Emergency Pipeline Repair Systems; A Global Overview of Best Practice

- Brief Introduction to EPRS
- EPRS: Key Challenges Worldwide
- EPRS: Global Approaches to These Challenges
- Best Practice Comparison

James Rowley
Hydratight
Hydratight has over 20 years experience supplying engineered Mechanical Connectors:

- +2800 DNV Type Approved (permanent repair) Connectors supplied to date
- 100% leak-free in-service record
- Shallow and deepwater repairs
- Provides EPRS Clubs and products for clients EPRS systems.

Connector Subsea Solution is a diverless inspection, repair and maintenance specialist:

- Pipe lifting and handling frames
- Pipe cutting, coating removal, end preparation tools
- Flexible Inspection and Cleaning tools
- Shallow and deepwater repairs
- Provides products for clients EPRS systems.

Formal Collaborative Agreement offers a complete combined system for SURF IRM
## Subsea Pipeline Repair

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**Outcomes**
- Holes
- Cracks
- Gouges
- Buckles
- Dents
- Severed Pipe

*Typical reference: DNV-RP-F116 – Integrity Management of Submarine Pipeline Systems*
EPRS is simply the management of risk through contingency planning. Every Operator must decide their own Asset Risk Rating and prepare accordingly.
Cost vs. Response

- EPRS might include:
  - Long Lead time Products
  - All ancillary products (enable installation)
  - Repair spools and flanges (MAFS)
  - Maintenance Contract
  - Service agreements with vessel/ diver/ installation contractor
  - “Dry Run” practices

Every addition to the EPRS reduces the potential risk and **Operational Expenditure** should damage occur, but increases the **Capital Expenditure** of the system.
Maintenance & Refurbishment

- Owning Repair Equipment is not enough to mitigate risk should damage occur

- EPRS must be Fit-For-Purpose
  - Ready to mobilize
  - Documents and Procedures in place
  - Supply route (logistics) tested and proven
  - Identifiable

- Storage and Maintenance are critical
  - Seal conditions
  - Availability
  - Location
  - Fit-For-Purpose
Operator Best Practice

- Conduct their own risk assessment
  - Different Political/Geographical Considerations
  - Different resource availability
  - Field specific production rates, asset age and condition

- Identify their own technical requirements
  - Industrial design code acceptance & legislation
  - Supply chain approval
  - Installation capability
  - EPRS mobilization times and locations

- Determine their own commercial budgets
  - Industrial design code acceptance
  - Supply chain approval
  - Installation capability

- Include the ongoing storage and maintenance of their EPRS

Support obtained from third party engineering firms or direct from the vendors and suppliers
Future Considerations With EPRS

- Risers
- Pipe-in-Pipe
- Clad Pipe
- Exotic material (duplex, >X70 etc)
- Deepwater/ Remote Installation
- High Pressure
- High Temperature
- Well Fluid Composition (CO$_2$, H$_2$S)
Key EPRS Options

- “Required Response Time”:
  - Fully built Items (choice of storage locations)
  - Part built Items (stored at OEM only)
  - Materials only (stored at OEM only)

- “Location of Storage/ maintenance options”:
  - Ad Hoc (OEM contacted when required)
  - Framework (OEM fulfils contract to ensure all items remain functional)

- Maintenance restrictions:
  - Workshop/ office space
  - QHHSE Management
  - Support (technicians, lifting gear, hydraulics, test bay, machinery
Global EPRS Leaders

- **Statoil PRS**
  - Established for over 15 years ($300m investment)
  - All pipelines to be repaired remotely – 7 successful installations to date
  - Bespoke PRS team responsible for Installation systems
  - Framework agreement agreement with Hydratight to provide ALL mechanical connectors

- **Petrobras CRD**
  - Established for 10 years
  - Includes diver assisted and diverless repairs
  - Bespoke maintenance and refurb. Team

- **Gulf of Mexico RUPE/DWRUPE**
  - Established for 10 years
  - Includes diver assisted and diverless repairs
  - Managed by Stress Engineering
Case Study – EPRS Club UK

<table>
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<tr>
<th>Category</th>
<th>A</th>
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<tbody>
<tr>
<td>Pipe Size Range</td>
<td>8” – 16” #300lb</td>
<td>16” – 24” #600lb</td>
<td>24” – 28” #900lb</td>
<td>30 – 34” #900lb</td>
<td>36” (complete)</td>
</tr>
<tr>
<td>Delivery Commitment</td>
<td>4-6 weeks</td>
<td>6 – 8 weeks</td>
<td>8-10 weeks</td>
<td>10-12 weeks</td>
<td>10 days</td>
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- Low CAPEX cost ‘membership’ fee
- Low annual OPEX ‘subscription’ rate
- Tailored contingency solutions
- Guaranteed access to high quality pipeline repair equipment
- Short lead times for supply of connectors – within mobilisation times of owners
Case Study – Statoil (Norway)

- Deepwater Contingency 1000mwd
- Diverless (Remote) Connectors - 3in, 10in, 12in, 16in, 20in, 28in and 30in coverage
- Fully complete, utilising shared components across all sizes – offering considerable savings
- Maximum 18 day call off for EXW mobilization
- Maintenance and storage contract including personnel competencies for installation
- Frame agreement for future manufacturing
Case Study – ONGC (India)

- Complete connectors (8” – 36”) bought as contingency
- MAF terminations for maximum flexibility
- Bespoke storage requirements
  - Pressurized container
  - Nitrogen filled
  - c/w tensioners supplied and tested as single “system”
- Ad Hoc Maintenance
Case Study – Chevron/ Inpex (Australia)

- EPRS contract direct with Subsea7
- Chevron Gorgon and Wheatstone EPRS (4off 34” and 4off 44”)
- Inpex Ichthys EPRS (2off 42”)
- Up to 1350mwd
- Substantial lifting equipment required
- Ground conditions soft and on gradient
- Storage and maintenance in-country
Best Practice Comparison

• Shallow and deepwater are considered as only one scope, with the benefits of high experience exchange, short operational mobilization time, cost reduction; among others advantages.
• Actual and new pipeline scopes to be covered in the ongoing EPRS through development and delivery clauses for new demands.
• New technologies and developments also covered through technology development and upgrade clauses.
• Worldwide deployment through specific logistics.
• Frame agreement for future manufacturing.