Future Ultra Deepwater Umbilical Technologies

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London - November 12th 2013
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What is an Umbilical?
What is a Subsea Umbilical…?

- Fluid Conduits
  Thermoplastic Hose
  Or Steel Tube

- Electrical Cables

- Fibre Optic Cables

- Polymer Fillers

- Protective Outer Sheath
Umbilicals – Product Mix

- Thermoplastic
- Steel Tube
- Power Cable
Technip Umbilical Systems

- Newcastle, UK
- Steel, thermoplastic and electrical umbilicals

- Houston, US
- Steel and electrical umbilicals

- Lobito, Angola
- Steel and electrical umbilicals

- Johor, Malaysia
- Thermoplastic and electrical umbilicals

- Global Presence – four continents
- Project management know-how
- Dedicated R&D Centre
- Pioneering Technologies

Developing pioneering umbilical solutions for over 30 years
Ultra Deepwater Umbilical Study
Ultra Deep Water Study – Technology Challenges

- Ultra Deep water presents a number of key challenges,
  - Design:
    - Fluid Pressure, Water Depth, Fluid, Tube Stress
  - Manufacture:
    - Assembly Machine Capability
  - Installation:
  - In service conditions:
    - Stress Utilisation, Environment, Buoyancy, Vessel Type, Fatigue
Ultra Deep Water Umbilical Design

Future Umbilical Challenges

- **Ultra Deep Water Umbilical Design Study**
  - Predict future umbilical requirements
  - Deeper water 3000m+
  - Harsher environmental conditions – greater fatigue requirement
  - Identify technology gaps

- **R&D and New Technology Projects**
  - Strength Members & Evolving Joints
  - High Strength Aluminium Power Cables
  - Deep water thermoplastic umbilical
  - Smart Umbilicals
  - MQC Stab Plate
  - Compressi-Grip
  - Investment into Manufacturing Capabilities
Quality of R&D Execution

Technology Readiness Levels

- Structured and quality driven process focused on mitigating risk and build reliability
- Based on industry recognised best practice
- Progress monitored and approved by senior management
- Ensures new technology is market ready
Future Ultra Deepwater Technology
Strength Members and Evolving Joints – TRL7

- High Strength Steel Strength Members
  - Technical Qualification included;
    - Tensile strength
    - Fatigue capacity
    - Corrosion resistance

- Evolving Joints
  - Mechanical joint mid-line in umbilical
    - Dynamic – load bearing capability
    - Static – low cost, light weight, polymer

Commercial Benefits;
- Optimisation of Dynamic umbilical
  - Bias strength towards hang-off
  - Strength added where needed
- Optimised umbilical weight.
  - Minimise weight for storage & transport

First project deployed in GOM.
Aluminium Power Cable Innovation – TRL4

### High Strength Aluminium Power Cables
- Light weight, high corrosion resistant aluminium conductor.
- Load share capability.
- Extensive risk based technology qualification program, including:
  - Corrosion, Fatigue, Electrical, Splicing, Termination

### Commercial Benefits:
- Water depth capability > 3000m
- Superior reliability at any water depth
- Greater fatigue capacity
- Reduced electrical stress
- Dynamic mass can be optimised
Aluminium Power Cable Innovation – TRL4

Limitations of Conventional Technology

Conductor Material → Ratio → Tensile Material

0

DAF=1.5

DAF=1.3

DAF=1.1

Water Depth (m)

Increasing Dynamic Service

Technology Challenge

- Static Service (Installation)
- Quasi-dynamic Service (SPAR, TLP, etc.)
- Dynamic Service (FPSO)

North Sea
West Coast of Africa
Gulf of Mexico

Technip Umbilical Systems
Deep Water Thermoplastic Hose Developments

- **Deepwater umbilical challenges;**
  - DUCOflex – ultra low permeation liner – TRL8
  - Higher working pressure – TRL3
  - Higher collapse resistance – TRL2

- **Challenges for Arctic Service**
  - Greater temperature range, hotter & colder – TRL5
  - Temperature management

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**Commercial Benefits**
- Experience of near Arctic projects.
- Expanded temperature envelope.
- Higher working pressures.
- Greater water depth capability.
- Robustness for dynamic service.
Smart Sensing Umbilicals – TRL5

- **Fibre optic sensors**
  - Temperature sensing, Strain monitoring.
  - TUS can support sensor systems.
  - Synergies with Flexible Pipe & Cybernetix
- **Retro-fit position monitoring device**
  - Clamped to umbilical below bend stiffener.
  - Full scale dynamic fatigue test undertaken.

**Commercial Benefits**
- Record actual response to service conditions;
  - Hotspot monitoring of power cables.
  - Position monitoring during extreme storm events.
  - Feedback loop for operation optimisation.
Multi-Quick Connect Stab Plate – TRL5

- **Light weight and Compact MQC Stab Plate**
  - Connector for flying lead and jumper umbilicals
  - Developed in conjunction with Technip ROV experts
  - Extensive full scale test programme including:
    - Hyperbaric mating and de-mating
    - Misalignment mating
    - Impact and vibration loadings

- **Commercial Benefits:**
  - Easier manipulation by ROV subsea.
  - Greater out-of-alignment mating capability.
  - Robustly protects couplers from damage.
  - High clamping force
  - Wide choice of coupling sizes.
Investment into Manufacturing Capabilities
A World-class Steel Tube Umbilical Plant

Compliments existing Thermoplastic Umbilical plant
Summary
Summary

- Future Ultra Deepwater Umbilical Challenges
  - Deeper water.
  - Longer lengths.
  - Greater fatigue capacity.

- Pioneering Umbilical Technology Solutions
  - Strength member & Evolving joints – tensile strength optimisation
  - Aluminium power cables – greater reliability in deep water
  - Arctic service readiness – pushing the operating envelopes
  - Design flexibility – ISU® LBCT and hybrid umbilicals
  - Smart umbilicals – providing essential feedback to enable operational optimisation
  - MQC Stab plate – robust and easy to install
  - Manufacturing capability – world class steel tube facility

Taking umbilicals further...
Thank You