

SCOTLAND'S SEEBYTE FOCUSES ON THE CUTTING EDGE: UNDERWATER AUTONOMY

By Brett Davis

Autonomy is the cutting edge of technology for unmanned systems. It enables them to be transformed from simple data collection systems to intelligent, decision-making assets. Military and commercial companies around the world now require and depend upon autonomous solutions to carry out ever more complicated missions.

Undersea robots increasingly require the ability to think for themselves. Adding additional smarts on board has become a key push for robot users, which is where a small but fast-growing company based in Edinburgh, Scotland, comes in. The company, SeeByte, which is an advanced software systems and products company, has made a significant impact in this area in the last decade.



Another view of the AIV, which could be deployed from ships or from underwater facilities. Images courtesy Subsea 7.

The U.S. Navy's explosive ordnance disposal (EOD) teams use SeeByte's SeeTrack Military software, which is a core component of the Common Operator Interface Navy (COIN) software suite, alongside clearance divers, marine mammals and unmanned systems for mine countermeasures (MCM) and EOD missions. Eleven other navies are also customers.

SeeByte is also collaborating with one of the world's leading subsea engineering and construction companies, Subsea 7, to create the first commercially available Autonomous Inspection Vehicle (AIV), scheduled to be in-service during 2011.

SeeByte, which now has offices in Edinburgh and Seattle, Wash., is a spin-out company from Edinburgh's Heriot-Watt University, home of the Ocean Systems Laboratory. Since its formation in 2001 SeeByte has averaged 40 percent year-on-year growth. Last year, during the recession, "maintaining that standard of growth was unrealistic," says Chief Operating Officer Stuart Genet. "However, we still grew by roughly 25 percent, which I feel was equitable considering the world's financial climate."

From the beginning, the company has focused on providing autonomy to underwater vehicles and working with "remote assets," or systems that are difficult to reach (think offshore wind turbines) and therefore require autonomous capabilities which help lower fixed, variable, and marginal costs and increase operating profits.

Genet says SeeByte currently has three market-focused strands, or business areas: military, oil and gas, and the emerging market of renewable energy. For that work, the company has developed SeeTrack Recovery software. This is a fault detection, diagnosis and condition monitoring system that allows customers to detect trouble and predict faults before they occur. The development of this product is currently focused on providing smart tools for offshore wind farms.

"There is an approximate four-month window of opportunity for maintenance in the North Sea due to the harsh winter conditions," Genet tells *Unmanned Systems*. "The wind farms are positioned in the areas that experience the peak of this stormy weather, which is great in principal; however, maintaining them is posing a key issue, and that is where our software is beneficial."

The software can be applied to vehicle fleet management and other power-related areas (including oil and gas), and SeeByte is watching the development of the renewables market carefully.

As with many companies in the unmanned systems market, military work is a key driver for SeeByte. The company's SeeTrack Military system provides mission planning, monitoring and post-processing for anti-mine missions, taking some of the drudgery away from already overburdened and time-challenged military operators.

The system replaced the U.S. Navy's "sneakernet," where information was shared on an ad hoc basis, usually scribbled on sticky notes. SeeTrack Military has a point-and-click interface and can display satellite imagery, bathymetry data and sonar images among other data. It also operates with the Mine Warfare and Environmental Decision Aids Library (MEDAL), the U.S. Navy's command-level software, to aid in mission planning.

"We have a real-time shared interface so MEDAL information can be displayed within SeeTrack and the SeeTrack information displayed within MEDAL. This makes the next stage of planning in a tactical campaign exceptionally rapid," says Chris Haworth, SeeByte's business development manager.

Oil and Gas and AIV

SeeByte's software product for the oil and gas industry, which relies heavily on remotely operated vehicles (ROVs), is named SeeTrack CoPilot. This is a dynamic positioning software product. ROVs are controlled via a tether and have an operator in the loop, controlling position and monitoring the system. The autonomy requirements are different from those of an autonomous underwater vehicle (AUV) and focus on assisting, rather than replacing, the operator.

As an example of the benefits provided by SeeTrack CoPilot, the company shows a video where a human operator is conducting an offshore maintenance operation (securing a shackle pin at 300 meters) both with and without SeeByte software. Without SeeByte's Autonomy software, the operator tries to secure the shackle for 20 minutes because he has to both control the ROV and work the arm,

dropping the bolt in the process at one point. The operation is successfully completed in a significantly reduced time of two minutes using SeeTrack CoPilot.

The system can add additional layers of autonomy onto an ROV depending on what an operator wants to accomplish.

“The operator can select inspection tasks they wish the autonomy software to handle,” says Scott Reed, SeeByte’s head of engineering. “An example of this would be for the inspection of a specific oil riser or subsea structure. Here, the pilot would hand control to our software which would allow the task to be conducted autonomously, leaving the progress to be monitored by the operator.”

More complicated missions are handled by a high-level autonomy module, called the Mission Executive. This “assesses the overall goal of the mission and divides it into a number of manageable tasks” and can be used for overall mission planning.

Another of SeeByte’s products is SeeTrack AutoTracker, an underwater pipeline inspection system for AUVs, which allows for fully autonomous pipeline detection and survey operations. It has been integrated on a number of commercial AUV systems to include Gavia by Hafmynd, and various derivatives of REMUS by Hydroid.

The program with Subsea 7, AIV, will bring many of these products and practices together. AIV, expected to hit the market late next year, will be an autonomous underwater vehicle that’s shaped like a ROV and can hover like one but which has more smarts than today’s AUV.



A SeeByte test vehicle, Nessie 5, in a water tank at Heriot-Watt University. AUVSI photo.

The first version of AIV will be equipped with a 360 degree sonar, two forward-looking sonars, color cameras, a downward-looking camera and profiling sonar. Later versions will gain the ability to do “light intervention tasks,” such as taking samples and tightening a bolt using a robotic arm.

AIV could be deployed from ships, which would lower the vehicles and then pick them up again after the mission is complete. The vehicles could also be permanently installed on a host facility and deployed for planned or unplanned inspection tasks at the operator’s convenience, providing an instant inspection capability without costly vessel mobilization.

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AIV will use high level Mission Executive software, Reed says. "With AIV, the operator can request that the vehicle conduct a high-level inspection mission, such as the inspection of a specific subsea structure where the collection of video data is also required. In this case, the software would divide the mission into a series of manageable tasks to determine the best route and method to complete the mission autonomously and efficiently."

Looking Ahead

In the near future, the company wants to enable multi-vehicle control so Navy operators can dictate a high-level mission goal and the vehicles on hand will collaboratively carry out several tasks to complete the stated mission.

"Where we want the U.S. Navy to go is, instead of having specific vehicles for specific tasks, the goal-based mission planning system will look at the assets that are available and use these in the most efficient manner to execute the tasks that achieve the mission goals. Each vehicle will carry out whatever tasks they're best suited and positioned to do based on the high-level goal while communicating progress with each other." Reed says.

SeeByte intends to expand further into the oil and gas and military markets and in July appointed a new CEO to help it do that. Bob Black joins SeeByte from Paris-based IT and consulting firm Capgemini, where he headed the Oil & Gas division in Aberdeen, Scotland. He worked for 15 years before that in international busi-

ness development for U.S.-based SAIC.

"Black's mission is to take SeeByte deeper into global energy and defense markets, where its customers already number 11 of the world's leading navies, several major oil companies and global offshore contractors," says a company press release announcing the appointment. "Revenues, currently at \$5 million, continue to grow, and the 35 employees are divided between its Edinburgh HQ and an office in the U.S."

However, Genet advises that SeeByte will remain focused on key sectors, preferring to work with customers to tailor its software to their needs.

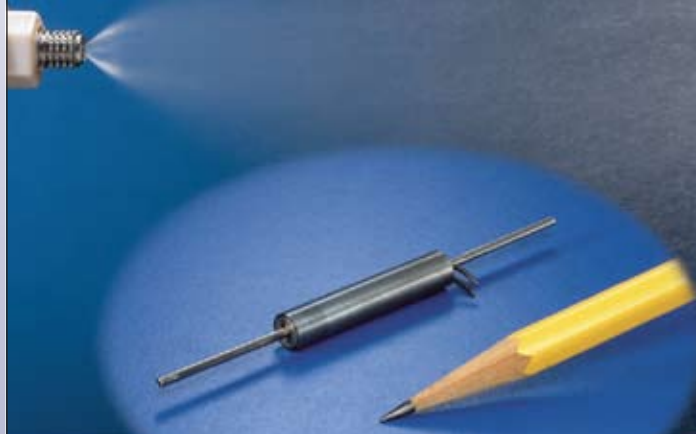
"The only way to continue our aggressive growth in this marketplace is by understanding your customers' needs and building long-term relationships," he says. "We spent weeks and months with the U.S. military understanding what it was about current anti-mine operations they were having problems with, what they were trying to achieve and why the current system wasn't working. It was by working closely with them that the relationship developed and they got exactly what they needed to accomplish their mission."

Brett Davis is editor of Unmanned Systems.

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