Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2020-719

Topic # N181-010

Rotorcraft Integrated Electro-Optic/Infrared (EO/IR) Plumes and Effects Signature Modeling

ATA Engineering, Inc

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-261 H-53 Heavy Lift Helicopters, including the new CH-53K King Stallion.

Transition Target: Greater simulation fidelity in analysis of infrared (IR) signatures and light detection and ranging (LiDAR) systems is sought by the NAVAIR Avionics, Sensors, and Electronic Warfare Department's Electro-Optic (EO) and Special Mission Sensors Division (4.5.6) to aid their engineers' ongoing signature analysis support of multiple Program Offices (including PMAs 261, 275, 299, and 272). This organization is anticipated to be the first user of ATA's technology.

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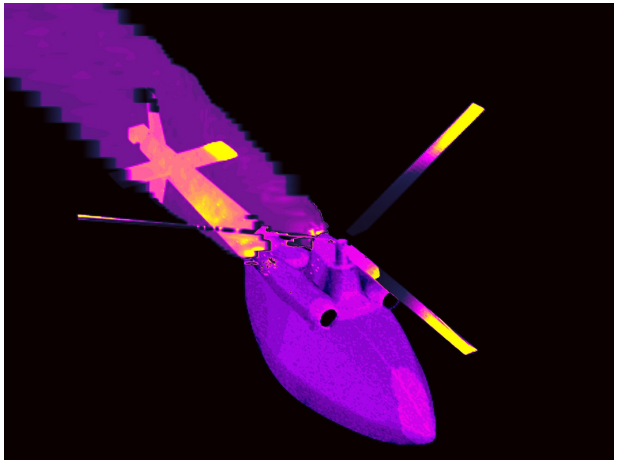

Other transition opportunities: Such needs are shared by other NAVAIR organizations, including the test ranges in China Lake and Point Mugu, California, where many of the Navy's electronic warfare systems are tested. In addition to possessing unique capabilities for in-flight IR measurements, these test ranges perform aircraft IR signature modeling and threat IR signature and acquisition range analysis. Outside of NAVAIR, the Tactical Electronic Warfare Division (TEWD), Signature Technology Office (STO), Advanced Techniques Branch (Code 5750) of the Naval Research Laboratory (NRL) has similar requirements for their high-fidelity simulations of EO/IR signatures of surface ships, missiles, and several other Navy platforms. All of these Navy organizations would have immediate access to ATA's toolkit.

WHAT

Operational Need and Improvement: The US Navy seeks to develop improved rotorcraft electro-optic/infrared (EO/IR) signature modeling capabilities to counter advances in adversary technologies and ensure aircraft survivability and weapon lethality. ATA's technology offers a variable-fidelity approach, where modeling of complex physics such as aeroelastic blades and the inclusion of combustion byproducts may be switched on and off to reveal their relative influence on the resulting signature. This approach is also advantageous in situations where advanced modeling parameters are not known and lower-fidelity models are preferred.

Specifications Required: The Navy requires a single rotorcraft EO/IR signature modeling solution that incorporates body, engine, environmental, and asymmetric plume effects. The solution should utilize validated and widely used EO/IR signature modeling tools.

Technology Developed: ATA's Rotorcraft Advanced Signature Prediction (RASP) toolkit incorporates leading computational fluid dynamics (CFD) and EO/IR modeling solvers in a modular, variable-fidelity framework for rotorcraft plume and signature analysis. The technology provides greater realism in computational EO/IR signature prediction by accounting for the interaction of rotorcraft downwash, engine plume asymmetry, full-body thermal state, and environmental effects. RASP's multidisciplinary approach provides greatly improved accuracy of rotorcraft EO/IR signature prediction over existing methods.

Warfighter Value: As advances are made in adversary sensing technologies embedded in present and future weapons systems, minimizing US military rotorcraft EO/IR signatures is increasingly critical for vehicle design and survivability. ATA's RASP toolkit utilizes advanced computational tools to produce high-fidelity estimates of these signatures for the analyst, providing relevant insights on the observability of rotary-wing vehicles. These insights, coupled with operational military intelligence, will support successful mission execution, ensuring that the warfighter benefits from the most accurate vulnerability assessments.

WHEN

Contract Number: N68335-19-C-0725 **Ending on:** September 7, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
QF-4 fixed-wing IR validation	Low	Target IR signature within 20% measured value	3	October 2020
Account for heat transfer effects	Low	Achieve first-principles modeling of skin heat transfer	3	January 2021
Rotorcraft IR validation	Med	Target IR signature within 20% measured value	5	April 2021

HOW

Projected Business Model: Consistent with the licensing paradigm of the existing Government-owned software codes that RASP is intended to interface with, ATA will make the toolkit available as open-source software at no cost to qualifying organizations. Rather than relying on sales of a niche software product, ATA's business model for commercializing this technology will involve offering a number of engineering services making use of this technology, including engineering consulting services, software customization and configuration control, training, and end-user support.

Company Objectives: As an advanced engineering services company, ATA provides superior and innovative analysis- and test-driven design solutions and exceptional support to our aerospace engineering clients. To further that mission and expand our capabilities portfolio, ATA's objective in continuing development of the RASP toolkit is to have a leading role in advancing rotorcraft electro-optic/infrared (EO/IR) signature analysis within government and commercial enterprises.

Potential Commercial Applications: By integrating signature and rotorcraft engine exhaust and downwash modeling into a common framework, RASP will provide engineers and mission planners with improved signature prediction accuracy and therefore potential benefit to a number of vehicle platforms. This need is particularly acute for rotary-wing aircraft used by special operations forces in covert missions. Such aircraft are typically derivatives of other platforms, with special modifications. In addition to informing rotary-wing aircraft design, potential secondary applications for RASP include the development of EO/IR sensing technologies for more-accurate threat models for aircraft-borne sensors and weapon seeker system analysis, countermeasures, and even commercial aircraft, which are also at risk from air defense systems. Prime contractors developing military rotorcraft (e.g., Bell Helicopter, Sikorsky) and weapon/sensor systems (e.g., Raytheon, L3Harris) will likewise find great value in the RASP toolkit.

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