Manned-Unmanned TEAMING

The Case of the U.S. Navy

With the shift from land wars to conflicts in contested air and sea spaces, new concepts of operations and systems are developing. The terms *anti-access* and *area denial* have been coined to describe how certain competitors (notably Russia and China), are shaping their capabilities in an attempt to ensure combat dominance in times of direct conflict, but also to underwrite other forms of combat operations, such as "gray zone" operations or hybrid-war concepts of operations.

The core military challenge for liberal democracies is to operate decisively in a contested combat environment to protect their interests – and not allow the 21st century authoritarian powers to rewrite the rules of the game.

As Admiral Gilday, the Chief of Naval Operations, recently put it in testimony before the U.S. Senate: "Despite benefiting from decades of peace and stability, China and Russia are now using all elements of their national power to undermine the international order at sea. Both attempt to unfairly control access to rich sea-based resources outside their home waters. Both intimidate their neighbors and enforce unlawful claims with the threat of force. Both have constructed sophisticated networks of sensors and long-range missiles to hold important waterways at risk. And China, in particular, is building a Navy to rival our own."

A number of new platforms and capabilities have already been introduced by the United States and core allies and partners to reshape approaches and training for new concepts of operations to deal with the new challenges. New maritime patrol capabilities, surface and sub-surface platforms, missile defense and strike missile systems, and new combat aircraft are all coming into the forces. Along with those new capabilities, new multi-domain training approaches are being introduced as well.

But figuring out the best ways to leverage remotes in combat operations is clearly a work in progress, and lessons learned with initially deployed systems will provide a path to shaping a way ahead. The challenge is not just to build and use remotes, but how to communicate and use the data they gather for proper combat effect. Indeed, one way to look at the impact of remotes is upon the challenges they pose to the networks through which such systems would be managed.

In this article, I will draw upon two different systems that highlight both the potential and the challenges for shaping a way ahead for manned-unmanned teaming or collaboration. The first is with regard to Triton and the second is related to counter-mine operations at sea.

The Case of Triton

There is an expectation that unmanned or remote systems are part of how the U.S. and the allies will shape effective forces going forward. At the heart of that effort will be an expanded leveraging of these systems, and shaping ways for manned and unmanned systems to collaborate.

A key area in which the U.S. Navy is already doing this, is anti-submarine and anti-surface warfare. Here, the key element has been the introduction of the Triton unmanned system working with the manned, fixed-wing P-8 maritime patrol aircraft (MPA) and the Romeo helicopter.

This year, I have visited Norfolk, Jacksonville, Florida, San Diego, and Fallon Naval Air Station, the home of the Naval Aviation Warfighting Center or NAWDC. During those visits I had significant opportunities to talk with senior Naval officers,

Northrop Grumman Triton UAS provides real-time intelligence, surveillance and reconnaissance (ISR) over vast ocean and coastal regions.

Boeing P-8 Poseidon Maritime Patrol Aircraft conducts anti-submarine, anti-surface missions using acoustic sensors and radar.

operators of both P-8s and Tritons, as well as the other key assets in maritime warfare that are most central to shaping a way ahead with the ISR/C2 enabled air combat force. This effort included visiting the USS *Gerard R. Ford* in October and November 2020, where the new carrier will be incorporating data from the maritime patrol community, including Triton, to shape its way ahead in conducting 21st century ISR-enabled combat.

The U.S. Navy's approach to working maritime patrol functions relies on the new manned aircraft, the P-8 MPA; the Romeo variant of the Sea Hawk helicopter; and the unmanned Triton. With these three systems, the Navy is working through how to handle the data necessary to make timely decisions to execute the anti-submarine and anti-surface warfare missions.

Earlier this year, Captain Matthew Pottenburgh, the Commodore in charge of Patrol and Reconnaissance Wing Eleven, highlighted during an interview with me in Jacksonville how these manned assets are working with the Triton.

The USAF remote piloted operating community is isolated from the manned pilots, whereas the P-8 and Triton operational community is unique in the U.S. military in that personnel rotate between the two platforms. This has led to the formation of a new generation of operators who cross-train for both manned and unmanned IRS platforms.

What is being shaped are coordinated operations between the two, where the Triton can sweep the field of operations to identify targets and allow the P-8s to focus directly on those targets – where they need to go, and what they need to do.

While the P-8 can operate with autonomy and networkability, the Triton is a network-generating, network-enabling asset. The vast amounts of data provided by Triton is requiring the Navy and the joint force to rework how to handle data flows from the unmanned asset to gain combat advantages. Put another way, traditional methods of handling data are not adequate to properly manage such massive amounts of information). In fact, learning how to manage data from Triton has been a key driver for change in how to redesign the ISR to C2 empowerment systems, which the U.S. Navy seeks to execute distributed maritime operations.

The unmanned asset operates differently from the P-8 or the Romeo in a way that is also leading to adjustments. For instance, both the P-8 and Romeo sortie into an operational area, operate for a period of time and land (either on land in the case of the P-8 or on a ship in the case of the Romeo helicopter). The concept of operations for the Triton, however, is very different. Triton provides the U.S. Navy with a whole new level of situational awareness that the Navy would attain no other way. With 24/7 coverage of the area, and in continuous orbit at 3000 km, the Triton can provide domain awareness knowledge crucial to informing the threat and opportunity calculus for the area of operations.

The Triton/P-8 dyad then, poses a significant challenge to reworking the C2/ISR enabled force. Without enhancing the data management network side of the challenge, the ability to leverage the data generated by Triton will not be maximized.

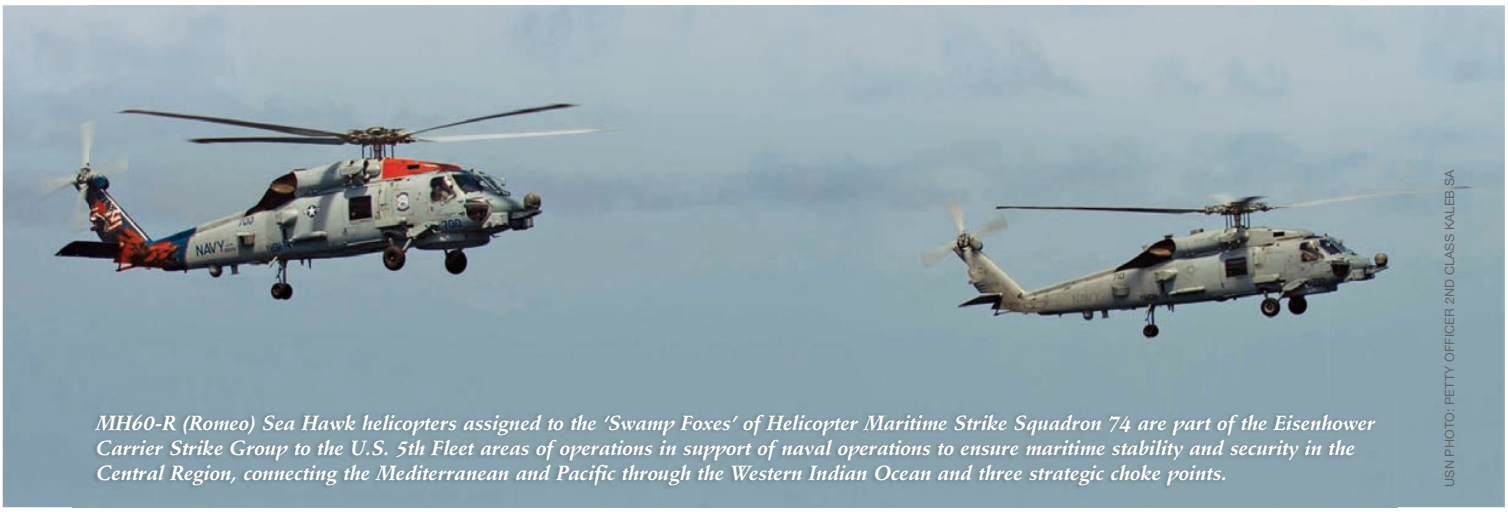
The data backbone for Triton is not yet completely there. But by deploying Triton, the Navy and the Air Force are moving forward with new ways for data management and to flow ISR more effectively into decision making systems. But again, this is being driven by operational experience of the Triton and other new air systems, and adaptation is based on real world experience, not an abstract science project.

There is clearly a cultural learning process as well. The MPA community has operated throughout its history based on a concept of operations driven by air platform sortie operations. The Triton is based on a multi-aircraft orbit concept of operations which yields a very different data stream than one gets from an air sortied aircraft – somewhere between what space systems deliver and what the sortied air collection platforms can deliver.

And given that the Triton is engaged in tasking, collecting, processing, exploitation and dissemination of information in real time, learning how to do this for the

July 2019 – Aviation Ordnance technicians conduct loading operations as part of Conventional Weapons Refresher Training.

U.S. NAVY PHOTO: MCS SEAMAN WILLIAM C. ANDREWS.



MH60-R (Romeo) Sea Hawk helicopters assigned to the 'Swamp Foxes' of Helicopter Maritime Strike Squadron 74 are part of the Eisenhower Carrier Strike Group to the U.S. 5th Fleet areas of operations in support of naval operations to ensure maritime stability and security in the Central Region, connecting the Mediterranean and Pacific through the Western Indian Ocean and three strategic choke points.

USN PHOTO: PETTY OFFICER 2ND CLASS KALEB SA

fleet is a crucial challenge facing the future of a kill web enabled force.

As Triton gains multi-INT or multi-intelligence capabilities, it will become a more effective platform to contribute to the collaborative effort where multiple sensors can be cross-referenced to provide greater fidelity on targeting, and notably when it comes to smaller vessels of interest as well.

What the Triton experience has demonstrated, without a doubt, are the challenges that unmanned or remote systems pose to the C2 and ISR networks. By navigating effective ways ahead with regard to network and C2 innovations, the role of remotes will be reduced and their contributions more limited than might otherwise be the case.

Again, the Chief of Naval Operations has highlighted how to look at the challenge. Referring to maritime remotes, he had this to say: "Those vessels are useless unless we can command and control them with a very high degree of precision and reliability. And so that's where we start talking about the Navy's Project Overmatch, that falls underneath, or nests underneath JADC-2. And so there are four big pieces to that. It's the networks. It's the infrastructure. It's the data standards.

"And then finally, it's the capabilities, whether they're battle management aids or whether they're artificial intelligence and machine learning capabilities that we apply to that data that allow us to decide and act faster than the bad guy, and then deliver ordnance faster out of these unmanned platforms."

An Approach to Counter-Mine Warfare

An alternative approach to leveraging maritime remotes is to work with them within the realm of the operational space of a ship, and then to deliver information from the ship to the relevant members of the operational fleet.

During a visit to San Diego earlier this year, I had a chance to look at a demonstration of how this might work with a new counter-mine system featured at Trident Warrior 2020 which was held in San Diego from 13-16 July 2020. There is a compelling need creatively to apply new, innovative technologies to address the operational and tactical challenges posed by mines, as well as the need to expand the use of unmanned systems to tackle Mine Countermeasure Mission (MCM) challenges.

Meeting this demand with COTS hardware and software—and not wagering on emerging technologies that will take years to develop, mature and field—should be a priority for Navy and Marine Corps planners. Rear Admiral Casey Moton, Program Executive Officer, Unmanned and Small Combatants (PEO USC), has stated that one of the functions of his office is to ensure that unmanned systems the Navy seeks to buy have the right level of technical maturity, especially in the most basic hull, mechanical and electrical (HME) attributes.

This strongly suggests that the Navy would be well-served to move forward by focusing on COTS technologies that have been wrung out in Navy and Marine Corps exercises, experiments and demonstrations. This will ensure that these systems have the requisite HME attributes and maturity to succeed.

U.S. NAVY PHOTO: MCS 2ND CLASS RYRE ARCIAGA

Oct 2020 – L.t. Eric Stewart, assigned to Helicopter Maritime Strike Squadron 51, embarked aboard the Ticonderoga-class guided-missile cruiser USS Shiloh, pilots an MH-60R "Romeo" Sea Hawk.

What I saw in San Diego were all the component parts of what several industry representatives, led by Teledyne Brown Engineering Inc, brought together to demonstrate an autonomous MCM solution that takes the Sailor out of the minefield. It is important to emphasize that every component part of this solution has been in the water and tested in the operational environment.

I witnessed what each individual component could do, and received a briefing on how Teledyne Brown has an integrated solution—dubbed "Clear-Sea"—to pull all these components together and achieve a single-sortie detect-to-engage MCM capability. The "mother ship" for all the components of this Clear-Sea MCM capability demonstrated in San Diego was the T38E (38-foot extended) MANTAS high-speed catamaran. Earlier versions of the MANTAS have been proven in numerous Navy and Marine Corps exercises, experiments and demonstrations.

I rode on the MANTAS and noted how the catamaran hull allows the boat to slice through choppy waters and provide a smooth ride that mono-hulls cannot. I also noted how the size of the vessel can easily accommodate the mine-hunting and mine neutralizing systems that complete the system.

The planned production T38 is similar in size to an eleven-meter RHIB carried by many U.S. Navy ships and thus can be easily integrated aboard most U.S. Navy warships. In comparison to an eleven-meter RHIB, the T38 is two feet longer, five inches wider, drafts 17 inches shallower at max displacement, and includes a cross-section height over eight feet lower, making it extraordinarily hard to detect. The T38 can operate in up to sea state five, has a cruise speed equal to, and a maximum speed twice that of an eleven-meter RHIB.

The first component that I saw – and that will be carried by the T38 – is the ThayerMahan Sea Scout subsea imaging system. The Sea Scout is specifically designed for missions such as mine hunting. The Sea Scout system is founded on the in-production COTS system Kraken Robotics Katfish-180 tow-body mounted Synthetic Aperture Sonar. The system is designed to search for mine-like objects (MLOs), and is integrated by ThayerMahan's remote operations and communications system.


Triton

I learned that this system can survey up to three and a half kilometers per hour at a resolution sufficient for MLO classification, and is programmable for bottom following, terrain referencing, obstacle avoidance, and "flies" at a pre-programmed depth. Automatic Target Recognition identifies likely MLO anomalies, which are then presented in near-real-time to the man–in-the-loop for verification as an MLO. Verified MLOs are added as a waypoint for validation, while invalid MLOs are discarded or passed to the navigation database as a hazard to navigation. Verified MLOs are continuously updated to a recommended route for the Mine Neutralization System (MNS) Remotely Operated Vehicle (ROV).

The next component I saw was the Idrobotica Pluto Plus MNS ROV which executes the "dull, dirty and dangerous" work previously conducted by classes of U.S. Navy ships by providing real-time HD video validation of mine-like objects. It too will be carried by the T38. I was briefed on how this MNS ROV autonomously executes the MLO route for final classification and man-on-the-loop validation of each MLO while the T38 shadows and supports it as an over-the-horizon communications link and countermine charge supply link. Once the operator identifies a validated MLO as a likely mine that must be destroyed, an explosive charge is placed on the mine.

The MNS ROV then clears the area. The classification, validation and engagement processes are then repeated until the field is cleared. The countermine charge detonation sequencing may be altered to detonate in any order and at any time desired. I was able to see what these sensors found during their several-week operation from the Idrobotica Pilota Watch-Stander Station.

I was struck by the fact that this watch station is manned by a single individual.

This system and its software architecture accommodate integration of variable depth sonar or hull mounted sonar, AUV and ROV functions, auto-pilot control and propelled variable depth sonar. I noted that the fidelity of the images displayed on this watch station left little doubt as to the identity of what was observed.

While each component in this system was impressive in its own right, that is not enough—not by a long shot. These individual components must be fully integrated in order to deliver the subsystems as a cohesive turn-key unmanned MCM solution that is easy to operate and easy to maintain. Teledyne Brown Engineering has a deliberate plan to do just this and is prepared to demonstrate incrementally more integrated versions of what I observed in San Diego.

Importantly, from my point of view, among all the MCM solutions I have examined in my years following (and writing about) this mission area, this one stands out as a very capable single-sortie detect-to-engage MCM capability solution.

With regard to manned-unmanned collaboration, this kind of solution allows for the data that is collected onboard the vessel, gets interpreted for the anomalies back to the professionals onboard the fleet. This means that one does not need a wide area network to deliver the desired mission effect, but one tied back to the operating ship, which can then use a variety of communication tools to provide data with regard to the mine threat and the results from the counter-mine operations.

In other words, Triton highlights the broader opportunities which remotes can deliver to the wide area network; and counter-mine case highlights how networks can be focused on a core mission without the need to rely on a broader network. Progress on both sides will be key to sorting through the opportunities which unmanned or remote systems can provide the operating forces. **FLD**

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