

Department of the Navy SBIR/STTR Transition Program

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Topic # SB162-009

Cloud Analytics of Satellite Imagery (CASI) for Tomahawk Mission Planning
DZYNE Technologies Incorporated

WHO

SYSCOM: NAVAIR

Sponsoring Program: Strike Planning & Execution Systems (PMA-281)

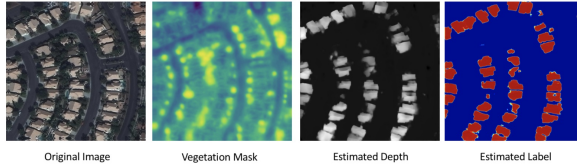
Transition Target: Theater Mission Planning Center (TMPC) system, AN/SSQ-126

TPOC:
(301)757-1884

Other transition opportunities: Other opportunities include battlespace awareness focused data set – DCGS-N, Trident missile – SSP, NGA – National Geospatial Intelligence Agency, PEO Sub – ISIS (Integrated Submarine Imaging Systems) – AN/BLQ-10. Core technologies are relevant to GPS denied navigation applications.

Notes: The Air Force Research Laboratory (AFRL) Center for Rapid Innovation (CRI) and DZYNE Technologies Incorporated resumed flight testing of the ROBOpilot unmanned air platform last year and completed a successful fourth flight test at Dugway Proving Ground, Utah, during which ROBOpilot flew for approximately 2.2 hours, completing all test objectives. ROBOpilot is an applique kit that converts a general aviation aircraft into an unmanned aerial vehicle rapidly and affordably without making any permanent modifications to the aircraft. The system can fly missions autonomously and then be removed to return the plane to its manned configuration. Installation involves removing the seats and attaching the robot to the seat rails.

CASI algorithms can perform multi-class detection against vegetation, water, roads, and depth to generate semantic label for each detection class.



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WHAT

Operational Need and Improvement: There is a compelling need for automation in the creation & validation of route navigation objects used in Tomahawk cruise missile mission planning. Assessing numerous scene areas for changes on a recurring cycle is time-consuming for a human analyst and fails to capitalize upon the dramatic increases in imagery collection, network bandwidth, and storage density over the past two decades. When coupled with the Advanced Imagery Management capabilities in development under Topic #N172-112, automated, algorithm-driven, feature-based change detection under this effort (Cloud Analytics for Satellite Imagery (CASI)) leverages both classified and unclassified commercial & public satellite imagery as well as land use classification data to assist the human analyst by flagging scene areas for prioritized review.

Specifications Required: Develop algorithmic approaches that monitor, predict, and assess selected mission-specific scene areas. Identify metrics, constraints, and performance levels needed for supporting the scene validation task, including data distribution approaches. Develop and demonstrate a limited-functionality prototype of the software system. Applications may use a single data source/type (e.g. panchromatic imagery) or a combination of sources/types (e.g. pan & multispectral imagery with topographic vector data). The prototype should focus on information collection, analysis, and product dissemination at the appropriate time scales.

Technology Developed: The CASI program will continuously and autonomously monitor scene areas as imagery is received, notifying analysts if changes in image content such as buildings, roads, vegetation and water consistently exceed threshold values. The effort will develop solutions that support (a) change detection to cultural and geographic features; (b) assessments of shadow-casters; (c) a robust notification and reporting system. Its Image Validation Service (IVS) will leverage state-of-the-art Deep Learning algorithms to detect and localize changes in newly received imagery against a stored reference (product) image.

Warfighter Value: CASI will enable the DoD to take advantage of the latest advances in AI/ML and Deep Learning to automate change detection over designated scene areas within the ISR analyst workflow. The IVS will be a modular component that can be configured to interoperate with Advanced Imagery Management or an existing collections management plan.

WHEN

Contract Number: N68335-20-C-0564 **Ending on:** June 22, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Enhance and implement detection module	Med	Routine detection of scene changes at a 50% false positive / 30% false negative threshold performance	6	December 2021
Image Validation service development	Low	Functional software release on TMPC testbed at PMA-281 Washington Planning Center (WPC) test facility	6	March 2022
Initial integration into TMPC	Med	Functional software release that is integrated into TMPC workflow	6	June 2022

HOW

Projected Business Model: DZYNE Technologies specializes in the rapid design, development, and production of advanced unmanned aircraft and analytic systems. We start from concept creation and rapid prototype development and carry it all the way through to delivery of operational systems. DZYNE Technologies has assembled a team proven in their ability not only to conceive of groundbreaking designs but also to deliver functioning systems based on those innovative designs. We house experts in many fields including aerodynamics, structural design, systems engineering, and flight test, as well as artificial intelligence, image understanding, and autonomy software. DZYNE will transition CASI into the TMPC imagery-based navigational object validation workflow and seeks other NAVAIR, Navy & DoD development opportunities related to AI/ML and Deep Learning applications. In addition, DZYNE hopes to transition CASI to multiple NGA programs for global-scale monitoring and assessment.

Company Objectives: Commercial satellite imagery combined with other intelligence can support international drug interdiction, maritime security, and treaty compliance. Further, the use of unclassified satellite imagery and data enables greater sharing of analysis products with non-DoD US agencies and coalition partners for conducting joint operations. We would like to meet with other mission planning organizations across the Services and beyond DoD who may have similar ISR & remote sensing-related workflows that might be made more efficient and less costly through the adoption of CASI capabilities that are being developed for the Navy under this effort.

Potential Commercial Applications: The commercial sector has needs in area site surveys, resource exploration, and agriculture monitoring. Information collection, analysis, and product dissemination workflows in the commercial sector may all be candidates for DoD-initiated advances such as CASI.

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