

Department of the Navy SBIR/STTR Transition Program

DISTRIBUTION STATEMENT A. Approved for public release. Distribution is unlimited.

NAVAIR 2020-829

Topic # N151-026

Discretionary PII - Small Non-Cooperative Collision Avoidance Systems Suited to Small Tactical Unmanned Systems
Scientific Applications & Research Assoc., Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-263

Transition Target: Group 2 thru 5 UAVs

TPOC:
(301)342-3728

Other transition opportunities:

Establish early introduction of Unmanned Aircraft Systems (UAS) for use in low-altitude operations in the National Airspace System (NAS)

beyond what is currently outlined in 14 CFR Part 107 enabling the use of UAS in Beyond Visual Line Of Sight (BVLOS) operations. Additionally, growth of acoustic DAA systems will directly contribute to multi-modal acoustically cued Counter UAS systems.

Notes: Passive Acoustic Non-cooperative Acoustic Motion Analyzer (PANAMA) is the evolution of SARA's mature Passive Acoustic Non-cooperative Collision Alert System (PANCAS). With commercial and government partners, SARA has performed integrated testing on eleven different Group 1, 2 and 3 UAS. In flight testing PANCAS demonstrates omni-directional detection of even small aircraft to ranges exceeding 10 km, and is able to warn the UAS operator when another aircraft is on a collision course. A collision course is determined like a seeker missile: by detecting the constant acoustic signal bearing and frequency from a colliding aircraft.

SARA's experience with state-of-the-art microphone technology and acoustic tracking algorithms places SARA in a unique position to integrate PANAMA into any Group 2 thru 5 UAV platform.



Copyright 2019 Scientific Applications and Research Assoc., Inc.

WHAT

Operational Need and Improvement: UAS must have sense and avoid capability. The Department of Defense's (DoD's) stated focus in unmanned systems is to "Enhance situational awareness, reduce human workload, improve mission performance, and minimize overall risk to both civilian and military personnel..." As the battlespace becomes more crowded, the potential for collisions between UAS and manned aircraft increases dramatically.

Specifications Required: (i) Provide the level of airspace access necessary to accomplish the wide range of DOD UAV missions at current and projected operational tempos (OPTEMPOs); (ii) Autonomous Control of UAVs Air Operations in the air traffic management (ATM) environment; and (iii) Compliance with Title 14 of the U.S. Code of Federal Regulations (14 CFR) 91.111(a), Operating near other aircraft and 91.113(b), Right-of-way rules: Except water operations.

Technology Developed: SARA has developed passive acoustic ABSAA technology named PANAMA which detects the low-frequency sounds emitted by aircraft and reliably detects them. Because it is passive and based on lightweight, low-power microphone technology, PANAMA is possibly the only ABSAA approach capable of meeting UAS SWaP requirements, especially for small, group one UAS. SARA has successfully demonstrated a PANAMA system integrated on a RQ20 Puma UAS which was evaluated by the Coast Guard in August 2020. The event culminated in a sortie where the Puma was flown in 13 Near Mid Air Collision (NMAC) scenarios against fixed and rotary manned aircraft. The existence and precise bearing of that collision hazard was reported to the Puma remote pilot with an average time of 47 seconds before Point of Closest Approach (PoCA), more than enough time for the remote pilot to complete an avoidance maneuver that would have prevented the NMAC.

Warfighter Value: The PANAMA system has successfully demonstrated long-range detection of aircraft ranging from small ultralight aircraft to military transport aircraft. As a passive acoustic system, it is small and requires minimal power. This system was tested during the experiments where it demonstrated the ability to reliably detect an incoming intruder at a range of 10 km (~5.4 NM) with a 360-degree field of view with zero missed detection events and no false alarms. This provides the warfighter with highly reliable intercept information at longer ranges than current visual detection distance of 2.37 NM and is nearly double the recommended minimum detection distance for BVLOS operations.

WHEN

Contract Number: N68335-19-C-0217 **Ending on:** September 30, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Engineering Design Unit Software Updates	Low	SARA has updated the PANAMA engineering development unit (EDU) software to refine the detection and declaration logic, fix data output logs and recoded our algorithms to regain FPGA resources.	7	June 2019
Data Analysis and Modeling	Low	SARA has completed PANAMA testing on a Coast Guard Group 2 UAV PUMA with manned aircraft. The PANAMA system detected nearby aircraft and then conducted an avoidance course change via autopilot. Test reports are available upon request.	7	August 2020
FAR Update	Low	The PANAMA software version tested is able to store multiple tracks, but it only declares on the loudest track for any given instant. SARA is optimizing their PANAMA system with machine learning algorithms to improve probability of declaration of imminence	7	July 2020
Other UAV Evaluations	Med	SARA has been preparing for equipping a UAV with a PANAMA field kit. SARA has been iterating with the TPOC and test group to finalize an integration and flight plan. Testing is tentatively scheduled in FY-21.	7	July 2020

HOW

Projected Business Model: SARA intends to sell PANAMA field and production kits directly to the military as well as lease the technology to industry partners. SARA has worked as a prime and for major primes and has mature in-house manufacturing capability. PANAMA requires interfacing with the host UAS avionics, so collaboration with the manufacturer is a requirement and leads to licensing profit vectors.

Company Objectives: SARA has developed PANAMA over the course of 15 years of research and development and have been installed on over ten UAS platforms. In 2016, SARA entered into a teaming/development agreement with a major UAS manufacturer to develop and test embodiments of PANAMA on current UAS platforms and support accelerated flight testing and safety qualification at FAA test ranges. Currently, the system is under evaluation by the FAA for special condition certification to fly beyond visual line of sight (BVLOS) commercial missions within the national airspace. SARA wishes to discuss this technology with PEO U&W and UAS system integrators.

Potential Commercial Applications: The incoming wave of commercial unmanned air systems require BVLOS operations, including sense and avoid capability. Applications range from the logistical (Amazon's package-delivery concept, food delivery and disaster response), to the utilitarian (infrastructure monitoring such as power lines, telephone, pipelines and hard-to-reach structures like bridges and tall buildings/towers) to civic surveillance such as policing, traffic and safety. As more unmanned aircraft occupy military airspace, mechanisms for autonomous motion and collision avoidance will become increasingly critical.

Contact: Jesse Klang, Acoustic Detect & Avoid Program Lead
JKlang@sara.com 7142244410