A NEW IMPERATIVE FOR OCEAN OBSERVATION

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MARTAC's MANTAS T12 is a commercial-off-the-shelf USV ideally suited for environmental monitoring evaluation. (Photo credit: MARTAC)

As readers of ON&T know, it is the oceans that sustain the planet. A number of streams, most notably accelerating climate change, have come together in 2021. Collectively, they highlight the continuing importance of comprehensive ocean observation and making data-driven decisions based on these observations. Making these decisions depends on collecting the right data, at the right place, at the right time. This is not a trivial undertaking.

However, where those with stewardship for various aspects of ocean sustainment cannot find an affordable way to collect this data, it will not be obtained. These gaps lead to an incomplete picture of the ocean's health, and with it, sub-optimal solutions to achieving long-term ocean sustainment. Today, due to rapidly emerging technologies such as commercial-off-the-shelf (COTS) unmanned maritime vehicles, there now exist new, innovative ways that this real-time cataloging of oceanic phenomena can be conducted at relatively low cost.

In the past, there have been some tentative attempts, such as employing sea gliders, to leverage unmanned maritime vehicles to collect such data, but there have been few comprehensive evaluations of such a capability. Under U.S. Navy-NOAA stewardship, a months-long test has been completed, and now the oceans community can build on the results of this demonstration to evolve a more-comprehensive oceans observation regime.

NEW DATA COLLECTION PARTNERSHIP

The National Oceanic and Atmospheric Administration (NOAA) and the U.S. Navy have formed a partnership to obtain and utilize unmanned maritime systems and to codify their policies that govern their operations. As reported previously in *ON&T* in an article entitled, "NOAA, U.S. Navy Will Increase Nation's Unmanned Maritime Systems Operations," this cooperative effort was driven by the need to enhance ocean observation to address pressing environmental and national security concerns.

A major part of this effort involves the two organizations expanding the development, acquisition, fielding and operations of unmanned maritime systems in coastal and ocean waters. The U.S. Navy's Naval Meteorology and Oceanography Command is leading the Navy-NOAA effort, one that formalizes the Commercial Engagement through Ocean Technology Act of 2018 that directs NOAA to coordinate with the U.S. Navy on a wide range of functions including research of emerging unmanned technologies.

This NOAA-U.S. Navy partnership is an important initiative that underscores the vital nature of robust data collection that is critical to ensuring the health and vitality of the world's oceans. Both organizations have previously sought ways to collect more data at lower cost. For both the U.S. Navy and NOAA, a major appeal of unmanned systems is that they can provide an affordable and persistent sensor picture.

UNMANNED SYSTEMS

Unmanned systems have a strong appeal. Due to the prohibitive costs of using manned air or sea craft to conduct these observations, as well as the dangers of using these vessels in bad weather or in turbulent waters, the only effective solution may be to proactively pursue a substantial investment in unmanned surface vehicles to conduct these observations.

In support of NOAA and U.S. Navy objectives for ocean observation, the Commander Naval Meteorology and Oceanography Command (CNMOC) invited one U.S. corporation, Maritime Tactical Systems Inc. (MARTAC) to demonstrate the use of commercial-off-the-shelf unmanned surface vehicles to conduct a comprehensive environmental monitoring evaluation. Under CNMOC's stewardship, an Advanced Naval Training Exercise (ANTX) was conducted in the Gulf of Mexico.

CNMOC scientists outfitted a commercial-off-the-shelf MANTAS unmanned surface vehicle with an environmental monitoring system which was carried by this USV in order to provide a one-vehicle solution to important environmental sensing. Key to the success of this ANTX was the fact that the catamaran-hulled, compartmented MANTAS was outfitted with solar panels which enabled it to remain at sea for thirty continuous days.

Equipped with an environmental monitoring system and outfitted with solar panels, the MANTAS T12 is able to operate at sea uninterrupted for 30-day periods. (Photo credit: MARTAC)

MANTAS T38 DEVIL RAY, using a surveying speed up to 10-15kts, can stay underway for up to 8-10 days. (Photo credit: MARTAC)

CNMOC equipped the MANTAS with seven state-of-the-art sensors. This sensor data was communicated in real-time to the CNMOC control station. A second unmanned surface vehicle (another MANTAS), this one equipped with a different suite of ocean monitoring systems and sensors, was employed to conduct a second round of testing.

As testing continued with both USVs, CNMOC scientists and engineers provided vital feedback and suggested several enhancements to these vessels. This iterative process between developers, operators and engineers was inspired, in part, by past Office on Naval Research work in the area of user-centered design. Additionally, the ability to conduct surveys in higher sea states that had thwarted other unmanned surface vehicles in the past was one of the highlights of this months-long event. The catamaran-hull MANTAS was able to operate in low Sea State 3 during the ANTX.

SUSTAINABLE OCEAN OBSERVATION TAXONOMY

The informed readers of *ON&T* know that it is not hyperbole to say that dying oceans could imperial humanity. Ocean health cannot be sustained absent a robust, affordable and sustainable oceans observation regime so that data-driven decisions can be made to take steps to address the well-being of the oceans.

The use of commercial-off-the-shelf unmanned surface vehicles successfully employed during this ANTX can be readily "scaled-up" in oceans, seas, bays, rivers and other waterways and can lead the way to enhanced data collection, transmission and evaluation of water conditions. The results will help sustain a healthier ocean.

As one step forward in this effort, U.S. Navy officials encouraged MARTAC, to scale-up the 12-foot MANTAS used for this ANTX and produce larger vehicles. This was accomplished last year and a larger, 38-foot DEVIL RAY T38 USV, was deployed during U.S. Navy exercise Trident Warrior 2020 with positive results.

These larger vessels will be ideal USVs to conduct ocean observation due to their ability to carry considerably more sensors and remain at sea for longer periods. As one example of what this increased size provides vis-à-vis ocean observation, the T38 DEVIL RAY, using a surveying speed up to 10-15kts, can stay underway for up to 8-10 days.

The U.S. Navy, NOAA, and many other stakeholders recognize the critical need to understand the ocean environment. Therefore, we envision a tremendously increased demand for unmanned systems prototyping and experimentation to support robust and continuous ocean observation