Topic: N162-133

Charles River Analytics Inc.

Smart Weather InstruMentS (SWIMS)
Smart Weather InstruMentS (SWIMS) system has a blimp that moves up/down in the air-sea boundary, collecting in-situ data up to 1km from the sea surface, tethered to an autonomous surface vehicle (ASV), enabling autonomous deployment to any location on the surface; improving data quality/quantity. It has a satellite communication link to remote command and control (C2) stations to stream real-time field data as well as receive any mission instructions, can operate unattended for 3-4 months with its onboard adaptive behavior based autonomy architecture enabling it to track and follow weather patterns, and can be fitted with sensor suites to fit with customer requirements, and Charles River Analytics, maker of intelligent systems solutions is targeting the Navy's Meteorology & Oceanography (METOC) office, Coast Guard, and NOAA.

Technology Category Alignment:

None
None
None

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SYSCOM: ONR
Contract: N68335-18-C-0173
Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-18-C-0173

Department of the Navy SBIR/STTR Transition Program

Topic # N162-133
Smart Weather InstruMentS (SWIMS)
Charles River Analytics, Inc.

WHO

SYSCOM: ONR

Sponsoring Program: Proposed FNC on the EM effects in near surface conditions; also EM Railgun for over water targets

Transition Target: ONR Monsoon Intra-seasonal Oscillations in the Tropical Indian Ocean and the Bay of Bengal (MISO-BOB) Program

TPOC:
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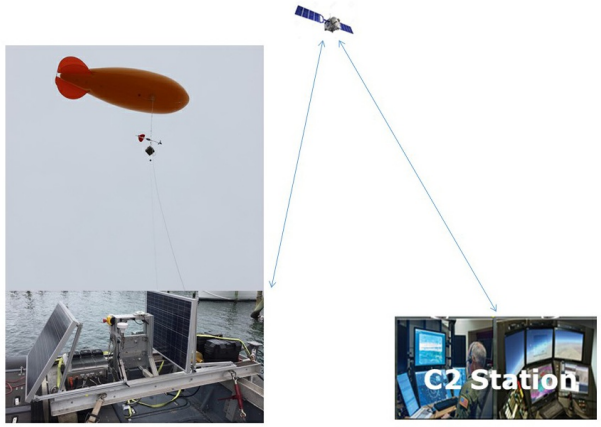
Other transition opportunities: This leap-ahead technology would also have tremendous utility to other agencies that support at sea-operations such as the Coast Guard, NOAA air-sea boundary measurements program, and the Navy METOC community.



SWIMS first prototype in operation (Copyright 2018 Charles River)

Notes: We are working on transitioning SWIMS to the ONR MISO-BOB program; we're planning to attend the 2019 at sea experiments in the Bay of Bengal to demonstrate the capabilities of the SWIMS platform for Monsoon measurements.

WHAT

Operational Need and Improvement: For air-sea interaction measurements, it is important to measure the atmospheric boundary layer at the same time that we measure the ocean wave boundary layer and the ocean mixed-layer parameters. Because we have moved field measurements in the ocean to autonomous vehicles, we now have a mis-match between the measurements of the ocean wave-boundary layer and ocean mixed layer and the atmospheric boundary layer. The present methods of measuring boundary layer data and fluxes at sea are very rough and crude with a large loss of accuracy - this will improve the quality as well as quantity of the data.

Specifications Required: The following parameters are desirable: real-time reporting; steerable, stable platform with navigational accuracy to 1 meter over 1 hour; duration of 2-6 months; retrievable (desirable but not a hard and fast option); and deployable from surface vessels. Operating conditions: operational up to Beaufort Scale 4 [winds 13 - 17 mph; wave height 3.5 - 6 ft; small waves with breaking crests; fairly frequent whitecaps], and functional at storm conditions is desirable but also needs to be examined as a trade-off.

Technology Developed: Smart Weather InstruMentS (SWIMS) systeman autonomous mobile surface buoy measures the ocean surface and a tethered blimp that measures the adjacent air layer. A novel, wave-generated jet propulsion system propels the SWIMS buoy, and an automated winch system inside the buoy deploys the blimp. SWIMS transmits geo-registered meteorological data to a command and control (C2) station via a satellite communication link, makes decisions using a behavior-based autonomy software architecture, and maintains power during long missions by recharging its batteries with solar panels. SWIMS can provide the DoN with data on the complex interface between the ocean mixed layer, ocean surface, and adjacent air layer that is critical to the genesis of meteorological phenomena, data required to accurately predict global weather, climate, and the evolution of greenhouse gases.

Warfighter Value: Deploy SWIMS platforms in regions of interest to obtain in-situ data updating environmental forecast models, tuning weaponry to operate in these regions and for mission planning.

WHEN

Contract Number: N68335-18-C-0173 **Ending on:** February 10, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Prototype Version 1 - Well tested data collection platform	Med	High	5	4th QTR FY18
Prototype Version 2 - Well tested data collection platform which can operate for longer period	Med	High	5	1st QTR FY19
Prototype Version 3 - Software upgrade with adaptive behaviors	Low	High	6	1st QTR FY19
Prototype Version 4 - Platform tested for short period deployments	Med	High	6	3rd QTR FY19
Full first Prototype - Complete first prototype tested at sea for long duration deployments	Med	High	7	1st QTR FY20

HOW

Projected Business Model: We see two possible approaches to commercializing the SWIMS technology developed under this program. First, our Autonomous Mobile Marine Meteorological station design can be licensed to other commercial entities that will use it directly or incorporate it as added functionality to their commercial products. In particular, Liquid Robotics® has expressed interest in transitioning SWIMS technology onto their products (see attached Letter of Interest). SWIMS' novel, wave-driven propulsion system directly benefits the Wave Glider—it can improve the efficiency of their wave-based propulsion by replacing the current wing rack with the SWIMS novel propulsion system or it can combine both wave energy harvesting mechanisms to improve the propulsion system. SWIMS' automated, tethered blimp system can be used as an additional sensor suite for air-sea boundary layer measurements as required. Second, we can use SWIMS novel technology as a key building block in an adaptive marine observation system product, which we are currently designing and for which we are beginning to explore possible markets.

Company Objectives: Charles River would like to meet with those that are interested in conducting a full-scale scenario operational demonstration of the Phase II prototype for the purposes of weather monitoring, communication gateway, aerial surveillance, and wave generated propulsion systems. Also interested in meeting with those that would integrate the technology into the broader FNC programs or DRI programs to provide an operation use evaluation and to demonstrate viability across the naval force.

Potential Commercial Applications: There commercial potential in industry, other governmental, and NGO organizations engaged in weather forecasting, climate-change assessment, marine condition forecasting, oil spill assessment and response, disaster response, disaster relief and recovery, maritime recovery, and marine science and exploration conducted in countries/regions possessing or lacking developed maritime infrastructure will benefit from this product.

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