RPSEA PROJECT DW 2301

ULTRA-DEEPWATER RISERLESS INTERVENTION SYSTEM (RIS)

DTC International, Inc.
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Houston, Texas 77041

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RIS PROJECT TEAM MEMBERS

- DTC International, Inc.  Project Management & Engineering
  - Dana Beebe  Project Manager
  - Bill Parks  Technical Lead & Subsea Lead
  - Margaret Buckley  Controls Lead

- Superior Energy Services  Wireline Operations/Services

- NOV Texas Oil Tools  Wireline Intervention Equipment

- Deepwater Research Inc.  ROV/Tooling & Vessel Operations

- ROV Company – TBD  ROV Interfaces & Operations

- Rick Smith (Consultant)  Risk & Safety Analysis/Management

- Det Norske Veritas (DNV)  Third Party Verification/Certification
RPSEA Goals & Objectives

- Reduce the Cost of conducting Wireline Intervention Operations on Subsea Wells by 50% or more

DTC Goals & Objectives

- Shorten the Planning and Preparation Time for Wireline Intervention Operations
- Reduce the Need for Reallocation of Critical Resources from Other Projects
- Reduce the Risk of Equipment Damage, Loss of Well Control or Discharge of Fluids to the Environment
- Increase the Operating Envelope for Conducting Wireline Intervention Operations
- Be Applicable for Use on ≥ 80% of Subsea Wells in the Deepwater and Ultra-Deepwater Gulf of Mexico
- Develop Standardized Interfaces between the RIS & Subsea Tree
RIS PROJECT STATUS

- Kick-Off Meeting Held on 6 Jan
- Task 1 – Project Management Plan Submitted 11 Feb
- Task 2 – Technology Status Assessment Submitted 15 Feb
- Task 3 – Technology Transfer Plan Submitted 15 Feb
- Task 4 – Routine Reports & Other Activities
  - Project Team Meetings
    - Kick-Off Meeting Held 11 Feb
    - Team Meetings Held every 2 Weeks
  - Project Status Reports
    - Status Report #1 Submitted 18 Feb
    - Status Report #2 Submitted 18 Mar
- Task 5 – System Architecture and Design Basis in Process
TECHNOLOGY STATUS ASSESSMENT

- **15 Riserless Intervention Systems Identified**
  - 12 Operational
    - Blue Ocean Technologies - IRIS (1)
    - FMC - RLWI Mk1 (1) and RLWI Mk2 (2)
    - Helix Well Ops - SIL (2)
    - Oceaneering - S-SILS (1)
    - Subsea Group AS - SSL (1)
    - Superior Energy Services - SSIS (3)
    - Marine Subsea - Subsea Lubricator (1)
  - 2 Under Development
    - Expro Group - AX-S (1)
    - Schlumberger - OWWL (1)
  - 1 Developed but Never Commercialized
    - Exxon Mobil / BJ Services - SIMS (1)
TECHNOLOGY STATUS ASSESSMENT

Continued

- **Location of Operational Systems**
  - **US Gulf of Mexico** - 5
    - Blue Ocean Technologies (IRIS) - 1
    - Helix Well Ops (SIL) - 1
    - Oceaneering (SILS) - 1
    - Helix Well Ops (SIL) - 1
    - Superior Energy Services (SSIS) - 2
  - **North Sea** - 6
    - FMC (RLWI) - 3
    - Helix Well Ops (SIL) - 1
    - Subsea Group AS (SSL) - 1
    - Superior Energy Services (SSIS) - 1
  - **SE Asia / Australia** - 1
    - Marine Subsea (Subsea Lubricator) - 1
TECHNOLOGY STATUS ASSESSMENT
Continued

- RIS Operational Characteristics
  - Pressure Rating
    - 10,000 psi (14)
    - 5,000 psi (1)
  - Temperature Rating
    - > 250 °F (0)
    - 250 °F or less (15)
  - Water Depth Rating
    - 10,000 Ft (13)
    - 6,500 Ft (1)
    - 3,000 Ft (1)
  - Tree Type
    - VXT (15)
    - HXT (15)
  - Bore Size
    - 7” Nominal (10)
    - 5” Nominal (3)
    - 4” Nominal (1)
    - 3” Nominal (1)
  - Bore Configuration
    - Monobore (14)
    - Dual Bore (1)
  - Wireline Capability
    - E-Line & Slick Line (12)
    - E-Line Only (1)
    - E-Line, Slick Line & CT (1)
RIS SYSTEM ARCHITECTURE
AND DESIGN BASIS

- 12,000 ft Water Depth Rating (10,000 ft)
- 15,000 psi - Upgradeable to 20,000 psi (10,000 psi)
- 300 deg F - Upgradeable to 350 deg F (250 deg F)
- Applicable for Use on Both Vertical & Horizontal Trees
- Slick Line, Braided Line & E-Line (Upgradeable to Composite Line)
- No Connections Between RIS and Intervention Vessel
  - Subsea Wireline Winch (Battery Operated)
  - Subsea Wireline Tool Storage (ROV Assisted)
  - MODSYS® Modular Subsea Control System (ROV Retrievable)
  - Hydraulic Fluid & Chemical Supply via Production Control Umbilical or Separate Skid(s)
  - Acoustic Communication (via Subsea Transponder on ROV Cage)

- Part of a Fully Integrated Subsea Well Intervention System (SWIS)
RISERLESS INTERVENTION SYSTEM (RIS)

Intervention Control System (ICS)
- E/H MUX w/ Acoustic Communication
- Subsea Hydraulic Supply
- Subsea Electrical Supply (Battery)
- Packaged in ROV retrievable Modules

Subsea Wireline System (SWS)
- Subsea Winch
- Subsea Tool Storage & Change-Out
- Tool Catcher
- Lubricator
- Injector Head

Emergency Disconnect Package (EDP)
- Annular BOP
- Retainer Valve
- EDP Connector

Well Control Package (WCP)
- WCP RE-Entry Hub
- Production Isolation Valve (Gate Valve)
- Wireline BOP (3 Rams)
- WCP Connector
WHAT’S NEXT

- Develop System Architecture Philosophy
- Formalize Basis of Design
  - Design Requirements
  - Functional and Operational Requirements
  - Interface Requirements
- Develop System Level Drawings
  - System Level Block Diagram
  - System Level Schematic / P&ID
  - Control System Schematics
  - System Stack-Up Drawings
  - Equipment Envelope Dimensions
- Conduct Compliance Review
- Perform Risk and Safety Assessment
MODSYS® Modular Subsea Control System

Subsea Control System Components Packaged into Small, ROV Retrievable Modules
MODSYS® Modular Subsea Control System

- Multiple Applications
  - Drilling Control Systems
  - Production Control Systems
  - Intervention Control Systems
  - Acoustic Control Systems

- Modular Construction
  - SCM – Subsea Control Module
  - SVM – Subsea Valve Module
  - SRM – Subsea Regulator Module
  - SFM – Subsea Filter Module
  - SSM – Subsea Shuttle Valve Module
  - SAM – Subsea Accessory Module
  - SOM – Subsea One-Atmosphere Module
  - SBM – Subsea Battery Module
  - ??? – Other Applications

- True ROV Retrievability
MODSYS® Modules

- **SCM (Subsea Control Module)**
  32 solenoids, 28 ea ⅛” valves, filter, hydraulic reservoir, 90 pressure transducers, 10 humidity detectors

- **SRM (Subsea Regulator Module)**
  4 regulators, in combinations of piloted, hyd. controlled, large, small

- **SVM (Subsea Valve Module)**
  Either 32 ea ¼” valves, 8 ea 1” valves or various combinations

- **SFM (Subsea Filter Module)**
  Dual filtrations with bypass, pressure differential and check valves

- **SSM (Subsea Shuttle-valve Module)**
  6 large shuttle valves (or quick dump valves), 12 small shuttle valves

- **SAM (Subsea Accessory Module)**
  6 one quart accumulators, selector valve, filters, project specific components
XS™ EXtreme Service Intervention Riser with Breech-Loc™ Connector

- DTC Breech-Loc™ Connector
  - Patent Pending
  - Small Diameter (11 ¾” OD)
  - Full Bore (5 ¼” ID)
  - High Strength (1.5 MM lbs)
  - 20 ksi Working Pressure
  - 350 °F Working Temperature
  - Ti Gr-29 (110 ksi Sy)

- Simple, Robust Design
  - Only 4 parts – Upper Pin, Lower Pin, Nut & Seal Sub
  - Castellations transmit torque thru connector body, NOT nut
  - Field-Inspectable/Replaceable Seal Sub w/ redundant seals
  - Fast Make-Up (1/6 turn of nut)
  - Shoulder f/ 10 ¾” Elevators

- Titanium Riser Joint (45 Ft Length)
  - 45 lbs/ft in seawater
  - > 12,000 ft Water Depth Rating
  - Rated for H₂S Service
**XS™ EXtreme Service Drilling Riser**

with **Breech-Loc™ Connector**

- DTC’s XS™ (EXtreme Service) Drilling Riser has been developed specifically for use in Deepwater, High-Pressure / High-Temperature Applications
  - 15,000 Water Depth Rating
  - 15 ksi or 20 ksi Choke & Kill Lines
  - Temperature Rating up to 350 °F
  - Rated for H₂S Service (NACE MR-01-75)
  - Replaceable Seal Sub on Primary Riser Tube
  - Replaceable Boxes & Seal Subs on Ancillary Lines
  - Up to Six Ancillary Lines
  - Joint Lengths up to 100 Ft

- Based upon DTC’s patented Breech-Loc™ Riser Connector

- API 16R Class I (4 Million lb load rating)
  - Rapid Make-Up (1/16 Turn), Pre-Loaded Connection
  - High Strength to Weight Ratio
  - High Fatigue Resistance

- Available in 16 In and 21 In Nominal Sizes