

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2021-0442

Topic # N193-A01

WiseOwl

North Point Defense, Inc.

WHO

SYSCOM: NAVSEA

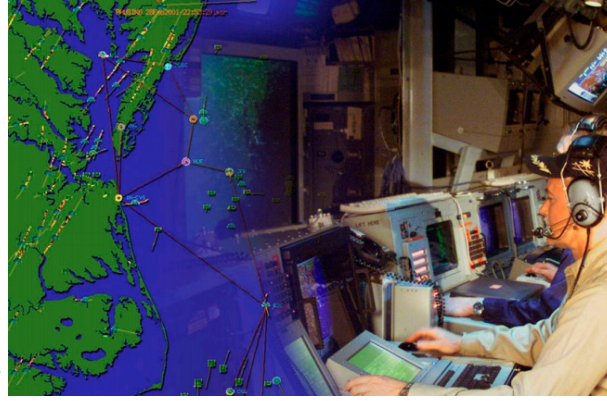
Sponsoring Program: PEO IWS 6

Transition Target: AN/USG-2, AN/USG-3 Cooperative Engagement Capability (CEC) Increment 2

TPOC:
(202) 781-3014

Other transition opportunities: US Navy Battle Damage Assessment; US NORTHCOM/FAA Air Defense; DHS Customs and Border Patrol; US Navy Aegis Common Source Library; Multiple DoD/IC SIGINT collection platforms

Notes: North Point Defense (NPD) has developed modular software capabilities for seamless integration with multiple architectures. Capabilities developed by NPD can be rapidly transitioned as individual components or entire NPD-developed system. Technology developed by NPD can potentially be applied to a broad array of signals and protocols throughout the Navy/DoD/IC SIGINT community.



<https://www.dote.osd.mil/Portals/97/pub/reports/FY2020/navy/2020cec.pdf>
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WHAT

Operational Need and Improvement: As Automatic Dependent Surveillance-Broadcast (ADS-B) sensors are integrated with signal collection units, algorithms to process and derive intelligence from this data are required. Artificial Intelligence and Machine Learning (AI/ML) has the capability to pull out important pieces of information from data rich environments such as ADS-B. Furthermore, modern AI/ML approaches can transform overwhelming amounts of data that can only be analyzed with simple, archaic algorithms into a rich source of actionable intelligence detecting anomalies beyond human capacity.

Specifications Required: The solution shall aim to develop algorithms using AI/ML approaches to characterize aircraft behavior. Specifically, these algorithms will identify air corridors and detect anomalous behavior. Aircraft exhibiting anomalous behavior should be identified on a continuous basis feeding upstream systems such as Combat Identification. Although ADS-B data feeds are uncharted territory for the CEC platform, customer reviewed metrics include accuracy and false alarm rate.

Technology Developed: NPD is developing a suite of independent machine learning algorithms to analyze and detect anomalies in ADS-B messages in near real-time. The first is a Deep Neural Network (DNN) approach that verifies whether the RF signature of the data matches the expected signature for that aircraft. This algorithm will detect, in real-time, an instance of a message spoofing attack or, in other words, when ADS-B messages are broadcast with an impostor ICAO address. Beyond that, NPD has also developed algorithms for the following: identifying abnormal flight patterns (e.g. figure-8), clustering tracks to identify apparent air corridors and outliers, comparing aircraft kinematics with the physical limitations of the airframe; multilateration (geolocation) using several ADS-B sensors, and finally comparing tracks in instances when more than one source of track data are available. NPD has integrated these modules in a framework that includes ADS-B collection, message and track aggregation, and data cleaning in near real-time with multiple sensors.

Warfighter Value: The application of AI/ML algorithms enables far more collected data to be processed and allows discovery of anomalous behavior that would have gone unnoticed without such algorithms. Because ADS-B is publicly broadcast data, anomalies detected in this domain could indicate a degree of nefarious activity intending to conceal enemy behavior or mislead U.S. collection assets. Detecting these events allows the operator to gain a better understanding of the true air picture in real time.

WHEN

Contract Number: N68335-20-F-0543 **Ending on:** November 1, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Receiving and storing In-Phase and Quadrature (IQ) ADS-B samples	Low	>= 1GB of raw IQ data collected	6	September 2020
Detection of aircraft inconsistencies using known performance characteristics	Med	>= 85% detection of inconsistent aircraft performance	6	December 2020
Detection of spoofed messages from RF signature	Med	>= 80 detection of anomalous/spoofed messages	6	June 2021
Demonstration of prototype system	Med	Accurately identify anomalies in real time with live ADS-B collections.	6	September 2021

HOW

Projected Business Model: NPD plans for technology insertion for either overall system architecture or individual components and intends to transition this technology to the prime integrator for the AN/USG-2 CEC system via a software license agreement. NPD also intends to provide the developed software to other Government agencies via direct sale to the Government or software license agreements and can support routine software upgrades and maintenance. All technology is software-based and has a simple interface to expedite integration and transition.

Company Objectives: NPD seeks Government arrangement of test and evaluation in operationally relevant environment either through direct contract or through the prime integrator's test environment. While the algorithms developed as part of this software solution specifically target ADS-B data, there is potential for algorithms to apply more broadly to multiple other signals with minimal parameter tuning. As such, NPD is also seeking partners throughout the SIGINT community for potential technology transition in other signal collection environments.

Potential Commercial Applications: Other potential applications include enhancing maritime and border security for US Coast Guard counter-narcotics mission as well as improving Federal Aviation Administration's situational awareness for homeland security. Other potential applications include investigations into aircraft traffic patterns and anomalous behavior for specific aircraft (e.g. corporate aircraft, foreign government-owned aircraft, etc.).

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