Recent Advances in Underwater Remote ACFM® Inspection

Subsea Expo 2016

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Topics

- Subsea Inspection
- Review the ACFM® technique
- ROV remote deployment
- Q&A
The need for inspection

Photograph: Offshoreenergytoday.com
The ACFM® technology

- Alternating Current Field Measurement (ACFM®)
- Alternating current induces a uniform electromagnetic field into the surface
- The electromagnetic field is disturbed by surface-breaking defects
- Sensors measure this disturbance and locate the defect
- The interaction is recorded and modelled using advanced mathematics, which allows sizing for depth and length without the need for on-site calibration
Diver deployed ACFM®
Remote underwater ACFM® inspection

- TSC’s remote inspection capability makes use of ROV’s to either carry out the inspection, or place sub-systems that guide the probes while the ROV stands off.

- TSC develops solutions to suit the specific application, usually based on the TSC ‘toolkit’ of remote tooling.

- Remote weld inspection using ACFM® has been carried out across a wide range of applications including:
  - Structural node welds on jackets.
  - Caisson inspection.
  - Inspection of welded plate structures.
  - Inspection of mooring systems including chains.
  - Inspection of spudcans.
Why Arrays?

- Multiple sensors in one probe
- Broad sensitive area
- Tolerant to error in tracking
- Tolerant to lift-off variations
- Data density improves interpretation
ACFM® Mag Crawler Concept
Crawler Deployment

- ACFM® MagCrawler™
- Compact, magnetic tracked vehicle
- On-board cameras and lights
- Deployed by workclass ROV
- 150m operating depth
- Fitted with ACFM® array probe
- Probe mount can translate vertically and rotate
- Suitable geometry:
  - Flat plate butt welds
  - Large diameter circumferential welds
  - Fillet welds
ACFM® MagCrawler example deployment video
ACFM® NodeScanner™ Concept

Node Scanner
The **ACFM® NodeScanner™** has been developed by TSC for the inspection of node connections and has been used offshore.

- The scanner uses a scanned array probe that is capable of covering a complete weld cap.

- This scanner has a combination of active and passive degrees of freedom.

- The drive systems are electric and so can be deployed easily by electric or hydraulic ROVs.
ACFM® NodeScanner™ deployed in Gulf of Thailand
Independent approval of the TSC ACFM® technique

“Accepted technique for the in-service examination of structural welds, heat-affected-zone and adjacent parent material in uncoated or coated structures.”

ACFM® is referred to in LR Survey Procedures Manual and NDE training programmes.

TSC is an LR certified ACFM® Inspection Services Provider.

Approved technique surface breaking crack detection.
In Conclusion

- ACFM is a mature and certified technique
- Surface crack detection and sizing
- No need to remove and re-apply coatings
- A variety of methods available to deploy ACFM® on subsea structures

Experience with ACFM® inspections using ROVs includes:
- Norwegian Sector of North Sea: Talisman, Repsol, Statoil, Shell, Total
- Australia: Woodside, Apache
- UK Sector of North Sea: Shell, Elf, Enquest, Britannia
- Brazil: Petrobras
- Gulf of Thailand: Chevron
- Africa: Exxon Mobil

Working with partners to provide inspection service solutions:
- Fugro, DeepOcean, Subsea 7, DOF, Ocean Installer, Sonomatic, Oceaneering, Technip, Prezioso Linjebygg
Any Questions?

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