MANY TASKS IN MANY SHAPES AND SIZES

ROVs as Versatile Workhorses

The concept of ROVs does not seem to change too much over time. Basically, they are self-propelled instruments working in deep waters up to about 6,000m that are linked to a vessel-based controller. This distinguishes them from AUVs that move underwater without a tether to a vessel. As with any other machine, they are available in many shapes and types, evolving over time. With a hydrographer's eye, we give an overview of the varieties available and the direction in which ROVS are moving.

ROVs are available in different classes, which as such point to their main use. Observational, light work and work class are well-known and describe their duties quite accurately. The observational class sometimes also features further differences, for instance, micro, eyeball and fly-out. The first two indicate size (an eyeball ROV is generally a smaller ROV mainly containing a camera for observations). The fly-out is a category further developed by AC-Cess where the ROV is hosted by a larger ROV (for example, inspection or work class), and launched closer to the job to be an extra pair of eyes on the job or to enable operators to see the job from a different perspective. It can also be used to inspect places that are too small for the larger 'mother' ROVs.

Compact ROVs and Sonar Payload

The main developments appear to be found in the category of the smaller observation class ROVs like the AC-Cess, Deep Trekker and VideoRay products. Their size enables them to excel in accessing smaller areas and they can operate in confined spaces or shallow water. Traditionally, their video cameras or imaging sonar were their main asset. The video camera is ideal for showing the conditions of constructions, coatings, undersea equipment or environmental characteristics – i.e. visual inspections. Imaging sonar is useful for creating an image of constructions or establishing positions or objects in deeper waters or when visibility is limited. However, as they are more readily available in compact sizes, sonar equipment like side-scan sonar or even multibeam sonar can also be integrated and used to map or inspect shallow waters, breakwaters and constructions. Deep Trekker, for example, is versatile and can be equipped with USBL positioning, thickness gauges, CP and CO2 probes.

Their sizes make them popular in science for observations. Where in some cases divers make observations and interpret them, scientists can just grab the smaller ROVs, go to the place and see the results themselves. This is something that scientists use for habitat mapping, however, it also applies to maintenance duties like underwater wall inspections, water outlets at hydropower dams or shipwreck surveys.

Observation Class Adopts Diver Tasks

Whereas the compact ROVs are mainly dedicated to observations and inspections, observation class machines have fewer size constraints. They can house more powerful thrusters for propulsion and have more space for payload. There is a variety of sensors like side-scan sonar, multibeam sonar, video cameras and heavier equipment such as ADCP. They can also be mounted with sampling systems. The very confined spaces are not a place where they are likely to operate but they are still capable of accomplishing a versatile range of duties. They take over some of the divers' tasks: they can make their observations in dangerous areas (strong currents, polluted waters or very limited view). Mapping of dams and hydropower plants with strong and changing currents can easily be done with these types of ROVs. Their size allows the ROVs to access environmentally sensitive areas as well. Small does not always have to be a limiting factor as Teledyne Seabotix mentions - ROVs have been used for cable inspections in the oil & gas industry, lasting for 27 hours in currents up to 0.7knots and waves of 3m.

The advantage of these observation class ROVs is their small footprint in the water, but also on vessels they require less space compared to full diving support equipment. Some of these ROVs still do not need a launch and recovery system (LARS) adding to the flexibility of mobilisation. The US Navy is using the Outland 1000 and 2000 ROVs as they can be launched by hand and are still capable of having a versatile payload like multibeam and tracking. Apart from saving space, it is also cost effective as ROVs can complete the tasks faster than divers. In general, fewer staff are required for ROV operations.

As this type of ROV is still relatively light and has limited space for thrusters, environmental conditions such as strong and changing currents may be a limiting factor in using observation class ROVs and the heavier and more powerful work class ROVs would need to be chosen.

Work Class - Less Focus on Survey

The bigger horses are the workhorses and so are the work class ROVs. Their size allows them to be equipped with a higher number of and more powerful thrusters, to withstand strong currents and to have advanced equipment as payload. In addition to the sensors and tooling of observation class ROVs, the bigger work class ROVs add CTDs, sampling equipment with more capacity. They are used in the oil and gas industry for maintenance jobs with a wide array of tools, including manipulators, cutters, water jets and grinders. The work class ROVs can be precisely positioned and are more stable than the lighter observation class ROVs. For scientific purposes, they are suited to work in difficult conditions, like very deep water. Their size allows them to be equipped with redundancy systems that take over when parts break down or are damaged. Saab Seaeye mentions use of sampling from seamounts off Portugal and analysing sea ice algae in Antarctica.

Cost Efficiencies

As mentioned earlier, the use of ROVs can be more cost efficient compared to divers. Bibby HydroMap mentions that both the oil and gas industry and renewables are looking for cost efficiencies. In the operational side, there is a trend towards the use of ROVs for shallow-water depth cable burial rather than divers. This is challenging work with few options available making an ROV an attractive alternative.

Another development for pipeline surveying has been developed by the Swedish survey company MMT and Kyst Design. Their challenge was to accomplish pipeline surveys both precisely and cost effectively. For this type of job, AUVs are often used, however, they were not meeting all MMT's criteria. They developed an ROV equipped with an ultra-high resolution multibeam (Kongsberg EM2040 Quadro), two inward tilted laser systems allowing it to fly 5m over a pipeline and achieve precise mapping of the pipe at high speed (double compared to traditional ROV surveys). The Interceptor Surveyor, as the ROV has been named, can also make videos, sub-bottom profiles and still images with high positioning accuracy, high resolution and at high speed (up to 6kn). First tests have achieved more than 50% time savings and 75% time saving on post-processing and a higher quality imagery compared to previous work.

AUV More Attractive for Surveying?

For surveying, there is a strong case for the use of AUVs. AUVs share many characteristics with the ROV – however they are not connected. The AUV should be more flexible in operation and Bibby HydroMap mentions this aspect. One of the advantages of the ROV above the AUV for some survey projects may be the fact that there is a direct link with the surface vessel where the survey data can be seen in real time. This is one of the time gainers for MMT in the application mentioned above. The AUV is not yet capable of depth of burial, taking samples and similar tasks – they can just survey the seafloor using sonar, ADCP, CTD and other payloads.

An AUV is also pre-programmed so if there is a particular observation during a survey, it only can be seen when the data have been unloaded from the device and processed. The live link with ROVs facilitates immediate action or a refocus on a discovery, thus saving time.

The hybrid option that solves this issue is a development by ISE. Their control systems manage their ROVs as well as their AUVs – for example leading to the development of a multi-vehicle docking station.

Conclusion

ROVs are versatile in their use, even though AUVs seem to be the more attractive solution for surveying as they are free-swimming. Looking at the mini observation ROVs, their attraction increases with the reduction in size of (multibeam) sonar systems, making them easy to handle for small teams and still returning valuable data, especially from shallow water. New developments lead to increased speed and dedicated solutions for applications such as pipeline surveys, where the direct link with the surface vessel proves to be an advantage over an AUV, where data is only available once it has been downloaded.