

Department of the Navy SBIR/STTR Transition Program

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NAVAIR JSF18-948

Topic # N161-002

Stealthy RF-based Alternative PNT (STRAP)

Charles River Analytics, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: JSF-MS Program Office

Transition Target: Possible transition targets include (1) Joint Strike Fighter (F-35), (2) other military aircraft, and (3) unmanned aerial vehicles (UAVs).

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Other transition opportunities: Key components of STRAP-- including the Context Awareness Engine and improved Extended Kalman Filter-- will contribute to more reliable UUV navigation, a key requirement outlined in the Navy Unmanned Underwater Vehicle (UUV) Master Plan and the DoD Unmanned Systems Integrated Roadmap. The technologies incorporated in the STRAP system can also improve the indoor and outdoor navigation capabilities of devices such as smartphones and ground vehicle-based navigation systems, while also improving tracking of first responders in GPS-denied areas.

Notes: Charles River Analytics plans to target the market for GPS-independent positioning, navigation, and timing (PNT) systems for aircraft/UAVs, ground vehicles, small craft/boats, and dismounted personnel.



<https://www.public.navy.mil/surfor/lcs4/pages/uss-coronado-lcs-4-conducts-dynamic-interface-testing-with-mq-8b-fire-scout.aspx>

WHAT

Operational Need and Improvement: GPS may not be available or reliable in anti access, area denial (A2/AD) environments. Inertial navigation systems (INS) and precision clocks may extend PNT for short periods, but are subject to growing drift errors when GPS is not available. No other current PNT technology provides world-wide, jam-resistant localization with accuracy comparable to GPS. Alternatives are needed to compliment GPS navigation in GPS denied environments.

Specifications Required: Developed technologies should be suitable for vehicles such as small UAVs with constrained space, weight, and power (SWaP); system hardware and software designed to minimize acquisition and life cycle costs; readily adaptable for use on different types of platforms and automatically includes or excludes sensor inputs as available; can be deployed rapidly because it requires minimal infrastructure to service large coverage areas; has a low probability of detection (LPD) and does not burden electromagnetic spectrum (EMS) management; hardware does not require special operator training or secure handling/storage, and has a low probability exploitation (LPE) if captured or lost. Specific objectives include PNT accuracy and availability comparable to GPS when GPS is denied; jam-resistance without an anti-jam antenna; operation in all-weather conditions; operation over land and sea environments having minimal distinguishable features with minimal or no supporting infrastructure; and robust operation in RF-contested or congested environments.

Technology Developed: STRAP has several features 1) its software intelligently fuses data from multiple sources to generate accurate estimates and ensure adaptable, robust performance under varied environmental and tactical conditions; 2) it uses an innovative, RF-based localization technology that is covert, jam-resistant, GPS-independent, and as accurate as GPS; 3) by fusing inputs from miniaturized IMUs and aiding sensors, STRAP enables accurate navigation even if all other localization inputs fail; and 4) its hardware will be small, lightweight, and low-power, and compatible with military aircraft and unmanned aerial vehicles (UAVs).

Warfighter Value: We expect the navigation capability developed under STRAP to have immediate and tangible benefit for Government programs involving military aircraft, UAVs, and other unmanned vehicles; and to provide a substitute source of PNT data in environments where the GPS functionality is degraded or completely denied.

WHEN Contract Number: N68936-17-C-0065 **Ending on:** September 28, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Implement Context Awareness Engine (CAE)	Med	CAE demonstrates continued operation despite sequential or simultaneous changes in platform orientation and/or failure of inputs	5	January 2019
Implement Visual Odometry	Med	Visual odometry demonstrates continuous output in all weather and lighting conditions	5	January 2019
Develop integrated STRAP NAV device	Low	Integrated STRAP NAV device demonstrates localization <2m without GPS	5	March 2019
Test and demonstrate complete STRAP system	Low	STRAP NAV system demonstrates localization <2m without GPS, despite sequential or simultaneous changes in platform orientation and/or failure of inputs	5	July 2019

HOW

Projected Business Model: Charles River Analytics has over 30 years of steady growth providing innovative, cost-effective solutions through intelligent systems R&D. Over 100 Charles River Analytics projects have yielded advanced-technology prototypes that facilitate rapid integration of critical technology into operational systems.

Company Objectives: The proposed technology will have an immediate application to GPS-independent positioning, navigation, and timing (PNT) systems for aircraft/UAVs, ground vehicles, small craft/boats, and dismounted personnel. We hope to engage Large System Integrators (LSIs) that build PNT systems for aircraft/UAVs, ground vehicles, small craft/boats, and dismounted personnel.

Potential Commercial Applications: This technology can also be used for navigation and timing for commercial air and marine vehicles, such as commercial aircraft. For example, because of the proliferation of low-cost GPS jammers, the FAA has become concerned about the loss of GPS signals due to RF interference, such as recently occurred in the Newark airport area. The technologies incorporated in the STRAP system can improve the indoor and outdoor navigation capabilities of devices such as smartphones and ground vehicle-based navigation systems, and can also improve tracking of first responders in GPS-denied areas

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