

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2021-0355

Topic # N193-A01

Integration of Automatic Dependent Surveillance

Skyward, Ltd.

WHO

SYSCOM: NAVSEA

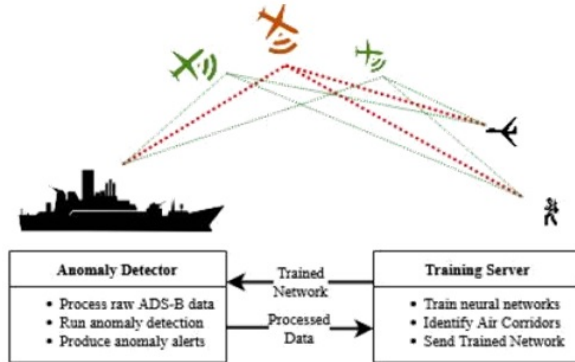
Sponsoring Program: Broad ranging topic related to AI/ML in support of the Navy Technology Acceleration Pilot, PEO IWS 6

Transition Target: Cooperative Engagement Capability (CEC)

TPOC:
(202) 781-3014

Other transition opportunities: Battle Management Aid (BMA), Air Traffic Control in unimproved regions, AIS anomaly detection for watercraft anomaly detection, civil/military aviation integration

Notes: Anomaly detection in imagery has been demonstrated to the Air Force through another SBIR by identifying debris and potential unexploded ordnance in post-attack airfield scenarios.



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WHAT

Operational Need and Improvement: Extracting patterns from Automatic Dependent Surveillance-Broadcast (ADS-B) data to identify air corridors and detect anomalous behavior could provide crucial information for both commercial and military applications. Advancements in machine learning (ML) allow for identification of complex patterns and adaptive anomaly detection. Since flight routing is constantly changing due to temporal variables such as weather, identifying air corridors and detecting anomalous aircraft behavior requires a live approach that takes into account such variables.

Specifications Required: The Navy seeks to develop models and algorithms through AI/ML processes to autonomously characterize behaviors of self-reporting aircraft using ADS-B data. The behavior models and data will be used to (1) identify apparent air corridors and (2) detect anomalous behavior in support of determining aircraft intent.

Technology Developed: To autonomously identify threats in a challenging and ever-changing airspace, Skyward has developed a system which includes hardware signal detectors with on-board processing and identification of anomalies based on trained algorithms, a training server which continuously gathers ADS-B data from detectors and updates the system as conditions change, Machine Learning (ML) algorithms which analyze the signal data and adapt to understand "normal" behavior in the airspace, and a Common Operating Picture (COP) to graphically display flight corridors and anomalous flights for review by the analyst or air traffic controller monitoring the airspace. Different from other ML algorithms which operate in a "black box" process, the Skyward system also offers explainability - descriptions of why particular flights have been identified as anomalous.

Warfighter Value: ML enables the system to understand a complex and changing environment with autonomous anomaly identification to identify trends and abnormalities which would be impossible for human observers. Autonomous identification of anomalies presented along with context of each anomaly allows those interacting with the system to understand the airspace faster and with better information. This will reduce workload and stress on air traffic control as they try to identify friend or foe.

WHEN

Contract Number: N68335-20-F-0565 **Ending on:** November 1, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Phase I Feasibility Research of Anomaly and Corridor Detection of ADS-B Data	N/A	Assessment of feasibility, award of Phase II	3	April 2020
Successful ADS-B Flight and Global Anomaly Detection	Med	Detect 90% of anomalies in dataset	6	August 2021
Working scalable prototype COTS Anomaly Detector Unit	Low	Prototype successfully collects data and passes inspection testing	6	October 2021
ADS-B Anomaly Detection Training Server Software implemented locally and on DoD HPC	Low	Collect, store, and train on 12 months of data collected	6	October 2021
Integration into CEC program with prime contractor	Med	Successful integration into prime contractor's system with full-scale evaluation	8	December 2025

HOW

Projected Business Model: Skyward's ADS-B anomaly detection will be integrated with the CEC program across several USN platforms. Phase III efforts with PEO IWS 6 will ensure successful integration within the CEC architecture. Skyward will license its AI/ML algorithms to the prime contractor for CEC, working closely to ensure successful integration with their systems. Skyward will also license the hardware designs as necessary to supplement the AI/ML algorithms for use within the CEC program. Additional uses in other areas such as the integration of civil and military aviation with the Air Force and FAA will be sought to apply the unique capability developed by Skyward to the global airspace.

Company Objectives: Skyward's objective is to improve the situational awareness of the U.S. military by continuously improving AI/ML techniques for use across all branches to improve the safety and survivability of people and their resources. Skyward intends to pursue DHS and USCG use as well to protect the borders of the U.S. for potential terrorist threats as well as drug and human trafficking.

Potential Commercial Applications: Skyward is seeking integration with existing air traffic control (ATC) systems such as En Route Automation Modernization (ERAM) and Standard Terminal Automation Replacement System (STARS) to improve the air traffic controller workload and speed of anomaly identification. The AI/ML algorithms are expected to assist ATC more quickly identify potential concerns in the air space and with more confidence improving the safety of air traffic and reducing the stress on controllers who are often over-burdened.

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