Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2019-849

Topic # N172-115
Selective Emission of Light Utilizing Functionally-Graded Energetic Materials
Special Aerospace Services, LLC

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA 272, Advanced Tactical Aircraft Protection Systems Program Office

Transition Target: Decoy Devices

TPOC:
(812)854-6631

Other transition opportunities: Army and Air Force Decoy Devices, commercial fireworks

Courtesy of U.S. Navy

WHAT

Operational Need and Improvement: As sensors and decision-making algorithms employed by missiles become more sophisticated, so too must the aerial countermeasures used to deceive them. For countermeasures to be effective, they must produce an electromagnetic (EM) signature which has been precisely calibrated to match that of the target vehicle. Historically, these countermeasures have been fabricated in batches by a multi-step process, which is labor-intensive, dangerous, and may not result in the precision required to produce highly tuned EM signatures. The Navy is seeking an innovative method to safely fabricate and consistently produce precisely tailored EM signatures.

Specifications Required: A novel method of fabricating aerial countermeasures which can incorporate multiple pyrotechnic materials into a single pellet with layered structures and features which will sequentially and distinctly display the EM characteristics of each material. The countermeasures produced using the new method should retain physical integrity and operational functionality after being subjected to an array of sensitivity tests, including: a 40 foot drop test, vibration testing commensurate with aircraft and transportation loads, and 4-week temperature and humidity cycling. The grains produced should ignite and burn consistently within a temperature range of -65F/+160F.

Technology Developed: Special Aerospace Services (SAS) has developed a method of fabricating countermeasures by leveraging accuracy and autonomy of Additive Manufacturing (AM). The system is able to autonomously fabricate multiple countermeasure grains simultaneously, with the composition of the grains being adjustable to produce the time-varying spectral output necessary to match that of the target vehicle. The system produces grains which can be ejected and ignited sympathetically using the CCU-136A/A impulse cartridge. The system has been prototyped and verified.

Warfighter Value: SAS's countermeasure fabrication method decreases the cost, time, and safety risks inherent in the current method by automating the process with AM technology. This manufacturing technology enables increases in countermeasure effectiveness/performance without an increase in device size – allowing quantity-on-board to remain constant. The countermeasures developed using this technology will be designed to be ignited and ejected using a proven impulse cartridge, so as to be a drop-in replacement for current countermeasures.

WHEN

Contract Number: N68335-19-C-0162 **Ending on:** February 25, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Successful Phase I performance evaluation completed by Navy	N/A	5 propellant grains delivered to Navy	3	February 2018
Development of auger extruder	N/A	Auger extruder successfully tested	3	June 2019
Pyrotechnic formulation small scale sensitivity testing	Med	Materials deemed insensitive to printing environment	3	August 2019
Print settings validation and verification	Med	Printer settings produce consistent results	3	October 2019
Full scale grains printed and analyzed	Med	Distinct and predicted spectral outputs observed	4	February 2021

HOW

Projected Business Model: SAS will pursue a strategic partnership with Northrup Grumman Innovation Systems (NGIS) for near-term commercialization of the technology developed in this SBIR program. SAS believes that building a countermeasure production sector from the ground up would be impractical, and a joint commercialization approach with NGIS is a much more feasible method of rapidly transitioning countermeasure AM technology for near-term implementation in warfighter systems. Under this joint partnership approach, SAS would be largely responsible for designing and manufacturing the production-scale countermeasure AM system and next-generation countermeasure prototyping, and SAS would rely on NGIS for technical expertise, printed pellet integration, testing, quality assurance, and eventual marketing to DOD organizations. This approach allows SAS to control the printed countermeasure prototyping and development process, and subsequent pellet production is sourced to qualified energetics manufacturers.

Company Objectives: To SAS' knowledge, there are no near-term competitors of the technology developed in this SBIR program. SAS will be prototyping next-generation countermeasures and AM processes and subcontracting production to energetics manufacturing companies to promote additional sourcing options for the DOD. Competitors would need to demonstrate the ability to successfully print prototype spectrally-adapted pellets. Although NGIS is a prime US countermeasure manufacturer, SAS will be sourcing countermeasure production to NGIS and not competing for market share.

Potential Commercial Applications: SAS's AM countermeasure grain fabrication system will have applications in any commercial arena in which pyrotechnics are used. There are potential commercial applications in the fireworks industry, and the system can be augmented to print more energetic materials which could potentially be used to make tailored, small-scale solid rocket motor grains.

Contact: M. Allen Minor, Staff Engineer / Analyst
aminor@specialaerospaceservices.com (720) 459-2998