Platelets® & Plasma™
The Management of Unplanned Flow
Who are Brinker?

Range of innovative products & specialist services to enable operators to effectively manage unplanned flow events thus minimising non-productive time:

platelet®  plasma™  telepath™
Agenda

- Platelets®
- North Sea Case Study – Shell E&P, July 2008
- Plasma™
- North Sea Case Study – Shell Monotowers
- Telepath®
- North Sea Case Study – Shell Skua/Egret/Heron
Platelet Technology®

Platelets® injected into leaking pipeline
Platelet Technology®
Platelet Technology®
Solution Optimisation

- Information gathering – P&ID’s, Isometrics, pigging data, Injection/retrieval, site visit.
- Computational Fluid Dynamics (CFD), Finite Element Analysis (FEA).
- Platelet® Design – size, shape, density, batch size, fluid compatibility, longevity.

Engineered solution → mitigated risk → high probability of successful outcome
North Sea Application - BP Foinaven
• Shell approached Brinker to seal a leak in a service & firewater supply system in an offshore installation.

• Brinker team attended brainstorming meeting.

• Bespoke team identified and a project plan devised by close of business on day 1.

• Exact leak location unknown – Brinker team working alongside third parties specialising in camera work to aid leak location.
Data provided by Shell estimated leak flow rate as 500m$^3$/hr, but the leak location was unknown.

The Brinker team used this available data to estimate the maximum/minimum leak geometry – thus enabling Platelet$^\text{®}$ design.
North Sea Application – Shell E&P, July 2008

- Large single Platelet® deployed in first instance.
- Platelet® tethered and lowered into position to prevent further system damage.
- Additional batches of small Platelets® deployed to further reduce leakage.
- Deployment successful – leak rate reduced to a negligible level.
- Temporary barrier allows preparation of long-term integrity solution.
Managing Unplanned Flow

• Brinker able to respond rapidly & work with Shell to provide a solution to a difficult problem.
• Brinker Team & bespoke equipment offshore within 3 days of initial contact.
• 42 different types of Platelets® provided to maximise potential of successful outcome (i.e. Leak changing with time).
• Demonstrates Brinker’s consultative type approach: work with client to understand problem then provide a solution.
Managing Unplanned Flow

• Shell considered the operation to be a complete success on Brinker’s part.
• Importance of close relationship with client to deliver successful operation.
• Reinforces Brinker’s decision to remain North Sea focused at this time.
Technology Development – Well Integrity

• Wellhead / tubing hanger leaks
• Tubing leaks
• Annulus leaks
• Casing leaks
• Xmas tree leaks
New Technology - 2008

Plasma™ is a dynamic sealing solution consisting of fine particulate ‘Platelets’ suspended in a gel carrier medium.
Plasma™

- Plasma™ locally injected & responds to applied pressure
- Designed for ‘low flow’ or ‘zero flow’ applications
- Hairline cracks, either metal to metal or elastomer
- Provides an active or dynamic seal
- No solidifying or hardening with time
- Can be used for insurance against future leaks
Use Plasma™ to:

- Regain valve integrity – PWV’s, gate valves, ball valves
- Temporary seal to allow intervention/maintenance
- Restore the functionality of damaged o-rings & other seal failures
- Provide a secondary barrier in dynamic clamping operations.
North Sea Application – Shell Monotowers

- December 2007, tear discovered in Subsea Expansion bellows installed on 16” gas export riser – Shell operated Caravel Monotower.

- Andrew Palmer & Associates / Penspen – Contracted by Shell to devise a clamp solution capable of providing a dynamic seal and then project manage its procurement & installation.

- Plasma™ recognised as excellent means of safeguarding against leakage in the event of partial seal failure.
Shell Monotowers – Onshore Testing

- Onshore testing carried out to ensure:
  1. Capability of Plasma™ to be pumped through a hose
  2. Ability to provide secondary seal
  3. Ability to displace water to ensure full cavity
- ≈100 litres of Plasma™ required – therefore timing issues also considered.
Onshore Test Set-Up
Subsea Deployment

- Plasma™ deployed through 1” hose from Dive Support Vessel.
- Clamp at depth of 30m however 100m of hose used to allow for vessel stand-off.
- Cavity between clamp & bellows completely filled with Plasma™
- Further to successful completion of operation Brinker contracted for similar topside operation on four of Shell’s North Sea Monotowers.
Telepath®

A turnkey solution – comprising offshore data capture & a proprietary software package - enabling detailed analysis of flow & pressure conditions in small bore pipes. Can be used to accurately locate the position of leaks & blockages in subsea umbilicals.
• Leak identified in 1” Methanol core to Skua, Egret & Heron UTA’s when attempts to restart Skua drill centre failed.

• DSV operations showed that leak was in main umbilical.

• Topside pump testing confirmed that the failure had occurred subsea.
Background

- The umbilical has a total length of 22km with the Skua, Egret & Heron drill centres tied in at various points along its length.
- Maximum achievable pressure of 50 bar at a flow rate of 1 m³/hr.
Operational Procedure

Telepath® Inputs:
• Pressure & flow data collected by Brinker Team.
• Accurate pipeline & fluid properties information.

Telepath® Outputs:
• Estimation of leak location.
• Estimation of leak size & effects of pressure.
Pipeline Data Required

### Pipeline Data

<table>
<thead>
<tr>
<th>Nominal Diameter</th>
<th>1 inch</th>
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<tbody>
<tr>
<td>Internal Diameter</td>
<td>25.4 mm</td>
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<tr>
<td>Pipe Material</td>
<td>Super Duplex</td>
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<tr>
<td>Pipe Roughness</td>
<td>5 micron</td>
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<tr>
<td>Design Pressure</td>
<td>10,000 psi</td>
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<tr>
<td>Total Length</td>
<td>22148 m</td>
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<tr>
<td>Burial Depth</td>
<td>0.6 – 1.0 m</td>
</tr>
<tr>
<td>Vent Port Spacing</td>
<td>None</td>
</tr>
</tbody>
</table>

![Umbilical As Laid Depth Profile](image-url)
Output of Telepath® Model
Telepath® Results

• Leak located 12.3 km from the platform (+/- 0.6 km).
• Leak size increases fourfold when pressure increased from 5 bar to 24 bar.
• This suggests a circumferential or axial crack as opposed to a point defect.
Moving Forward

- Scale Inhibitor (SI) core identified as alternative for methanol supply.
- However pressure test on SI core unsuccessful – pressure drops from 330 bar to 7.5 bar in 1 hour.
- Further Telepath® work carried out on SI line.
- Excellent relationship between client & service provider – Completion of this work has enabled Shell to plan appropriate remediation work in a timely & costly effective manner.
Any Questions?