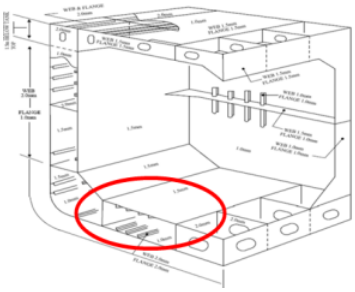
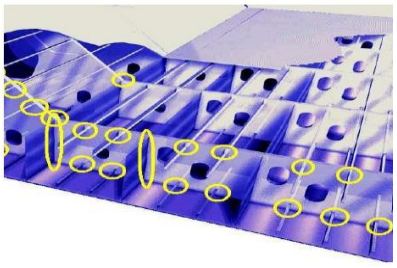
SHIPINSPECTOR - Detection of safety critical corrosion in ships using novel sensors and systems based on ultrasonic linear phased array technology

Structural failure is a major cause of the wreckage of ships, vessels and tankers and causes loss of life and pollution of the seas and coastal waters of Europe. Structural Health Monitoring (SHM) of safety critical engineering structures has seen a significant rise in recent years and Guided Wave Ultrasonics (GWU) technology has been a valuable tool of choice. Inspection techniques employing GWU have been developed for tubular structures using various transducer types and are currently applied successfully in pipes.



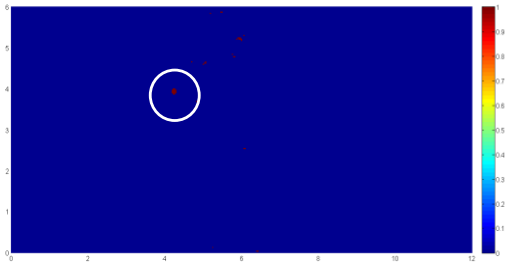
The main mechanisms of degradation within ships are corrosion and fatigue cracking. It was determined by the Shipping Classification Societies within the project consortium that the main area of concern, for which this project could provide a useful solution, was the occurrence of corrosion in the large stiffened steel plates for the double hull oil tankers, where water and other contaminants may collect under the hydrocarbon cargo and cause corrosion. Therefore this was the main focus of the project activities.



Project objective

The goal of the SHIPINSPECTOR project was to develop a means of remotely monitoring the condition of large areas of stiffened plate structure within ships for the detection of degradation in service. It was aimed to reduce the cost of ensuring that the tanks are free from metal loss due to corrosion, which could cause the tanks to leak and release the oil or hydrocarbon products into the sea.

The chosen approach was to use low frequency ultrasonic guided waves to enable the very large areas of the cargo tank floors to be monitored using a relatively small number of sensors in a 'sparse array'. The requirement to detect a single corrosion pit was used to set the performance target of detection of a circular patch of corrosion 40mm in diameter and ½ the plate thickness deep. Extensive tests were carried out to assess the performance of different sensors and designs of encapsulation for those. These resulted in a final design being produced for a field-usable prototype. It was concluded that provided that specified measures are taken, it is possible to detect the defect. This equates to 0.002% of the area examined by the array.



Thresholded image of the plate showing the defect detected by the ShipInspector sensor array

The requirements for the system components and the training and certification of inspection personnel to carry out the monitoring tasks have been specified. Guidelines for equipment specification, application, and operator training and certification were formed to prepare a basis for future standards.

The SHIPINSPECTOR project was a cooperation between the following organisations: TWI Ltd., DGZfP, USNDT, Bulgaria NDT Society, AIPND, SMART Group, I&T Nardoni, Isotest ,Tecnitest, BME, Cereteth, HSE, American Bureau of Shipping - Europe , Lloyds Register EMEA ,Class NK.

For further information, please visit the project website at **www.shipinspector.eu**.

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under Grant agreement number 218432.

SHIP INSPECTOR