Subsea Expo 2016

Remote Riser Cleaning & Inspection

Hydratight

In collaboration with
Connector Subsea Solutions

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Overview

- Brief Business Introduction
  - Hydratight
  - Connector Subsea Solution
  - SURF IRM Collaboration Agreement

- Riser Integrity Management

- Design Consideration

- Operational Challenges

- Lessons Learnt

- Moving Forward
Hydratight Overview

Part of the Actuant Corporation ($1.3B), Hydratight is a world leading engineering company who provide a range of specialist products and services to the Oil & Gas and Power Generation industries. Since 1901, our aim is to maximise safety and improve operational efficiency by supplying products and services that provide safe, reliable connections.

Subsea Pipeline Inspection, Maintenance & Repair Solutions:

- Mechanical Connectors, Clamps, Split nuts and remote bolt tensioning equipment
- Supplied worldwide over 20 years
- Repair, contingency, tie-in & construction for critical and non-critical applications
- Product DNV Type Approval for permanent pipeline repair
- 100% leak-free in-service record
**Connector Subsea Solutions** is a technology leading company who provide complete deepwater inspection, maintenance and repair solutions for risers and flowlines. Since 2000, Connector has focused on supplying innovative, reliable and cost effective solutions to deepwater challenges.

**Diverless Pipeline Inspection, Maintenance & Repair Solutions:**
- Pipeline lifting and handling tools
- Coating and weld seam removal tools
- Pipe cutting tools
- Pipe end preparation and bevelling tools
- Lightweight and small footprint pipeline repair connectors
- Structural and leak sealing clamps
- Safety Clamps
- Riser cleaning and inspection tool
- Flexible Pipe Retrieval Tool
- Flexible Pipe Protection and Repair
Joint Collaboration

- **Formal Collaborative Agreement (signed May 2014)**
  - **Multiple peer contact**, ensuring an integrated alignment through all aspects of the business
  - **Fully Integrated offering**, reducing operation risk and optimizing delivery
  - **Profit Sharing**, ensuring lower cost solutions
  - **Combined technical offering**, providing over 45 years of subsea expertise in pipeline repair products and services.

- **Collaboration offers a complete combined system for SURF IRM including:**
  - Horizontal and vertical repair systems
  - Pipe handling and lifting tools
  - Pipe coating removal and end preparation
  - Mechanical connectors and clamps
  - Subsea power and control modules
  - ROV Customized and special tooling
  - Riser cleaning and inspection
Riser Integrity Management

Continuous process applied throughout the life cycle

Planning-Operation-Monitoring-Inspection-Repair-Maintenance

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The Challenge

- Risers are critical elements of the subsea infrastructure
  - Exposed to dynamic loading
  - Impact to flexibles can cause damage to outer sheath leading to water ingress and further damage
  - Visual inspection limited by surrounding infrastructure and cleanliness
  - Sea growth will affect the weight and dynamic response which can increase fatigue

- As the industry pushes further into deeper water developments, the technical demands (and associated risks) for the riser system increase, leading to an increased requirement for complete Riser Integrity Management
Brazil Operator needed a solution provider to develop a riser cleaning option:

- May be powered by ROV ~206bar @ 50l/min = 17kW
- Any cleaning mechanism
- Shall not damage flexible
- Cover flexibles of size 2.5", 4", 6" and 10"
- Cleaning from 200m upwards
- Buoyancy – close to neutral
- May be operated through ROV
- Automatically detach from riser in case of power loss

- Marine Growth:
  - “Soft fouling offering low resistance and body composed on bacteria and algae”
  - “Wide spread hard fouling organisms such as barnacles made by crustaceans that offer major resistance to mechanical removal”
• Limited scope of work providing no information on marine growth composition (Corals turned out to be present in addition to design basis assumptions)

• Opportunity to develop a bespoke solution to meet the challenges

• 3 stages envisioned:
  – Riser Cleaning Tool
    Efficient cleaning and movement along riser
  – Riser Cleaning and Inspection Tool
    Adding inspection capabilities
    • Visual
    • CP probes
    • UT/NDT
  – Self propelled Riser Cleaning and Inspection Vehicle
    Thrusters incorporated – No ROV support or interface required
Stage 1 – Remote Riser Cleaning

- Water Jetting chosen as primary cleaning technology
- Extensive track record
- Wide scope achievable through adjustment of:
  - Distance between nozzle and pipe
  - Angle between nozzle and pipe
  - Water pressure
  - Water flow
  - Various nozzle types – Turbo nozzles, Cavitation nozzles, etc

- Fine tuning these parameters required to get efficient cleaning without damaging flexible
After extensive testing, the water jetting parameters for the tool was created (conservatively) but with modification and adjustments possible.
Remote Tool Carrier

- Composite structure with buoyancy
- Dedicated umbilical (7t) with 95kW power transmittal
- Dedicated (ROV) control system to enable future functionality
- Tool carrier enabling multiple options for cleaning and inspection
  - Water jets with various nozzles
  - Mechanical cleaning tools
  - Visual Inspection capability (6 cameras)
  - Rotating heads for 360-degree coverage
  - Mount points for bespoke inspection
- 4 wheel serial drive
  - “Out of water” operation
  - Overcome vertical wave loads
  - Access splash zone
  - Large pipe OD Range (100 - 400mm)
- Containerised for mobilisation
Factory Acceptance Testing

- Cleaning function test (top and bottom mount points)
- Connection / Disconnection with Riser
- Wheel drive up/ down
- Driving over bumps (35mm circumferential “bump” on 250mm diameter riser)
- Power cut – Emergency release
- Climb test
- Drop test
Mobilization

- Containerised
  - Workshop area
  - Tooling
  - Winch & umbilical's
  - Operations room

- Suitable for variety of vessels and geographical locations
Deployment and Operation

12-month development contract for deployment, operation, refurbishment and upgrade.
Challenges encountered

Deployment and Retrieval

- Congested work zones, ROV tethers can get caught & twisted
- Challenge for ROVs to manipulate without heave compensation
- Reprioritisation of Vessel
- ROV downtime, repair and maintenance

Cleaning and Inspection Operation

- Many different categories of sea growth required specialist calibration of water pressure cleaning methods
- Debris and resulting robustness of fittings

Potential Solutions

- Simplify ROV/RCIT interface; or
- Eliminate need for ROV
- Develop various mechanical cleaning technologies
- Include additional mount points for redundancy
Upgrades

- Class 7 Bucket – Stinger for easy handling and manipulation by ROV – Elimiated need or manipulators
- Additional mechanical cleaning tools for soft and hard marine growth
- Optimized water jet cleaning
- Additional cameras for inspection capability
Lessons Learnt

Experience provides understanding and knowledge regarding:
- Marine growth types and characteristics
- Efficiency and parameters of cleaning methods
- ROV - RCIT handling
- RCIT – operations – deployment - retrieval
- RCIT maintenance procedures
- Riser Inspection requirements

- Accurate information on sea growth will ease operation and reduce tooling adjustment
- Good quality ROVs with experienced operators aid deployment time
  - ROV tether liable to get stuck
  - ROV failures (hydraulics) limit operation
- Consideration for sea growth waste
ROV Mounted Remote Riser Inspection & Cleaning Tool

- Robust tool carrier with flexible interface to deploy a range of tools, on a range of pipes and flexibles
- Track record with inspection and cleaning
- Capable of cleaning to CVI quality @ 60 metre per hour
- Deployable in 2.5kt currents
Self Propelled RCIT now under development

- Same functionality and mobility as current tooling
- Removes requirement for ROV interfaces (reduces risk to operation windows)
- Suitable for regions where vessel availability is limited
Questions?