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Displaced: Industry Looking for LDUUV Opportunities

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In his 2016 posture statement to Congress, Secretary of the Navy Ray Mabus said that autonomous under- water vehicles are a key component of the Navy's e ort to expand undersea superiority. AUVs are conducting sea-sensing and mine countermeasure tasks today with human-in-the-loop supervision.

"Unmanned systems have often been described as the answer to dull, dirty, dangerous jobs where the nature of humanity is the main limiting factor. So by removing the need for environmental control systems — things like oxygen generation, G-force limitations, we can develop platforms that stretch the bounds of our imagination. Endurance is another important advantage unmanned technology brings to the fight. Our UUVs need to be able to stay out for months at a time, allowing them to observe large areas for prolonged periods, without interruption and without degradation," Mabus said.

"While nominal force structure requirements for FY25 [fiscal year 2025] have not been determined, the Navy is committed to growing both the size and composition of the AUV force. In the near-term, AUVs present an opportunity to increase undersea superiority and o set the e orts of our adversaries," said Mabus.

The Large Displacement Unmanned Underwater Vehicle is an unmanned undersea vehicle that will offload missions from manned plat- forms, beginning in 2022. The platform will be launched from a variety of platforms, including both surface ships and submarines. Its missions include intelligence, surveillance and reconnaissance; acoustic surveillance; antisubmarine warfare; mine countermeasures; and offensive operations, according to Mabus.

Speaking at Unmanned Systems Defense 2015 last October, Mabus said, “We plan to deploy LDUUVs from an exclusively UUV squadron on an independent mission no later than 2020.”

The Office of Naval Research has long been involved in undersea technology and the development of underwater vehicles, including LDUUV. According to Chief of Naval Research Rear Adm. Mat Winter, ONR’s Innovative Naval Prototype LDUUV program will design and build five LDUUVs: two preliminary designs, two pier-to-pier vehicles and one submarine-compatible vehicle.

“The program is developing energy, autonomy and core systems to operate in a complex ocean environment near harbors, shorelines and other high-traffic locations. Goals include doubling air-independent UUV energy density, using open architecture to lower cost and enabling pier-to-pier autonomy in over-the-horizon operations. Achieving these goals will reduce platform vulnerability and extend the Navy’s reach into denied areas. ONR is developing a long-endurance, fuel cell-based power plant to be incorporated into LDUUV prototypes. A long-endurance mission demonstration is scheduled in FY 2016.”

Echo Voyager by Boeing is an example of a pier-to-pier system. It’s too big to deploy from a host platform, but with its range measured in months instead of hours or days, a mother ship isn’t required.

According to Lance Towers, director of sea and land systems for Boeing’s Phantom Works, Echo Voyager’s payload bay is scalable — from zero to 30 feet long. The size of the pay-load bay can be made to fit the operation. “We’ve eliminated the need for a unique, proprietary interface. The payload bay has standard commercial interfaces, so that anyone can design a payload that will go inside,” he says.

The idea isn't new. The joint U.S.-Canadian Theseus vehicle was developed in 1992 by International Submarine Engineering and was designed for long missions placing fiber-optic cable under the Arctic ice. The Theseus pressure hull payload bay and sensor suite are configurable and can be adapted or replaced with new modules designed to support a wide variety of missions and tasks and can be "parked" on the bottom for extended periods of time and then reactivated.

"Our view is that the Navy sees AUVs as a component of their effort to increase undersea superiority. We have platforms out there — surface ships, submarines and aircraft — that are involved in undersea superiority," says Frank Drennan, director of business development for mission and unmanned systems at Lockheed Martin. "And AUVs are another component of that. Eventually they'll see these AUVs operating independently or, in some cases, in cooperation with the manned platforms for a variety of tasks that are associated with operations from under the sea, such as intelligence surveillance and recon- naissance or a new category referred to as seabed warfare. at would entail disrupting an adversary's seabed infrastructure."

Eventually AUVs will operate in places where manned platforms can't or probably shouldn't operate. But to do that, they really need to have en- durance, payload and then autonomy to be able to operate longer without a human in the loop or without human intervention over a fairly long period of time. And practically speaking, Drennan says that means that the vehicle has to be larger.

" There's just so much energy you can pack into a 21-inch vehicle [the diameter of a submarine torpedo tube] with current technology. So the larger the vehicle, the greater the energy capacity you have, the more payloads and sensors that you could put onboard, and perhaps have more redundant systems to allow that vehicle to operate longer, at longer distances, into areas where it needs to reliably operate without a human in the loop for an extended period of time," says Drennan. "That's what a larger vehicle offers the U.S. Navy."

According to Alan Beam, unmanned underwater vehicles used to be large because they couldn't make the computers small enough to t inside. Beam, a retired Navy captain, was the DARPA program manager for unmanned underwater vehicles back in 1991. "We wanted them to be small, but we didn't have the technology."

Today, the problem revolves around energy.

“We need bigger vehicles to get bigger batteries so we can achieve longer endurance. With small vehicles and current batteries, mission endurance will still be limited to hours or a few days at most. That means the vehicle has to be delivered to the operating location by a host platform, such as a submarine or a surface ship, and it has to be recovered.”

To achieve the kind of endurance necessary for persistent surveillance may require a vehicle large enough to carry a diesel or fuel cell system, which would likely make it too big for a submarine, Beam says.

Having a vehicle that can operate for weeks or even months without intervention must be reliable. “We don’t like sending these things out and not getting them back,” Beam says.

Some UUVs have the ability to change mission capability by changing payloads, such as sensors. Just with large containerized mission modules, the ability to swap out systems requires open interfaces. Large vehicles can carry smaller unmanned vehicles in the payload bay.

According to Chris Roper of Saab North America, who is the lead for Saab’s commercial offering of UUVs, with an eye for how they might be used for military applications, Saab’s Seaeye vehicles can be deployed and recovered from larger UUVs.

“Our electrically powered Sabertooth is a hybrid — it’s both an ROV and AUV — so it can operate tethered or untethered. It can be remotely controlled by an operator on the surface or it can be programmed to run autonomously for up to 18 hours.”

Roper says Sabretooth is designed to t into a docking cassette that can be carried on a host platform, and that would include an LDUUV.

The Navy’s LDUUV program of record calls for a vehicle to be stowed, launched and recovered by multiple-host platforms, including littoral combat ships, Virginia-class submarines (SSN) and Ohio-class guided-missile submarines (SSGN). The Unmanned Maritime Systems Program Office, under Program Executive office Littoral Combat Ships, is responsible for LDUUV.

The Navy held an industry day and went so far as to issue a draft request for proposal. But although industry was ready, pulling together teams and preparing to bid on the project, the fiscal year 2017 budget showed that the work was assigned to a Navy lab, the Naval Undersea Warfare Center in Newport, Rhode Island.

“NUWC Newport Division is the lead system integrator,” says Naval Sea Systems Command spokesperson Dale Eng. “ The effort is projected

to include industry, academia and governmental field activities. NUWC Newport Division will release LDUUV-related opportunities for industry under FBO [Federal Business Opportunities] announcements.”

According to analyst Bryan Clark of the Center for Strategic and Budgetary Analysis, having NUWC be the “prime contractor” for LDUUV speeds up the acquisition process.

“The Navy’s decision to shoot this to NUWC as the integrator rather than industry is primarily designed to accelerate the program, because they’re trying to get an LDUUV in the water and operating by FY 19. If they do the integration at NUWC, industry can supply parts to NUWC and then get the thing in the water — and NUWC has the capability to do that. They have huge facilities for constructing and modifying UUVs, which they’ve been doing for decades.”

Despite the fact that Mabus envisions a squadron of LDUUVs, Clark says LDUUV is going to be a niche capability, because it will be submarine- deployable and big and expensive.

“There will be some missions where they really want to use it, but it won’t be the kind of thing where the Navy will buy dozens of them.”

“What we see is that UUVs will be going toward the two ends of the spectrum to a much greater degree,” says Clark. “As power, technologies and payloads become more miniaturized, they both improve. We expect to see small UUVs with reasonably long endurance and relatively inexpensive, which essentially makes them expendable. Smaller UUVs — that are the size of a sonobuoy — can do the sensor and survey missions, and the things you might want a smaller UUV to do can be cheap enough to where you could send them out and then not have to bring them back. At the other end of the spectrum, we have really large UUVs like the Boeing Echo Voyager, which can go out for months at a time and carry what amounts to a 20-foot shipping container worth of stuff in it.”

“We’ve had three programs of re- cord for submarine-launched UUVs. I think the capability is a good idea, but our record for sub-launched UUVs is not good,” says analyst and author Norman Polmar.

“The SEAL Delivery Vehicle we’re using is 30 years old. The advanced swimmer delivery system that was supposed to replace the SDV was canceled after it took too long, cost too much and caught re too often,” says Polmar.

“ The ASDS is a good example of why things that swim underwater should be developed by companies that know how to build things that operate underwater,” Polmar says.

According to one industry representative, the industry teams are very interested in working with NUWC on their LDUUV e ort.

“Together we bring our mission system integration expertise and experience to their design and prototyping e ort to help them more rapidly develop a LDUUV vehicle design that will be a more open, production-ready, reliable, modular and maintainable mission platform. Ultimately, we believe this will re- duce risk to the LDUUV program’s ability to deliver a mission-capable platform to the fleet.”

Jeff Cares, president and CEO at Alidade Inc. and co-author of “Operations Research for Unmanned Systems” with John Dickmann, says submariners look at the problem based on what can be useful to them and what can t inside a submarine, where space is at an absolute premium.

But, he says, while there have been lots of engineers looking at how to build an underwater vehicle to do something, the operational analysis has been lacking.

“Are we doing this because the engineers say we can? Who really wants the capability, and what do they really want it to do? Maybe a submarine-launched vehicle isn’t the best answer. Maybe we should take the capability away from the submarine or ship and distribute it over the battlespace. We should focus our innovation on the operations research and the science of how to use it, not the engineering,” says Cares.

Unmanned systems may have been envisioned as a manpower saver. But Cares says as long as we insist on central control, we won’t remove the man from the mission, we will just move them somewhere else.

“If we want a lot of specific systems to do unique tasks and make them work on an SSN or a SSGN, maybe we would be better o building smaller submarines for those specialized roles,” says Cares.

“Industry doesn’t know what the Navy wants,” Cares says. “And maybe that’s because the Navy doesn’t know what it wants.”