Blind Faith Tails Tie-In

Huy T. Phan, Williams
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Agenda

- Animation – Blind Faith Subsea Tie-In

- The Challenges
  - Combining new construction and pipeline repair techniques

- Project Objectives

- Solutions Considered
  - Key Components of Solutions

- Testing and Installation

- Lessons Learned / Summary
Animation – Blind Faith Subsea Tie-In
The Challenges

- On bottom connection to bare pipe (subsea intervention)
  - Connector type
  - Removing weld seam / FBE
  - Cutting and pipe end preparation

- New Construction
  - PLEM Structure – Size and Weight
  - Offset angle between existing and new pipeline
  - Tooling and pipe support structures

- Jumper Installation
  - Horizontal vs. Vertical
  - Gantry Frame System
  - Alignment Issues
  - Vessel availability
Project Objectives

- Successful subsea intervention – But How?
- Really, It’s a Juggling Act

Diagram:
- Success
- Cost
- Schedule
- Quality
- Design
- Manufacturing
- Operability
- Ease of Installation

Cost
Schedule
Quality
Original Concept: Basic - But Complex

- **Pros**
  - Similar to contractors previous experience
  - Smaller individual nodes
    - Smaller individual vessel
    - More vessels available

- **Cons**
  - Seven (7) sealing elements
    - 3 HSF (elastomeric seal)
    - 2 Telescoping Joints
    - 2 Hydraulic Ball Joints
  - Three (3) subsea installations
  - Greater cost
Revised Concept – Better, But Not Quite

Pros
- High integrity metal to metal seal connection
- 2 installation packages
  - Pipeline end sled (PLES)
  - Jumper Spool

Cons
- Seven (7) sealing elements
  - 3 Grayloc Connections
  - 1 Hydraulic Smart Flange (HSF)
  - 1 Telescoping joint
  - 2 Hydraulic Ball Joints
Near Final Solution: See the light

Alignment Issues
• Jumper Type
• Tooling

FIELD LAYOUT

LIFT FRAMES

Blind Faith

GL  GL-R  MAB  GL-R  SMART FLANGE
Where’s the Key to the Final Solution?

Alignment
Compliant Jumper
Tooling Suite
FAT / SIT
Final Solution – Alignment Methods

- **Guide Pins**
  - Fine Alignment

- **Translation**
  - Coarse Alignment

- **Stabbing**
  - Guide
  - Stab Pin
Final Solution – Compliant Jumper
Final Solution – Tooling Suite
Testing – SIT Sequence 1/3

Sequences:
1. Set up yard
2. 300’ of 18” pipe
3. PLF set in place
4. Pick up pipe
5. Set PPS
Testing – SIT Sequence 2/3

**Sequences:**

1. Set HSF mat
2. Set HSF
3. Annulus Test
4. Set Grips
5. Land Jumper
Sequences:
1. Stab pin on PLEM side
2. Land HSF end
3. Extend Bowstring
4. Make up PLEM
5. Extend Bowstring
6. Make up HSF end
Installation – Phase 1

Sequences:
1. Cut Tails
2. Install pressure plugs
Sequence:
1. Lift tails
2. Install PPS’s
3. Install HSF mats
Sequence:
1. Ovality
2. Weld seam
3. FBE
4. Straightness
Installation – Phase II 3/3

**Sequence:**
1. Final cuts
2. End prep
3. Install HSF’s
4. Annulus tests
5. Metrologies
Installation – Phase III 1/2

**Sequence:**
1. Fabricate
2. Test
3. Load
4. Seafasten
Installation – Phase III 2/2
Lessons Learned 1/2

- Company and Contractor Interface Meetings
  - Williams • Oceaneering • Blue Water Technologies • OPE
  - Saipem • C&C Technologies • Global Industries

- Order equipment early in process
  - Plan for and expect delays

- FAT
  - Full FAT before start of SIT

- Finite Element Analysis / Load Testing

- SIT

- Have a Plan but be Flexible
Lessons Learned 2/2

- Installation and ROV Contractors of opportunity / interface issues
  - Vessel of opportunity
    - Vessel Size
    - Weather-ability
    - Crane capacity
  - ROV of Opportunity
    - Hydraulic capacity / circuits
    - Electrical capacity / circuits
    - Interface software

- Metrology Verification
  - What went wrong
  - How to avoid – Validation
    - Tolerances
    - Data
Summary

- Successfully connect the Blind Faith and Devils Tower Export Pipelines

- Proven Technology – New Packaging
  - Horizontal Compliant Jumper
    - Minimum deflection – minimum stress
    - Bowstring
    - Connectors
      - Strong as the pipe
      - No running tool required
      - Lightweight connector
  - Tooling
    - Purpose built multi use

- Williams PERK (Pipeline Emergency Repair Kit)
Speaker and Co-Authors Contact

- **Huy T. Phan**
  - Williams Field Services
  - Office: 713-215-3167
  - Cell: 281-660-9671
  - Email: huy.phan@williams.com

- **Oran Tarlton**
  - Blue Water Technologies, LLC
  - Office: 713-215-3695
  - Cell: 713-724-0449
  - Email: oran.tarlton@bluewatertech.net

- **John Charalambides**
  - Oceaneering International
  - Office: 713-329-4962
  - Cell: 832-368-4543
  - Email: jchara@oceaneering.com