TAILORING SYSTEMS FOR INSHORE OPERATIONS

Cable Tracking in Shallow Water

Whilst there has been an increased effort to resolve the issues of supporting deepwater construction operations, issues specific to shallow-water operations seem to have been largely overlooked, the attitude being that standard equipment packages would be perfectly adequate. What makes this all the more surprising is that the majority of offshore developments have some sort of shallow-water requirement associated with beach landing points.

As always, the other factor driving all developments is cost. Whilst the high price of oil has produced a boom in oil-construction support, the laws of supply and demand have increased vessel and service provision rates to the point where the proverbial coach and horses has been driven though the business plans of non-oil & gas construction projects. Offshore wind-farm developments being a case in point. There is now, therefore, an imperative to look at systems dedicated to shallow-water operations, and here we shall use cable-tracking is an example.

Cable Tracking

Traditional cable-tracking systems have relied on relatively large frames, typically deployed on a work-class or large inspection-class ROV where the size and weight of the frame can be easily accommodated. However, the cost associated with supporting such ROVs, in terms of support vessel, equipment and personnel, is a significant issue for many inshore projects. Recent developments in both cable-tracking systems and compact ROV design have presented the opportunity to put together a cable-tracking package that can be tailored specifically to address the requirements of shallow-water operations. It was with this in mind that MK Services organised a demonstration in Lowestoft using the Gardline Environmental vessel MV *Confidante*; a 29m-long vessel with a draft of 2m, dedicated to inshore survey operations. The package was based around an Innovatum Smartrak cable-tracking system mounted onto a Teledyne Benthos Stingray ROV.

The Smartrak is a new family of lightweight pipeline & cable trackers designed to be smaller and lighter than existing cable and pipeline trackers. It achieves this by using an array of vertically mounted magnetic gradiometers that collect magnetic field gradient information. The gradiometers are mounted in three compact vertical sensor housings. The change in field gradient near to the target is induced by either the intrinsic magnetism of the target, or the effect of the permeable material in the –target “bending” the field of the earth. Local terrestrial field effects can be mathematically removed and the field gradients resolved to produce a two-dimensional target position in the plane of the array: across-track and vertical positions.

An tri-axial fluxgate sensor, which may be part of one of the gradiometer instruments, is used to provide heading information, and this is used to adjust the calculations for angular offsets. An altimeter, mounted to either the sensor frame or the ROV, is used to determine the height above the seabed of the sensors and therefore deduce depth of burial, and to produce the tracking display. The along-track position of the ROV provides the third dimension for the complete cable-tracking position. Passive Magnetic Tracking is used for cable surveys, either tracking the weak natural fields of the cable or the stronger field developed by specially magnetising the cable armour or strength member prior to cable lay.

Platform

The Teledyne Benthos *Stingray* is designed as a small, inspection-class ROV, but having the performance characteristics of significantly larger and more powerful ROVs. The *Stingray* is of flexible and modular design, enabling it to be easily configured for a wide range of inspection and light work-task operations. The payload capacity allows it to undertake jobs previously possible only with larger, more expensive, systems. The three Smartrak sensor housings were mounted on a one-metre wide aluminium frame to give the necessary sensor separation, and the frame itself was mounted to the main body frame of the ROV, about a metre in front of the ROV itself. Flotation blocks were mounted on the sensor frame to counter the weight of the aluminium frame, the cable-tracking sensors and the electronics bottle.

Whilst there were some concerns over mounting such a relatively large frame to such a compact ROV (the Stingray is only 99cm x 46cm x 46cm), these were overcome by moving the two main thrusters from their normal position underneath the ROV onto the outside of the main body. This allowed any yawing effect induced by the sensor frame to be easily countered without having to use excessive thruster power, the moment provided by the position of the thrusters working to offset the power needed.

Trials

The trial itself consisted of tracking a length of single-armoured, fibre-optic telecomm cable deployed in Lake Lothing in Lowestoft. It was

used to prove firstly and most obviously that the package could successfully track the deployed cable and, secondly, that the sensor frame could be mounted to and be successfully operated from a compact ROV such as the Teledyne Benthos *Stingray*. Finally, the trial established that the compact package could be deployed from a vessel such as the MV Confidante, which is dedicated to inshore operations

The Smartrak was found to have excellent range performance when compared to previously used cable-tracking systems, showing detection of the cable at a range of over 3m, and consistent tracking at ranges of over 2.5m. Throughout the trials the ROV handled much better than had been anticipated with the sensor frame attached, the alternate thruster position giving excellent control. It was also found that there was no discernible noise induced on the sensors when the thrusters were operated.

Proposed Developments

The next stage of development for this package will be twofold. Firstly, to use a sensor mounting frame that is both faired and has inherent buoyancy, to reduce drag and remove the need for the flotation blocks. And secondly, to conduct further tests to see if the sensor frame can be moved closer to the ROV, to reduce overall package size, without incurring any discernible noise impact from the ROV.

The package is already scheduled for use on several cable-tracking projects over the next few months, primarily in support of wind-farm construction and maintenance projects.

Concluding Remarks

So in conclusion, the equipment and techniques are now available to enable packages dedicated to shallow-water operations to be developed and operated. In addition to the cable-tracking system outlined, sonar-based swathe systems with improved coverage in shallow water and buoy-deployed underwater tracking systems that remove the need for vessel-mounted transducer heads are just some of the systems now available to support shallow-water construction operations.
