ENSURING INTEGRITY

Danny Constantinis, EM&I, Malta, explores the future of integrity management.

The field of integrity management has become even more important since the downturn in the oil industry began. It is now going through a period of significant change to improve economics, efficiency, and safety in a US$50/bbl world.

Digitisation and robotics are playing an ever-increasing part in helping to make permanent changes in the way the industry operates, with a focus on enhanced safety and cost reduction whilst keeping assets on station, and in operation, while inspection and maintenance tasks are carried out.

Although the oil industry has traditionally been conservative in accepting new technologies, they have recently made great headway in working together to implement radical and positive changes.

There are real opportunities to improve the take up of new technology by putting additional effort into identifying areas for fundamental improvements and quantifying total cost, operational and safety benefits.

Technology proven in other industries can provide a shortcut to implementing new technologies, while proven successes in one sector of the industry can be shared more widely and quickly.

The FPSO Research Forum and the HITS (Hull Inspection Techniques & Strategy) joint industry project, the Sprint Robotics and the OGTC (Oil & Gas Technology Centre) in Aberdeen are all helping to promote the integrity of the future in the industry by working together with oil majors, operators, class societies and regulators, in order to identify challenges, investigate and encourage innovations and make the market aware of practical and economic solutions.

Digitisation and robotics

Digitisation and robotics are beginning to make a big impact on asset integrity.

While risk-based methods have been used for some time, the question remains whether the industry is risk-based enough. Statistical interrogation of digitised 'big data' can help once the industry has carefully validated the methods used.

Churchill was famously dismissive of statistics, stating that: "Statistics are like a drunk with a lamppost, used more for support than illumination".

However, he did not have the advantage of the large databases that are available today nor the IT tools to interrogate big data to draw accurate information on asset condition and trends which will improve industry knowledge of integrity status more efficiently and at lower cost than has been previously possible.

An example of digitisation is the ability to reduce workscopes safely using statistical analysis of data collected for pressure system inspections.

The industry has, for many years, taken huge numbers of thickness measurements in pressure systems to help establish the integrity of the internal surfaces.

Risk-based methods focus this activity on higher risk systems and components but this still results in significant data collection costs, much of which may not be necessary once the historical data is statistically analysed.

Non-intrusive inspection (NII) methods also bring real added value by avoiding shutdown of pressure systems and other equipment for inspection. Often this requires a combination of knowledge condition (digitisation) and robotic methods.

Systems such as ANALYSE™ have been tested and can demonstrate that between 25 - 50% of the thickness readings taken can be removed without any loss of integrity assurance.

Furthermore, the level of assurance is quantified and consistent with code guidance. The system is self-regulating; the number of readings taken is assessed on-line and on-site, and once sufficient readings are taken to demonstrate the required level of assurance no further data needs to be collected. Similar applications no doubt exist for structural and electrical equipment integrity.

Robotics also help avoid placing people in hazardous areas, such as working at height, underwater or in confined spaces.

Robots can take many forms, from the traditional image of a crawler, ROV or UAV (unmanned aerial vehicle) to high performance optical or laser systems or even snake type or primate type devices.

Some examples of robotic systems in practical use include, ODIN® (diverless hull inspection and valve repairs), NoMan® (remote inspection of tanks and confined spaces) and LORIS™ (diverless mooring chain inspection).

ODIN uses technology adapted from the nuclear and gas industries to carry out diverless underwater inspections of ship hulls which includes the inspection of critical isolation valves, whilst in service with

Figure 1. *NoMan camera insertion through desk opening.*

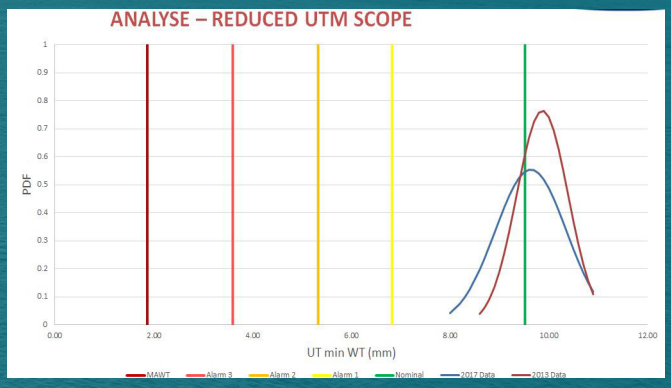

Figure 2. *Reduced workscope using ANALYSE.*

Figure 3. *Typical NoMan tank inspection.*

minimal weather downtime. ODIN combined with the ability to clean and inspect critical external hull components with specialised ROVs, offers enhanced safety, cost savings of up to 50% and POB (people on board) savings of 70%.

Diverless methods are particularly beneficial to those in the offshore drilling industry, who often use dynamic positioning and cannot use divers while operating and need to inspect hull, moonpool, thrusters, and so forth.

Equally, putting people in tanks and other confined spaces is hazardous and costly. Currently, the costs for tank inspection are substantial and often asset specific. In addition to the cost, POB and increased safety risk of manned entry are the cost and time penalties of tank cleaning and purging, gas freeing, isolation, ventilation, fire watch, lighting, waste removal, offload changes, loss of storage capacity, shuttle tanker rescheduling, and management time to name but a few of the items that need to be considered.

Remote inspection methods, such as NoMan, use technologies adapted from the civil engineering and nuclear sectors to inspect tanks, pressure vessels and other confined spaces without the safety risk or other costs of man entry.

This type of remote inspection technology is proven to make 90% savings in the site manhours and 50% reduction in cost required for tank inspections.

Mooring chain inspections

Historically, mooring tank inspections have involved divers cleaning and then measuring the links to see if any damage or corrosion has occurred in the first 30 m – a time consuming and weather dependent activity which can be quite costly. Robotic methods are now available using specialised ROVs with cleaning heads and callipers, and others are being developed – such as LORIS™ – which are less sea state dependant and will be able to clean, inspect and temporarily repair broken or fractured chain links.

Figure 4. *EM&I 'LORIS' for mooring chain inspections.*

The 'commercial and technical readiness' of new technologies

New technologies not only need to be technically validated but also need to be commercially ready to deploy.

This means approval by the relevant authorities as well as adequate training, equipment, spares and capacity, and commercial structure to deliver the agreed volume the market requires.

Cost comparison conundrum

Consequential costs of having to shut down, or come off hire or off station – particularly for drilling assets – often get treated as 'normal and unavoidable' costs rather than as a consequence of conventional methods which can be avoided using new technologies.

The challenge is to identify all the costs and benefits across an individual operator's business. These often cross boundaries of responsibility within the organisation, meaning that they are not recognised by different departments as being connected to the new methods being evaluated – this may require a 'step change' in the approach to asset integrity in future.

Understanding the cost benefits and the management level at which these need to be understood can have a profound effect on the take-up of new technology.

Long-term contracting strategies

As more robotics and digital systems are being utilised the contracting strategy used in the industry will need to change.

Existing contracting strategies are based on lowest rates, often switching contractors to take advantage of the reduced costs. This approach gives the cheapest price but at the cost of ineffective methods, poor quality data and ultimately higher cost. What operators are looking for is proven technology that is lower in cost, safer and can be carried out while the asset is on hire, on station and in operation.

Value based pricing and long term 'partnerships' help ensure that the benefit to operators is maximised through greater efficiency, personnel stability and willingness to invest in the contract by all stakeholders.

Service providers also need to have more than a good idea or two. Experience gained from working on numerous assets helps, as do good R&D facilities, globally consistent quality and good relationships with regulators, class societies and other industry bodies.

Long term relationships allow better planning which gives better operational flexibility, more efficient work programmes, and improved safety and productivity due to familiarity with the assets and working practices.

For example, agreement with classification societies and regulators to accept '20 Year' Inspection Plans means that campaigns can be scheduled at the most appropriate and convenient times for both the class society and operator, and costs are spread over a much longer period.

What does the future look like?

More economic, effective and efficient technologies are being developed and becoming available all the time. Many of these have come from other industries such as nuclear, medical, forestry and aerospace.

The downturn over the last three years has focussed minds on more cost-efficient, competent, and safer ways of carrying out asset integrity, and is making significant savings in both time and money.

Technicians will need to be retrained to use sophisticated robotic equipment and liaise with onshore teams in real time to optimise inspection regimes. Fewer personnel will be required offshore which will save on POB and helicopter transfers as well.

Only those companies who can cope with these changes will thrive in the longer term. The lessons of the last three years mean that clients are ready to consider new and disruptive technologies which will save money and time and are much safer than traditional methods of asset integrity.