Real-Time Data Improves Structural Integrity Management

For some time, owners have been looking at aging assets to determine if these units could safely remain in service beyond the design life. The value of allowing a floating production unit (FPU) to stay on station and continue to function effectively, efficiently and in compliance, can be substantial, so it is not surprising that a lot of time and effort have gone into evaluating these assets.

BY CHRIS SERRATELLA AND SAMEER KALGHATGI

One approach to extending FPU life is to map the unit's structural behaviour according to class rule requirements and to develop trend curves for each finding by accumulating the design and operations modifications and their consequences on structural behaviour and global performance. This process involves reviewing the original and updated design basis and existing analyses for strength, fatigue, and stability as well as existing in-service inspection plans (ISIPs) and inspection reports from the class society and the owner in addition to modification and repair records, metocean history, and measured load history.

Following this approach, designers, operators and the class society can understand how each specific critical point of the hull structure develops over the years. Having this data gives engineers a valuable tool for predicting the future behaviour of the unit and then to better specify safety factors, reducing the number of additional complex numerical simulations and close-up surveys required.

The next steps would be an assessment of the unit based on a review of collected data, a baseline survey according to the survey plan, engineering analyses, and a modified survey scope based on the findings. This effort generally is followed by the development of a revised ISIP and finally, a decision on the part of the classification society about life extension.

Having the best data on hand makes this process much more simple and straightforward. If an asset owner could be sure that the current state of the asset was well understood, it would be possible to begin the life extension, maintenance, or repair process with greater confidence.

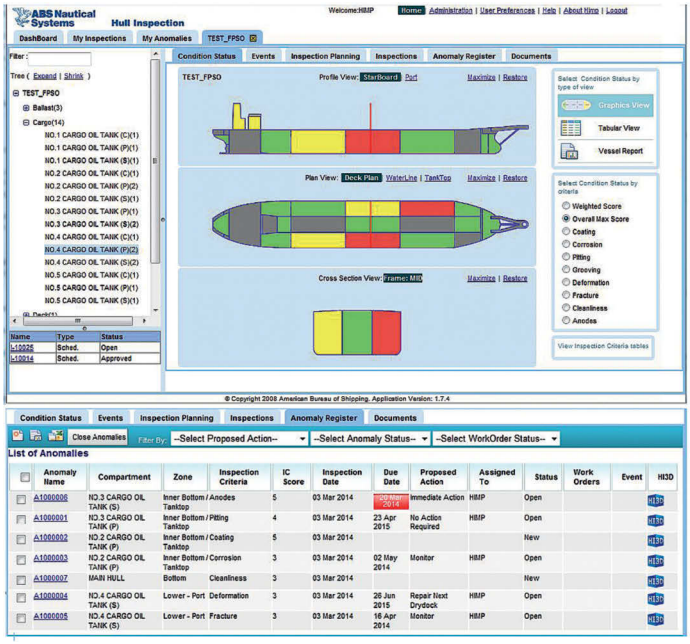
Monitoring an asset is essential, and the value of being able to monitor in real time is self-evident. Being able to gather real-time data can vastly improve decision-making. Having a tool that constantly monitors steel condition and thickness allows for better planning for the life of the asset. Reviewing processed data and using it to make decisions based on the current condition of the asset improves the ability to determine when it makes sense to schedule maintenance and when it is appropriate to make immediate repairs to prevent escalation of risk and cost.

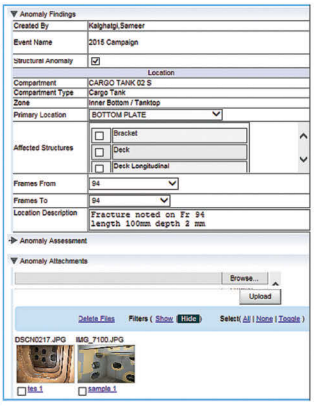
With the price per barrel of oil hovering around $35.00 at the beginning of March 2016, it is apparent that the "lower for longer" market scenario is a reality. Industry has responded by scrapping units, stacking rigs, and taking stock of active drilling and production systems. Dropping day rates make it even more important that working rigs remain up and running. Now more than ever, the industry is making critical decisions about the future life of offshore assets.

Monitoring in 3D

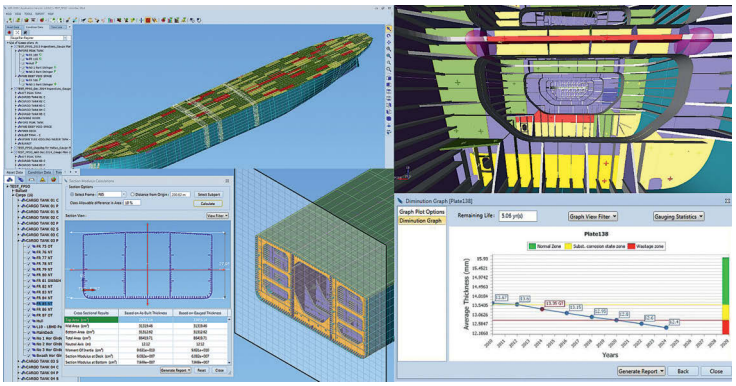
Fortunately, there are Structural Integrity Management (SIM) tools that have been designed specifically for continuous monitoring. ABS has created both a 2D tool and 3D tool that provide a foundation for structural integrity management that enhances understanding of asset structural condition.

With a web-enabled 2D tool, it is possible to plan, prepare, carry out and review structural inspections using a traffic light snapshot of vessel conditions. And the ability to generate reports provides tools for documenting, tracking and managing anomalies. Using this type of tool makes it possible to carry





SIM tools provide a foundation for structural integrity management that enhances the understanding of asset structural condition to minimise downtime and assess structural health for continued service and future life extension ***(illustrations: ABS)***



The 3D tool tracks the structure condition for plan repairs and interfaces with structural analysis tools for anomaly treatment and life extension planning

out a hull condition management assessment of a fleet of assets within a centralised database, which enables fleet-wide trending via the data gathered during inspections.

Using a 3D tool takes this functionality a step further because the ability to record and view the structural condition data in a virtual environment provides the vessel management team with a "digital twin" of the asset that can be used to manage condition data.

Using a 3D tool also allows for refined asset integrity management because it converts a computer aided design (CAD) model into a relational database in which real-time data is processed and captured to show the historical and future projected condition of a structure in the 3D environment.

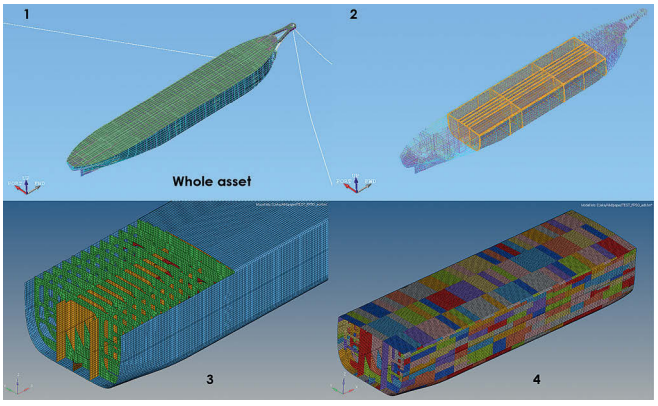
Data Provides Future Planning

Having a 3D image of an asset allows unnecessary inspection, maintenance and repair work to be avoided, and data can be leveraged to determine when future maintenance or repair is likely to be necessary, or from a larger perspective, to manage the remaining life of an asset.

Corrective action also can be optimised. Functions within a 3D tool allow for areas of substantial corrosion to be assessed to determine the appropriate amount of steel replacement and repair needed. Repair plans and associated costs of materials can be generated and used within a repair campaign.

A 3D tool also allows basic CAD functions such as adding brackets and stiffeners and anode replacement, enabling practical repair options common to offshore units that sometimes go beyond simple crop and renew scenarios.

Continuous processing – reporting, collecting and analysing data – opens the door to making better decisions. Further, such information can be used to make decisions about the health of the hull inspection program and what plan modifications and tweaks are necessary to adapt trends and findings to the asset and perhaps the overall fleet, thus keeping the inspection program evergreen going forward.



The SIM tool allows 3D data to be used for reassessment

Efficiency of Data Models

Functionality within a 3D tool suite allows data to be converted for use within more holistic structural assessment scenarios, such as life extension and larger repair planning scenarios. This data can be used to map life prediction and life cycle analysis using a finite element (FE) interface that allows geometry and materials to be imported from the 3D monitoring tool to create an FE model.

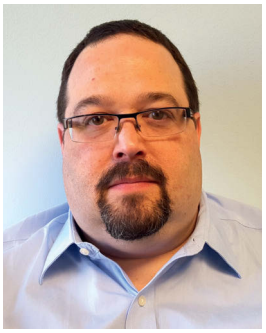
Historically, an FE model design based on geometry has taken a long time to build because updating the FEA model thickness to represent gauged condition is labour intensive and could take weeks to months depending on the age of the asset.

Using data from a SIM tool, it is possible to create an FE model from the structural condition model in one to three days because the data generated by the continuous monitoring is assigned via an automated process. The difference in time required to generate the FE model can have a significant impact on the speed with which decisions can be made regarding repairs and upkeep.

In a time when it is particularly vital to get the most out of offshore assets, using SIM tools is one of the asset owner's best ways to carry out structural integrity management. Being able to manage inspections, track condition, plan repairs and interface with structural analysis tools for anomaly treatment and life extension planning can be the difference between having active or inactive assets.

Keeping offshore units in the best possible condition delivers value on many levels. Today, with the tools available, it has never been easier to capture that value. ■

The Authors:



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