Hiawatha Aircraft Anti-Collision System, Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

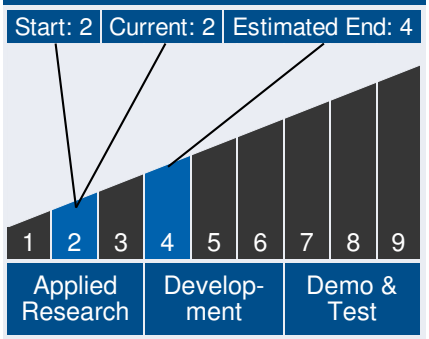
ABSTRACT

For SUAVs, the FAA mandate to equip all aircraft with ADS-B Out transmitters by 1 January 2020 to support NextGen goals presents both logistical and mission security issues. Aircraft without ADS-B Out capabilities, ranging from commercial or general aviation aircraft with failed transponders to adversarial aircraft deliberately operating without required transponder equipment, will continue to exist within the general airspace and pose navigational hazards and tactical threats to SUAVs. Nokomis proposes to adapt its ultra-sensitive RF sensor system, called Hiawatha, to provide an unsurpassed trajectory management and anti-collision avoidance capability. The Hiawatha system provides flight-tested state-of-the-art ultra-sensitive RF detection, identification and geo-location performance. Nokomis will develop a system-level design of an anti-collision system to aid in trajectory management and safe traffic flow of autonomous UAV operations capable of meeting the SWaP requirements for incorporation into a representative SUAV payload platform. The RF-based traffic management and anti-collision avoidance system will be capable of monitoring the entire spectral range from 30 MHz to 3 GHz, while providing the necessary detection, identification, and locating abilities from all angles while operating in a non-interfering manner with other potential payloads. Specifically, Nokomis will demonstrate system sensitivity including long range detection and identification of representative UAV emissions, system geo-location and contact bearing capabilities, Doppler-based bearing and range to aircraft, and design Trajectory Prediction and Avoidance System and efficient Traffic Flow System for maintaining aircraft spacing. The Phase I effort proof of concept demonstrations will focus on a demonstration of the Hiawatha airborne system, detection, identification, and location of relevant targets using existing AoA algorithms, and existing source classification algorithms.

Table of Contents

Abstract 1
Technology Maturity 1
Management Team 1
Anticipated Benefits 2
Technology Areas 2
U.S. Work Locations and Key Partners 3
Image Gallery 4
Details for Technology 1 4

Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

Continued on following page.

ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: In addition to the nearly 102,000 flights in the air across the United States today, in the near future UAVs and drones will start making up increasing segments of the aviation traffic in this country. Aircraft without ADB-D Out capabilities, including malfunctioning and 'non-cooperative' aircraft will continue to exist within the general airspace and pose navigational hazards and tactical threats to SUAVs. These 'non-cooperative' aircraft could range from commercial or general aviation aircraft with failed transponders to adversarial aircraft deliberately operating without required transponder equipment. The ability for UAV to detect, identify, and track these aircraft to ensure safe operation and trajectories in traffic will become of increasing importance. The Hiawatha aircraft anti-collision system will provide a tool for trajectory managements and efficient traffic flow, especially for preventing collisions in case of transmitter failure or non-cooperative traffic. In addition, the Hiawatha aircraft anti-collision system can aid in operations during approach or in dense traffic areas by providing range and bearing of nearby aircraft to maintain spacing during approach. The passive nature of the system allows for the detection of non-cooperative or disabled aircraft, while the low cost and small size of the system allow for integration on various platforms.

To the commercial space industry:

Potential Non-NASA Commercial Applications: The Hiawatha anti-collision system can be applied to a variety of UAV and drone applications in which way-finding or obstacle avoidance is necessary. For drones used in agricultural applications, the system can be adapted to help the aircraft avoid electrical towers and other obstructions near fields. Further applications can use beacons to provide location points for the tracking and way-finding of UAVs on long distance per-mapped routes beyond user control. The system can also be reconfigured as a

Management Team *(cont.)*

Principal Investigator:

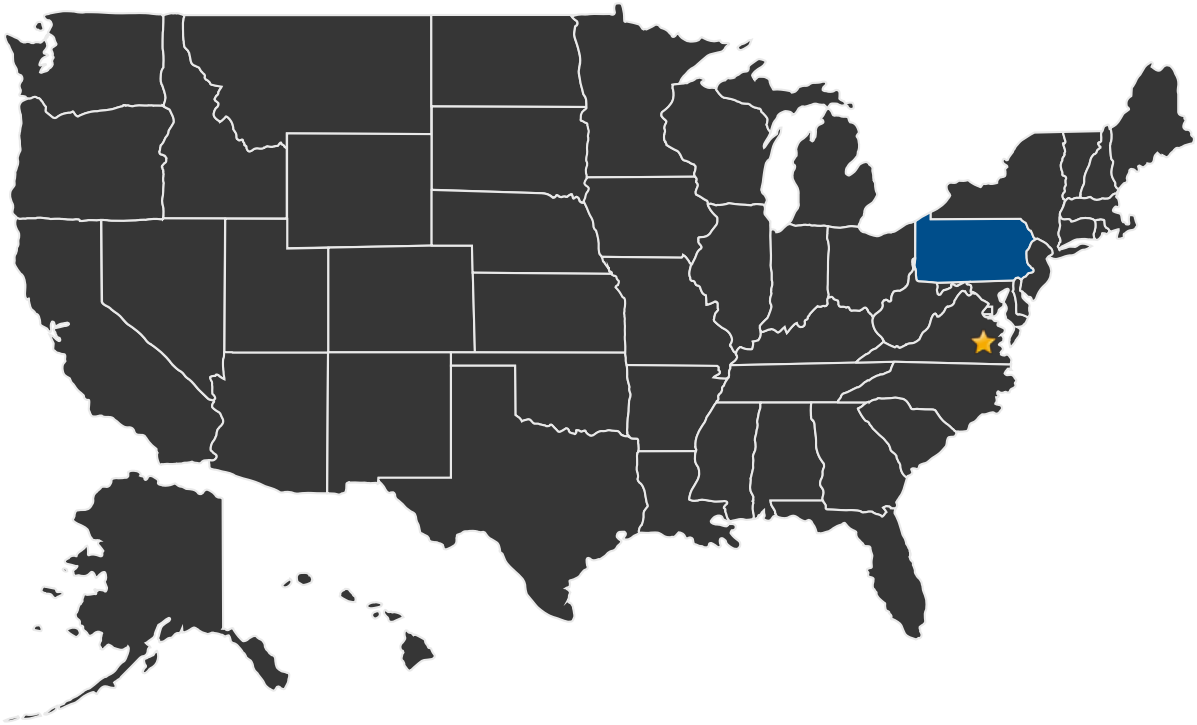
- Karen Canne

Technology Areas

Primary Technology Area:
Communications, Navigation, and Orbital Debris Tracking and Characterization Systems (TA 5)
└ Position, Navigation, and Timing (TA 5.4)
  └ Sensors and Vision Processing Systems (TA 5.4.3)

ground-based detection, identification, and tracking system of UAVs or other platforms, providing information about a region of airspace for space operations such as UAV and balloon launches. In addition, the automobile industry is expanding exploration into the development of fully automated vehicles. This technology represents a distinct capability for potential anti-collision avoidance systems that are not reliant upon inter-vehicle communications. The automotive semiconductor market represents a potential $37.3 billion market for insertion at approximately the time that this technology would be ready for transition.

U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Langley Research Center

Other Organizations Performing Work:

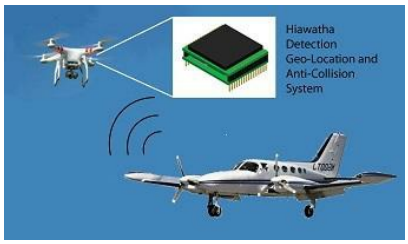
- Nokomis, Inc. (Charleroi, PA)

PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/23198)

IMAGE GALLERY



Hiawatha Aircraft Anti-Collision System, Phase I

DETAILS FOR TECHNOLOGY 1

Technology Title

Hiawatha Aircraft Anti-Collision System, Phase I

Potential Applications

In addition to the nearly 102,000 flights in the air across the United States today, in the near future UAVs and drones will start making up increasing segments of the aviation traffic in this country. Aircraft without ADB-D Out capabilities, including malfunctioning and 'non-cooperative' aircraft will continue to exist within the general airspace and pose navigational hazards and tactical threats to SUAVs. These 'non-cooperative' aircraft could range from commercial or general aviation aircraft with failed transponders to adversarial aircraft deliberately operating without required transponder equipment. The ability for UAV to detect, identify, and track these aircraft to ensure safe operation and trajectories in traffic will become of increasing importance. The Hiawatha aircraft anti-collision system will provide a tool for trajectory managements and efficient traffic flow, especially for preventing collisions in case of transmitter failure or non-cooperative traffic. In addition, the Hiawatha aircraft anti-collision system can aid in operations during approach or in dense traffic areas by providing range and bearing of nearby aircraft to maintain spacing during approach. The passive nature of the system allows for the detection of non-cooperative or disabled aircraft, while the low cost and small size of the system allow for integration on various platforms.