Discovery™
Subsea CT Scanner for pipeline integrity and flow assurance visualisation
Lee Robins, Head of Subsea Services
Tracerco

A world leading technology company providing unique and specialised measurement solutions to our customers
A world leading technology company providing unique and specialised detection and measurement solutions to our customers
Tracerco Subsea Process and Integrity Services

- Integrity Inspection
  - Pipelines
  - Flooded Member
  - Mid-water Arches & Buoyancy Tank
- Flow Assurance Inspection
  - Deposition Studies
  - Stuck Pig Location
- PIG Tracking/Detection
- Density Profiler
- Radiation Monitoring
A Familiar Problem

“It is believed that up to 40% of the world oil and gas pipelines are deemed to be unpiggable.”

A Familiar Problem

There are no reliable subsea detection tools to accurately detect and characterise hydrate, wax, scale and asphaltene blockages.
A Familiar Problem

Integrity

Flow
Two New Pipeline Inspection Technologies

**Tracerco Explorer™** – a fast screening technology to highlight Flow Assurance and Integrity issues for further detailed investigation by **Discovery™**

**Tracerco Discovery™** - the world’s first Subsea CT Scanner
Tracerco Discovery™ – Subsea CT Scanner

• Based upon medical Computed Tomography principles
Tracerco Discovery™ – Subsea CT Scanner

• Based upon medical Computed Tomography principles
• A non-intrusive technology for inspection of subsea pipelines
• Inspection of ‘difficult to pig’, ‘challenging’ and ‘unpiggable’, coated or uncoated pipelines
• Inspection of complex pipeline systems:
  ✓ pipe bundles, pipe-in-pipe, flexibles, CRA lined, plastic lined

Why use Discovery:
Obtain integrity and flow assurance data online and non-intrusively to enable critical decisions to be made and reduce operational intervention time
Applications

<table>
<thead>
<tr>
<th>Asset Integrity</th>
<th>Life Extension</th>
<th>Flow Assurance</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrity inspection without production interruption, meaning you don’t have to reduce or defer production.</td>
<td>Cost effective life extension inspection projects by removing the requirement to modify unpiggable lines for inline inspection, or remove coatings for other external inspection technologies. The only solution for full integrity assessment of entire pipeline structure and contents.</td>
<td>Characterize pipeline contents, and learn if your deposit or restriction is hydrate, wax, asphaltene or scale. Exact knowledge allows you to select accurate remedial action first time, eliminating the cost of ineffectual remediation. Run a progressive pigging campaign with confidence.</td>
<td>Reduce the risk of environmental issues during decommissioning activities by getting a full picture of exact pipeline contents and condition.</td>
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</tbody>
</table>
THE WORLD’S FIRST SUBSEA CT SCANNER
FULLY OPERATIONAL IN 2015
Real-time data transmission
Wall thickness measurements to 1mm accuracy
Discovery™ – A unique solution

- Provides integrity images to approximately 1mm wall thickness accuracy
- Any type of pipeline
- No need to remove any type of coatings
- No interruption to normal pipeline operations and production
- Fully Operational and Field Proven–TRL 7
- DNV RP-A203 Certified
- 3000m Water Depth rated
- Diameter range currently 2” to 26” (can be increased)
Verify pipeline contents and **KNOW** the exact amount, structure and type of deposits prior to operational pigging and progressive cleaning campaigns

Why rely on historical and often inaccurate data, such as temperature profile, pressures, flow rates, product chemistry, pipeline geometry features and any operational pigging history to create a ‘best guess’ picture of what may be in the line?

Carry out a pipeline survey so that operational pigging and progressive pigging cleaning campaigns proceed with confidence.
Discovery™ - Flow Assurance Application

Verify pipeline contents and KNOW the exact amount, structure and type of deposits

High percentage of remediation campaigns are ineffectual due to lack of accurate information; wasting millions of dollars and losing months of production time

Reduce operational downtime – *lost production savings*
Accurately plan an effective and efficient cleaning campaign – *big OPEX savings*
Discovery™ - Flow Assurance Application

Pre-deployment trial – proof of concept

8” in 12” pipe in pipe
Discovery™ - Flow Assurance Application

Pre-deployment trial – proof of concept

Wax or Aspheltene blockage as density-equivalent plastic
Discovery™ - Flow Assurance Application

Pre-deployment trial – proof of concept

Gas pockets as density-equivalent plastic
Discovery™ - Flow Assurance Application

Pre-deployment trial – proof of concept
- All 6 Channels clearly detected
- Proof of required detection resolution
- Provides confidence to proceed with the offshore inspection campaign
Four steps to cost effective remediation

1. **Locate deposits:** Use Explorer™ to scan and identify the position – know **WHERE** it is
Discovery™ - Flow Assurance Application

Four steps to cost effective remediation

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Four steps to cost effective remediation

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Four steps to cost effective remediation

2. Quantify and characterise it: use Discovery™ to identify the type and nature of the deposition – know WHAT it is.

- Discovery™ - Flow Assurance Application

Discovery image of a clean PiP line

Asphaltene @1.2g/cc
Four steps to cost effective remediation

2. Quantify and characterise it: use Discovery™ to identify the type and nature of the deposition – know WHAT it is

Asphaltene @1.2g/cc

Scale @2.3g/cc
Four steps to cost effective remediation
3. Remediate efficiently and cost-effectively

Choose the correct remediation method and plan the campaign with confidence
4. Monitor the effectiveness of the Remediation: use Discovery™ to monitor effectiveness and optimize cleaning operations

**Discovery™ - Flow Assurance Application**

- Static – Water/Oil/Gas
- Flowing Conditions
- Hydrate Formation
4. Monitor the effectiveness of the Remediation: use Discovery™ to monitor effectiveness and optimize cleaning operations

- Hydrate Blockage
- Hydrate Dissociation
- Hydrate Removed
Discovery™ – Pipeline Integrity Application

Validate and accurately measure defects detected from ILI campaigns
  - No need to remove/replace any type of coatings
  - Inspect online – no production losses
  - Use on pipe-in-pipe systems and bundles

Cost effective solution for Lifetime Extension of any type of ‘unpiggable’ and ‘difficult to pig’ lines
Discovery™ – Pipeline Integrity Application
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Discovery™ – Pipe Bundle Integrity
Discovery™ – Pipe Bundle Integrity
Discovery™ – Pipeline Integrity – Flexible
**Explorer™ – Flexible Integrity**

**Fundamental principles:**

Tracerco Explorer™ (patent pending) is a new innovation that is far superior to existing Digital Radiography techniques, allowing fast inspection of flexible risers.

- External clamp-on device
- Crawler mechanism
- Better resolution than DR
- Fast inspection speed of 0.5 metres/minute
Explorer™ – Flexible Integrity

360 degree image of both inner and outer SWA layers

- Gaps between 2-layers of SWA strands - produce a repeating diamond pattern across the image
- Shadows of gaps which produce elongated diamond pattern across the image
- Reduction in SWA strand tension, and resultant wider gap between strands
Explorer™ – Flexible Integrity

360 degree image filtered to show just one of the SWA layers

Slippage of the SWA where gaps have opened up between strands are clearly visible. Broken and cracked strands will also be clearly visible.
Explorer™ + Discovery™ – Flexible Integrity
Life Extension – Unpiggable Lines

Save as much as 35% on the total cost of life extension inspection projects by scanning through coatings.
Life Extension – Unpiggable Lines

Get close to 1mm resolution data on a variety of integrity issues including wall thinning, pitting, and corrosion.

Eliminate the risk of damaging the pipeline during coating removal.
Life Extension – Unpiggable Lines

Get close to 1mm resolution data on a variety of integrity issues including wall thinning, pitting, and corrosion.

5-layer PP Insulated Pipe with Piggyback Line
Solution Engagement

Understanding the perceived challenges;
- Develop the IRM solution
- Develop the process understanding
- Enable Decisions and mitigate risk

Engagement with our customers at the front end operational engineering stage, to understand the operational challenges, and enabling us to provide the most effective solutions.

Tested, verification ready for mobilisation
Summary

Provides detailed images of all pipe walls and contents without need to remove coatings

Reduce costs on Remediation campaigns:
- Verify pipeline contents and KNOW the exact amount, structure and type of deposits prior to operational pigging and progressive cleaning campaigns

Validate and accurately measure defects detected from ILI campaigns
- No interruption or risk to production
- No coating removal/replacement
- Reducing intervention costs and duration
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