

RPSEA PROJECT DW 2301

**ULTRA-DEEPWATER
RISERLESS INTERVENTION
SYSTEM (RIS)**

DTC International, Inc.
5540 Brittmoore Road
Houston, Texas 77041

23 March 2010

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 |

RIS GOALS & OBJECTIVES

□ 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 $\geq 80\%$ 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 -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)

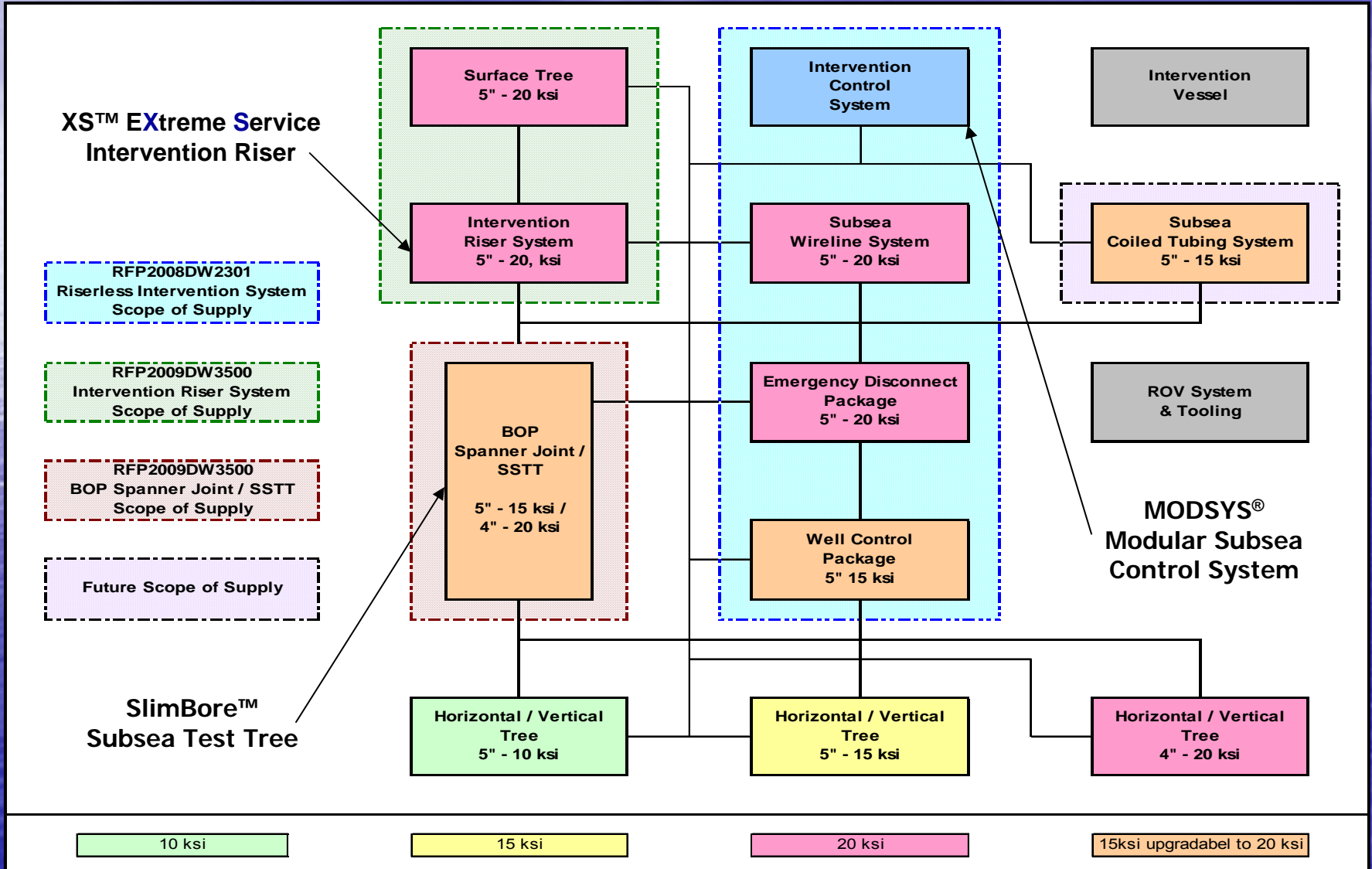
E-Line Only (1)

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)

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)

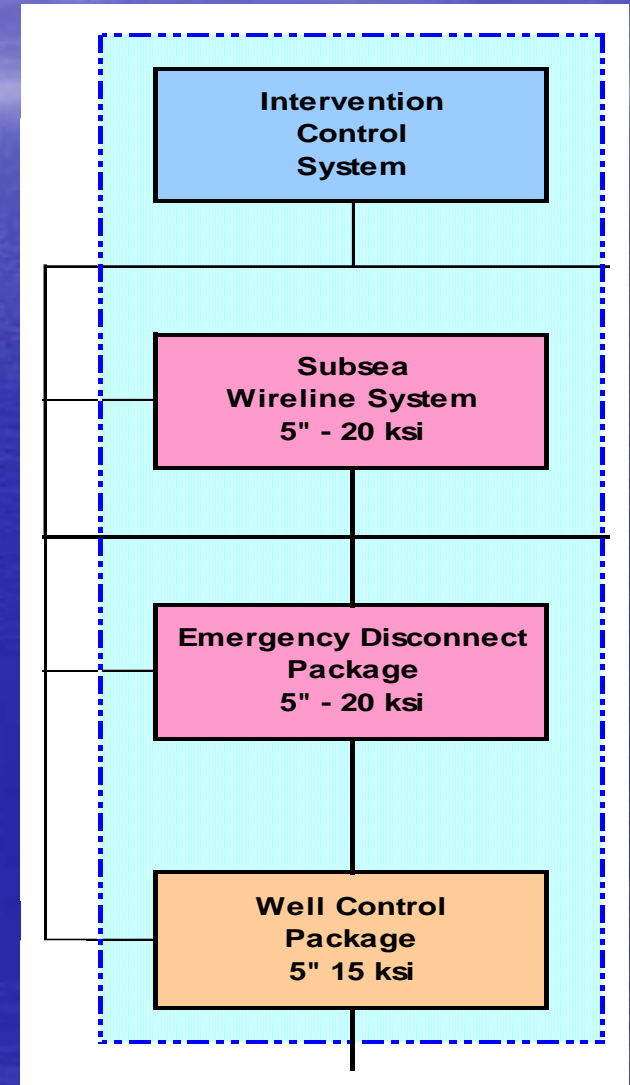
- Subsea Winch
- Subsea Tool Storage & Change-Out
- Tool Catcher
- Lubricator
- Injector Head

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



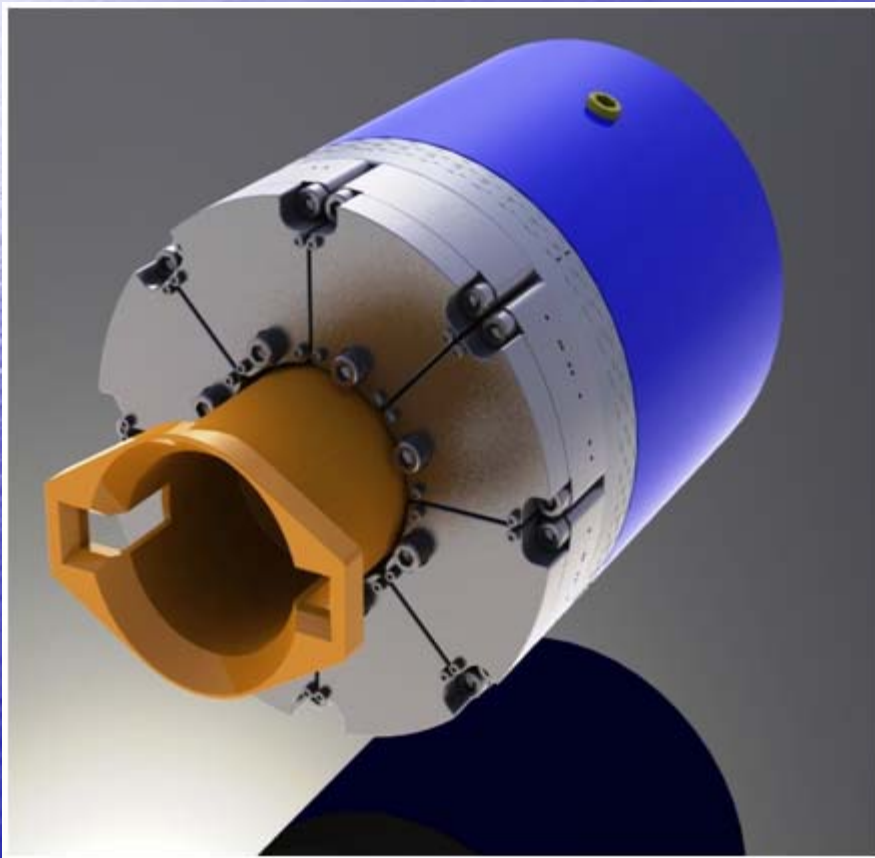
WHAT'S NEXT

- ❑ 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

QUESTIONS ?

MODSYS[®] Modular Subsea Control System

Subsea Control System Components Packaged into Small, ROV Retrievable Modules

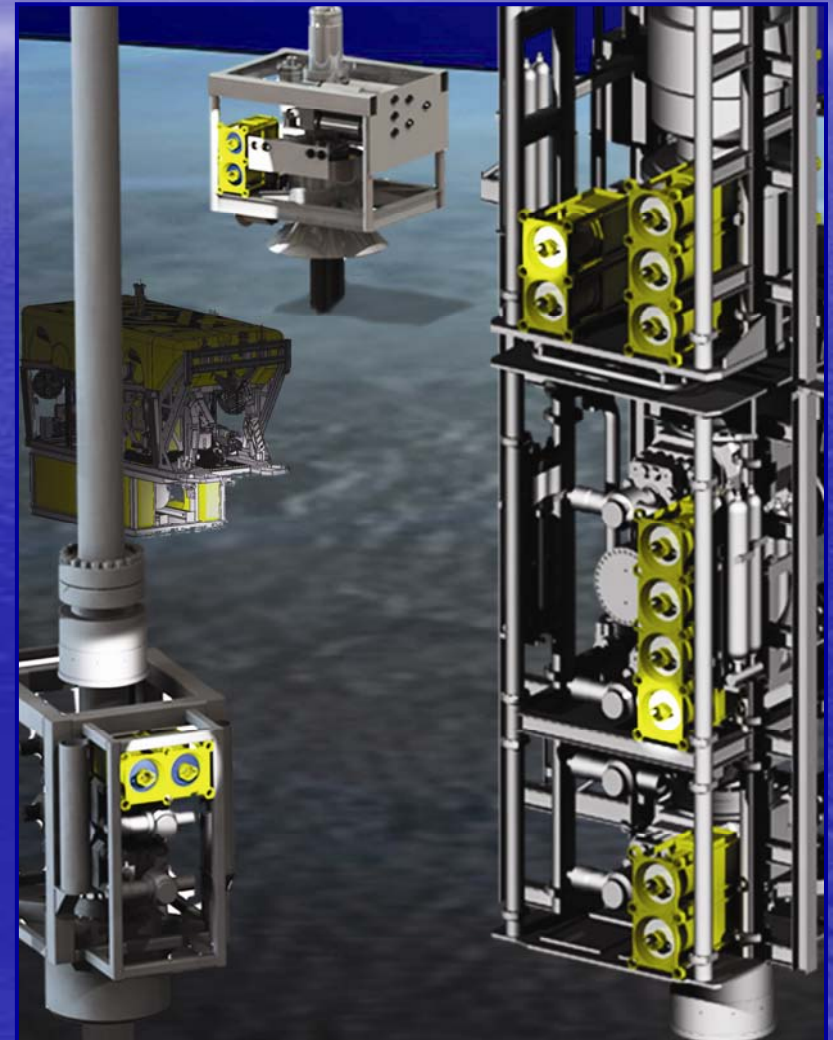


MODSYS[®] Modular Subsea Control System

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

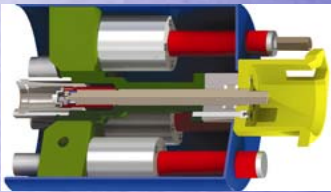
- ❑ Modular Construction
 - ❑ SCM – Subsea Control Module
 - ❑ SVM – Subsea Valve Module
 - ❑ SRM – Subsea Regulator Module
 - ❑ SFM – Subsea Filter Module
 - ❑ SSM – Subsea Shuttle Valve Module
 - ❑ SAM – Subsea Accessory Module
 - ❑ SOM – Subsea One-Atmosphere Module
 - ❑ SBM – Subsea Battery Module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

- ❑ True ROV Retrievability

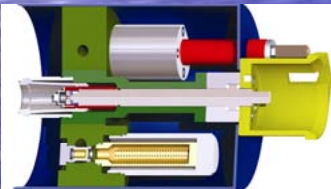


MODSYS® Modules

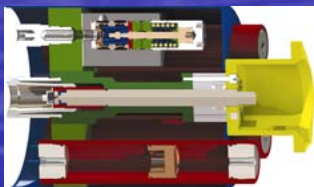
SRM



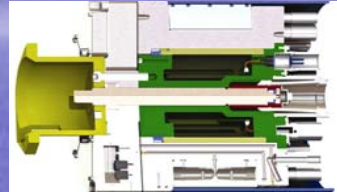
SFM



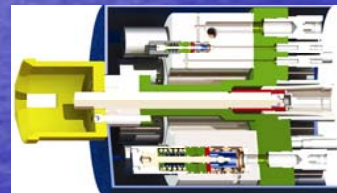
SAM



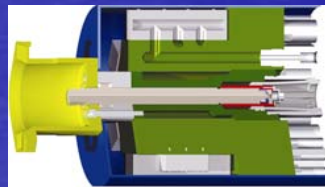
SCM



SVM



SSM



□ **SCM (Subsea Control Module)**

32 solenoids, 28 ea ¼" 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

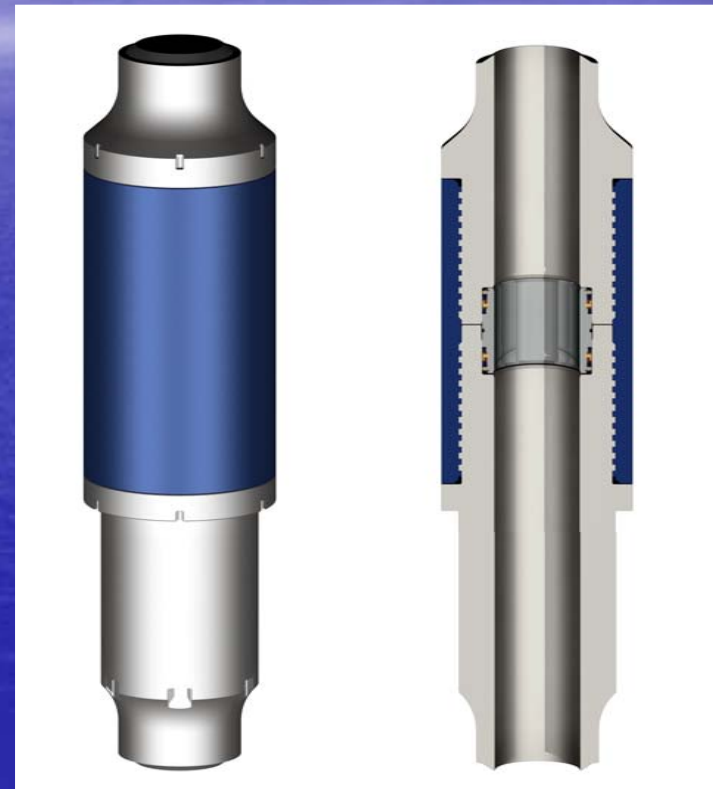
□ **SAM (Subsea Accessory Module)**

6 one quart accumulators, selector valve, filters, project specific components

XS™ EXtreme Service Intervention Riser with Breech-Loc™ Connector

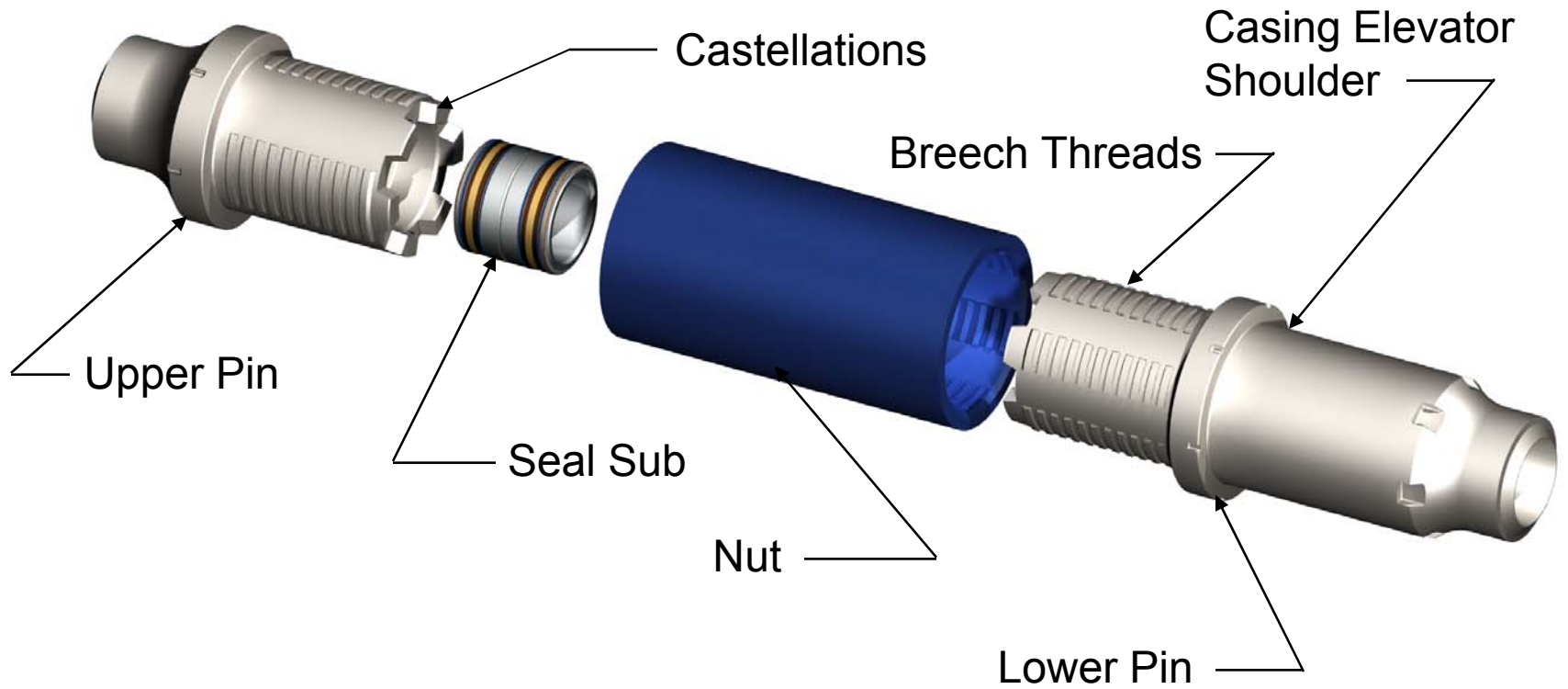
- ❑ DTC Breech-Loc™ Connector
 - Patent Pending
 - Small Diameter (11 ¾" OD)
 - Full Bore (5 ¼" ID)
 - High Strength (1.5 MM lbs)
 - 20 ksi Working Pressure
 - 350 °F Working Temperature
 - Ti Gr-29 (110 ksi Sy)

- ❑ 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

DTC Breech-Loc™ Connector



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

