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Electric ROV Systems Take on More Tooling

Improvements in Power Capabilities Enable Mini-ROVs To Perform Tasks Previously Carried Out by Work-Class Vehicles

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Not long ago, some people likened an ROV to simply a truck onto which kit was loaded and sent off to do a job or two. Times have changed. Today, no one would consider the ROV as anything other than a sophisticated multimission vehicle packed with advanced electronics.

This transformation has resulted from a focused revolution in underwater technology driven by collaboration between ROV manufacturers, underwater system builders and innovative end users. Smaller camera, sonar and sensor technologies have given ROV operators the chance to undertake more tasks with more power in a smaller vehicle in a single dive. ROV users have also driven key developments by combining new technologies to create unique solutions to underwater challenges.

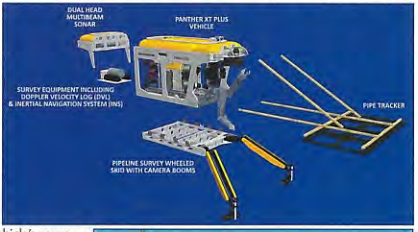
When meeting the challenge to increase a vehicle's scope by adding more systems of different size, weight and shape, the critical consideration is that the vehicle must remain dynamically stable and not left operating at the edge. This is where collaboration pays off, with all parties working to find the location on a vehicle where a system functions most effectively.

The Rise of Electric Work-Class ROVs

Significantly more power and tooling has been introduced into the electric-work ROV, allowing it to tackle more work previously undertaken by hydraulic vehicles, such as drill support, full pipeline survey and some construction tasks. This boost in power means that an electric ROV has the equivalent power and lift capacity of a 100-horsepower hydraulic ROV.

For instance, an electric-work ROV now has the tooling power to run Tritech International Ltd.'s (Aberdeen, Scotland) Merlin ROV excavator on maximum load, while still operating its thrusters at full force and keeping the vehicle steady. For such a cable-laying dredging task, a 150-horsepower hydraulic ROV would normally be needed and take up twice the deck space, among other costs.

Regardless of size or class of electric ROV, the advantage of the new multimission vehicle has been to find more ways to fit additional equipment on board without increasing its size. These can include a seven-function position feedback manipulator, heavy-duty five-function grabber, hydraulic hot stab



(Top) A diagram of Saab Seaeye's Panther XT Plus with some system options.

(Bottom) Innovatum's SMARTRAK 9 inshore cable survey system.

(Top) Global Diving & Salvage Inc.'s sampling tool system, with suction cups fitted to Saab Seaeye's Cougar ROV.

(Right) ROV pilots in Global Diving & Salvage Inc.'s topside control cabin extract samples from a shipwreck while navigating, piloting and operating the ROV's manipulators.

tooling, linear actuator override tool, torque tool, flying lead orientation tool, AX/VX ring change-out tool, single- or dual-point tool deployment units, 6-inch rotary or 4-inch anvil cutter, high-pressure water-jet or cleaning brush tools, zip jet suction tool, contact probe, anvil cutter and custom tooling.

Innovatum Ltd. (Bury St. Edmunds, England), for example, has created the SMARTRAK 9, a system capable of sensing AC or DC cables, as well as those carrying no current or signal. It can also sense steel pipelines. The SMARTRAK uses three different methods to acquire target data: a passive magnetic mode for pipeline survey work and for cable survey; an active DC mode for tracking live high-voltage DC cables and transoceanic telecommunication cables; and an active AC mode for locating, tracking and surveying cables. The system creates reports and charts that show the cable route and depth of burial. This data is required by installation contractors, owners and regulatory authorities to ensure that the cable is properly buried and not in danger of being exposed to damage.

Saab Seaeye's Falcon ROV was fitted with a Tritech Super SeaKing profiler system; a Tritech Micron-Nav ultrashort-baseline navigation transducer, with pitch and roll sensing for underwater ROV positioning; an accurate flux gate compass; a high-accuracy altimeter; and a pressure sensor for depth. Two people per shift are needed to launch and operate the system, with one controlling the ROV and the other the survey equipment.

Stabilizing Sonar Operations

The upsurge in use of multibeam sonar has come alongside efforts to extend the tasking capability of electric ROVs.

Examples of tooling skids for the Saab Seaeye Cougar ROV: from the left, torque tool and five-function manipulator with hot stab; high-pressure seawater pump for hot stab; 300-meter-rated Cougar; water-jet pump for cleaning nozzle; and two five-function manipulators, one with cleaning brush and nozzle for precise directional orientation.

Having far less acoustic noise than a hydraulic vehicle, the electric ROV is particularly suited to sonar work, as it also offers a maneuverable and stable platform.

In 2010, a Falcon ROV fitted with a sonar system was used by AUS Diving (Spokane, Washington) for a project that involved blasting a hole for a new tunnel deep through the bottom of Lake Mead, America's largest reservoir. The placing of explosive charges, which were specially shaped to focus the explosive energy for blasting through the rock on the lake floor, was critical.

Using a sonar system from Kongsberg Mesotech Ltd. (Halifax, Canada) onboard the Falcon, AUS Diving monitored the lowering of the frame that held the charges. With the shifting sediments and low-visibility conditions from three blasts a day at the lake, the sonar was the only way to check the accurate positioning of the explosive setting frame. The project was completed in March 2012.

Deploying More Powerful Thrusters

Like the wheels on a truck, the ROV can go nowhere without its thrusters. But that is where the comparison ends. The modern ROV thruster provides a sophisticated and powerful

driving force that has advanced considerably in recent times. It is the single device on board that brings the greatest confidence to an operator that a vehicle will go to and return from where he or she wants instead of flying it around tirelessly and holding steady in strong currents for delicate tasks.

For example, in carrying out work for AGR Field Operations (Straume, Norway) in the Bass Strait in 2009 and 2010, Dive Works (Hobart, Australia) used thruster power for a task that normally needs a hydraulic work-class vehicle that has a seven-function manipulator with the muscular outreach power to engage, turn and fit a monitor onto a well-head.

Dive Works has designed and fitted a well-head key-lock to the underside of a Falcon ROV, below the central thruster. The ROV is then maneuvered over the well-head using a slave camera fitted inside the key itself.

Once in position, the Falcon thrusts down and rotates 90 degrees to lock the monitor in place. The procedure is reversed for recovery. This use of a small ROV can be cost-effective, as only one operator is needed, and minimal deck space is required for a vehicle that can be deployed by hand into the water.

In another instance, Global Diving & Salvage Inc. (Seattle, Washington) has created a tooling system that, mounted on a Cougar XT ROV, can penetrate a sealed container and extract a sample without creating a leak point.

The neutron backscatter tool fitted on Global Diving & Salvage Inc.'s custom-developed skid.

The company was contracted by the U.S. Coast Guard to determine if oil was present aboard the sunken SS *Montebello*, which was torpedoed in 1941 off the coast of California. Global Diving & Salvage fitted the Cougar to perform 3D modeling, sonar inspection, thickness gauging, a backscatter investigations physical sampling of the ship's fuel tanks, coupon cutting and sediment sampling from the general area.

To examine the tank, Global Diving & Salvage first had to clean an area on the ship's surface by removing more than 60 years' worth of debris. The company used the Cougar, equipped with a brush and barnacle buster, to clear off the tank.

A Tracerco Ltd. (London, England) neutron backscatter system, a noninvasive sensing device that can determine the presence of oil in a wreck, was then mounted on a skid attached to the ROV. Global Salvage & Diving extracted a sample of the content using this system, which drilled a hole through the tank to retrieve the sample and sealed the hole without the use of fitting valves. The success of this procedure required the sampling system to be attached to the tank with suction cups and a magnet, and to be held steady by the ROV's responsive power, while the sample was taken and the surface sealed.

Global Diving & Salvage Inc.'s custom-developed skid, fitted with the neutron backscatter tool, was deployed to determine the presence of oil aboard a sunken vessel.

The ROV's thrusters and added suction cups held the system steady throughout backscatter operations. The outcome of the mission was that no oil was present in the wreck, which offered no threat to the ecological environment.

Future ROV Tooling

Innovations in developing more compact and powerful technologies have furthered the capabilities of electric ROV systems, enabling subsea operators to undertake more tasks. This evolution has overcome the problem of systems having to be fitted to hefty underwater vehicles because they were too bulky for small ROVs.

Not only can tasks now be tackled that were only possible using a hydraulic work-class ROV, such as fitting a full survey system to an electric ROV, but operators can enter more locations with restricted access and operate in strong currents.

With offshore and inshore work increasing and the limits continually being pushed, the demand for developing smarter and more powerful underwater vehicles will continue. ■

Jan Robertson joined Saab Seaeye in 1998 with a responsibility for special projects. He was appointed engineering director in 2004. During his time with the company, he has led the continual development of the product portfolio and innovations that are shaping the future of ROV technology.