

# US navy developing Large Displacement Unmanned Undersea Vehicle (LDUUV) and Extra Large UUV (XLUUV) for assured access in A2/AD environment

The US Navy needs to strengthen and enhance naval power-projection capabilities and integrated layered defense by improving manned and unmanned platforms, payloads and weapons. This enables U.S. and our partner nations' forces to complete missions at extended ranges within hostile environments by avoiding, defeating and surviving attacks.

Rear Adm. Robert Girrier, director for Unmanned Warfare Systems, re-affirmed the importance of UUVs as a part of the Navy's undersea dominance vision. USN has revised its Maritime strategy, for decisive war fighting advantage, in anti-access, area denial environment. The capability gaps have been mapped into nine S&T focus areas that help align, balance and communicate the efforts between the warfighter, ONR and the S&T community.

The Navy has launched Large Displacement Unmanned Underwater Vehicle (LDUUV) program that will design, fabricate, and field a new class of large displacement highly autonomous, Unmanned Undersea Vehicles (UUVs) to provide increased endurance, long range, and payload hosting.

The Navy has a similar multi-pronged approach for the Extra Large UUV (XLUUV) – a 54-inch diameter UUV, compared to the 48-inch diameter LDUUV, which would likely be launched from a pier instead of from a ship at sea. ONR is in the process of

building its second XLUUV INP boat, and at the same time PMS 406 has already released a request for proposals for construction that should be awarded by the end of the year. This mine warfare asset will go through the same dual-pronged learning effort from ONR and the unmanned systems program office – though not as a rapid acquisition program – and ultimately all the prototyping work will lead to an unmanned system with multiple payloads for multiple mission areas.

Berkof said the Navy set up its LDUUV and XLUUV programs in a similar fashion, and the only reason LDUUV was chosen for rapid acquisition was the fact that it was farther along.

## **LDUUV Program**

The LDUUV effort has split into two concurrent programs, one to continue experimenting with software and autonomy and the other as an accelerated acquisition program intended to put a boat in the water quickly.

The Program Executive Office for Littoral Combat Ships' (PEO LCS) Unmanned Maritime Systems program office (PMS 406) designated its rapid acquisition program the "Snakehead LDUUV" a couple months ago and is aiming to put a prototype UUV in the water in 2019, deputy program manager Howard Berkof said Monday at the Navy League's annual Sea-Air-Space exhibition.

"We are leveraging existing technologies out there – mature, proven technologies out there – and building this first Phase 1 vehicle to get it in the water as quickly as possible," he said. "The objective is to get the first Phase 1 prototype wet in '19. So get it in the water as quickly as possible, get it into the hands of our sailors, enable them to use it and get those lessons learned and that feedback, and that will feed our future LDUUV acquisition program. In fact, it will feed our family of UUV programs."

The Phase 1 Snakehead LDUUV will focus on intelligence and

preparation of the environment (IPOE) and intelligence, surveillance and reconnaissance (ISR) mission sets, and Phase 2 would seek to add extended ranges to both missions. The eventual program of record Snakehead Increment 1 would include additional payloads, potentially including electronic warfare, mine warfare, mine countermeasures, anti-submarine warfare and anti-surface warfare, according to a UUV Systems Vision chart included in Berkof's presentation.

At the same time, Berkof told USNI News after his presentation, the Office of Naval Research will continue with its LDUUV Innovative Naval Prototype effort. The first two ONR LDUUV INP vehicles will go to the unmanned systems program office, Berkof said – one of which is an empty hull that will be put on display and the other which will go to a "UUVron" squadron out of NUWC-Keyport, Wash., to learn operational lessons that will feed the Snakehead program.

With its two remaining vehicles, ONR will continue research and development efforts on "specifically software and autonomy and all that. Command and control. So ONR will continue maturing the two other vehicles, and then at some point they will transition to 406 in the future," Berkof said.

## **Large Displacement Unmanned Undersea Vehicle (LDUUV) System**

The Naval Undersea Warfare Center Division Newport (NUWC DIVNPT), had released the Top Level Requirements (TLR) document for the Large Displacement Unmanned Undersea Vehicle (LDUUV) System. The LDUUV program will design, fabricate, and field a new class of large displacement highly autonomous, Unmanned Undersea Vehicles (UUVs) to provide increased endurance, long range, and payload hosting.

It will have a large payload bay, making it capable of releasing sensors, communication buoys, smaller UUS and

weapons. LDUUV is intended to be fitted to accomplish mine warfare tasks including mine countermeasures (MCM); anti-submarine warfare (ASW); anti-surface warfare (ASuW); electronic warfare (EW); intelligence, surveillance, and reconnaissance (ISR); and projected operational environment missions.

**Large UUVs (about 80" in diameter) like** Large Displacement UUV (LDUUV) are designed to use the planned Virginia Payload Module (VPM) tubes in Block V Virginia-class submarines. The LDUUV also may evolve into a large UUV mothership that launches, operates and recovers smaller surveillance UUVs when it reaches its mission areas. Ultimately, it is likely to be armed. The LDUUV will provide a way for submarines to increase their sensor reach, expand their payload capacity, or deliver payloads into areas that are too risky or constrained for the submarine to reach.

Extra-Large UUVs (More than 80" in diameter) in development would be designed to launch from shore or very large ships with well decks or "moon pools." They could be used for long-endurance surveillance missions or primarily as "trucks" to deliver other payloads and UUVs. Experience with LDUUV will help inform concepts for using XLUUV.

The LDUUV System must have sufficient range and endurance to provide the fleet with a capability to autonomously complete missions in the current mission set and expected future missions under development. The vehicle can already operate for up to 30 days, but the goals are much loftier. "I'm talking power generation, fuel and battery technology, that can approach months and years of underwater domain activity," Winter said.

The ONR has made breakthroughs in underwater technologies for power, power generation, navigation, and sense and avoid, Adm Winter had earlier said at Navy League. This has provided the ability to deliver at some point in the future, he said, "an

unmanned underwater vehicle that will be able to deploy for weeks, months, and years at a time.”

The LDUUV will be a modular, open architecture and reconfigurable that will allow the Navy to incrementally develop new mission sets for the craft.. It is envisioned to be an unmanned system that can be transported to and deployed from worldwide port facilities, or carried by and deployed from US Navy platforms such as the Littoral Combat Ship (LCS), the Ohio Class Cruise Missile Submarine (SSGN), and the Virginia Class Nuclear powered Fast Attack Submarine (SSN).

The LDUUV must be able to avoid all vessels in its area of operations, including fishing boats. Development challenges include detecting and avoiding undersea stationary and moving obstacles, as well as path planning algorithms to minimize energy consumption while avoiding obstacles; detecting, locating, and identifying surface vessels; determining the intent of detected surface vessels; and detecting and avoiding all kinds of fishing nets and fishing gear, including mono-filament and twine nets which are difficult to detect. Once outside the specified areas, human operators may intervene over satellite links, if necessary.

US Navy’s vision is to achieve an integrated hybrid force of manned and unmanned systems with the ability to sense, comprehend, predict, communicate, plan, make decisions and take collaborative action to achieve operational goals. The employment of these systems will reduce risk for Sailors and Marines and increase capability.

## **Navy UUV concept**

RAND Corporation’s 2009 Report: “A Survey of Missions for Unmanned Undersea Vehicles” sponsored by the US Navy, recommended the most practical and cost-effective applications

for underwater vehicles.

MCM operations in denied areas can be conducted by launching autonomous undersea vehicles (AUVs) from nuclear attack submarines (SSNs) operating within the denied areas or by launching longer-endurance AUVs from surface ships operating outside denied areas. The feasibility of deploying leave-behind acoustic arrays has been demonstrated by the Advanced Distributed System (ADS), which uses AUVs to deploy its sensor arrays.

They can conduct near-land and harbor monitoring missions could provide protection for special operations forces (SOF) operations in countering militant extremists. They are useful for monitoring undersea infrastructure such as undersea communications cables, the Integrated Undersea Surveillance System, and instrumented undersea ranges.

They can be employed for ASW tracking missions, which detect the movement of potential adversary submarines out of port, classify them and possibly track their subsequent movements. Inspection/identification missions support homeland defense and antiterrorism/force protection needs through the inspection of ship hulls and piers for foreign objects (such as limpet mines and special attack charges).

US Navy vision is for naval platforms that are agile, fuel efficient, flexible and capable of operating cost effectively in varied environments. Enable manned and unmanned naval platforms and forces to seamlessly operate in hostile environments while avoiding, defeating and surviving attacks

## **References and Resources also include:**

<https://news.usni.org/2017/04/04/navy-splits-lduuv-into-rapid-acquisition-program-at-peo-lcs-rd-effort-at-onr>

[http://www.navy.mil/submit/display.asp?story\\_id=97063](http://www.navy.mil/submit/display.asp?story_id=97063)

<http://auvac.org/newsitems/view/2939>