Topic: N08-195

Yankee Environmental Systems, Inc.

Next-Generation Marine Atmosphere Observing Instrumentation

This mature small business specializing in environmental sensors for meteorological applications such as severe weather forecasting or radar ducting at sea has developed an Automated Dropsonde Dispenser (ADD) for its Expendable Digital Dropsonde (XDD). The XDD measures a high resolution vertical profile of pressure, temperature, relative humidity and sea surface temperature, and real-time data initializes operational electro-optical propagation or weather models. The ADD replaces a human-in-the-loop dropsonde operations and allows deployment based on geographic positioning, making this a perfect solution for MQ-4C Triton and other UAV systems. The system has been demonstrated on NASA WB-57 and DC-8 aircraft in support of ONR, NOAA, NASA and Naval Postgraduate School experiments, making it a suitable system for U.S. Navy P-8A Poseidon and USAF WC-130J aircraft.

Technology Category Alignment:

RF Components for sensing, transmission and communication
Electronics Integration
Sensors
Advanced Electronics

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SYSCOM: ONR
Contract: N68335-17-C-0073

Department of the Navy SBIR/STTR Transition Program

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Next-Generation Marine Atmosphere Observing Instrumentation
Yankee Environmental Systems, Inc.

WHO

SYSCOM: ONR

Sponsoring Program: Code 32

Transition Target: Maritime Patrol and Reconnaissance Aircraft; High Altitude Long Endurance (HALE) UAVs

TPOC:
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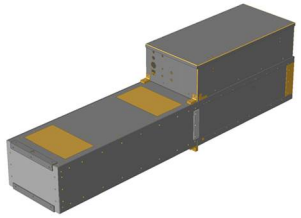
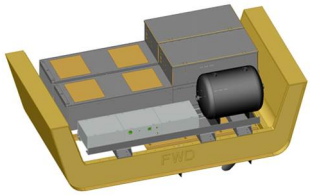
Other transition opportunities: Upper Air data in support of electro-optical/electromagnetic propagation at sea; USAF Weather Reconnaissance Aircraft



Automated Dropsonde Dispenser (ADD)



High-Definition Sounding System

Notes: At left, the Automated Dropsonde Dispenser (ADD); at right, a pair of ADD form the High Definition Sounding System payload flown on the NASA WB-57F. Universal dispenser targeted for flight on National Center for Atmospheric Research (NCAR) Gulfstream V (G-V) in March 2019.

WHAT

Operational Need and Improvement: The Navy is seeking a next-generation instrument to autonomously measure atmospheric parameters and meteorological (METOC) variables in 3-D space and time. This capability is needed for both operational scenarios as well as S&T environmental data collection. Of particular interest is atmospheric data collection related to Tropical Cyclones and effects on mission systems such as lasers, radar and communications.

Specifications Required: Measurements should focus on aerosol properties, optical properties, low cost METOC expendable instrumentation, through-the-sensor methods (i.e. radar) and/or the accurate measurement of temperature, humidity, winds, and wave properties near the surface in extreme conditions. Expendable Instrumentation includes both one time usage as well as long time in situ usage and the sensors should be affordable..

Technology Developed: Yankee Environmental Systems (YES) developed the field-proven eXpendable Digital Dropsondes (XDD). Under this Phase II effort we have created a fast response, commercially available bulk polymer sensor for the XDD. This task is not only sensor development, but requires developing a precision, automated system to perform multi-point absolute calibration of each polymer sensor plus a means to store these values on board. This capability will enable real time vertical profiles of relative humidity (RH) in engineering units to support direct ingest into meteorological numerical weather prediction models.

Warfighter Value: Significant airspace is physically inaccessible from surface upper air stations, leaving data sparse regions over the oceans. Automated airborne dropsonde deployment systems will provide reliable “on demand” vertical atmospheric profiling, enabling meteorological measurements at predetermined geographical coordinates, increasing the spatial granularity of ocean surface and subsurface environmental measurements in data-denied areas via automated profiling observations. This will improve both numerical weather prediction (NWP) accuracy as well provide significant benefits to anti-submarine warfare operating in typically data-sparse domains.

WHEN

Contract Number: N68335-17-C-0073 **Ending on:** March 6, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Develop hydrosol impactor for RH sensor	N/A	Demonstrated performance on test flight	8	July 2017
Develop humidity calibration system	Med	Characterizes new RH sensor	8	October 2017
Develop fast response RH sensor	Med	Compares to RD-94 in speed and accuracy	8	December 2017
Develop improved telemetry, GPS measurements	Med	Improved FEC, 18 Hz GPS, fall speed	8	March 2018
Universal dispenser for maned/unmanned platforms	Med	Demonstration on NCAR G-V or equivalent	8	March 2019

HOW

Projected Business Model: YES will manufacture the fast humidity sensor and integrate it within existing XDD meteorological sensors. Similarly, the improved telemetry receiver and associated forward error correction protocols will be integrated within the ADD system. It is anticipated that a revised ADD system with these capabilities will be flight proven on a fast pressurized platform equipped with a 3" drop tube such as the NCAR G-V or the NASA DC-8. YES is pursuing U.S. Navy and USAF collaboration for flight test on USAF WC-130J Weather Reconnaissance Aircraft.

Company Objectives: We want to be able to offer a solution for a dropsonde dispenser for any customer. This implies support for propeller/turbine aircraft, pressurized/unpressurized, and manned/unmanned systems. To accomplish this we will use a flexible, modular approach to a core design having a scaled expendable magazine and aircraft-specific mechanical mounts. Systems will leverage common firmware control, remote control software, aircraft power and data telemetry electronics.

Potential Commercial Applications: The US Government and foreign governments in the tropics are the primary commercial customer. There are three core markets for maritime upper air soundings:

1. Routine tropical cyclone reconnaissance as conducted by manual operators on the USAF and National Oceanic and Atmospheric Administration (NOAA) probe aircraft with the legacy RD-94 dropsonde,
2. DoD Electronic Warfare and Anti-Submarine Warfare operations; any ship has a need to predict radar ducting at sea.
3. Research programs working on improvements to Tropical Cyclone storm prediction. A much smaller university research market exists, but few organizations have the funds to operate high altitude probe aircraft.

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