KEY ARTICLES

- Safety is a lifestyle campaign
- M-SKIP: Inspection under pipe supports
- Oceaneering’s new Magna Scan Subsea Inspection System™
NOTES FROM THE EDITOR

Many thanks go out to all Oceaneers who have contributed to this edition of The Inspection Standard. As always, we are offering a meal for two up to the value of £75, at any restaurant of choice to the Oceaneering employee who submits the best article.

This edition’s winner is Stuart Kenny for his article on M-Skip: Inspection Under Pipe Supports.

For the opportunity to win the meal for two in our next edition of The Inspection Standard please send all articles to Lucy Watkinson, lwatkinson@oceaneering.com.

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M-Skip Inspection under Pipe Supports

Corrosion under pipe supports is regarded as a worldwide integrity threat within the oil and gas industry. Due to the inherent physical restrictions created by the support, there are no conventional methods of Non-Destructive Testing (NDT) that can reliably detect the presence of corrosion at the contact point. In the absence of such a method, end users are forced to mechanically ‘lift’ lines, to assess the condition of the pipe.

Numerous advanced technologies have been developed and successfully deployed, but to date these techniques have been screening methods that provide qualitative information at the support location. Guided Wave and EMAT technology has shown some promise in the detection of corrosion, but currently only offer percentage wall loss as volumetric measurements and do not provide quantitative information on remaining wall thickness.

A non-intrusive inspection technique to enable quantitative inspection to prove the absence of corrosion was therefore required. The technique that was proposed was M-Skip.

M-Skip is a Time of Flight (TOF) method. The technique uses two transducers, one acting as a transmitter and the other as a receiver. Both of these transducers are mounted on a dedicated M-Skip wedge that produces and receives a refracted shear wave beam. This pitch-catch arrangement allows the search units to travel either side of the support and send ultrasonic signals within the material underneath the restriction.

The ultrasonic waves will experience skips between the internal and external surface of the pipe. The arrival times of the numerous skip signals are measured and can be used to calculate the thickness of the pipe wall between the probes. If any corrosion is present, this will be detected by loss of the signal amplitude, reduction in signal arrival times and also changes in signal shape caused by direct reflection from localised pitting.

As a means of assessing the technology, Oceaneering Specialist Inspection Services (SIS) have been completing internal validation, both in the laboratory and in the field, even though the M-Skip technology is already third party validated and a recognised technique within the Non-Intrusive Inspection recommended practice DNV-RP-G103.

Oceaneering have developed their own scanning system to house the M-Skip probes and acquire the TOF data. The prototype system used two independent tractor units that are manipulated with a single motor control. This solution allows the probes to travel either side of the support, maintain positioning and collect the data without disturbance.

Initial testing included using simulated corrosion type defects on numerous samples within the SIS workshop in Swansea. The purpose of this exercise was to assess the detectability of the method and also to quantify the sizing capability on defects of known sizes.

In addition to the laboratory based trials, SIS have completed numerous site trials in order to test the technique in principle, but also to assess the system in realistic environments. The trials have proven beneficial and have shown extremely promising results.
SAFETY IS A LIFESTYLE CAMPAIGN

Our company values say 'Oceaneering’s number one ethic is the safety, health, and well-being of its employees, contractors, customers, and the public'. Oceaneering is committed to safety because we care about each other. As an employer, there are legal duties to ensure the health, safety and welfare of employees. But, far more importantly, we each have a moral duty to look after ourselves and the people we work with.

At Oceaneering we firmly believe that all injuries can be prevented. Oceaneering already have an excellent safety record, however, we know that there is always room for improvement. With this in mind, the 'Safety is a Lifestyle' programme has been introduced, which will help to take personal safety to the next level.

The Oceaneering policy on Health, Safety, and the Environment includes 'We are committed to a culture where all employees adopt a HSE mindset both at work and at home to keep themselves and each other safe'. This programme builds on Oceaneering's other safety activities by focusing on general safety topics affecting everyone at work and at home. Safety in the workshops and on clients' assets rightly has a high profile, but there are also many ways that we can seriously hurt ourselves around the home and office. For example, each year thousands of people end up in hospital after falling down stairs, after lifting a heavy item awkwardly, or after receiving an electric shock. These are serious injuries and many have the potential to kill. But all of them can be avoided if we adopt the right mindset.

We want to encourage you to make safety your personal number one priority, as it is for Oceaneering. Each month, the Safety is a Lifestyle programme will focus on a particular safety topic. Information will be available from posters, team briefings and hands-on demonstrations. We hope that you will engage in these activities and take the information home, ensuring safety and avoiding injury for your family and friends.

The programme is named 'Safety is a Lifestyle' because we believe that safety is a lifestyle choice. You can choose to act safely, or not; you can choose to risk injury, or not; you can choose to harm others; or not. Every accident and injury is the result of a wrong choice. Maybe it was the injured person’s own action, or maybe it was something done by another person, that caused the accident. No one sets out to have, or cause an accident. They occur in a moment, but the effects last much longer. The worst feeling in the world is after an accident when you say to yourself ‘This wouldn’t have happened if only I had chosen to do something different instead’.

We know that Oceaneering is committed to a culture where all employees adopt a HSE mindset. What this means is that we want you to think about the choices you make each day. We want you to make a personal commitment to choose to act safely at all times. If you leave safety to luck, you risk injuring yourself or others. You risk killing yourself or others.

Don’t wait until after an accident - choose to act safely first. In everything you do, ask yourself “is this safe?” If it is not, then do something about it. Taking a moment to review a task before you start it or to correct a hazardous situation may save you from hurting yourself or others.

In short, safety is a lifestyle. Make it your lifestyle.

SAFETY AWARD AT BP SVT

On Wednesday the 15th April Gary Morgan & Phil Burns-Salmond of Oceaneering Asset Integrity were presented with the Gold Contractor Safety Award [for 2014] by Hans Gruner, Area Operations Manager at the Sullom Voe Terminal (SVT).

Oceaneering are one of only two contractors to BP who has achieved this prestigious Gold Award, which is testament to the attitude and effort of all of the team’s contribution towards safety.

The criteria for the award is a combination of several key performance indicators which include:

- Attendance and active participation at safety meetings
- Timely completion of HSE plans
- Number of recordable injuries
- Safety inputs per 100,000 man hours worked

Stephen McKay, BP Contractor Service & Performance Lead, carried out regular self verification audits with the contracting companies, where he assessed and scored each against the set criteria.

Oceaneering have 66 full time employees based at the BP operated Sullom Voe Terminal and operate a two shift system, while the additional midstream team are based in Oceaneering house in Dyce. Oceaneering worked 141,775.40 man hours in 2014.

Safety is a lifestyle, and this Gold Award is recognition that we as a company and individuals here at SVT are serious and committed to seek and continually improve our Safety Performance.
Oceaneering Asset Integrity’s Crane & Lifting Department has become the first company in Norway to achieve an accredited certification of Enterprise of Competence (EOC) within the area D7, which is more commonly known as SDLA, Special Design Lifting Accessories in the drilling and well area.

After several safety incidents, the Petroleum Safety Authority Norway (PSA) decided that practice around documentation and inspection of lifting equipment in the well and drilling area had to be improved. As a result of this, all lifting equipment used in Norway is required to undergo an annual inspection by the Company certified as EOC. This has also led to new requirements of this equipment in the second edition of NORSOK R-002 (design) standard.

The PSA has a strong focus on lifting operations in the well and drilling area, and requirements for EOC inspection of D7 equipment will most likely be implemented in the NORSOK R-003 (inspection) standard. The new edition is expected to be launched in second quarter of 2015.

The Norwegian Society of Lifting Technology has prepared a D7-course, and is currently the only provider. Inspectors from the Oceaneering Crane and Lifting department have already completed the new D7 course. We are proud that Oceaneering is the market leader in this field, being well prepared to handle new regulatory requirements for our customers.

In addition, the Crane and Lifting department have ordered a new state-of-the-art tensile bench from Oceaneering Deepwater Technical Solutions (DTS). The tensile bench has a working length of 17 metres and a capacity of 750 tonnes. Equipment tested in the bench will include all general lifting accessories as well as lifting subs, drilling and well equipment (D7), chains, wires, umbilical cables for breakage tests and many more.

With the development of multiple technologies, the Oceaneering Magna Subsea Inspection System™ (Magna Scan) is the first of its kind providing numerous advantages compared to traditional subsea inspection methods. Prior to the development of the Magna Scan, conventional ultrasonics methods have been the primary inspection technique optimized by the industry for online assets.

The Magna Scan is a versatile screening tool that assesses the mechanical integrity of assets at a high rate of speed without disrupting production. Additionally, the system only requires clean surface access from the top portion of subsea assets. The advanced system is ROV-deployable, inspects volumetrically 360° around the pipe, and provides real-time data of the wall condition within a single deployment.

The Magna Scan identifies localized defects and general wall loss by optimizing ultrasonic techniques including lamb and shear horizontal guided wave capabilities. By combining Oceaneering’s automated scanner known as the “SeaTurtle” with our proprietary ultrasonic sensors, the system is capable of detecting internal and external damage mechanism including corrosion, isolated pitting, cracking and other potential anomalies. This innovative system safely assists in preventing any catastrophic disasters that may be caused by damage mechanisms in subsea piping resulting in the release of product into the environment.
On Monday, 23 February 2015, Oceaneering celebrated the official opening of the company’s new Perth headquarters.

The Hon. Bill Marmion MLA, Minister for Finance; Mines and Petroleum, and Oceaneering International CEO, Kevin McEvoy graced us with their presence as our Guests-of-Honour to preside over the event, together with Brett Smith, Managing Director – Australia.

Attending the event were around 100 clients from over 30 organisations. During the opening, guests were treated to a 10 station guided tour of the campus which showcased some of the company’s range of engineered products, services and capabilities: Umbilicals, ROV Simulator, Subsea Asset Integrity, Specialist Inspection Services, Remote Visual Inspection, Engineered Solutions, Subsea First Response Toolkit, Decommissioning, Managed Integrated Solutions, ROV Services. Located in Jandakot, the purpose built 40,000 square metre site was developed to provide highly specialised support services to Australia’s growing oil and gas industry.

“Oceaneering has some of the most sought after subsea capabilities in the Australian market,” said Brett Smith. “This multi-million dollar investment demonstrates our confidence in, and commitment to the Australian oil and gas industry.”

The facility houses around 200 personnel, including a permanent engineering workforce providing bespoke engineering solutions and project management.

Kevin McEvoy told the audience that while the industry may be entering challenging times in the face of uncertain commodity prices, Oceaneering remains convinced about the long term viability of the oil and gas market in general, and the offshore market in particular. “We are investing heavily in the future – not just here in Western Australia, but also in Norway, Angola and the U.S. where similar large, modern facilities are coming to completion”.

An amine reboiler on a large gas facility suffered a major failure due to apparent circumferential cracking at the back of the tubesheet. The tubes were manufactured from 304L austenitic stainless steel.

Non-ferromagnetic heat exchanger tubing is susceptible to circumferential cracking in the vicinity of the tubesheet. These cracks are induced by the localized stress created during the tube-to-tubesheet rolling process. Circumferential cracking is very difficult to detect and characterize with standard eddy current bobbin probes currently used in the industry to inspect tubes:
- Bobbin probes are very sensitive to tube expansion and ferromagnetic materials, out of which tubesheets are usually made.
- The orientation of standard bobbin coils is not well suited to circumferential cracks because eddy currents flow parallel to the indications.

The asset owner approached Oceaneering SIS to come up with the most suitable inspection technique and DefHi® ECA (Eddy Current Array) probes were identified as the most effective technology for the detection of tubesheet cracking in austenitic tubes. Recently developed DefHi® ECA probes utilise the multi-function Eddyfi Ectane® system and Magnifi® display and analysis software.

DefHi® probes combine a conventional bobbin probe and a 24 or 30 element circumferential array. Because of the coil configuration in the probe, eddy currents flowing in the inspected tube are perpendicular to circumferential defects, making them easier to identify.

Through multiplexing, several array coils of the DefHi® can detect defects and allow the operator to estimate their circumferential length and position, something a standard bobbin probe cannot do. The high capture rate of the Ectane allows inspection speeds of up to 1m/s using these probes.

In addition to improving the detection of circumferential cracking, DefHi® probes also allow improved defect resolution and characterisation for other common defect types such as pitting and baffle plate fretting.

An Oceaneering inspection team was deployed to the facility and a DefHi® inspection was carried out to reveal no evidence of further cracking, but severe baffle plate fretting in some tubes. Magnifi utilises the raw inspection data to produce 2D and 3D C-scans, which use colour patterns to identify defects.

In order to validate the DefHi® results, extensive IRIS inspection was undertaken. The bundle was pulled to reveal severe fretting and disintegration of baffle plates. The correlation between ECA data and IRIS data showed acceptable agreement, with ECA tending to slightly oversize defects in comparison with IRIS. All defects in excess of 10% loss were detected by ECA.

As a result of this exercise the client has accepted DefHi® ECA as a replacement for IRIS on stainless steel tubes for future turnarounds.
**COMBINING DIGITAL AND PULSED X-RAY TECHNOLOGY FOR CUI SCREENING**

Oceaneering have recently had operational success involving the use of a Pulsed X-Ray Camera and a Digital Detection Array (DDA) unit to identify Corrosion Under Insulation (CUI) on a client’s site in the UK.

This combined approach produced radiographic images in a matter of seconds, identifying suspect areas of the pipe work in almost real-time, enabling on-site decisions on workscopes for insulation removal and reinstatement. The combination is simple and quick to set-up whilst improving on a number of safety critical factors normally associated with site radiography, including permit requirements, lowering dose rates and reduction in size of the controlled area. As a new approach to radiography, the initiative for this application was agreed with the client at the outset.

This is a significant step forward on ALARP (as low as reasonably practicable). It reduces the health and safety risks associated with the manual handling of radioisotopes, i.e. loss or detachment and surface dose risks to hands, as well as eliminating the need for statutory requirements of movement and transport, driver training etc.

James McNab, Global Technology Manager, commented: “Our aim is to provide a new, quicker approach in detecting CUI and other smallbore piping corrosion issues, with significantly safer equipment that avoids the use of radioisotopes and champions the Health & Safety Executive principles of ALARP”.

Ian Drummond, Senior Operations Manager, added: “Improving the safety for our radiography teams, client site operational personnel and not impacting on the quality of the digital images is an impressive result indeed and I look forward to seeing this duel approach being implemented across our other Projects”.

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**ASSET INTEGRITY WILL PROVIDE INSPECTION AND NDT AT OCEANEERING’S NEW BRUXAS MANUFACTURING FACILITY, ANGOLA**

Oceaneering Asset Integrity will be providing the Inspection and Non-Destructive Testing (NDT) services at the new Bruxas Manufacturing Facility in Viana, Luanda, Angola. This new facility is dedicated to the fabrication of Subsea Products for various customers within Angola. The main focus at present is the production of Hydraulic Flying Leads (HFLs), used as communication lines between various subsea installations.

Asset Integrity will service the Inspection and NDT needs of not only Subsea Products, but also the other Oceaneering business units that are located at the Bruxas facility, including ROV and DTS. The NDT services will include Digital Radiography (DRT) utilising the VMI DRT system, with conventional film radiography also available if the client so requires. Other services provided will include: Ultrasonic Testing (UT), Magnetic Particle Testing (MT) and Penetrant Testing (PT).

The Asset Integrity NDT team will consist of four technicians, two Angolan nationals, and two expatriate personnel working on a rotational basis.

Further training for personnel is planned on the VMI Digital Radiography system as well as on the use of the Positive Material Identification (PMI) units, to test material compliance to customer specifications.

At the present time the facility has existing orders for HFLs which will keep the NDT team busy until at least the middle of 2016. This is another example of the ‘One Oceaneering’ approach offered to our Clients.
PREVENT SERIOUS INJURY OR FATALITIES, FOLLOW THE LIFE SAVING RULES

**ENERGY ISOLATION**
Verify isolation before work begins and use the specified life protecting equipment

**SUSPENDED LOADS**
Do not walk under a suspended load

**WORKING AT HEIGHT**
Protect yourself against a fall when working at height

**CONFINED SPACE**
Conduct gas test when required

**PRESSURE TESTING**
Do not enter pressure testing areas

**RADIATION**
Use radiation monitor and wear a TLD badge

For further information on any of the articles in the newsletter or on Oceaneering's services please email: asset-integrity@oceaneering.com

Statements in this newsletter that express belief, expectation or intention, as well as those that are historical fact, are forward looking. The forward-looking statements include the statements concerning Oceaneering’s expected contract revenue and anticipation average annual revenue. These forward-looking statements are made pursuant to the safe harbour provisions of the Private Securities Litigation Reform Act of 1995 and are based on current information and expectations of Oceaneering that involve a number of risks, uncertainties, and assumptions. Among the factors that could cause actual results to differ materially from those indicated in the forward-looking statements are risks and uncertainties related to: industry conditions; prices of crude oil and natural gas; Oceaneering’s ability to obtain and the timing of new projects; and changes in competitive factors. Should one or more of these risks or uncertainties materialize, or should the assumptions underlying the forward-looking statements prove incorrect, actual outcomes could carry materially from those indicated. These and other risks are more fully described in Oceaneering’s latest annual report on Form 10-K and is other periodic filings with the Securities and Exchange Commission.