DOD Pursues EMSO Projects in Small Business Solicitations

The DOD has released its first large batch of small business solicitations for FY2023. The topics for its Small Business Innovative Research (SBIR) Broad Agency Announcement (BAA) (DoD SBIR 2023.1) and its Small Business Technology Transfer (STTR) BAA (DOD STTR 2023.A) include several Electromagnetic Spectrum Operations (EMSO)-related efforts. These SBIR and STTR program funds research in phases. Phase 1 work usually includes paper studies to evaluate the technical feasibility of a project. Phase 2 work often includes technology development and lab demonstration. Some topics, where there is a higher level of technology maturity, are "Direct to Phase 2" efforts.

The SBIR 2023.1 solicitation includes US Air Force and US Navy research topics. Among the Air Force's EMSO related topics are:

- Advanced Millimeter-Wave Radar Absorbing Materials (Topic AF231-0012): The objective of this topic is to develop "practical absorber capabilities in the mmW bands to suppress unwanted EM interference in indoor anechoic chambers and on outdoor RCS [radar cross section] measurement ranges." The topic description says "…broad-band outdoor materials can range from 10-15 dB. Outdoor RAMs are desired to be rugged, UV and water resistant." Phase 1 calls for an "…in-depth evaluation and analysis of current RAM design/development techniques for use in indoor and outdoor RCS measurement facilities." Work will be "focused on practical, rugged field use and indoor anechoic chambers with materials optimized for performance at Ka & W frequency bands." The topic point of contact is William Parnell, (850) 882-9960, e-mail william.parnell@us.af.mil.

- Millimeter Wave (mmW) RF System on a Chip (RFSoC) Technology (Topic AF231-0013): This effort aims to leverage advances in commercial mmW RFSOC development and apply them toward developing an “integrated sensor package that incorporates RFSoC technology and is tailored to support common military radar RF bands” while featuring “arbitrary waveform generation and digital signal processing capabilities” for use in in a variety of military radar applications for test ranges. More specifically, the project seeks to provide a miniaturized mmW RFSoC that “1. Supports C, X, Ku, Ka and W military radar bands at min. 4 GHz signal bandwidth; 2. performs arbitrary waveform generation and processing of received signals over a min. of eight transmit and eight receive channels; 3. supports multi-channel synchronization of transmit and receive channels; 4. supports multi-radar (i.e., multi-chip) synchronization; and 5. use-case targets instrumentation radar at outdoor range.” The topic point of contact is Jason Gallina, (850) 882-8409, e-mail jason.gallina@us.af.mil.
- Fully Adaptive Radar Electronics (FARE) (Topic AF231-D022): This project aims to “develop new approaches targeting advanced radars employing Fully Adaptive and AI techniques.” The description states, “Fully Adaptive radar (FAR) has emerged as the next generation of highly adaptable systems for military applications. FAR uses both advanced AI techniques and full-adaptivity (transmit and receive) to ‘probe’ the total radar environment (targets, clutter, jamming, etc.) to gain an optimal understanding of how to best prosecute its mission. This highly agile transmit probing is supported by advanced real-time adaptive waveform and MIMO techniques, high performance embedded computing (HPEC), knowledge-aided (KA) processing, model-based signal processing, and other AI techniques The goal of CFATs [Counter-Fully Adaptive Techniques] is to disrupt this

channel learning OODA cycle thereby degrading its performance. These advanced techniques must themselves employ many if not all of the aforementioned Fully Adaptive systems techniques to: 1) degrade a FAR's understanding of the environment to a degree sufficient to degrade its receiver-operator-characteristic (ROC) performance, and 2) remain undetected to the victim FAR." This effort aims to leverage existing research (M&S, simulation of prototype concepts, cost benefit analysis, system-of-systems studies, etc.) and move directly to Phase 2. The topic point of contact is Muralidhar Rangaswamy, (937) 713-8567, e-mail muralidhar.rangaswamy@us.af.mil.

- RAdar Disruption Systems (RADS) (Topic AF231-D023): Noting that "Mechanical motion is an alternative way to manipulate radar signals, as opposed to pure electronic means," this topic "seeks to develop imaging radar disruption systems by using passive mechanical action for at least a portion of their functional mechanism." The description states, "These types of systems offer certain advantages, such as broadband response, simplicity, and likely cost. Other possible advantages include ease of operation and set up, which along with the design and operation simplicity which provides a smaller logistical tail." This is a "direct to Phase 2" effort. The topic point of contact is Robert Nelson, (937) 713-9907, e-mail robert.nelson.21@us.af.mil.

US Navy SBIR topics include:

- Broadband Antenna Solution for Vehicle-Mounted Electronic Warfare Systems (Topic N231-003): Under this project, Marine Corps Systems Command wants to "develop an innovative and operationally suitable consolidated (minimized size and weight) antenna solution for sensing and transmitting broadly across the electromagnetic spectrum with angular resolution sufficient for

geolocation and direction finding." The description states, "With the emergence of ultra-wideband photonic receiver technology that can very rapidly process, de-conflict, and identify threats across the entire frequency range of the electromagnetic spectrum, there comes a need for complimentary broadband antenna hardware to sense and locate threats and transmit to defeat them." This effort calls for a four-element array weighing between 10 and 50 lb than can provide "accurate" DF and geolocation of emitters covering from DC up to 20 GHz (Threshold), 80+GHz (Objective). The topic point of contact is Alicia Owsiak, e-mail alicia.owsiak@usmc.mil.

- High Power Microwave (HPM) Solid State Amplifier Topologies (Topic N231-062): This effort will focus on developing "a radio frequency (RF) Solid State Power Amplifier (SSPA) topology specific to high power microwave (HPM) applications for use either as a stand-alone source or in an array, capable of generating a variety of waveforms while exploring the trade-off between power and bandwidth." The description adds, "Solutions could cover pulse widths ranging from nanoseconds to microseconds. Frequency interests span L, S, C, and X band SSPA topologies." The topic point of contact is Ryan Hoffman, e-mail ryan.b.hoffman.civ@us.navy.mil.
- Cognitive Tactics, Techniques and Procedures (TTP) Synthesis (Topic N231-067): The objective of this effort is to "synthesize Artificial Intelligent (AI)-generated Electronic Support (ES) and Electronic Attack (EA) Tactics, Techniques and Procedures (TTPs) in near real-time against known legacy or unknown/complex sensor waveforms using online and unsupervised Machine Learning Algorithms (MLAs) based on real-time collaborative Tactical Situational Awareness and mission objectives for Size, Weight, and Power (SWaP)-constrained unmanned and/or manned naval platforms." The description adds,

"Research will develop AI-generated, machine actionable ES and EA TTPs in near real-time using online and unsupervised MLAs based on all-available information and multi-modality data present in the Electromagnetic (EM) Spectrum for a single platform and across multiple collaborative Manned/Unmanned naval platforms." It also states that this approach "…extends beyond traditional library look-up solutions that are typically pre-loaded in an on-board Mission Data File (MDF)." It will focus on augmenting and eventually replacing traditional ESM techniques libraries and databases "while reducing offline human-derived TTP development, analysis, and testing timeline by orders of magnitude." The topic point of contact is Charles Stein, e-mail charles.s.stein2.civ@us.navy.mil.

The DOD STTR 2023.A solicitation included the following EMSO-related topics:

- Coherent Sensing Approaches for Dynamic Spectrum Allocation (Topic N23A-T017): This Navy effort aims to "design a distributed, coherent sensing solution to generate a spectrum map of available channels in sparse or dense spectral environments for channel allocation in a decentralized multi-hop network." It will also "develop a scheme for sharing spectrum sensing results across the network for all channels to reach distributed consensus on the spectrum map between multiple geographically-dispersed nodes." The description states that this project will "develop the foundational mathematical analysis to address coherence for distributed sensing in dynamic spectral environments. This topic also seeks an initial design of a methodology for disseminating results and awareness across the network to achieve distributed consensus among the sensing nodes for applications, such as adapting communications within the spectrum and identifying

primary and secondary users." The topic point of contact is Scott Batson, e-mail scott.c.batson.civ@us.navy.mil.

- Improved Fiber Laser for Spectral Beam Combination (Topic N231-D01): This direct to Phase 2 topic from the Navy calls for developing a "…robust, spectrally stabilized, continuous wave fiber-laser system with < 15 GHz spectral bandwidth that is free from stimulated Brillouin scattering [SBS] and thermal mode instability [TMI] at kW power levels." This work calls for developing and optimizing an "innovative prototype fiber-laser system suitable for conventional spectral beam combining" that can demonstrate greater than 1kW output, narrow spectral bandwidth (less than 15 GHz), center wavelength long-term stability (less than 50 MHz) and completely mitigate SBS and TMI. The topic point of contact is Philip Peters, (760) 939-1569.

The DOD will begin accepting proposals for SBIR 2023.1 and STTR 2023.1 via its Defense SBIR/STTR Innovation Portal on February 8. The deadline for all proposals is March 8. Details of the solicitations and topics is available at www.dodsbirsttr.mil.