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SAFETY

A FACTOR THAT IS CRITICAL TO THE SUSTAINABLE GROWTH OF **THE SECTOR**

HIGHLIGHT: André Araújo, president of Shell Brasil, explains why Brazil is strategic for the company's ambitions.

WORKING IN CONFINED SPACES AND AT HEIGHT – CAN WE MINIMISE THE RISK?

The question 'Why enter tanks for surveying' is often asked.

The story behind the question is clear, from a classification perspective; classification bodies need assurance of the condition of the hull's internal structures, to ensure that the hull is structurally sound and that it will not leak cargo and cause an environmental incident.

Owners and operators also need to understand the structural and coating condition too, for example in planning repairs and drydock scopes or indeed to confirm tanks are ready to accept a different cargo, in the case of product carriers.

Specialised vessels such as FLNG and FSRU assets have particular needs, for us to understand the condition of their cargo containment systems.

Gaining these condition assurances has involved working in confined space and working at height, because of the sheer size of the structures and the need to get close enough to measure thickness and carry out close visual inspections (CVIs)

But until recently the only way of meeting the classification and owners' requirements was to put people inside the confined space.

The risks of doing so were well known and detailed procedures and processes were put in place to minimise and mitigate the risks. Ventilation, cleaning, removal of toxic residues, purging, valve double blocking, lighting and back up rescue systems helped reduce the confined space risks.

Rope access methods replaced scaffold staging and rafts as a safer means of getting data from high structures.

Risks were reduced to what was considered at the time to be ALARP (As Low As Reasonably Practicable). Nevertheless, getting people safely in (and out) of these confined spaces remained challenging, costly and operationally difficult.

The risk equation of two persons operating a robot outside a confined space for a day compares very favourably with the risk of five or more persons working for many days inside the confined space and often at height.

Can these risks be avoided?

These risks can be reduced, not just by stringent safety precautions but simply by using technology that avoids putting people in harm's way for any more than is practicably necessary – in other words to a new ALARP level.

HITS (Hull Inspection Techniques & Strategy) is the JIP that gave direction, more than 8 years ago, for developing technology to minimise human entry into confined hull spaces.

This article, the first of three, describes the steady progress that has been made to understand and define the regulatory requirements that made tank entry necessary and then to encourage the industry to develop solutions.

Industry put forward a number of different options for HITS to evaluate, including a variety of UAVs, crawlers and robots.

Each of these offered a way forward, but none of them satisfied the regulatory requirements of general and close-up visual inspections. In 2016, the first breakthrough came, in the form of a high-performance camera on a robotic arm that, when inserted through a deck aperture, was able to satisfy the general and close visual inspection requirements. (See Case History link).

In 2018, the NoMan optical camera system was successfully deployed on site and further developments were made to extend the reach of the system, to avoid 'shadow' areas and reduce the number of deck access apertures required (See Figure 1).

Figure 1 - NoMan Optical Automatic Robotic Manipulator (ARM)

NoMan also started to be used for inspection of pressure vessels, mooring turrets and jetties and, with improved lighting and manipulators, has now become a classification approved 'tool of choice' for unmanned visual inspections of confined spaces.

But thickness measurements and distortion surveys still required human entry into tanks– work progressed on the radical idea of using a specialised laser system. The NoMan Laser breakthrough also occurred in relation to using 'Synchronous Laser' methods, whereby multiple scans of a structure could be processed to derive the component's thickness. (See Figure 2)

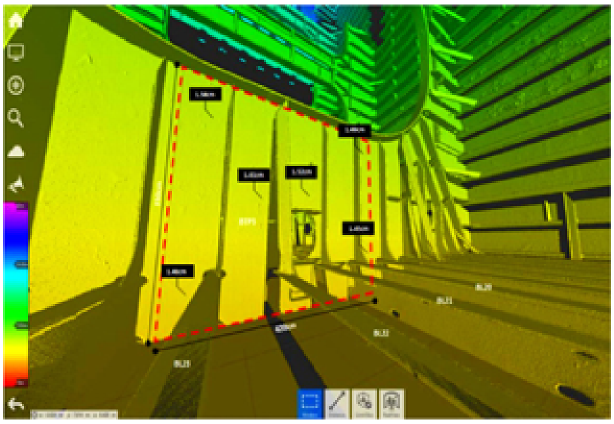

Figure 2 – Synchronous Laser Thickness Measurement

A Proof-of-Concept trial took place on an operational asset in West Africa and the 'take away' learning helped HITS to design further stringent tests on pitted and corroded test samples, so that comparisons could be made with conventional ultrasonic thickness measurement (UTM) and mechanical measurements.

These tests, carried out over a 3-year period, showed that the NoMan Laser system could provide equivalent thickness measurements to UTM and mechanical measurements at around a 10-metre range and a distortion survey accuracy well within conventional methods.

Pitting surveys also demonstrated the ability to determine accurate information about pitting size, depth and shape. So, can similar results be obtained with a remotely operated 'robotic' laser scanner?

In late 2020, the NoMan Laser 'Quadpod' was unveiled and demonstrated on HITS generated full-size test pieces at a nuclear test facility in Cumbria (UK).(See link for further details)

Fortunately, the classification societies were sufficiently assured by what they witnessed to grant approval for the NoMan Laser system (the major classification societies had already approved the NoMan Optical system).

A programme of pilot projects was instigated, involving oil majors, prestigious lease operators and the classification societies – currently over a dozen such pilot projects are being organised at different types of asset, geographical locations, structures, and applications.

They will also consider how we will increase awareness and training of those who need to use and understand the technology and the data produced, naturally including classification surveyors who play a vital role in using such technology.

The results of these pilot projects will be the subject of the second article in this trilogy.

Interestingly, the laser data offers opportunities for a radical new direction for tank and confined space surveys.

The industry is asking if thickness readings are the best way to determine structural strength and whether laser data can be used to monitor hull condition, including coating surveys, steel renewal surveys and other valuable information that can be derived or even input to a digital twin.

To what extent can such methods reduce the need to put people on board the installation? Are such methods easier to interface with remote working systems?

What is the true saving in safety, risk, operational disruption and improved integrity? These and other challenges remain to be answered and they will be reported on in the third article of the trilogy.