Let's work together

A round of joint industry projects, plus adaptation of successful technologies from the medical, industrial and nuclear sectors, has resulted in a range of potential game-changers for offshore dive support, safe practice and unmanned operations, writes Danny Constantinis, executive chairman of the EM&I Group

The ODIN UWILD technology means operators can replace human divers with deck-launched mini-ROVs that can clean and measure anchor chains

Since 2012, international asset integrity management specialist EM&I has been leading a joint industry project (JIP) called HITS (Hull Inspection Techniques & Strategy) on behalf of the Global FPSO Research Forum. The JIP has produced some ground-breaking innovations and technologies for the inspection and maintenance of floating assets such as FPSO units, drillships, semisubmersibles, and so on.

There is no point in reinventing the wheel – we look at other industries to see if somebody has already solved a similar problem and then adapt it for the oil and gas industries. This has allowed us to 'fast track' developments from the nuclear, aerospace, civil engineering, medical profession and forestry industries. Our technology centre is based in Cumbria (near Sellafield) as most of the nuclear technology is there.

EM&I has also new set up a new JIP called 'FloGas', aimed at the floating gas industry and FLNG/ FSRU vessels. The JIPs meet twice a year in different locations around the world, usually in the spring and autumn. The Global FPSO Research Forum was formed over 20 years ago and includes most of the major oil companies, operators, and class societies.

The JIP for HITS has been one of the most successful and attracts more members at every meeting. The most recent meeting was in Houston in October 2019 and had over 30 senior executives, representing most of the major players involved in offshore assets. The attendees set the objectives and decide on the parameters for new innovations and technologies to be researched by the JIP.

The JIPs monitor development and observe demonstrations of all new innovations and technologies, and, if satisfied, will allow these to be used on a 'case by case' basis for pilot projects. The relevant class society usually issues a 'letter of no objection' which allows the new technology or innovation to be considered after an engineering study has been carried out and accepted.

Human-free dive ops

One of the first objectives was to reduce or eliminate the need to use divers, as this is a dangerous and weather-dependent activity. The solution was the ODIN diverless UWILD (Under Water Inspection in Lieu of Drydocking) technology which uses deck-launched, inspection-class mini-ROVs to check the hull and its appendages. This has been specially adapted to clean inlet grills to sea chests, and to both clean and measure anchor chains.

The ODIN technology can also be used to check critical valves in operation using class-approved access ports adjacent to the valves, through which high-performance cameras on manipulators can be inserted to check the valves in operation, so that the valves and seals can be checked for wear and leaks.

Most FPSOs are converted very large crude carriers (VLCCs) so the valves are often as old as the vessel itself and there are no spares available, so a replacement must be made. This takes time so early detection of leaks is essential, as bilge pumps are not designed to cope with a critical valve failure.

If valves do need repairing or replacing, inflatable bladders can be inserted through the ODIN access ports, internally or by mini-ROVs if required externally. This allows the vessel to remain in operation throughout the repair or replacement. On a recent project on an FPSO in Angola, 21 valves were inspected and three repaired using this technology, to the delight of the client who awarded EM&I a 10/10 FPAL (Client Assessment System) rating as a result.

The first ODIN project was carried out on an FPSO in Brazil over five years ago, and the results checked again during the periodic survey this year. Numerous other projects have been successfully carried out on FPSOs, drillships and semisubmersibles in most parts of the world, so this technology has become widely accepted as the 'new norm' for UWILDs.

The specialised high-performance cameras were sourced from the nuclear

industry, where it's difficult and dangerous to use people because of radiation. These enable inspection to be carried out while the vessels are on station, on hire and in operation, thereby avoiding shutdowns or out-of-service periods.

Underwater hull repairs are notoriously difficult and expensive because of the diver or work-class ROV intervention. ODIN ports were used to enable a cofferdam to be pulled into place through the hull side shell and a substantial steel renewal to be carried out without diver intervention.

Inspection innovation

The second major development was the NoMan technology for the inspection of cargo oil and water ballast tanks. This also utilises high-performance cameras which can pan, tilt and zoom, and which are inserted through class-approved deck openings, meaning they do not require tanks to be prepared for manned entry or rope access teams working at height to carry out visual inspections.

Lasers can also be inserted in the same way, to scan the tanks and obtain precise imagery of the tanks and structure to check for any degradation and distortion, etc.

This has revolutionised tank inspections, which can now be carried out safely in a fraction of the time required for manned entry. On a recent project on an FPSO in the North Sea, just two technicians inspected four cargo oil tanks in two days to the complete satisfaction of both the client and class society. The client estimated that this represented a 90% man hour saving over traditional techniques. The technology is now also being trialled for pressure vessels and sea chests.

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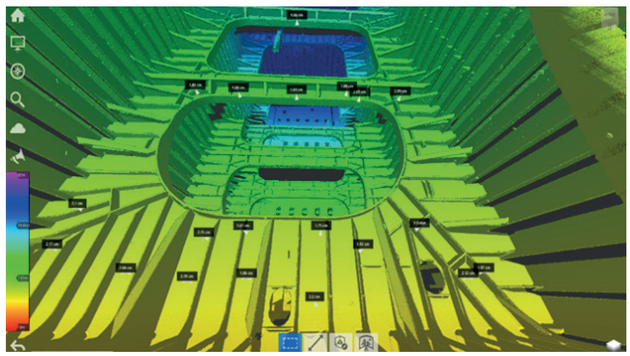

The NoMan technology enables the insertion of lasers into class-approved deck openings, to scan tanks to check for any degradation

A number of other innovations are also currently being considered by the JIP, including ExPert, which was developed for inspecting electrical items. ExPert uses technologies from the medical profession, so that it's possible to 'see through' electrical connections without having to shut down the system to dismantle junction boxes for inspection and then reassemble them.

This is a time-consuming, potentially hazardous operation as mistakes can be made during the dismantling and reassembly of the electrical items concerned. The ExPert technology enables the inspection to be carried out safely in a fraction of the time normally required while the vessel remains in operation, without having to dismantle or reassemble electrical items unless an anomaly is found.

A sophisticated statistical programme called ANALYSE has also been developed with a London university for safely reducing workscopes, based on the vast mine of information collected by EM&I in more than 35 years in the asset integrity management industry, having worked on hundreds of offshore assets. This can help to safely reduce inspection workscopes by around 50%.

ICCP protection

HullGuard is another major development in impressed current cathodic protection (ICCP) systems. EM&I came up with the solution of an anode which can be inserted through a class-approved access port in the hull bottom plating – usually in the engine room – which has sufficient headroom for a 'periscope type' anode and its launching tube.

Drilling holes safely in hulls had to be proven first, so EM&I initially conducted tests on a 9m-high tank at the National Hyperbaric Centre in Aberdeen. These tests and special cold-water welding procedures were observed by the client and class society, who were entirely satisfied that it was safe.

The next step was to design an anode that could be easily inserted through the access port and incorporate a dielectric shield to protect the hull in the immediate area of the anode. A number of alternatives were considered but, eventually, a tubular style anode, with a non-conductive part nearest the hull, was adopted. The anode itself is titanium with a mixed metal oxide coating. This is designed to have an operational life of around 25 years.

The launching mechanism comes from the hydraulic industry but is operated by compressed air in this particular case, for ease of use on site. For the average FPSO, only two HullGuard anodes will be required, which can cope with a hull coating breakdown of around 7.5%. If more coating breakdown is present, or occurs over time, this can be covered by varying the ICCP current or introducing additional anodes.

The 'wetted area' of an FPSO hull is approximately bigger than two football pitches so there is a significant area requiring protection.

There is no doubt that the JIP for HITS has stimulated the development of these new innovations and technologies and guided the asset integrity management industry in terms of its requirements and the performance parameters required. This is probably the ultimate type of market research, where all the major players work together to inform and guide service providers. *OMT*