A step change in Cathodic Protection (CP) surveys

FiGS®
Field Gradient Sensor
Predictive CP Inspection

- Reduced offshore vessel time
- Cost-effective subsea inspections
- Predicted future condition of your assets

FiGS takes CP inspection into the future

Increase SAFETY
Reduce COST
Predict RISK
Predictive CP Inspection

FPSO / Hulls / Mooring lines

Flexibles

Jackets

Exposed & buried pipelines

Semi sub & Jackups

Offshore wind & power cables

In-field structures

FiGS
History - from the PAST to the FUTURE

1979-1981
CPPR, Developed in Trondheim by CorrOcean

2007-2013
FiGS developed with partners;
Statoil, Shell Global, GASSCO

2015
Statoil approval TRL7 and Shell Global - approved for multi use
Statoil, Shell

2014 - 2016
Performed 13 CP surveys
## FiGS - CP Inspection of the future - Exposed

<table>
<thead>
<tr>
<th>EXPOSED STRUCTURES AND PIPELINES</th>
<th>Stabber/ Proximity/ Drop Cell</th>
<th>Cell to Cell</th>
<th>Dual Cell (FG)</th>
<th>FiGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential profile</td>
<td></td>
<td></td>
<td></td>
<td>FiGS</td>
</tr>
<tr>
<td>Anode current</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Anode wastage</td>
<td></td>
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</tr>
<tr>
<td>Coating damages</td>
<td></td>
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</tr>
<tr>
<td>Steel current density</td>
<td></td>
<td></td>
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<tr>
<td>Current drain to e.g. piles, wells &amp; substructures</td>
<td></td>
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</tr>
<tr>
<td>Outer sheat damage on flexible pipes</td>
<td></td>
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<tr>
<td>Correction of pipe routing</td>
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<td></td>
<td>FiGS</td>
</tr>
</tbody>
</table>
# FiGS - CP Inspection of the future - Buried

**BURIED STRUCTURES AND PIPELINES**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Stabber/ Proximity/ Drop Cell</th>
<th>Cell to Cell</th>
<th>Dual Cell (FG)</th>
<th>FiGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential profile</td>
<td>Red</td>
<td>Yellow</td>
<td>Red</td>
<td>Yellow</td>
</tr>
<tr>
<td>Anode current</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Yellow</td>
</tr>
<tr>
<td>Anode wastage</td>
<td>Red</td>
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</table>
FiGS – a step change in subsea CP Inspection

- Non-contact CP survey, buried structures
  - No need for removal
  - No need for stops
  - Continuous measurement

- Rock dump & Concrete mattresses

- Marine growth on anodes, no cleaning
  - No need for cleaning
  - Time-consuming with potential of destroying anodes
  - No need for stabbing
  - Time-consuming with potential of destroying anodes
  - Electrically disconnected

- Muddy waters & shallow waters – no issues
FiGS – a step change in subsea CP Inspection

- Measurements of coating damages
- Avoid the use of divers in operations - safety
- Accurate data and sensitivity of the sensor
- Vessel time efficiency

- Non-contact
- Faster CP inspections
- Reduced vessel time
- Inspection of all structures
- Shallow and deep waters
FiGS enables a high return on investment

Typical pipeline retrofit cost broken down:

- Design: 2-5%
- Materials: 20-25%
- Installation: 75-80%

Reduced the retrofit cost by 50% on a pipeline:
- SAVINGS: 12 MUSD
- ROI: 77

Reduced the retrofit cost by 50% on a jacket:
- SAVINGS: 10 MUSD (Design, Materials and Installation)
- ROI: 22

Avoided the use of divers. Fast inspection:
- SAVINGS: 1 MUSD
- ROI: 3
From the PAST to the FUTURE

Exposed structures and pipelines

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Potential (mV)</th>
<th>Location</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 15</td>
<td>- 1000</td>
<td>ABC-123</td>
<td>Steel Contact</td>
</tr>
<tr>
<td>- 30</td>
<td>- 980</td>
<td>ABC-246</td>
<td>Steel Contact</td>
</tr>
</tbody>
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Buried structures and pipelines

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<td>-</td>
<td>-</td>
<td>ABC-468</td>
<td>Contact measurement not possible</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>ABC-321</td>
<td>Contact measurement not possible</td>
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Critical areas
- non protected/protected
- coating damages

Accurate and detailed data
- current flow inside and around structures
- is the structure protected
- or is it protecting other structures/pipelines

Future predictions
- remaining life
- time to next inspection
- effect of modifications
- ~100% CP status

Spot checks
- Only a snapshot of the status
- Lack of knowledge regarding redundancy of the system
The combination of FiGS & CP modelling provides full control of the CP system for all structures and pipelines
FiGS CP Survey - The fast way to prediction

6-12 hrs

1 hr / structure

6 hrs

5 km/hr Buried / exposed

FORCE TECHNOLOGY
FiGS CP Survey - Condition of the asset

- 20% of the anodes on a jacket were inactive
- Detected 80 new anode sleds on a pipeline
- Detected inactive anodes in a template – other surrounding structures were protecting it
- Invisible coating defects detected – 2 mm gap in field joints
- Measured buried anodes to be active – no need for expensive retrofit of a pipeline
Optimise your inspections
- Pipelines and Structures

Combine subsea inspections

GVI (reporting)

EXPOSED & BURIED TEMPLATES & SSIV.

EXPOSED & BURIED PIPELINES (rigid and flexible)

Subsea structures & pipelines

Assets and installations

FIXED and FLOATING STRUCTURES

IN-FIELD STRUCTURES
Optimise your inspections
- GVI

<table>
<thead>
<tr>
<th>Structures</th>
<th>Qt.</th>
<th>Approx. time (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipelines Exposed (2 km/hr)</td>
<td>100 km</td>
<td>50 hrs</td>
</tr>
<tr>
<td>Pipeline Buried (5 km/hr)</td>
<td>100 km</td>
<td>20 hrs</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>70 hrs</strong></td>
</tr>
</tbody>
</table>
CP SURVEY OF SUBSEA PIPELINES & STRUCTURES

- **HSE**: No divers reduces HSE risk
- **More value with less cost**
- **Speed up the survey**
- **Predict service life**
- **No need for excavation**
With FiGS you get detailed reporting
Approved by Statoil and Shell Global for multiuse