AUVs and the Inner Space Race

Robert Wernli, noted fiction and non-fiction author, peers into the future of military AUVs.

When asked to write an article about Autonomous Underwater Vehicles (AUVs), primarily those used by the military and for homeland security (HS), I thought about all the details that could go into it. Those details would interest those directly involved with AUVs, but probably bore those who are thinking: What Inner Space Race? For those who desire details—Google the Internet for all you ever wanted to know. For everyone else, let's concentrate on the more philosophical, and actual applications of AUVs in military and HS applications.

AUVs have been around the block a few times already, however, many people have no idea what they can do or how well. For example, the U.S. Navy developed and tested the Advanced Unmanned Search System (AUSS) in the 1980's—that 31-inch diameter, 17 foot-long battery operated vehicle was designed to conduct search to depths of 20,000 feet. Other testbed vehicles existed internationally in both academia and the military. The missions were there, but the technology wasn't quite ready.

Today, according to Douglas-Westwood Ltd. (U.K.), there are over 400 AUVs worldwide (mostly smaller), and nearly a third are destined for military applications: search; survey; mine hunting, classification and neutralization; and port and harbor security.

Commercial AUVs are commonplace. Vehicles like the C-Surveyors, operated by C&C Technologies (U.S.), have provided underwater surveys for the offshore industry with a total number of miles transited underwater greater than three times around the Earth—impressive. The bottom line is that, today, the technology exits to complete many of the military missions envisioned for AUVs. However, to meet all the missions envisioned in the U.S. Navy's UUV Master Plan, the never-ending advances toward smaller, more powerful, more capable systems will be required. But by understanding today's capabilities, and properly applying the available technology, many missions can be performed today.

AUV development has not been revolutionary, but evolutionary, usually combined with the exploitation of technology developed for other applications: more efficient batteries, the shrinkage of electronics, exponential increase of onboard memory, better and smaller sensors, etc. All critical aspects of any system design.

But technological advancement is only part of the puzzle. This evolution requires the creation of an academic base; one that trains the newest engineers, military officers, and other future players about the existence, applications and capabilities of AUVs. This has taken time. Today's military, many of whom were prenatal when AUV technology was in its infancy, are now becoming experts on how these unmanned systems can remove man from the underwater battlespace. Let the robots do the work while the operator remains out of harm's way at a remote site. The key is that those who will be in command of the military in the future need to understand the potential of the tools available to them.

For example, Unmanned Aerial Vehicles (UAV's), which were at one time a good idea, are now an integral part of the battle force. And they aren't just up there staring down with their infrared sensors and cameras. Today, they've reached a level of acceptability that has them armed, albeit under the control of a remote operator. So let's take this one step further—cruise missiles. Now, a cruise missile is essentially a UAV, but one that is deadly and under the control of its onboard systems.

In the underwater regime, one may say that a torpedo is an underwater cruise missile. Torpedoes have been around a long time, but I think of them as more of a bullet than an AUV. However, as the onboard intelligence and sensor capabilities increase, they may eventually reach the AUV level of maturity. For now, man isn't going to turn over a warhead filled AUV to its own onboard controller.

But that may change in the future. Submarine developers are looking at including AUVs that are integral with the hull. AUVs like the Manta, envisioned by the Naval Undersea Warfare Center (U.S.), will increase the submarine's situational awareness and project a significant aspect of its stealthy capability into the undersea battlespace.

A logical application for AUV integration on submarines involves the conversion of SSGN missile tubes to launch SEALS, AUVs or other equipment. One recent test resulted in the Seahorse, a large (38-inch diameter, 28-foot long) AUV developed by the U.S. Naval Oceanographic Office, being successfully launched by the submarine. Following the launch, the vehicle supported a SEAL team mission.

The problem with vehicles like Manta and Seahorse is that they are big systems. Such vehicles will have big missions in the future, but big isn't always better. Something big takes a lot of room. Smaller is on the horizon. The amazing advancements in technology usable by AUVs—miniaturization and increases in efficiency—have allowed the development of smaller vehicles that are becoming more capable, seemingly by the minute.

Before discussing the smaller AUVs, let's first address the usual military requirements for "more capable" systems . . . usually "bigger" systems. In earlier articles I've discussed the problem of Navies trying to use a torpedo tube for launch and recovery of an AUV. Although successfully demonstrated on a Los Angeles-class submarine (emphasis on demonstrated) by Boeing (U.S.) with the development of the AN/BLQ-11 UUV MCM system, the technology is far from operational. Now, I'll give credit to Boeing for successfully putting the proverbial hundred pounds of stuff in a ten-pound bag, but is it too much stuff? This system (two AUVs, a launch/recovery system, control consoles, batteries, etc.) takes up critically needed weapon stows.

Are military systems being over-designed? Are new systems so potentially capable of doing everything, that they can't perform their original mission? In the case of Boeing's AUV—a large vehicle launched out of a tube—the mission is to keep the submarine out of harm's way, primarily from mines. It seems that the real operational need is for something that comes out of a tube, does its job satisfactorily, leaves the crew with a bright smile afterward and does not have to go back into the tube when done—Crest toothpaste fits this bill. An expendable product! A torpedo sized, "bell and whistle" stuffed, 21-inch diameter AUV doesn't accomplish this (at least not yet). Bigger means more power and longer range, which is good, but bigger may not always be necessary.

So, what about the smaller AUVs? AUVs like Hydroid's (U.S.) REMUS 100—an 8-inch diameter, 5-foot long AUV with a very capable sensor suite—are taking center stage with sales to eight navies worldwide. A notable military success using REMUS was the mine countermeasure missions (MCM) conducted by the U.S. Navy's Naval Special Clearance Team One in Operation Iraqi Freedom. The small REMUS did its job well.

Also on the military front is Bluefin Robotics (U.S.), with their classes of AUVs sized to meet the various military missions. Bluefin's AUVs, with diameters that range from 9- to 21-inches, have also produced notable successes. And not to be outdone is the sensor-laden Gavia AUV developed by Hafmynd ehf (Iceland). Their most recent claim to fame was a successful high-resolution bathymetric survey of the underside of the Arctic ice cap.

But even those AUVs are large and costly compared to the Iver2 and Ranger AUVs. The man-portable Iver2 (5.8-inch diameter, 50-inch long, and 42 pounds) built by OceanServer Technology Inc. (U.S.) is designed for shallow water coastal applications like surveys and environmental monitoring. A complete system can be obtained for less than $60K USD. Want a smaller vehicle? Try Nekton Research's (U.S) Ranger vehicle that weighs in at 20 pounds. Smaller yet? How about the biological-based design of Nekton's palm-sized MicroHunter.

Smaller, lower-cost AUVs will play an increasingly important role in homeland security applications. From port and harbor surveys and ship hull inspections to the prevention of chemical, biological or radiological terrorist attacks—or an emergency response to them. And the commercial developers can see this coming.

ONR and NOAA have sponsored an annual AUVfest that showcases AUVs, their technology, and runs them through a series of demonstrations to highlight their capability. In May, 2007, over 500 participants from 8 countries demonstrated the capability of 45 different platforms (not all underwater).

The previous examples were U.S. companies, so to be fair, international AUV developers for military applications are also pushing the technology toward the future: Talisman (BAE Systems, UK), Hugin 1000 (Kongsberg Maritime, Norway), Alister (ECA, France), to name a few.

So what does that future hold for military AUVs? That's why I use the "space" analogy in the title. We've spent over 50 years developing rockets and satellites that work for man—yes, there's an International Space Station, but only one! It's big! There are hundreds—thousands—of satellites in outer space. They're small. Are we beginning to see a trend here?

So, what about inner space? If you count gliding and drifting autonomous buoys and systems, there are many out there already. But the future military AUV "inner space race" will be won by those who balance capability, technology, cost and the impact on the platform to give the best financial and strategic return on investment.

Future AUV systems must be envisioned with tomorrow's technology in mind. Technology will continue to advance, systems will continue to shrink in size and increase in capability. Missions that can't be completed by an AUV today will become commonplace—and most will be done by smaller AUVs. This is an area where visionaries should think small. Whether launched from plane, helo, ship, submarine or by hand, the majority of future military and homeland security AUVs will be expendable—like toothpaste!

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