: 2x10-6 foot candles
- Color feature: Colorization of the optical channel is preferable to consistent colorization
- Color accuracy: Primary colors must be accurately perceived by the Operator. Unique colorization of various friendly and enemy laser wavelengths is desired
- Performance during colorization: Must not be degraded below 72 lp/mm, SNR 33, 2376 FOM, Resolution during colorization: 1.3 cycles per milli-radian
- Power consumption during colorization: Desired battery life of at least one operational period of darkness

4.1.2.8 ISR Robotics: Robotics are becoming ubiquitous on the modern battlefield at the lowest echelons. SOF teams of the future will continue to deploy robotics to assist in mission execution and will require dramatic reductions in cost in order to achieve acceptable losses in increasingly contested environments.

- SOF are seeking approaches and solutions to significantly reduce the cost of contemporary battlefield robotics through reduced sensor count, reduced processor power, and lower mass while retaining similar capability for obstacle avoidance and payload
- Increased heterogeneity and number of robotics on the battlefield leads to issues with tasking, operator overload, and deconfliction. Simultaneously, increasing challenges to the electromagnetic spectrum require fewer RF control link emissions from SOF teams. Traditional command and control links for robotics must be replaced by distributed dispatcher – agent task focused strategies for robotic control.
    - SOF are seeking architectures and software capable of deconflicting, tasking, and reporting data from multiple heterogeneous robots while minimizing RF emissions from any central or peripheral node.
- Communications have always served as an exploitable link in warfare, particularly radio frequency communications. Most robotic systems include an RF control link, and these links will be increasingly contested on tomorrow's battlefields. In spite of this, most robotic systems are commercial derivatives and come equipped with little, if any, RF spectrum awareness as spectrum is licensed commercially.
    - SOF are seeking low cost, disposable, easily integrated components to enable ubiquitous equipping of robotics with basic RF spectrum awareness of common robotic radio bands
- Robotic emplacement of sensors is a requirement for the future ISR environment. To be successful in certain environments the platforms need to avoid detection while

transporting the sensor to its required location.

- SOF are seeking robotic platforms that use technology to either avoid detection or blend into the environment (biomimicry) while emplacing sensors
- SOF are seeking long range robotic emplacement in all domains and possible domain transitions in route. Platforms that can function in multiple domains and/or platforms that can carry other platforms to extend range or avoid detection are desired.

4.2 Network and Data Management Capability Focus Area: USSOCOM must be able to utilize disruptively new and enhanced existing technologies to transform networks and data management techniques required to facilitate the HEO concept in the FOE. The FOE will encompass an increasingly contested and dynamic electromagnetic spectrum and will require a comprehensive approach for SOF to effectively operate.

4.2.1 Network and Data Management Disruptive Technology Areas Include:

4.2.1.1 Edge computing: SOF seeks technology solutions that provide advanced computing to support localized SOF teams in degraded, disconnected, contested or anti-access/ area denial (A2/AD) communications environments. Data collection, management, storage, and dissemination has become very complex. Edge computing hardware solutions need to be able to process data from multiple sources and sensors to process and analyze such data to further enable SOF Operators. Edge computing solutions miniaturized to a very small form factor (i.e. - individual chips) will allow for body-worn hardware components supporting either individual or multiple functions in a low-power consumption manner. Edge compute devices must facilitate multiple varieties of evolving analytical software and toolset processing needs. Those applications must include the fusing of multiple disparate data sources. The output must enable the SOF end user with the right data, at the right time, and at the right location. The following attributes are preferred:

- Provide low-power consumption computing relative to existing, Commercial-Off-The-Shelf (COTS) CPU/GPU hardware
- Support software applications that provide advanced data analytics and visualization tools that reduce Operator cognitive load
- Provide ability to compute and derive insights at multiple points within a tactical network prior to reach-back to enterprise-level network connection
- Support networking of multiple body-worn computing chips that can fuse multiple data types
- Technology submissions must finish at TRL 6 or greater
- The ability to conduct face-to-face engagement with non-English speaking individuals with a wearable system that automatically changes the words spoken into the desired language and transversely converts the foreign language back to English without network connectivity
- Innovative cognitive radios that employ AI/ML/Deep Learning to intelligently sense spectrum, adjust transmit power, and “roam” when in an Electronic Warfare cluttered environment with very little user interaction. Radios need to integrate with military

hardware owned and carried by SOF operators. Software should be available as a plugin or add on as required.

4.2.1.2 Non-Global Positioning Systems (GPS) Positioning, Navigating and Timing: SOF requires the ability to maintain accurate Position, Navigation and Timing (PNT) in areas where satellite Global Positioning System (GPS) services and other radio navigation signals are unavailable or untrusted. Effective navigation and situational awareness in space, in the air, on land or in sea-based environments are critical to SOF. SOF seeks alternative modalities for achieving Assured PNT (APNT) services. SOF operates in areas of incidental or deliberate GPS interference or denial. Incidental denial includes GPS services lost due to movement into subterranean areas (caves, basements, bunkers) or signal-blocking environments (urban canyon, parking garage, buildings, and dense urban areas). Deliberate denial includes electromagnetically contested environments. SOF are interested in countering the proliferation of advanced adversary Global Positioning System (GPS) jamming and spoofing capabilities. Capabilities should consider a multimodal approach that combines multiple PNT methods to determine the actual final result. Capabilities should consider advances in Alternate-PNT devices for mobile platforms that provide options for distributed networks of cooperative devices such as: celestial attributes, multi-platform-based beacons/triangulation (SUAS platforms and services), common timing, and the detection of jammers or other attack vectors. Such capabilities should have cognitive/automated attributes to assure seamless transition when interruptions or disruptions occur. The following attributes are preferred:

- Solutions must be applicable to multiple platforms including, but not limited to: Maritime, Fixed Wing, Rotary Wing, tactical vehicles, dismounted forces, and all groups of Unmanned Aerial Systems (UAS), etc.
- Alternate Timing solutions should consist of the following:
    - Rb Oscillator that can hold 1us at 1 week
    - Dimensions: 3.65” x 5.25” x 2.13” in or smaller, small is preferred
    - Weight (± 3%) 3.72 lbs. Less weight is preferred
    - Power (Steady State @ 25 °C) 20 W
    - Digital Adjustment Resolution (RAFS-C) ≤1.0E-15
    - Operating Temperature (at Baseplate): -20 to +60 °C
    - Storage Temperature Range -40 to +75 °C
- Solution accuracy must be equal to or greater than the following:
    - Position error (xy) < 1% distance travelled
    - Position error (z) < 2% distance travelled
    - Heading error < 20 degrees/hr
- Technology submissions must finish at TRL 6 or greater

4.2.1.3 Cyber Defense Effects:

4.2.1.3.1 Security at the Edge: The operational SOF environment requires edge computing devices prioritizing *fight-thru* capabilities, where functionality, connectivity, and security are all essential. Edge computing devices can take any form and endpoints are everywhere due to the

proliferation of Internet of Things (IoT) devices. SOF is seeking cyber-survivable (cybersecurity and cyber resilient) capabilities at the edge device endpoint, cloud, and network. The following attributes are preferred:

- Semi or Full Autonomy in functionality and performance
- Elimination or mitigation of vulnerabilities and exploits
- Platform-agnostic

4.2.1.3.2 AI/ML Capabilities: SOF is seeking various cyber defense technology solutions comprising of some or all the following attributes:

- IoT systems and sensors agnostic algorithms
- IoT systems and sensors integration and optimization of AI/ML capabilities without jeopardizing functionality and performance
- Supply chain data management
- ML data transference between systems and/or sensors
- Data security at the tactical edge

4.2.1.3.3 Automated Cyber Infrastructure Assessment: SOF is interested in technologies that provide automatic detection, geolocation, and characterization of the cyber terrain within defined areas of interest.

- Creation of a Tactical Digital Knowledgebase
- AI/ML applications paired with a Tactical Digital Knowledgebase
- Fusion of sensors/collection devices across the electromagnetic spectrum integrated with AI/ML analysis tools and/or predictive analysis tools
- Signal transmitters, emission software, radio theory wave disruption fields

4.2.2 Network and Data Management SOF Enhancement (Incremental) Technology Areas Include:

4.2.2.1 Information Systems: Technologies concentrate on exascale and zettascale compute processing and exploitation of intelligence and information data for global situational awareness and decision support to commanders at all echelons. Software applications will be deployed in a loosely coupled, open architecture that separates display and user interactions from data preparation, analytics, and algorithmic processing. Technologies should provide new capabilities via Application Programming Interface (API) processing of all sources of stored and streaming data. Areas of interest include:

- Connecting strategic and tactical Special Operations Forces commanders via near real-time collaboration leveraging advanced fused analytics, auto-correlation across joint functions, and warfighting domains
- Application of industry open standards, data quality and data management sufficient to execute advanced computational artificial intelligence and machine learning algorithms for shared situational awareness and military decision making
- Fusion of real and synthetic data streams enabled by advanced algorithmic processing of multi-dimensional data in order to visualize, collaborate, and act on unsynchronized and/or synchronized information in support of planning, rehearsal, and execution

- Data interchange for metadata, user generated content, and associated data structures and semantic representations to enable interoperable ingest, export, and exploitation by other designated information system or sub-systems

4.2.2.2 Data Visualization: Multi-modal interfaces and associated information presentation designs that permit SOF Operators to receive and intuitively understand networked information from communication, computing, and sensor systems. Physical aspects of the technology must not interfere with the Operator's native ability to see, hear, or feel the local environment nor constrain the Operator's ability to move.

4.2.2.3 Obfuscated Data Transport Systems/Architectures: This area covers secure communications transport networks used to route information, worldwide, to desired locations in a manner that takes full advantage of the trends in commercially available networks to obscure the originating source and final destination from third-party discovery. Technologies of interest would provide networks constructed potentially using a combination of co-location sites, public telecommunications service providers, and public cloud service providers and incorporate threat counter-measures.

4.2.2.4 Group 1 UAS Payloads: This area covers the ability for SOF to send and receive messages via a group 1 UAS in urban and/or rural environments. This small UAS should include payloads for the following capabilities:

- Radio broadcast (FM)
- Television broadcast (analog/digital)
- Cellular (GSM/LTE/5G)
- Non-RF communications
- Internet of Things
- Loudspeaker
- Sonic projection
- Air-drop capability
- Electronic warfare/ electronic attack
- Long-term viability either with solar panels or other energy source
- Holographic projection capability
- Secure transmissions (Type 1 encryption or NSA accepted substitute)
- Beyond Line of Site tactical data links, voice and data communications relays for austere environments (also applies to Group 2 UAS)

4.2.2.5 All-Terrain Terrestrial Platform: This area should focus on payloads similar to the group 1 UAS but with the ability to travel on the ground through all land terrains. Specifically, the all-terrain platform should be able to provide several capabilities to SOF:

- Radio broadcast (FM)
- Television broadcast (analog/digital)
- Cellular (GSM/LTE/5G)
- Non-RF communications

- Internet of Things
- Loudspeaker
- Sonic projection
- Air-drop capability
- Electronic warfare/ electronic attack
- Long-term viability either with solar panels or other energy source
- Holographic projection capability
- Secure data transmission (Type 1 encryption or NSA accepted substitute)

4.2.2.6 Low-Visibility Communications: This product line covers hardware and software solutions to provide low visibility team communication and situational awareness capabilities. Technologies of interest would provide:

- The ability to have two-way obfuscated communications between SOF personnel and allied personnel
- Allow more diverse infrastructure employments beyond those just found in US/Western industrialized countries including low-bandwidth and high-latency disadvantaged communications channels
- Disassociation of user signatures
- End-to-End **Type 1 encryption or NSA accepted substitute**

4.2.2.7 5G Communications: Advancements in commercial data transport (5G/6G and beyond) is important to SOF because it offers higher performance and additional capabilities, particularly for data-driven applications and for machine-to-machine communication. SOF must have access to a 5G (and beyond) defense industrial base that provides trustworthy technologies.

It is also important that SOF have access to trustworthy technologies at the lower end of the value chain, specifically in the 5G Radio Access Network (RAN) and 5G Core. SOF seeks radio frequency (RF) technologies including millimeter wave systems, as well as dynamic spectrum utilization capabilities. SOF also seeks networking technologies in both the RAN and 5G Core, with an emphasis on open architectures and virtualization approaches which leverage U.S. industry expertise. Potential solutions should include:

- Operations across all 5G spectrum bands, including the contiguous spectrum available at high frequencies above 24 GHz in the millimeter wave bands (mmW)
- How to control RF spectrum signatures, reduce adversary targeting
- Techniques to identify, track, and mitigate threats and vulnerabilities
- Provide a zero-trust model for 5G
- Modernization of electromagnetic battle management tools for command and control
- Enhanced Mobile Broadband (eMBB) – higher quality and rich content services to multiple users with full mobility
- Low Latency (>= 10x less than 4G)
- Massive Machine-to-Machine Communications – massive scale automation through widespread sensor networks and multiple connected devices; sensor data from the Internet of Things (IoT)

- Data rates above 500Mbits/second
- 100x number of connected devices per unit area (compared with 4G LTE)
- Ability to fallback to 4G if needed

4.2.2.7 Enhanced High Frequency (HF) and Satellite Communications: Significant advances in HF radio technologies as alternatives to traditional voice Satellite Communications (SATCOM) or Mobile User Objective System (MUOS) capabilities in RF contested expeditionary environments. These technologies would be integrated to support both Reconnaissance Surveillance Target Acquisition (RSTA), air assets (helicopter and fixed wing), and SOF mission sets.

4.3 Next Generation Effects Capability Focus Area

Introduction: USSOCOM seeks to study, design, develop and demonstrate advanced technology concepts and materials associated with the application of effects from non-lethal through non-kinetic effects, and overmatching lethality. These technologies may include, non-kinetic effects, electromagnetic warfare (EW), directed energy (DE), offensive cyber effects, and Military Information Support Operations (MISO) capabilities. The major developmental goal is a standalone effects system which gives an Operator or platform the ability to tailor the effects directed onto a target, ranging from incapacitation up through and including scalable effects, allowing for a wider range of non-kinetic effects on adversarial targets and infrastructure without increasing the logistical burden on a small SOF formation at the edge or during clandestine activities.

4.3.1 Next Generation Effects Disruptive Technology Areas Include:

4.3.1.1. Non-Traditional/Non-Kinetic Effects: USSOCOM Directorate of S&T is seeking to develop the next generation of non-kinetic effects capabilities. These next generation capabilities will be focused on potential SOF specific targets during peer/near peer engagements, encompassing all phases and levels of conflict. The immediate goal is to bound the problem by conducting a comprehensive analysis of potential SOF targets and their vulnerabilities to emerging, non-traditional/non-kinetic technologies and then determine the ability to leverage these new technologies to effectively deny, degrade, disrupt, deceive, or destroy adversarial targets and infrastructure. The analysis shall be conducted at the classified SECRET level or above.

4.3.1.2. Directed Energy and Electromagnetic Warfare: Directed energy technologies for delivering non-kinetic scalable effects on a multitude of hard and soft targets. Offensive electronic warfare payloads with overmatching target effectiveness at tactically and operationally relevant ranges. Solutions can encompass mounted, dismounted, or other ways of delivering DE and EW effects for small SOF formations at the edge of operation or clandestinely. SOF is interested in capabilities to disrupt adversary Electronic Warfare jamming while remaining undetected.

4.3.1.3. Offensive Cyber Effects:

- Cyber platforms with the capability to provide digital and physical situational awareness in connected environments through utilization of Internet of Things (IoT) devices, networks, and systems

- Cyber applications capable of tracking and exploiting targeted mobile electronics, Supervisory Control and Data Acquisition (SCADA) systems, and IoT devices
- Cyber payloads with deny, disrupt, degrade, or destroy capabilities that can be employed to both networked and air gapped computer devices and systems
- Systems should be able to be employed by SOF Operators with relative ease and short training cycles at the edge of operations or clandestinely

4.3.1.4. Military Information Support Operations (MISO): MISO technologies for influence operations, digital deception, communication disruption, and disinformation campaigns at the tactical edge and operational levels.

- Provide a next generation capability to collect disparate data through public and open source information streams such as social media, local media, etc. to enable MISO to craft and direct influence operations and messages in relevant peer/near peer environments
- Provide a next generation of "deep fake" or other similar technology to generate messages and influence operations via non-traditional channels in relevant peer/near peer environments
- Generate next generation capability to "takeover" Internet of Things (IoT) devices for collect data and information from local populaces to enable breakdown of what messaging might be popular and accepted through sifting of data once received. This would enable MISO to craft and promote messages that may be more readily received by local populace in relevant peer/near peer environments.

4.3.2. Next Generation Effects SOF Enhancement (Incremental) Technology Areas Include:

- Develop an architecture that allows legacy systems to be upgraded in order to process and share situationally obtained information onboard or off board those legacy systems
- Expand the role of all Operators on the battlefield by means of using multiple sensors to provide target inputs to the actionable entity. Improvements are sought to increase spatial resolution, reduce noise, and enhance contrast. Examples include optical and geometric super resolution techniques.

4.4 Human Interface Capability Focus Area

Introduction: The growing utilization and dependence on complex equipment and unmanned/autonomous systems and the increasing capabilities offered significantly burdens USSOCOM personnel. Human Interface seeks to integrate human considerations with and across all system elements and is primarily concerned with designing human-machine interfaces consistent with the physical, cognitive, and sensory abilities of the SOF Operator in order to mitigate this burden. Specific areas of focus include:

4.4.1. Enhanced human-machine interface to allow the seamless ingestion of collected information and the control of technical and unmanned/autonomous systems in order to capitalize on the opportunity to fully leverage developing technical capabilities with minimal Operator focus. Due to the massive increase in unmanned/autonomous systems available the human machine environment is complex and cannot be effective with proprietary

communications and data interoperability. SOF capability expects open architectures with maximum interoperability with other human and unmanned systems.

4.4.2. Automation of tasks and decisions suited for technical accomplishment thereby lowering Operator cognitive load during combat operations (i.e., automated decision making support). This includes the use of machine learning, artificial intelligence, data analysis, or other strategies and/or technology to increase the speed and accuracy of the observe–orient–decide–act (OODA) loop decision cycle.

4.4.3. Ability to provide eye protection and maintain normal unaided vision while displaying a range of easily digestible visual data with minimal interference to the Operator's field of view or visual situational awareness.

4.5 Next Generation Mobility and Signature Management Capability Focus Area: Introduction:

- USSOCOM seeks technologies that provide the SOF Operator with improved and versatile mobility capabilities in ground, air and maritime operating environments.
- SOF are interested in the ability to combine signals from distributed Satellite Antenna Arrays on Ground Vehicles, Maritime, and Airborne Communications on the Move (COTM) platforms to increase gain or constant satellite lock.

4.5.1 Signature Management: USSOCOM seeks solutions for signature reduction in visual, infrared, radio frequency, acoustic, and digital/cyber domains for currently fielded and future systems. USSOCOM is interested in advanced technologies which provide multispectral signature reduction for personnel and platforms while minimizing the size, weight and power requirements. Technologies that provide exceptional performance will be considered for next generation platforms and personnel solutions. Contractors and organizations selected for projects in this area will likely require active security clearances and cleared working facilities.

4.5.1.1 Cyber/Digital Signature Management: USSOCOM seeks technologies, techniques and procedures that will facilitate SOF operating in an environment equipped with ubiquitous technical surveillance, allowing them to complete their missions without impacts to their health, safety and operational effectiveness.

4.5.2 Next Generation Mobility: USSOCOM seeks capabilities/concepts for next generation mobility platforms that are versatile, increase SOF mobility capabilities and offer reduced multispectral signature management characteristics. SOF is interested in a truly "All Terrain" system that is capable of navigating in all forms of terrain (e.g., mountains, snow, frozen tundra, water, desert, etc.) in multiple environments (i.e., night, rain, snow, dust, urban, smart city, etc.) and is interoperable with existing logistical systems. Both manned and unmanned solutions are acceptable for submission.

4.5.2.1 Additional areas of interest related to this topic would include advanced materials, hybrid/electric systems, increased range/speed capabilities, renewable energy generation/storage, and foldable/jumpable electric motorcycles.

5.0 Supplemental Submission Instructions and Information:

5.1 Submission Website: All Offerors submitting white papers shall complete requisite data fields for USSOCOM-BAAST-2020 at the following URL: https://www.socom.mil/SOF-ATL/Pages/baa.aspx. If you experience problems uploading attachments, you are still required to complete requisite data fields and then email attachments to BAAST20@socom.mil. Subject line of email should state, "White Paper-Topic Area-STBAA20-Company Name."

5.2. White Paper Submission Process: Interested Offerors shall submit a white paper as described below that shall be valid for a minimum of six months from the closing date of the specific announcement to this BAA. Additional submission instructions regarding timelines, submission sites, email addresses and POCs are provided in this BAA and can be requested.

5.3. White Paper Content and Format:

5.3.1. Format: White papers shall use the format described at Appendix A - White Paper Format. White papers shall meet the following requirements: (1) Paper Size - 8.5 x 11inch paper; (2) Margins - 1"; (3) Spacing - single; (4) Font – Times New Roman, 12 Point; (5) Microsoft Office 2010 or compatible format and/or PDF format. The Integrated Master Schedule is not restricted in size. The naming convention of white papers shall conform to the following format: CompanyName_WhitePaperTitle_MMDDYYYY.doc or pdf and contain no more than 50 characters and no special characters.

5.3.2. Number of Pages: White papers will not exceed five pages. The cover page, quad chart, and Integrated Master Schedule are not counted in this page limit. All pages shall be numbered.

5.3.3. Cover Page: Labeled "WHITE PAPER" and shall include: (1) BAA number and Technology Areas of Interest as referenced in Section 4 above; (2) white paper title; and (3) Offeror information to include address, phone, fax, and technical contact with email address.

5.3.4. Technical: The Offeror shall submit a description of the scope of work necessary to satisfy the BAA stated technical challenges and design objectives. This shall include: (1) technical approach; (2) technical risk areas; (3) design maturity; (4) any other technical data/information to be conveyed for consideration. The Offeror shall identify the management, technical qualification and composition of the research team, key personnel, and subcontractors. The Offeror must address the quality assurance process to assess its capability to successfully develop the technology and configuration control plan.

5.3.5. Price/Cost and Schedule: The Offeror shall provide a determination of the cost to develop the technology through each phase from concept development through prototype proofing. Each

Offeror shall submit a Rough Order of Magnitude (ROM) of the costs based on work areas of development to perform the overall technology development effort. The Offeror shall submit a schedule by major tasks to develop the technology through completion of the prototype and proof of readiness.

5.3.6. Quad Chart: The Offeror shall submit a quad chart following the example at Appendix A. The quad chart shall include: (1) description of the technology effort with drawing or schematic; (2) technical performance required to achieve and complete the effort; (3) costs by deliverable and schedule; and (4) technical resources and team members.

5.4 Technology Development Cost and Schedule: Offerors are advised to consider if the proposed solution meets the following criteria:

5.4.1 S&T Activities: USSOCOM desires proposals that conform to the definitions of Budget Activity 2, Applied Research or Budget Activity 3, Advanced Technology Development. Please refer to the DoD Financial Management Regulation Volume 2B, Chapter 5 for the full definitions. The abbreviated definitions are listed below:

Applied Research- Applied research is defined as systematic study to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met.
Advanced Technology Development- Includes all efforts that have moved into the development and integration of hardware for field experiments and tests.

5.4.2 Technology Readiness Level (TRL): USSOCOM SOF AT&L desires proposals with TRLs between two (2) and six (6). The TRL definitions are listed below:

TRL 2- Technology concept and/or application formulated. Invention begins. Once basic principles are observed, practical applications can be invented. Applications are speculative and there may be no proof or detailed analysis to support the assumptions. Examples are limited to analytic studies.

TRL 3- Analytical and experimental critical function and/or characteristic proof of concept. Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.

TRL 4- Component and/or breadboard validation in laboratory environment. Basic technological components are integrated to establish that they will work together. This is relatively “low fidelity” compared to the eventual system. Examples include integration of “ad hoc” hardware in the laboratory.

TRL 5- Component and/or breadboard validation in relevant environment. Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so it can be tested in a simulated environment.

TRL 6- System/subsystem model or prototype demonstration in a relevant environment. Representative model or prototype system, which is well beyond that of TRL 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness.

5.4.3 Cost and Schedule: In addition to the S&T activities and TRL, USSOCOM desires white papers that are scoped between $3 to $15 million total cost of development and between 24 to 60 months to complete all efforts required to obtain a TRL of 6 (refer to section 5.2.2 for definition) for each submission under USSOCOM-BAAST-2020. Offerors do not have to conform to the cost and schedule criteria outlined in this section, but they may or may not be considered for award. If an offeror does not conform to the cost and schedule criteria outlined in this section, the offeror is highly encouraged to provide rationale why their proposal does not meet the cost and schedule criteria and why it still meets the S&T activities and TRL criteria.

5.5 White Paper Review Process and Periods: USSOCOM SOF AT&L-ST intends to conduct peer reviews within approximately 45 days of the closure of this announcement. At the end of the review, USSOCOM S&T will notify Offerors whose white papers were selected for submission of a proposal. A request for proposal will use similar Review Criteria for evaluation as are outlined in paragraph 6.0 below unless the request for proposal specifies different criteria. For planning purposes, a notional white paper evaluation schedule is provided below. Future changes to this notional schedule may not be published and are at the sole discretion of the Government.
Per SOFARS Provision 5609.507-1, the offeror's attention is directed to the fact that Government Support Contractor personnel may review and provide support during proposal evaluations. They may have access to offeror's proposals and may be utilized to objectively review a proposal in a particular functional area and provide comments and recommendations to the Government's decision makers. They may not establish final assessments of risk, rate or rank offerors' proposals. All advisors shall comply with procurement Integrity Laws and shall sign Non-Disclosure and Rules of Conduct/Conflict of Interest statements. The Government shall take into consideration requirements for avoiding conflicts of interest and ensure advisors comply with safeguarding source selection and proprietary data. Submission of proposal in response to the solicitation constitutes approval to release the proposal to Government Support Contractors.

5.5.1 Notional Evaluation Period: White papers submitted from date of issue through 15 December 2022, will be evaluated from 1 January 2023 to 31 March 2023.

6.0 White Paper Review Criteria

6.1 Review Criteria: The Government will review each white paper and select the Offerors that have the greatest potential to meet the needs of USSOCOM technology requirements. A determination will be made if the Offeror is responsive to the BAA criteria set forth in paragraphs 5.4.1, 5.4.2, and 5.4.3 (S&T Activities, TRL, and Cost and Schedule), is technically qualified, and has

a comprehensive understanding to undertake the development of the technology based on the information stated in the white paper.

6.1.1 Importance to Agency Programs: The degree to which the technical approach is relevant to the proposed area of interest.

6.1.2 Technical: The degree to which the technical approach is disruptive or enhancing, innovative, feasible, achievable, complete and supported by a technical team that has the expertise and experience to accomplish the proposed tasks. Of paramount importance is evaluation of the probability for transition of this effort into an acquisition program, a military system, or other military capability measured by the existence of standing or evolving formal requirement for the capability, and acquisition program funding in the context of the end-state TRL of the proposed effort. Additional salient characteristics surrounding the technical approach include a brief discussion on 1) Theoretical Rationale, Scientific Methods, and Research, 2) Significance, Relevance, Disruption, and Innovation, 3) Impact to SOF, 4) Technical Risk, as well as 5) Personnel and Facilities.

6.1.3 Schedule: The degree to which the proposed schedule is achievable; the resources, facilities, and equipment available; and the allocation of time per major task.

6.1.4 Funding Availability: The Government will review the proposed ROM to determine if it is a fair estimate of the proposed scope of work and whether funds are available to support the proposed scope of work. Higher Command priorities may preclude awards under this BAA.

Appendix A – White Paper Format

Section A – Title, technology area of interest as referenced in the specific technology area per Section 4 of this BAA, period of performance, estimated cost of task, name and address of the Offeror, technical and contracting points of contact, telephone and fax numbers.

Section B – Task objective with description of work to be performed.

Section C – Technical summary and proposed deliverables.
The white paper should include the anticipated period of performance as well as a ROM cost. The ROM cost consists of the total cost plus profit/fee, if any. It is a best guess of the anticipated cost of the effort and should be consistent with any dollar value or ranges specified in the announcement, as well as the level of work being proposed. The white paper does not include a cost proposal or any of the material that usually accompanies a cost proposal. It must include a short technical description of the concepts and plans to accomplish the technical objectives. It also briefly describes the technologies to be pursued in the effort. It should also identify any Independent Research and Development (IR&D) work underway within the company that may have direct application. The white paper should address only that specific part of the BAA the Offeror intends to accomplish. A single white paper that attempts to address the whole scope of the technology described in the BAA will most likely be rejected.

Section D – Quad Chart
The quad chart presents the overall view of the proposed work in a snapshot. It is essential that the quad visually present the relevant information of what the project will accomplish, a description, the technical efforts necessary to achieve results, benefit to SOF, technical and management resources, costs, and schedule/major milestones. It is preferred that quad charts be provided in the latest version of Microsoft (MS) Power Point, although they may be provided in MS Word or Adobe Acrobat files so long as the quad file can be opened and read.

Program Name and Technology Area of Interest

Program Overview

Description

The So-What

SOF unique Applicability

Participant POC

- Offer name and address
- Technical POC: Name, phone # and email address
- Contracting POC: Name, phone # and email address

Proposed Cost

(U) Funding Profile				
Prior	FY24	FY25	FY26	Total
$0.00	$0.00	$0.00	$0.00	$0.00

Proposed Schedule

Milestone/Event	FY24				FY25				FY26			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
Date of Proposed Award												
Proposed Period of Performance												
Proposed Design Reviews												
Proposed Prototype Deliveries												
Proposed Demonstration(s)												
TRL Level												
Other												
Other												

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