Unmanned Undersea Vehicles and Autonomuous Undersea Vehicles A Powerful Non-Kinetic Solution for the Joint Force Commander

by Lieutenant Commander Michael S. Salehi

Editorial Abstract: In this academic paper, Lieutenant Commander Salehi examines the idea and use of unmanned undersea vehicles in the context of the growing use of unmanned air-based vehicles and their IO related effects.

The utilization of unmanned vehicles (UMVs) in the battlespace has significantly changed the way in which commanders and their staffs plan, organize, and execute their missions. This revolutionary way of warfare has become limitless, as technicians and experts across the globe are continuously finding newer and more innovative ways in which these platforms can become further enhanced. With their growing insatiable appetite for technology, Joint Force Commanders (JFC) have demanded better improvements to tackle increasingly more complex factors such as time, space, and force.

Undoubtedly, one of the most appealing features of UMVs is their ability to minimize the loss of a pilot's life, but equally

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US Navy UUV
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important has been their dual ability to collect tactical, operational, and strategic intelligence and even employ kinetic solutions to a commander's objectives. While unmanned aerial vehicles (UAVs) have been on the forefront of this demand signal and have notably achieved tremendous results, the development and employment of unmanned undersea vehicles (UUVs)/autonomous undersea vehicles (AUVs) have also debuted with promising results.

The Navy has analyzed its potential use of UUVs/AUVs and concluded that a majority of the employment of UUVs/AUVs will be in an Anti-Submarine Warfare (ASW), Mine Countermeasures Warfare (MCW), and Intelligence, Surveillance, Reconnaissance (ISR) capacity.[1] While the Navy's 2004 Master UUV plan discusses the possible employment of UUVs in an Information Operations (IO) capacity,[2] it falls short to explain its full possible potential as a non-kinetic tool for JFCs. This paper attempts to elaborate and expand on its potential to serve as an IO tool for JFCs, providing support to operational functions such as fires, protection, intelligence, maneuver, and Command and Control (C2). It will broadly focus on three of the five pillars of IO – Electronic Warfare (EW), Military Deception (MILDEC), and Psychological Operations (PSYOP).

The use of UUVs as a warfare platform has been lauded for its relatively small size/signature, ability to be clandestinely deployed, and in some cases, autonomously operated. UUVs have been categorized by the Navy into four classes by their respective sizes: Man-portable, light-weight, heavy-weight, and large.[3] Furthermore, the Navy has broadly defined missions for each type of class of UUVs. For example, all classes can be utilized for ISR, while only light/heavy weight UUVs will be used for IO.[4] In a tactical sense, the Navy envisions IO-capable UUVs to be used primarily in an Anti-Submarine Warfare (ASW) capacity by appearing as a "decoy submarine."[5] Although the use of UUVs as an EW platform is demonstrated, it is skeptically illustrated due to communications challenges. For instance, while UUVs/AUVs can transmit and emit electromagnetic signals once above the water surface via satellite communications (SATCOM) or wireless, free-wave local area access (LAN) modems,[6] UUVs/AUVs are limited in their communications capacity underwater due to both inefficiencies associated with acoustic communications (ACOMMs) and oceanic conditions. While steadfast developments regarding underwater ACOMMs have attempted to bridge the gap, available bandwidth is currently still extremely limited.[7] These technical issues can to some extent

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limit the role that UUVs/AUVs can be employed in an IO capacity; however, in a joint, net-centric environment these issues can also be mitigated.

Nevertheless, a JFC can employ UUVs/AUVs as an IO option to augment existing EW air platforms within a Joint Operations Area (JOA). An existing EW airframe (even a possible UAV equipped with an EW sensor package) combined with an EW-equipped UUV/AUV can employ operational fires in order to facilitate the flow of coalition assets into theater, minimizing the destruction of infrastructure prior to a major campaign. For example, a UUV/AUV equipped with an electromagnetic jammer can employ electronic attack (EA) to deny the enemy the use of the electromagnetic spectrum. An autonomous undersea vehicle such as the Remus 600 can be an effective asset a JFC could employ to provide suppression of enemy air defenses (SEAD) within the littorals, harbors, or nearby shoreline. The Remus 600 is the predecessor to the Remus 100, which was used extensively in Iraqi's Umm Qasr in an Mine Counter-Measure (MCM) capacity just after the 2003 invasion.[8] Its efforts were highly lauded, and have led to subsequent technological developments in the Remus 600 that could possibly include EA capabilities. The Remus 600's man-portable size, increased payload capability, and modularity, make it a suitable candidate for clandestine EA operations that are near the shoreline.[9] Although the Remus 600 would need to surface in order to effectively conduct EA making it susceptible to detection, the 600 could also be outfitted with an electronic support sensor (ES) package to mitigate its discovery. Specifically, the ES package can provide immediate threat recognition[10] to the AUV should enemy intelligence assets detect friendly jamming emissions, subsequently alerting the back-end operator/pilot to this detection and forcing the vehicle to dive. Additionally, current technological research has been dedicated to enhancing onboard UUV/AUV digital signal processing (DSP), further eliminating human intervention and making the vehicle more autonomous.[11] This breakthrough will further compliment the ES package by eliminating the reaction time needed by the operator/pilot to adjust its mission profile to dive, ultimately providing better protection to the IO platform as it conducts joint fires with other assets in the JOA.

EW equipped UUVs/AUVs can also provide the JFC operational protection by ensuring the sea lines of communication (SLOCs) remain safe and open in order to facilitate the flow of joint forces into the JOA.[12] Strategically vital straits such as Hormouz and Malacca have historically been contentious between US naval and hostile naval/piracy forces, however these potential threats can be mitigated and/or averted through the effective employment of ES. In addition to their existing ASW capabilities, ES packages on AUVs such as the Remus

600 can provide indications and warning (I&W) support for naval vessels transiting through major chokepoints, ensuring they remain safe from potentially hostile assets. An ES package on a clandestine AUV can scan, detect, and even localize signals of interest on the horizon once the vehicle has surfaced its sensors. That time-sensitive information can be transmitted directly via numerous communications mediums to the Joint Forces Maritime Component Commander (JFMCC), or even a Joint Operations Center (JOC) for immediate threat identification and evasive action.

The uses of EW-equipped UUVs/AUVs are boundless, not only providing the JFC additional options to synchronize non-lethal operational fires, but also their ability to provide protection for his/her forces upon the commencement of major operations in a JOA.

Next, the Navy's 2004 UUV Master Plan provides a broad illustration of the use of UUVs in an MILDEC capacity. As such, the Navy envisions that the UUV can be used in MILDEC operations acting like a "submarine decoy," emitting underwater signatures that would otherwise be associated with a different size, or class of vessel.[13] This in turn would fool enemy ASW sensors and result in a mismanagement of enemy resources to the deception plan, ultimately minimizing the threat to friendly forces.[14]

While the UUV master plan provides a simple, tactical MILDEC illustration, a JFC could use a somewhat similar example on an operational level to facilitate operational intelligence and maneuver. For example, a JFC or Joint Special Operational Task Force (JSOTF) could use UUVs/AUVs in MILDEC during the early stages of the Joint Intelligence Preparation of the Operational Environment (JIPOE) by employing a man-portable AUV with a personnel Delivery Vehicle Team (SDVT). Pending a possible amphibious assault, a man-portable AUV could accompany a SDVT within the SDV that launches from a submarine's Dry Deck Shelter (DDS). In order to fool enemy ASW sensors and allow protection for the SDVT, the AUV can deceive the enemy into believing that an invading force is collecting intelligence on another side of a country's harbors, piers, and coastal ways. Working in conjunction with UAVs that are also facilitating the JIPOE process, these unmanned vehicles can fool the adversary into believing that a JIOPE

US Navy Cruiser in Pearl Harbor
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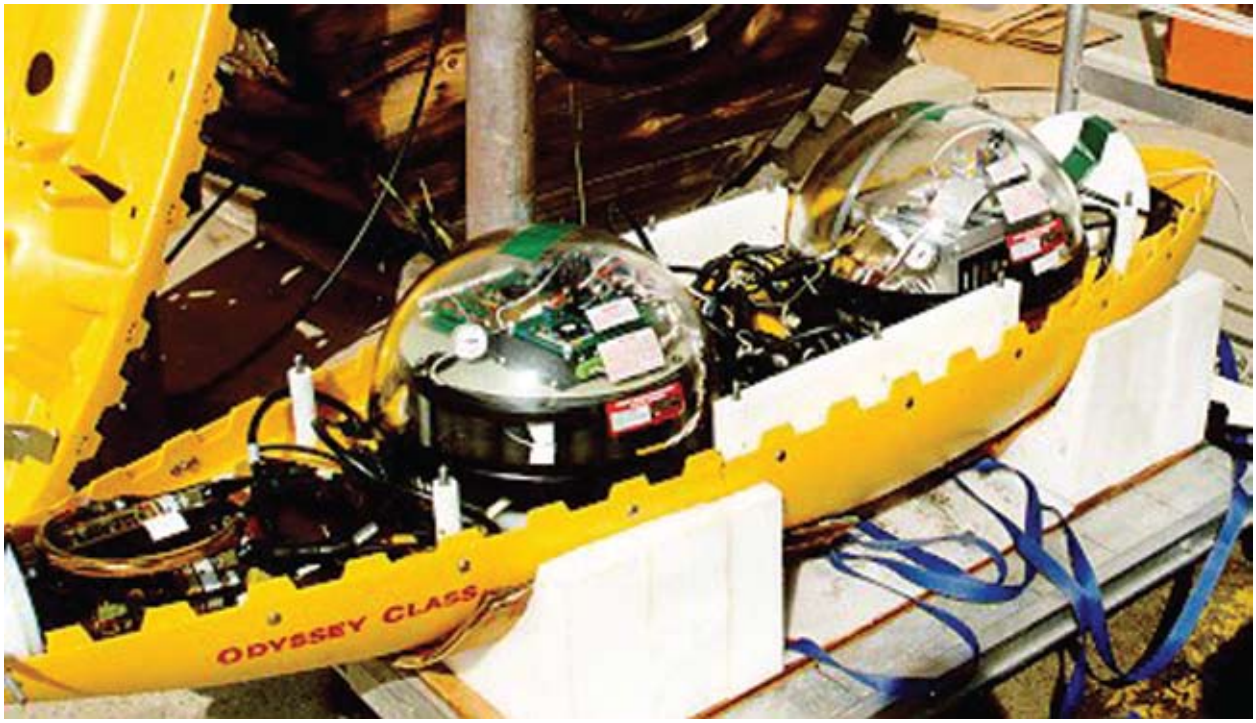
is being conducted in a completely different location than the actual one. The dedication of enemy resources and forces to the "spoofed" location can also ensure better safety for personnel that are assisting the JFC with the actual information gathering.

UUVs/AUVs can also assist the JFC facilitate operational maneuver by employing MILDEC during an amphibious demonstration that is actually a MILDEC operation. Considering the common scarcity of JFC resources prior to major campaigns and/or operations, unmanned vehicles such as UUVs, AUVs, and UAVs can employ electromagnetic deception to appear much larger, concentrated, and located at a different area or coastal location. Specifically, these platforms can employ simulative electromagnetic deception in order to simulate friendly, notional, or actual capabilities to mislead hostile forces.[15] Enemy commanders could possibly react to this UUV/AUV deception plan with forces/resources, and ultimately select an "unfavorable course of action."[16] Following the success of this deception plan, the JFC can better facilitate operational maneuver in conjunction with fires to conduct a much safer "actual" amphibious assault operation.

The employment of UUVs/AUVs in a MILDEC capacity has the potential to be a massive force multiplier for JFCs that are looking for better ways to facilitate operational intelligence and maneuver. Not only do these uses have the potential to fool and misled the enemy, but they can also ensure a safer operational environment for their scarce forces/resources.

MILDEC and EW are probably the most common potential uses for AUVs/UUVs supporting IO, but unconventional thought raises the possibility of UUV/AUV technology being further harnessed to employ PSYOP within a JOA. According to Joint Publication 3-13, "Operational-level PSYOP are designed to strengthen US and multinational capabilities to conduct military operations in the operational area and accomplish particular missions across the range of military operations."[17] While the 2004 Master Navy Plan for UUVs does not specifically mention the possibility of UUV/AUV PSYOP integration, there are numerous opportunities that are possible that certainly have the potential to make significant impacts for an operational commander.

As one of the biggest proliferators of PSYOP via the EC-130 Commando Solo airframe capacity, the Air Force has already begun to conceive ideas on how to employ PSYOP via UAV platforms. Proponents have argued that PSYOP radio broadcasts could be delivered to targeted foreign audiences to deter their intentions via UAVs.[18] For example, These programs will hit target individuals equipped with UAV-delivered PDAs capable of receiving wireless radio, TV, e-mail, and Internet traffic in real time. Scalable UAVs will conduct precise leaflet delivery, humanitarian assistance, and re-supply missions across the entire battle space as part of an integrated PSYOP effort.[19]



US Navy UUV Opened
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US Navy Helicopter Operations
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A JFC could integrate the employment of an Air Force UAV PSYOP delivery platform along with a Navy UUV to synchronize efforts designated to non-kinetically disrupt and/or influence enemy Operational Command and Control (C2) within a JOA. This disruption technique can limit kinetic solutions for the JFC, ultimately minimizing collateral and infrastructure damage within a JOA. One example has illustrated the potential of embarking miniature UAVs onboard UUVs for further launch once within proximity of the intended target/targets. The UAV embarked UUV could be either loaded with a small number of pre-loaded leaflets or could transmit broadcasts to intended targets in a highly selective process that minimizes the potential for the message reaching unintended audiences.[20] Upon its completion of mission, the UAV would vector back to the UUV for recovery for further docking onboard a coalition submarine.[21]

Although UUVs and AUVs can work in conjunction with UAVs in the JOA, they also can work autonomously in order to project selective, PSYOP radio broadcasts to adversary target audiences. UUVs/AUVs could utilize their organic, free-wave modem or SATCOM technology as a medium to deliver these messages to an intended audience once these vehicles have surfaced from underwater. Depending on the location of the operation, the AUV/UUV could receive further targeting guidance via acoustic communications (ACOMM) if there are gateway buoys in the vicinity that can relay broadcasting directions from a JOC while the UUV/AUV is underwater. This can be extremely critical when enemy C2 is dynamic; decentralized; on the move; and the UUV/AUV is travelling underwater with limited communications capabilities.

Some could contend that the biggest obstacle with the employment of UUVs/AUVs is within their ability to effectively transmit either electromagnetic signals and/or broadcasts/leaflets. This could be attributed to current technological challenges associated with the size and employability of communications devices/payloads near the water. However, these issues cannot only be mitigated as technology continuously improves, but net-centric operations/warfare could also bridge the gap of these potential connectivity issues. UUVs/AUVs have been lauded for their ability to interact not only with the host pilot that might be located vast distances from the vehicle, but also with other UUVs/AUVs within the area of operations.[22] AUVs are currently in the developmental stages of collecting, sharing, and processing information with other AUVs, ultimately these advances could assist in redirecting/refining their IO targeting solutions. Furthermore, UUVs/AUVs will eventually begin to interact with all net-centric platforms beyond unmanned vehicles

operating at the disposal of a JFC. The Navy has already commonly referred to this concept as "FORCEnet."[23] As digital signal processors (DSPs) are becoming more advanced within UUVs/AUVs, artificial intelligence will further limit the role of a host pilot and rely more on net-centricity. Intelligence and IO will eventually coexist within one another as a powerful non-kinetic solution for JFCs.

In conclusion, the role of a UUV/AUV platform as an IO tool for a JFC is boundless. The illustrations in this paper represent just a few ways in which EW, MILDEC, and PSYOP could be employed by a UUV/AUV to have significant operational impacts within a JOA. These examples will not only shape the operational environment by facilitating operational fires; protection; maneuver; intelligence; and disrupting enemy C2, but will ultimately minimize the amount of infrastructure/civilian damage that kinetic tools could potentially inflict. In the end, their potential ability to operate with other manned/unmanned, net-centric platforms within a JOA will become a force-multiplier that will further enable the JFC to achieve mission-accomplishment, and facilitate strategic success within a theater of operations.

Editor's Note: This article was first used to fulfill an academic requirement at the Naval War College. LCDR Salehi's knowledge of UUVs and AUVs and their possible application of Information Operations is very insightful and relevent.

Footnotes:

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Naval Riverboat Operations
Source: defenseimagry.mil

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