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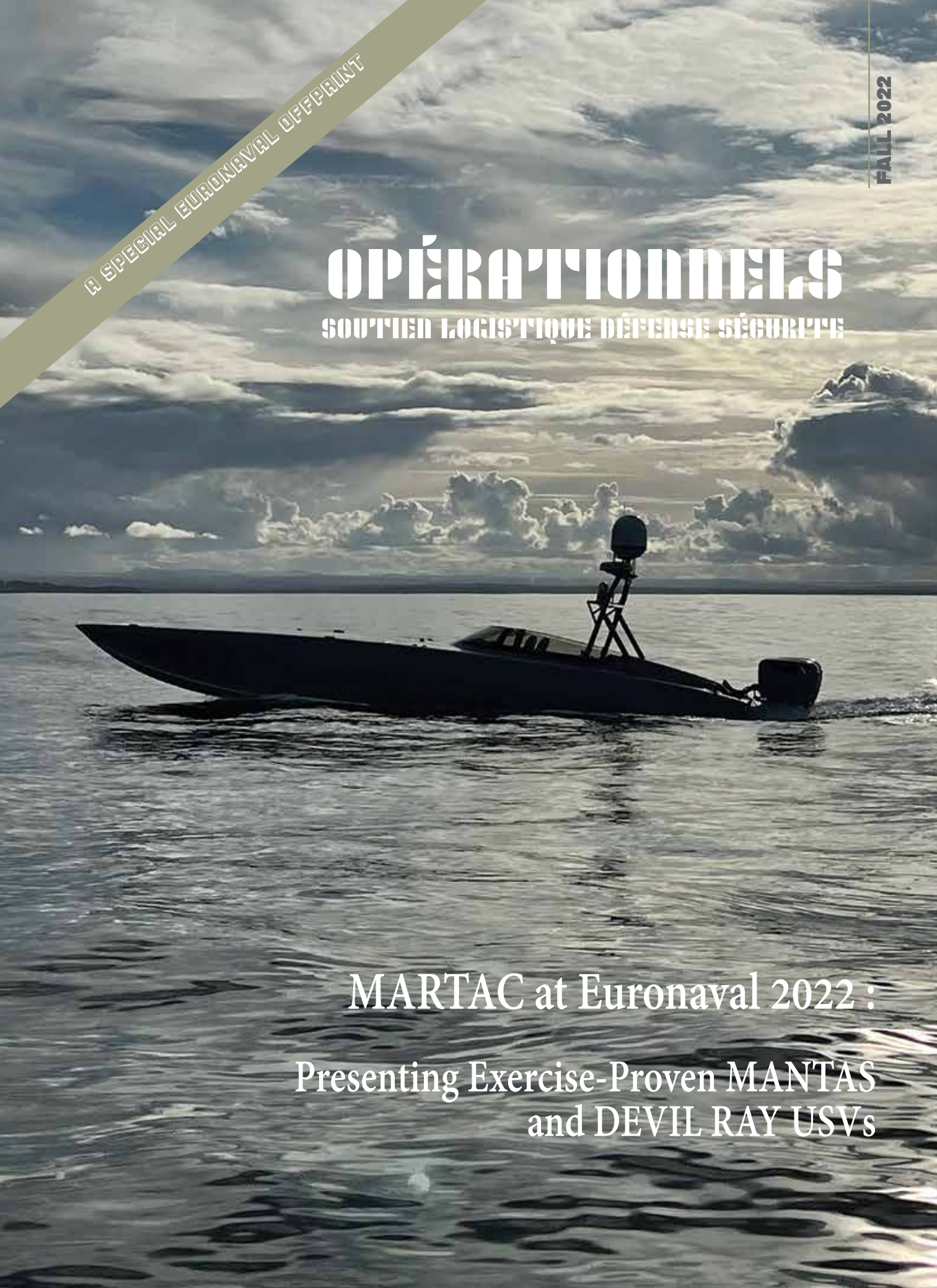

MARTAC at Euronaval 2022 :

Presenting Exercise-Proven MANTAS and DEVIL RAY USVs

EURONAVAL

THE WORLD NAVAL DEFENCE EXHIBITION

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MARTAC AT EURONAVAL 2022

By Murielle Delaporte

With the return of Euronaval in its 2022 Edition, we are publishing this year a new offprint dedicated to a Florida-based company named MARTAC Systems – Maritime Tactical Systems -, whose innovative and disruptive technologies are displayed Booth H 69 - along with its partner SubSea Europe Services - during the exhibit.

Why MARTAC? Because its catamarans – which by the way retain several world speed records – go beyond what one can expect from autonomous unmanned vessels systems. Truly autonomous, they do go beyond human capabilities when extreme conditions or challenging missions occur, as you will discover in the following pages.

This offprint is being released as a preview and will be included in our next issue coming up next. We look forward to presenting it to you soon with lots of new reporting currently being translated into print. But, before that, we wish you a good reading and an excellent Euronaval!

Cover Photo
Mantas © MARTAC, 2022

What might such a platform look like? MARTAC's Approach

In this interview, Bruce Hanson of MARTAC systems explains how they have built and are upgrading their platforms upon which various payloads are being operated. MARTAC has now delivered an autonomous USV capability which navies and maritime security organizations can use to build their operational experience for enhanced defense and security capabilities now and to learn how to reshape the force going forward.

The company currently features two boats, one 12 feet in length (MANTAS) and the other 38 feet in length (DEVIL RAY). They have other sizes of boats in process, but the core point is that they have built the boats so that if one can be trained to operate one of them one can operate the others as well.

Hanson underscores that they built their boats since 2010 initially by building vessels of three feet in length so that they could operate several of them to test out systems and capabilities. This meant also that from the ground up they have focused on how the vessels can operate as a wolfpack.

As he noted: "There is no point in simply looking at one of our boats in isolation: it is about they can operate as a wolfpack, operating in your terms within a broader fleet kill web or mesh approach."

Hanson underscored that "the vessels talk to each other and can adjust to single platform failures or degradation." As he put it: "They can operate as a self-healing commando team."

The boats are built to provide a scalable fleet of USVs. And Hanson noted: "What you get with the different size vessels are differences in range and payload ranging from 16 to 18,000-pound payloads and ranges from 35 to 1000 nautical miles on vessels from 6 to 60 feet."

The boats are built to interface with customer payloads, as the company has eschewed from the outset building their own payloads. From the beginning, they understood that customers would wish to operate their own payloads, whether that be a U.S. service preference, or for allies and partners.

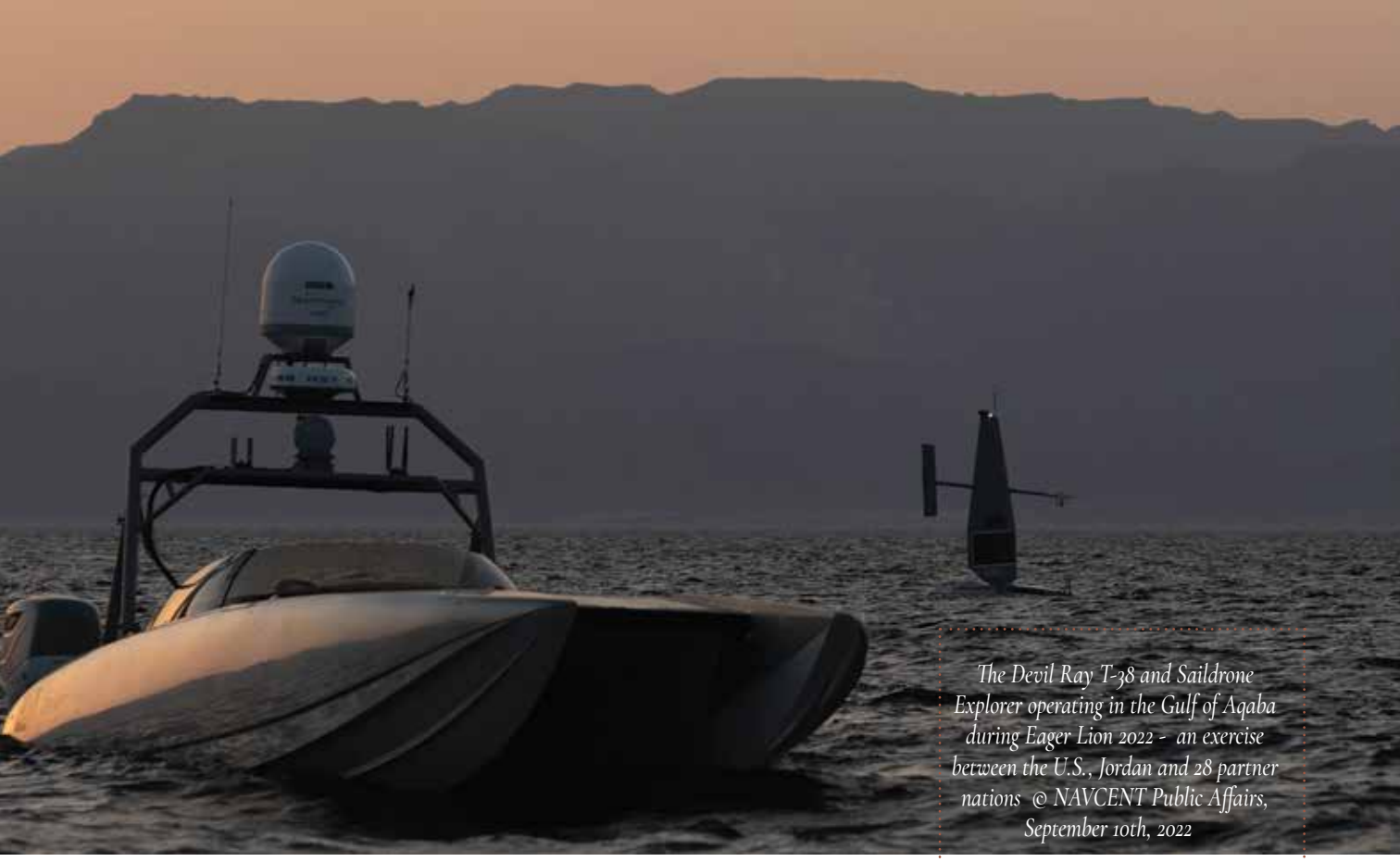
Customizing Catamarans With World Speed Records

The boats are catamarans. Hanson and his team hold the world speed records for catamarans and they have applied their real-world experience to building boats to operate as USVs for the maritime and security forces. The boats are built from carbon fiber and are very durable and able to operate through waves in high sea states.

The form factor of the boats is such that they can operate from standard navy RHIB launchers and can be configured to fit into various Naval standard launch systems as well.

The company has its own core software team which builds the software to operate the vessel, the C2 and the interface with the payloads. As with all good smaller companies building a focused capability, they control the entire upgrade capabilities of their operating software systems for their boats.

The boats come standard with four independent C2 systems which allows for flexibility in operating the boats dependent on the mission sets. The boats have low / high bandwidth sat com, high bandwidth line of site, low bandwidth line



The Devil Ray T-38 and Saildrone Explorer operating in the Gulf of Aqaba during Eager Lion 2022 - an exercise between the U.S., Jordan and 28 partner nations © NAVCENT Public Affairs, September 10th, 2022

MARTAC'S NEWLY CHARTERED WATERS: USING USVS AS WOLFPACK DEPLOYED ISR FORCE

AN INTERVIEW WITH BRUCE HANSON, CEO, MARTAC SYSTEMS

BY ROBBIN LAIRD, DEFENSE ANALYST

As the U.S. Navy shifts to a priority emphasis on distributed maritime operations, the opportunity for maritime autonomous systems to play a growing role is opened up. That is for the simple reality that as distributed modular task forces deploy, autonomous capabilities can contribute to the lethality and survivability of the force.

Autonomous USVs can provide wolfpack deployed ISR or relay systems to enhance the reach and survivability of the fleet in its distributed operational role. They can also provide an ability to move data to other deployed task forces to provide for enhanced integrability to do so.

This is about deploying autonomous USVs in a wolfpack to operate payloads appropriate to the mission assigned to them by the commander of the modular task force. This means that the nature of the payloads onboard the USVs and their ability to work as a mission team are key attributes of how an autonomous system wolfpack can contribute to the survivability of the fleet (situational awareness) and lethality (through target acquisition support).

of sight and 4G/5G communications capabilities. According to Hanson: "We have quite a bit of edge processing on the boat along with cyber protection systems."

The boats have a unique dead zone capability as well. This means that boats will stop, slow down, return to base, continue or do some other determined response if communications are cut so that the MARTAC boats do not suffer from the "runaway" boat problem which other USVs have demonstrated in various exercises.

The control system is designed for handoffs for boat control among operators in the fleet or ashore. The system can allow coalition transfer as well which would mean that a European nation with a fleet of MARTAC boats in operation could transfer control of those boats for a period of time to a partner or ally for their mission.

The boats are built to operate together or separately dependent upon the mission requirements. But they built the boats with a nested dolls approach. This means that the 38-foot boat can launch autonomously a 12-foot boat to collaborate in the mission as well.

"Truly Autonomous Boats"

The company has a slogan which goes with their company moniker which is "Beyond Human Capability." What this bluntly means is that the users of the boats need to understand that these boats are not simply mimic replacements for what humans would do if operating on the boats. Rather, the boats operate differently from how a human could do so if on the boats. What this means, for example, is that the speed of the boats and the turning ratios of the boats are beyond what a human onboard could survive.

Getting navies to understand that autonomous systems are not remotely piloted is a challenge as well. Hanson tells the story of an exercise with the U.S. Navy where the MARTAC representative told the U.S. Navy evaluator that he was going to lunch right in the middle of the live mission.

The evaluator commented: "You can't do that – who will run the boat?" "It's Sea State 3+"The MARTAC rep said: "The boat is operating itself. See you after lunch." When he came back from lunch, the boat was performing as expected and the U.S. Navy evaluator said: "Your boat truly is autonomous!"

Building a robust platform from day one to be autonomous, with appropriate operational software, but allowing for flexible customer payloads is what MARTAC is focused on doing with regard to their USV boats.

Devil Ray T-38 Being Unloaded © MARTAC, May 2022

MARTAC'S PATH OF DEVELOPMENT

CUSTOMIZED PAYLOADS FOR A WIDE-RANGE OF MISSION COMMANDS

Devil Ray during a naval exercise © MARTAC

The particular platforms highlighted in the previous article are a range of scalable catamaran's which are operated with robust systems software onboard and a variety of communications capability to deliver mission commands to the autonomously operating boats.

That software has been designed from the outset to work with a wide variety of payloads.

A Dynamic Interface Process

MARTAC made the decision from the outset not to design for specific payloads but provide interfaces that could work with adaptation to the operating system across a wide range of payloads.

This has two key advantages.

1. First, there is a very dynamic process underway in industry and the U.S. and allied militaries to develop payloads for maritime systems. Configuring your boat to a narrowly defined payload would lead to obsolescence
2. Second, allies and partners can operate these vessels with their own payloads onboard which means that there is a much wider opportunity to develop national solutions which can enable payload sharing, notably in the ISR domain.

A Wide-Range of Mission Capabilities

The MARTAC boats – notably the MANTAS 12-foot boat and the DEVIL RAY 38-foot boat – have demonstrated in many U.S. and allied naval exercises a wide variety of payloads which can operate from their boats and deliver specific mission capabilities, such as:

- *Situational Awareness*

The most obvious area where a wolfpack of USVs working together could contribute significantly to fleet security, safety and operational reach for situational awareness and targeting solutions, is with regard to ISR.

In the past several years, MANTAS has been used in a variety of exercises and some initial operations to provide for both SA and targeting solutions for the fleet.

A key need for the fleet is clearly enhanced SA when in critical choke points threats can increase. For capital ships, this comes clearly when they are at anchor or ingressing/egressing a harbor. The MANTAS has demonstrated the ability to provide core SA for security and safety in this situation.

Given that the form factor of the boats is such they can operate from standard navy RHIB launchers, and can be configured to fit into various Naval standard launch systems as well, MANTAS is fleet ready to do this mission.

- *Target Tracking and Target Destruction*

In one exercise, the DEVIL RAY has been deployed with the MANTAS in a nested doll configuration or a situation in which the smaller MANTAS is embedded into the DEVIL RAY.

Onboard was a UAV that could deliver the lethal element of following up after target identification. The MANTAS was launched from the DEVIL RAY and deployed into the mission area. The MANTAS identified the target, and there was follow-up verification of the target by a UAV launched from shore. After target identification, a missile was launched from the DEVIL RAY and proceeded on course to destroy the maritime target. The MANTAS returned to the DEVIL RAY and they then were given their coordinates to return to the desired landing area.

- *Exfiltration*

In another exercise, the extraction of special forces from a beach was managed by the MANTAS and the DEVIL RAY. In the exercise, there were two "injured" special forces soldiers who needed medical attention.

The DEVIL RAY launched the MANTAS with a sled attached to reach the shore. The "injured" special forces soldiers were put onto the MANTAS and the sled and joined by one uninjured special force solider on both the MANTAS and the sled.

The MANTAS and the sled went back to the DEVIL RAY where the injured soldiers received triage from medics onboard the DEVIL RAY. After initial triage, a helicopter lifted the soldiers off of the DEVIL RAY and the DEVIL RAY with the MANTAS "nested" returned to the desired landing area.

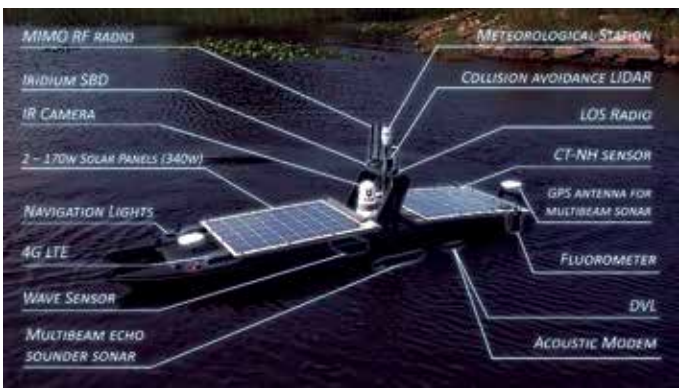
- *Extreme Conditions Search and Rescue*

In this exercise, four divers were involved, with one playing the role of the distressed diver. The T-38 DEVIL RAY launched the MANTAS T-12. The T-12 then went to the distressed diver who grabbed onto the T-12 and the T-12 then went back to the DEVIL RAY.

When the diver reached the DEVIL RAY the diver was manually placed in a basket for movement by helicopter to the shore. The diver was replaced by a dummy for the last piece of this recovery and the transfer to the helicopter.

But this exercise suggests a broader range of options.The exercise clearly demonstrated the possibility of a search and rescue scenario in which the autonomous asset could operate in weather too dangerous for manned operations.

And suggested as well that the DEVIL RAY being able because it "can operate beyond human capability" to get to the location of a sinking ship much faster than a manned asset.There are some key operational capabilities this maritime autonomous system has which allow these kinds of missions to be executed quite differently from a manned platform or a remotely piloted UAS system.



A NEW PACT TO COPE WITH CLIMATE CHANGE: USVS AT THE SERVICE OF OCEAN OBSERVATION

BY GEORGE GALDORISI,
NAVAL WARFARE ANALYST AND AUTHOR

For two weeks in November 2021, the Glasgow climate change summit dominated national and international headlines. While some perhaps rightly criticize the summit as being long on rhetoric and short on concrete actions, what it did accomplish was highlight the potentially disastrous impact of climate change.[1]

When most people think of climate they look to the sky. This is only partially correct, as it is the oceans that sustain the planet. Like other navies, the United States Navy plies the oceans and must have in-depth knowledge of the ocean environment. This is crucial to making optimal decisions regarding naval operations. For decades the U.S. Navy gained its knowledge of the ocean environment by conducting ocean sampling from Navy vessels. This worked – to a point – with a navy of almost six hundred ships. Today, with a ship count of less than three hundred, and with numbers of ships not predicted to increase for some time, the Navy is seeking viable alternatives to sample the ocean environment.

Fortunately, a new pact between the United States Navy and the National Oceanic and Atmospheric Administration (NOAA) has explored the idea of using unmanned surface vehicles equipped with a wide array of sensors to conduct this ocean sampling. This initiative serves two purposes: providing those with stewardship of the environment like NOAA with the information needed to make data-driven decisions to help combat climate change, as well as providing the U.S. Navy with timely and relevant information about the oceans which can then be used in tactical and operational situations.

A Partnership to Leverage Unmanned Surface Vehicles to Collect Oceanic Data

One of the reasons for this new U.S. Navy-NOAA partnership is that by working together, NOAA will be able to leverage the Navy's expertise, infrastructure, best practices and training to accelerate its science, service and stewardship mission, especially its efforts to address climate change. The Navy's executive agent and key stakeholder in this effort is the Naval Meteorology and Oceanography Command.

The Naval Meteorology and Oceanography Command's mission is to define the physical environment from the bottom of the ocean to the stars to ensure the U.S. Navy has freedom of action to deter aggression, maintain freedom of the seas and win wars. Additionally, Naval Oceanography has been a global pioneer in the development and use of unmanned systems.[2]

Rear Admiral John Okon, Commander Naval Meteorology and Oceanography Command, emphasized why this partnership is important when he noted, "This agreement lays the foundation for collaboration, engagement, and coordination between NOAA and the U.S. Navy that our nation has never seen before. It will help us take advantage of each other's strengths to advance each of our strategic and operational mission priorities."[3]

NOAA conducts research and gathers data about the global ocean and atmosphere to forecast weather, predict climate, protect the ocean and sustainably manage marine resources. These missions rely on a continuous process of testing and evaluation of new technologies such as unmanned systems to improve data gathering.[4]

Retired Navy Rear Admiral Tim Gallaudet, Assistant Secretary of Commerce for Oceans and Atmosphere and Deputy NOAA administrator, emphasized the importance of this partnership, "With the strengthening of our ongoing partnership with the Navy, NOAA will be better positioned to transition unmanned maritime technologies into operational platforms that will gather critical environmental data."[5]

Using Experimentation with MARTAC to Determine a Viable Oceanic Sampling Methodology

One important aspect of the U.S. Navy-NOAA partnership is to enhance the ability of both organizations to conduct data collection. This is critical to ensuring that the Navy Fleet has the right oceanographic and metrological information at the tactical and operational edge.

Much of this same data collected to support the operating forces is also vital to help assess the health and vitality of the world's oceans as well as the ability to make data-driven decisions to combat climate change. For both the Navy and NOAA, a major appeal of unmanned systems is to provide a persistent sensor picture for areas of interest.

One important factor that is driving this move to unmanned maritime systems is the high cost of using manned air or sea craft to conduct these observations. Add to this the dangers of using these vessels in bad weather, in turbulent waters, or at night. Given the totality of these factors, using affordable unmanned surface vehicles to conduct these observations has a strong appeal to a wide array of stakeholders.

The Navy and NOAA agreed to move out rapidly in an effort to experiment with ways to enhance their ability to conduct comprehensive ocean observation. In order to organize an experiment in the near-term, a decision was made to use commercial-off-the-shelf (COTS) technology that was mature and which met the exercise objectives. Based on these criteria, one U.S. corporation, (Maritime Tactical Systems, Inc. MARTAC), was invited to demonstrate the use its unmanned surface vehicles to conduct a comprehensive an environmental monitoring evaluation. This month-long endeavor was conducted under the auspices of the Naval Meteorology and Oceanography Command (CNMOC). Under CNMOC's stewardship, an Advanced Naval Training Exercise (ANTX) was conducted in the Gulf of Mexico, south of Gulfport, Mississippi.

Naval Meteorology and Oceanography Command scientists outfitted a COTS MANTAS unmanned surface vehicle with a CNMOC Environmental Monitoring System. These systems and sensors were designed to be carried by this USV to provide a one-vehicle solution to important environmental sensing that was, in the past, conducted by multiple platforms.

CNMOC equipped the MANTAS USV with seven sensors. These included: Teledyne Benthos ATM603 Underwater Modem, FLIR M232 Camera, Teledyne Citadel CTD-NH Conductivity Temperature Depth Monitor, Teledyne DVL with ADCP Doppler Velocity Log, Norbit iWBMSh-STX Echosounder, Turner C3 Fluorometer, Quanergy M8-1 Plus LIDAR, Airmar WX220 MET, Meteorological Sensor, and SeaView SVS-603 Wave Height Sensor. This sensor data was communicated in real-time to the CNMOC control station.

A second unmanned surface vehicle (another MANTAS USV), this one equipped with a different suite of ocean monitoring systems and sensors, was employed to conduct an additional round of testing. The sensors employed included an iWBMSh-STX and Klein UUV 3500 side scan sonar. As testing continued with both USVs, CNMOC scientists and engineers provided vital feedback and suggested several enhancements to these vessels.

The ocean observations included: wave height, wave frequency, current speed and direction, wind speed and direction, air temperature, barometric pressure, fresh and salt water concentration and bottom bathymetry/contour. All of these measurements are essential components that feed environmental models vital to naval operations and also contribute to important data-driven decisions regarding climate change.

The ability to conduct surveys in higher sea states had thwarted other unmanned surface vehicles in the past, but

was one of the highlights of this month-long event. The catamaran-hulled MANTAS was able to operate in sea state five conditions. Additionally, the USV has a number of compartments that protected sensor components in heavy weather.

Persistent Oceanic Observation is Within Reach

Given the ongoing importance of collecting the right environmental information at the right time at the right place to support the U.S. Navy, as well as help make data-driven decisions to address the national security implications of climate change, finding a cost-effective means to collect this oceanic information autonomously while having humans on-the-loop (as opposed to in-the-loop) is crucial.
The use of commercial-off-the-shelf unmanned surface vehicles successfully employed during this demonstration can be readily scaled-up in USV platform size and thus provide for added oceanographic sensors. This will allow for a further extension of capability within specific oceans, seas, bays, rivers and other waterways, and can also lead the way for enhanced data collection, transmission and evaluation of water conditions and the ocean environment.

U.S. Navy officials have encouraged MARTAC Inc. to scale-up the 12-foot MANTAS used for this CNMOC ANTX effort and produce larger vehicles in order to conduct more comprehensive ocean observation. To this end, a larger 38-foot unmanned surface vehicle, now referred to as the Devil Ray T38 USV was deployed during U.S. Navy exercises Trident Warrior and Integrated Battle Problem. These larger vessels (including 24-foot and 50-foot Devil Ray USVs) could be ideal USVs to conduct extended and more detailed ocean observation with their added 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, a 24-foot, or 38-foot Devil Ray, using an ocean bottom surveying speed up to fifteen knots, can remain underway for up to seven days until it needs refueling, after which it can again resume its survey mission. Multiple USV craft can be used to perform independent scans within the same area, thereby greatly increasing the amount of total area that can be surveyed.

Leveraging these larger USVs to accomplish these priorities will go a long way toward making data-driven decisions to provide valuable environmental information to Navy and Marine Corps forces, as well as help government agencies make better data-driven decisions to address climate change.]

Given the capabilities of USVs to conduct comprehensive oceanic observation, there will likely be an increased demand for unmanned systems prototyping and experimentation to support comprehensive ocean sampling. The vast array of technologies emerging in today's unmanned maritime systems provides a tremendous opportunity to move forward with an effective and affordable oceanic observation taxonomy.

[1] John Kerry, "COP26 Prepared the World to Beat Climate Change," The Wall Street Journal, November 22, 2021.
[2] Naval Meteorology and Oceanography Command website, accessed at: https://www.cnmoc.usff.navy.mil/
[3] Naval Meteorology and Oceanography Command press release, August 4, 2020, accessed at: https://www.cnmoc.usff.navy.mil/Press-Room/Press-Releases/Article/2383205/us-navy-and-noaa-sign-agreement-to-improve-nations-unmanned-maritime-systems-op/
[4] NOAA website, accessed at: https://www.noaa.gov/.
[5] "NOAA Finalizes Strategy to Enhance Growth of American Blue Economy," Ocean News, January 25, 2021

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Beyond Human Capability
MARTAC 's Devil Rays: performing a High G Turn no Human Can Survive

Building and Deploying Next Generation Autonomous Unmanned Surface Vessels

Our autonomous systems can operate beyond human capability. We build our catamarans to operate singly or in wolfpacks to deliver the kind of payloads which you need for your commercial, security or military purposes. We build the platform; you build the payload and deliver the result only an autonomous system can deliver.

"Self-Healing Commando Teams" At Work

Currently, our 12-foot MANTAS and our 38-foot Devil Ray can work in a nested doll fashion where the smaller boat can operate from the larger boat. As CEO Bruce Hanson has underscored: "the vessels talk to each other and can adjust to single platform failures or degradation. They can operate as a self-healing commando team."