Laser Guided inspection robot for the non-destructive testing of thin steel gauge welds in the shipping industry

X-Scan is a collaboration between EU companies and research organisations with the objective to develop and produce a novel inspection techniques and devices for the assessment of thin steel gauge welds for the shipping industry. Ultimately, the X-Scan system will inspect the weld, and classify it by means of laser, ultrasound and electromagnetic methods.

PROJECT AIMS

The X-Scan project aims to response to the need for more reliable, faster, cost effective and safer inspection techniques by developing novel automated NDT techniques for ship structures.

The objective of the project is twofold: First, the project will concentrate on solving the problem of inspecting thin steel welds using Phased Array Ultrasonic Testing (PAUT) and Alternating Current Field Measurement (ACFM) technique. Secondly, it will tackle the automated inspection of inaccessible welds by means of a laser guided manipulator.

The project technical goals are:

- To determine the performance of thin welds using an automatic system
- To develop and validate models for the development of the inspection techniques, both ultrasonic and electromagnetic
- To develop a laser tracking system that will guide the robot and visually inspect the welds
- To design, integrate and manufacture an automated system containing three sub-systems
- To validate the final prototype by carrying out laboratory and field trials

PRODUCT BENEFITS

The X-Scan technologies will be usable on both new and old build. The X-Scan device will enable the volumetric inspection of thin gauge welds and consequently the detection of surface breaking and sub-surface flaws, such as: porosity, lack of penetration, lack of fusion, cracking, etc.

The overall system will integrate three sub-systems:

1. An optical system to guide the robot and provide visual inspection
2. A PAUT system for the detection and sizing of sub-surface defects
3. An ACFM system for the detection and sizing of surface breaking flaws

A major dissemination programme will present the findings to industry via a network of events and seminars

PROJECT PARTNERS

The consortium consists of seven partners from four member states, including three SMEs representing a different EU country.

SME Partners
- Technitest
- Vermon
- Spectrumlabs

OTHER Partners
- Lloyds

RTD Partners
- TWI
- UBRUN
- Innora

The X-Scan project is partly funded by the European Union's Seventh Framework Programme managed by REA Research Executive Agency http://ec.europa.eii/research/rea for two years.

The X-Scan Project

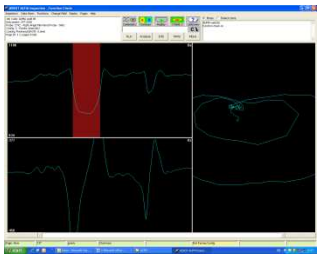
Ocean going ships are the most cost effective form of transporting bulk goods around the world. To date, Europe owns nearly 40% of the world's fleet of ships, which account for 90% of its external trade and 40% of its internal trade. Moreover, in the supply of ship building components and services, the EU is a world leader.

In this industry sector, structural failure is a major cause of the loss of ships, vessels and tankers resulting in loss of life and pollution of the world's oceans, seas and coastal waters of Europe. Indeed, it has been reported in 2006, that each year over 400 ocean going ships sink, many as a result of weakened structures due to corrosion and inadequate/poor welding quality.

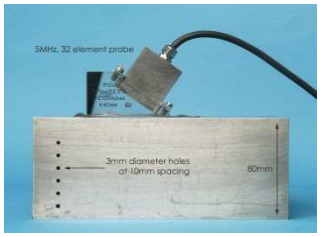
Most of the inspection techniques used to date proved to be disruptive to the manufacturing process and far from being cost effective. Additionally, as the current generation of ships are being built from thinner section steels (10mm or less) to lower the cost of build and ship operation, typical assessment methods are not as effective as for thicker sections. Therefore, there is a real need for more reliable, faster, cost effective and safer inspection techniques.

The X-Scan project aims to respond to this need by developing novel automated NDT techniques (ultrasonic and electromagnetic) for ship structures.

Technical Objectives



Typical ACFM data



PAUT probe on test block

The project will enable significant technological progress to be made in a challenging area that has seen little development work to date. The new ultrasonic system will provide defect imaging and analysis at much greater convenience and speed than currently exists.

Strategic Objectives Addressed

- To increase scientific understanding of the transmission of phased array generated ultrasonic waves in thin plate materials and welds
- To increase scientific understanding of the interaction of ACFM generated fields with defects in thin plate weld materials
- To develop an automated inspection system for thin steel gauge weld, consisting of three sub-systems (PAUT, ACFM and optical laser)
- To validate the final prototype by carrying out laboratory and field trial

Optical sub-system

PAUT sub-system

ACFM sub-system

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