Topic: N16B-T026

Atmospheric & Space Technology Research Associates

Novel Nanosat Payloads for Naval Weather Needs

Monolithic sensors and spacecraft have dominated space for decades. New low Size, Weight, and Power (SWaP) small satellite compatible sensors offer rapid configuration, manufacturing, and low-cost space access. The ASTRA CubeSat Ocean Observing (CO_2) sensor can be integrated with a variety of small spacecraft, and enables accurate sea-state vector wind measurements. The data from the measurements can be of great use for all DoD agencies, providing key real-time environmental weather information. A constellation of CO_2 sensors would allow constant monitoring of ocean winds, at a much lower cost to orbit than previous methods. Other commercial industries, such as maritime cargo and oil shipping, could also greatly benefit from this data. ASTRA has a rich history with SBIR/STTR programs, and a Commercialization Achievement Index of 90.

Technology Category Alignment:

Space
Sensors
Battlespace Environments

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SYSCOM: NAVWAR
Contract: N68335-19-C-0677

Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-19-C-0677

Tech Talk: https://youtu.be/xh6n-gSwkpw

Department of the Navy SBIR/STTR Transition Program

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NAVWAR SR-2020-210

Topic # N16B-T026

Ocean Surface Vector Winds (OSVW)

Atmospheric & Space Technology Research Associates

WHO

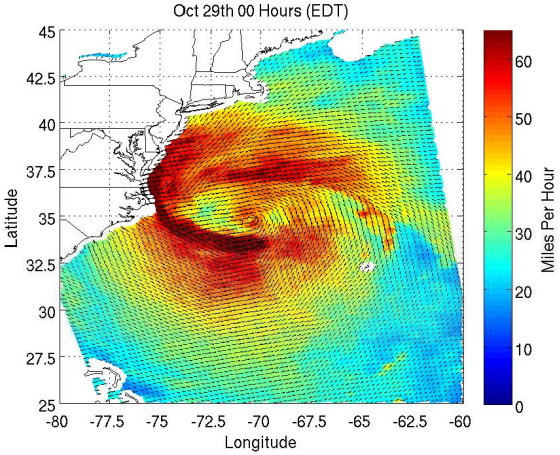
SYSCOM: NAVWAR

Sponsoring Program: Naval Information Warfare Center Pacific

Transition Target: The CubeSat Ocean Observing (CO2) sensor package is intended for integration on any small satellite platform, but its SWaP is ideal for use in a constellation of CubeSat buses

TPOC:

Other transition opportunities: Currently, CO2 is scheduled for a test flight on the International Space Station (ISS). This will serve as a flight test in anticipation of manufacturing sensors for a constellation of spacecraft.



Credit NASA: Indian Space Research Organization OceanSat-2 https://www.nasa.gov/sites/default/files/images/702072main_pia16219-full.jpg

Notes: Weather forecasting, specifically Ocean Surface Vector Winds (OSVW) is critical to battlespace awareness for planning, operations and risk management for all services. The CO2 sensor is the result of two separate successful SBIR efforts, with which ASTRA has a rich history, boasting a Commercialization Achievement Index of 90

The image above illustrates OSVW from Hurricane Sandy, and the effect storms have on sea state.

WHAT

Operational Need and Improvement: The Navy requires accurate and rapid weather forecasting for all operational theaters. WindSat, launched in 2003 as a proof on concept, must be augmented by a new generation of low Size, Weight, and Power (SWaP) sensors. The goal of this STTR is to Integrate a TRL 9 (terrestrial) low SWaP GPS reflectometry receiver for real time OSVW generation.

Specifications Required: Capability: Retrieve Ocean Surface Vector Wind speed & direction
Mass: <4.5 kg
Power: <10 W
Volume: Configuration Specific; range: 2U (20x20x20cm) - 4U**(40x40x40cm)
** This is a mission specific configuration (Phase II STTR). This payload was originally designed to occupy 2U of CubeSat volume. Mass, interface, data rate, and volume are mission configurable.

Technology Developed: A smallsat form-factor payload using the reflection of Global Positioning System (GPS) signals off the ocean to measure sea state and Ocean Surface Vector Winds (OSVW) for weather forecasting. CO2 leverages previous successful SBIR efforts that comprise the sensor package; the GPS receivers and Power Distribution Unit (PDU). We utilize commercially available hardware, as well as GPS antennas that complete the assembly.
GPS Receiver TRL: 9; PDU TRL: 8

Warfighter Value: CO2 is a novel small SWaP GPS receiver with associated signal processing algorithms to support the Navy's needs for Meteorological and Oceanographic (METOC) measurement and data collection.
These measurements are a critical input for battlepsace awareness, planning, operations, and risk management for all services.
Poor conditions impact resource movements, operational ship maneuvers, evacuations, and flight operations.
Currently, the Navy's only satellite for measuring OSVW is a proof of concept spacecraft 10+ years beyond design life, with its successor scheduled to fly no earlier than 2023.

WHEN

Contract Number: N68335-19-C-0677 **Ending on:** October 31, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
End Phase II: Fabricate CO2 custom configuration for flight on ISS	Low	Launch payload November 2021	9	January 2021
End Phase II, Option 1: Implement retrieval algorithm onto GPS receiver	Med	Retrieve Delay Doppler Map (DDM) on-orbit		November 2021
End Phase II, Option 2: Retrieve on-orbit data; assist Navy personnel in mission operations	Low	Asses DDM data for use in operational scenarios		October 2022

HOW

Projected Business Model: ASTRA seeks to manufacture CO2 sensors for sale and integration with government and commercial small satellite buses. We can meet low-rate initial production demands while scaling for lot manufacturing. ASTRA owns the design and controls the production for all major CO2 subsystems. We will continue to work with commercial partners to lower the cost and lead time of procured, off the shelf components.
ASTRA also offers an option to provide operational service to capture data from the sensors to be distributed to subscribers. We have a state-of-the-art missions operations center currently operating multiple spacecraft on-orbit. The CO2 sensor will be a great addition to any new or existing missions that seek to fly a comprehensive earth-observing platform.

Company Objectives: While ASTRA has a rich SBIR/STTR history, we are always seeking to transition our products to the marketplace. From designing custom sensors for commercial and government missions, to operating CubeSats from our Colorado headquarters, ASTRA has a diverse set of capabilities. Our objective for this specific STTR Transition Program is to make our sensor known to service branches or companies that are currently designing or operating earth-observing spacecraft with a need for ocean weather forecasting.

Potential Commercial Applications: Providing key real-time environmental weather information, a constellation of CO2 sensors would allow constant monitoring of ocean winds, at a much lower cost to orbit than previous methods. Commercial industries, such as maritime cargo and oil shipping, could also greatly benefit from this data. Energy companies can use the information to determine where to place oil rigs and plan offshore wind farms. Marine resource managers can use the data to help prevent coastal erosion and track oil spills. International disaster preparedness, response, and recovery teams gain information that enables activation of response teams and supplies in advance of extreme events to aid recovery both for business continuity and for human welfare.

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