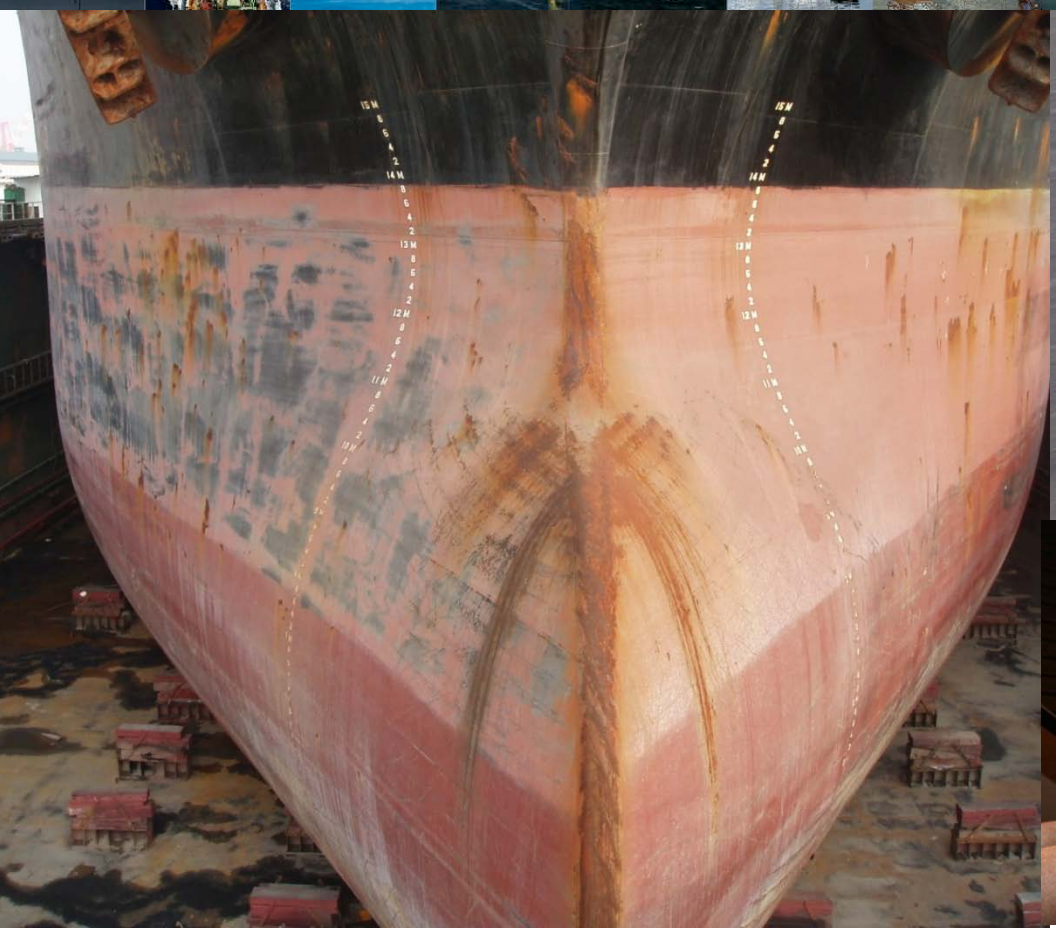


Lifetime Extension

Lifetime extension for FPSOs is a particular challenge as they may be required to operate uninterrupted for 10 to 25 years without dry-docking. Inocean has developed a methodology for hull assessment and lifetime extension which is tailor-made to vessel conversions and vessels already in operation (not just FPSOs). For the client the results are potentially huge savings and a better basis for operational planning.

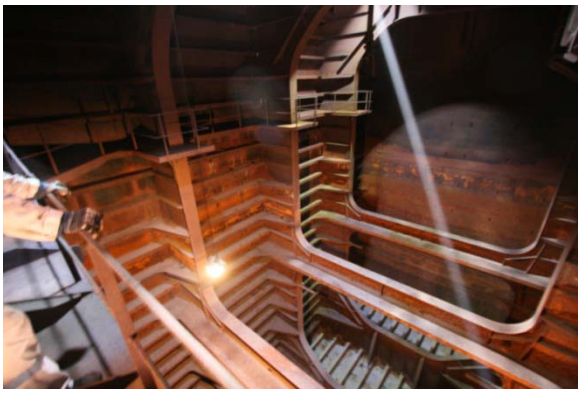
Few companies can match Inocean when it comes to hull structure assessment, fatigue analysis and lifetime extension. We find solutions that satisfy the customer as well as the classification society. Life extension programmes usually consists of condition assessment, fatigue analysis, repairs and an inspection programme.

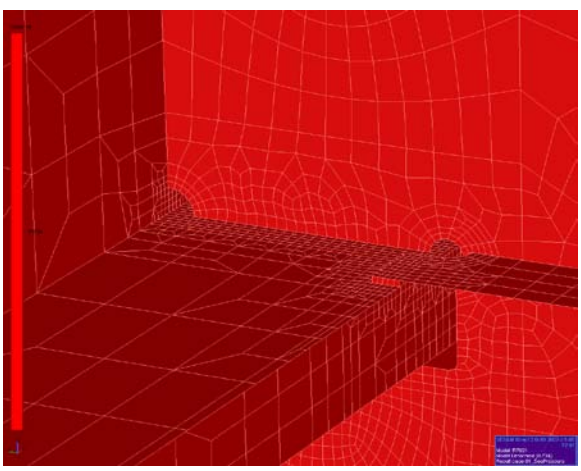
Quantify loads from historic trade → Assess Damage history → Establish analysis model, based on actual damages → Identify most critical details → Predict field specific fatigue life for the unit → Class approval of hull for extended service life

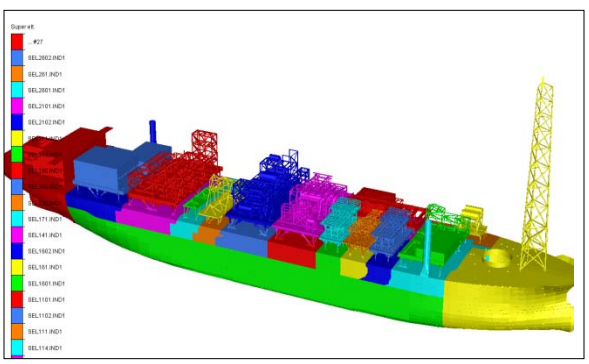
Inocean Structure Lifetime Extension Program

Address: Bryggegata 3, NO-0250 Oslo - Tel: +47 22 33 11 31 - E-mail: post@inocean.no - Web: www.inocean.no

inocean™ WATERPROOF SOLUTIONS







Hull assessment
The first and most basic assessment is about getting an impression of the overall condition of the hull and thus its residual structural strength. This indicates the extent of plate corrosion, amount of damage and prospective previous amount of repairs carried out. Such documentation is typically established through UTM measurements whereby parts (or the most critical parts) of the vessel are inspected and checked out.

Critical structural details and connections
The next step involves assessment of issues that are specifically vital to the fatigue strength of the hull structure. This implies dedicated inspection and evaluation of the extent of fatigue damage in critical structural details and connections to the hull.

Fatigue analysis
The fatigue strength and lifetime expectancy of the hull is partly dependent on the geometry and construction of its structural details, and partly the past and future loads on the hull structure.
These aspects need to be considered together to enable prediction of remaining fatigue life and to establish a basis for decision regarding where prospective repairs/upgrades are necessary – and where they aren't.

Methods
The Inocean methodology is a stepped approach starting with the actual damage history for the vessel and a simplified analysis to identify the critical areas of the structure. Based on this information, refined analysis is run to establish the remaining and future fatigue life of the critical areas. The refined analysis is based on spectral analysis, using actual loads from past trade and future operations. The structural response is analyzed using a global FE model of the hull structure, comprising refined models of the critical areas.

Longer lifetime
Spectral analysis involves large amounts of data using FE models containing 100,000 – 200,000 elements, and analysis of 1,000 – 1,500 load cases.
The benefit is a more accurate prediction of each specific connection, which may result in a longer lifetime as the conservatism of simplified methods is averted.

Such analysis requires experience and advanced tools. During the last 10 years and through 18 FPSO conversion projects, Inocean has developed such know-how and is now viewed as the world's leading expert in this field.

Address: Bryggegata 3, NO-0250 Oslo - Tel: +47 22 33 11 31 - E-mail: post@inocean.no - Web: www.inocean.no

inocean™
WATERPROOF SOLUTIONS