A Novel Approach to Non-piggable Subsea Pipeline Inspection

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The MEC (Magnetic Eddy Current) Inspection technology
The MEC-Combi Crawler™

- Crawler with axial and circumferential drive
- MEC Inspection Technology plus other (UT, Profiling, etc.)
- Adaptable to a wide range of diameter and flat surfaces
Testing with an adequate Test sample

• Tests for handling and defect detection
• Here in the Oceanlab near Aberdeen
The Pulsed Eddy Current Inspection Technology (PECT)

Phase 1: Magnetisation of steel
- PEC probe
- Transmitter and receiver coils
- Primary magnetic field
- Concrete
- Steel
- Magnetised top layer

Phase 2: Detecting secondary field
- Secondary magnetic field

Diffusion of eddy currents in steel

Pulsed Eddy Current signal

Signal

Time
PECT Inspection Equipment
PECT Inspection Data Visualisation

<table>
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<tr>
<th>Vertical %</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Defect</th>
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## Inspection Technology Selection

<table>
<thead>
<tr>
<th>Property of Pipe to be inspected</th>
<th>MEC™</th>
<th>PECT</th>
<th>UT</th>
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<tbody>
<tr>
<td>Pipe wall thickness</td>
<td>up to 30mm</td>
<td>up to 100mm</td>
<td>up to 50mm</td>
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<tr>
<td>Coating type</td>
<td>all electric non-conductive coatings and up to 3mm thick Monel coating</td>
<td>non-metallic coating and insulation including concrete weight coating</td>
<td>3LPP, FBE etc.</td>
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<tr>
<td>Coating thickness</td>
<td>up to 15mm</td>
<td>up to 250mm</td>
<td>up to 3mm</td>
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<tr>
<td>Bends</td>
<td>limited</td>
<td>1.5D x 90°</td>
<td>1.5D x 90°</td>
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<tr>
<td>Inspection speed</td>
<td>dynamic</td>
<td>static (2s per reading)</td>
<td>dynamic</td>
</tr>
<tr>
<td>Type of defects</td>
<td>localised external and internal defects and general corrosion / wall loss</td>
<td>general external and internal corrosion / wall loss</td>
<td>localised external and internal defects and general corrosion / wall loss</td>
</tr>
</tbody>
</table>
Case Study 1: PECT Subsea Pipeline Inspection

Factory Acceptance Testing
Case Study 1: PECT Subsea Pipeline Inspection

**Wet Testing**
Case Study 1: PECT Subsea Pipeline Inspection

Subsea Inspection Operation
Case Study 2: MEC-Combi Crawler™ Subsea Pipeline Inspection

Subsea Tool Deployment
Case Study 2: MEC-Combi Crawler™ Subsea Pipeline Inspection

Preparation and execution of subsea operation:

- **Full Circumference inspection required on subsea pipeline**
- **Several spots have been selected (high point, low point, etc)**
- **MEC-Combi Crawler crawls around the pipe to measure full circumference**
Case Study 2: Section of scanned Subsea Pipeline

Results:
One line of corrosion at 6 o'clock with several relatively deep pits.

MEC Legend
% Wall Thickness Loss

0% 10% 15% 20% 25% >25%

UT Legend
mm Wall Thickness and Stand-off

0 2 4 6 8 10 12 14
Case Study 2: Level of Detail for inspected Sections

The level of accuracy is not merely a screening. It is high resolution inspection comparable to ILI results. With multiple scanning even more reliable.
Conclusions

- An automated external subsea inspection of pipelines is possible with a number of technologies.
- Pulsed Eddy Current and Magnetic Eddy Current are versatile for inspection through coating and imperfect cleaning.
- Data quality comparable to ILI can be achieved. With multiple scanning and different technologies even better.
THANK YOU FOR YOUR ATTENTION

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