Strategy, tactics, logistics and technology

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When it comes to undertaking and completing asset integrity management for deepwater operations, strategy, tactics, logistics and technology are the keys to success. When miles from shore it is vital to plan ahead in meticulous detail – rather like a military campaign – to ensure that you have all the right personnel, equipment, materials, and technology to complete the agreed tasks on time.

Strategy provides direction, particularly in minimising the need to use divers or put personnel at risk working in hazardous areas, at height or in confined spaces. Tactics determine the targets, particularly permanently lower prices (at least 50%) and 70% less POB (people on board). Logistics ensure that all the right personnel, equipment and materials are available to do the job. And finally, technology leads the way in helping to tackle the work efficiently and safely with minimal disruption to normal operations.

It is also important to have a 'Plan B' in case the agreed workscope cannot take place for operational reasons, so that technicians who have been mobilised and are already on board do not need to be demobilised and can work on other medium to longer term projects while the operational problems are resolved.

Technology versus experience

Digitisation, AI and robotics can all help in this respect, but there is no substitute for experience and engineering judgement. If an answer looks wrong or sounds wrong, it usually is. Computers are only as good as the programmes and information fed into them. They have limitations and so should not be blindly believed.

Figure 1. In service isolation valve inspection.

EM&I has developed a number of procedures and technologies to cope with deepwater operations. The company initiated a joint industry project (JIP) called Hull Inspection Techniques & Strategy (HITS) for the FPSO Global Research Forum over six years ago, which has produced several new technologies. As the JIP includes oil majors, operators and class societies, the technologies have all been 'industry driven' and approved by them.

Setting the performance parameters, monitoring progress during development, observing demonstrations, and issuing informed guidance on improved inspection methods has been the successful ‘modus operandi’ of this JIP.

The oil industry has worked cohesively and effectively to identify better ways of working and supporting innovation in its goal to reduce operating costs by 50% while improving safe operations and production outputs.

New technologies

EM&I has concentrated particularly on innovations and technologies that minimise the need to use divers or personnel working in hazardous areas, at height, or in confined spaces, and can be used during normal operations, and do not involve shutting down or coming off-hire or off-station. This is very important for dynamically positioned (DP) drillships and semi-submersibles, where it is dangerous to use divers. This also avoids all the consequential costs involved with weather dependent activities, which can be considerable and often include penalties as well.

Figure 2. Valve and pipe isolation.

The company has worked on over 175 offshore assets in almost every part of the world, gaining experience of their asset integrity problems and developing close working relationships with clients, operators, and class societies as a result. Developing bases and companies in the major markets, and recruiting and training nationals of the countries concerned, has been an important element in solving language, logistical and national content issues.

Learning from other industries

Many of the innovations and new technologies have come from other industries that have already solved similar problems and have developed well-proven solutions. Together with the JIP for HITS, EM&I has ‘fast tracked’ some of these innovations and adapted them for the oil and gas industries. The industries involved have been nuclear, aerospace, civil engineering, forestry, and the medical profession.

The oil industry has generally been slow to accept new technologies, which is understandable when considering the high costs of failure. On the other hand, it has been leading other industries in setting up JIPs to study common problems and getting competitors to collaborate together and jointly finance research into solutions.

The benefits of cooperation

The FPSO Global Research Forum has been a success in this respect. It has set the scene for the FLNG/FSRU sector and could help develop common standards. There only needs to be one major disaster to bring this important new market sector to its knees.

Some of the new technologies could be used on most floating assets including, FPSOs, FSOs, FLNG and FSRU vessels, drillships and semi-submersibles, and even accommodation vessels. The hull is critical to all of them and needs to be monitored and maintained carefully. It only represents around

25% of the cost of the asset, but failure of the hull can be catastrophic, so this is one of the most critical elements.

Frame agreements

Frame agreements can be particularly beneficial when using robotic technologies, as the technicians of the companies concerned are usually the most familiar with the technologies concerned, so can complete the work quickly and efficiently. They also allow both the client and contractor to plan well ahead to optimise on the timing of workscopes and avoid any disruption to normal operations.

With rates and terms and conditions already agreed and technicians familiar with the asset(s) concerned, work can proceed quickly, as soon as workscopes have been agreed. It is a 'win-win' situation for both parties as long-term partnerships in most industries usually mean that it is possible to get good value for money and a first-class service, as everybody concerned is committed to keeping the asset 'fit for purpose' with the minimum of unplanned shutdowns or maintenance.

For operators with a fleet of vessels, lessons learnt on any of their assets can help in the efficient operation of all their other assets. It may also allow the contractor to offer a substantial discount if the frame agreement covers a number of assets.

Floating assets

Floating assets should be as complete as possible when they leave the shipyard, as work offshore can cost up to two or three times as much. The new robotic technologies often require class approved access ports to be installed so that specialised cameras and manipulators can be inserted to check critical valves and tanks, etc. It is much more economical to do this at the conversion or new build stage rather than retrofitting offshore.

'Baseline analyses' of the hull, pressure and EX items are also much easier and more cost-effective to carry out at this stage to identify any anomalies. This can help to reduce both CAPEX and OPEX, particularly for pressure systems if the information can then be inserted in an appropriate digitisation programme such as ANALYSE™, which can help to reduce inspection workscopes safely.

Long-term plans benefit both the operators and class societies

Most floating offshore assets have to have periodic surveys every 2.5 and 5 years to satisfy class society requirements. This can be very disruptive to normal operations, as the tanks, valves, and hull have to be made available for inspections at these times.

The concept of the '20 year plan' is a direct result of the ODIN® diverless 'Under Water Inspection in Lieu of Drydocking' (UWILD) technology, which negates the need for divers to carry out underwater hull surveys at the prescribed periods, allowing the inspections to be scheduled over a 20 year period.

This approach benefits both the operators and class societies, as the operator does not suffer from disruptions to normal operations, and the class society get regular and high-quality information about the asset. It is a 'win-win' situation for both parties, and keeps the asset fit for purpose throughout its operational life.

Figure 3. The NoMan camera can pan, tilt and zoom.

Every aspect of the normal periodic surveys is covered in the 20 year plan. This includes critical valve inspections using ODIN access ports and specialised cameras and manipulators, and tank

inspections using NoMan® remote camera technology, which does not require man entry into the tanks, meaning operations can be carried out in less time.

Monitoring mooring chains

Mooring chains are a critical item on floating assets, with much emphasis being placed on their integrity by class societies and regulators following several failures in recent years.

Inspecting them has conventionally required divers to clean, inspect and measure the links, with all the associated costs and risk of putting people in hazardous areas.

EM&I has developed a new approach using a specialised ROV equipped with a cleaning tool and a measuring calliper that can complete a class equivalent inspection in less time, at lower cost and with improved safety.

The system was validated at EM&I's Technology Centre facility in Cumbria earlier this year, witnessed by all the major class societies who have now written letters of acceptance of the system.

Figure 4. Technology centre in Cumbria.

The first site application was on an FPSO in Angola where the job was completed in just four working days by a four man team. This represents a saving in time and cost of over 70%.

Enhancing life extension

Life extension of offshore floating assets used to be difficult as anodes on the hull normally had to be replaced using divers, and class societies are not keen on welding underwater. However, it has now become much easier with the new diverless HullGuard® IcCP 'periscope type' anodes which can be inserted through class approved access ports in the hull and retracted at any stage for inspection, cleaning or replacement. This is a significant step forward in extending the life of floating assets, which are often required to stay on station for additional periods.

Conclusion

The principle challenges for asset integrity management of offshore installations are understanding the risks that lead to significant equipment failures, and having the right technology and competent personnel available to establish equipment integrity status and future trends, safely and at a permanently lower overall cost than in previous years.

Minimising unplanned shutdowns and unnecessary maintenance can be achieved by using robotics and data analysis, which allow the asset to remain on station and in operation while inspections are being carried out safely and without putting personnel at risk, such as divers or people working at height or in confined spaces.

The JIP for HITS has been at the heart of many of these developments because the JIP members include many of the leading oil majors, class societies, operators and service companies.

However, as operators explore and produce hydrocarbons in ever more hostile environments and turn their attention to alternative energy sources for the world, the oil and gas industry needs to continue to improve and indeed adapt technologies from other sectors.

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