

Subsea Completions Installation and Intervention

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We put you first.
And keep you ahead.

Subsea Completions



Subsea Completions Installation and Intervention

- Contents
 - Overview of various types of Installation methods and benefits of each
 - Different types of Interventions and drivers for each
 - Identify major types Installation/Intervention Tooling
 - Overview of Vertical Completion System
 - Overview of Horizontal Completion System
 - Identify major interfaces and functional requirements of tooling
- Expectations
 - After reviewing this material, the reader should have a good understanding of:
 - Tooling required for various types of Interventions/Installations
 - Technical requirements for the tooling
 - Interfaces to consider when planning an intervention/installation

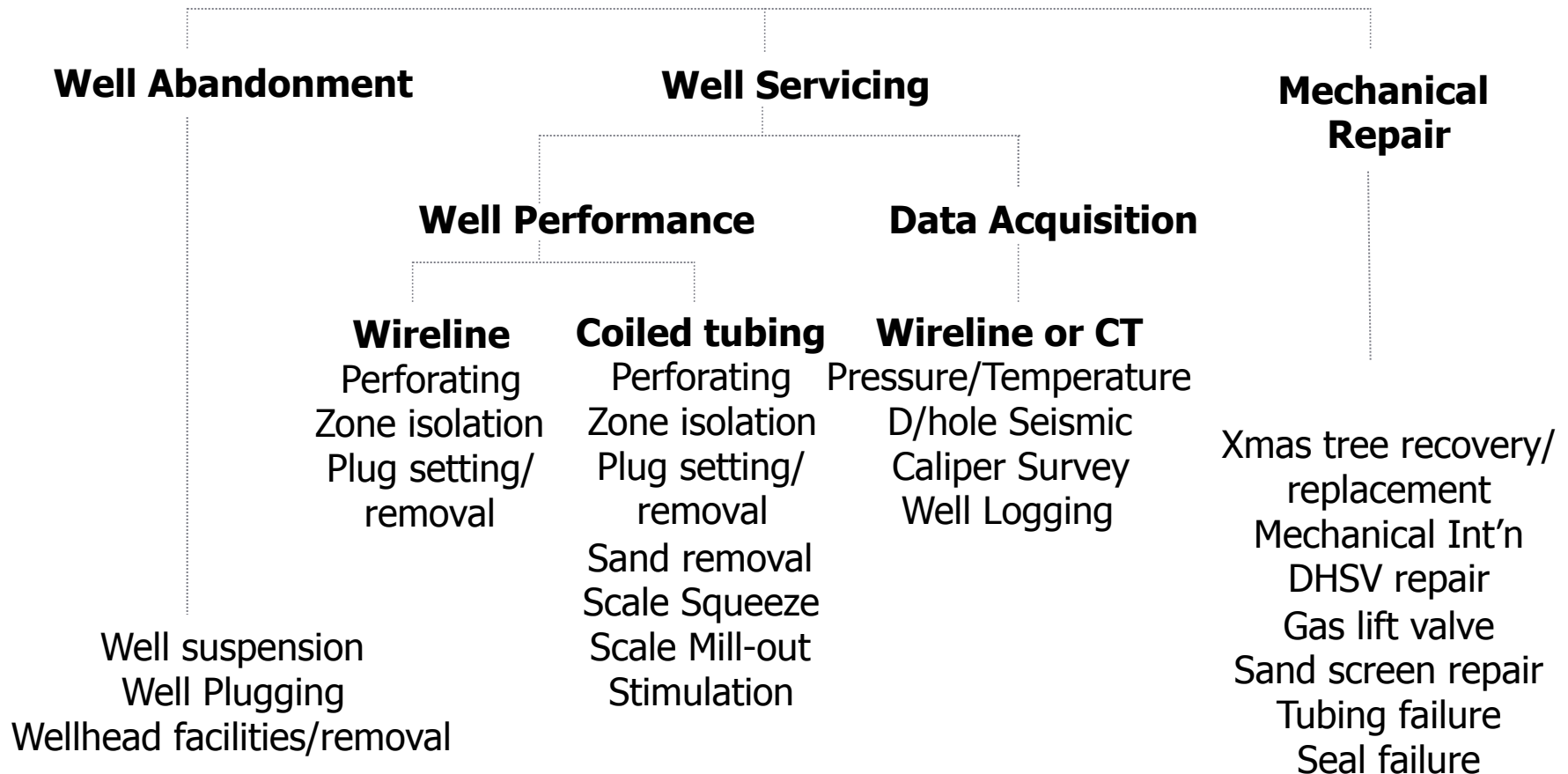
Primary Installation and Intervention Types

Type of Operation	Subsea Product	Vessel
Completions (critical path)	VXT/THS/TH, EHXT/TH, IWOCS, Riser, Warm Interventions	Rig
Completions (non-critical path)	VXT/THS, EHXT	Boat
Subsea Infrastructure	Subsea Distribution, Manifolds, Jumpers, Cold Interventions	
Topsides	HPU, Software, MCS	FPSO, Platform
DVA	DVA, SDS, Surface Trees	TLP, Spar

Warm Intervention
Cold Intervention

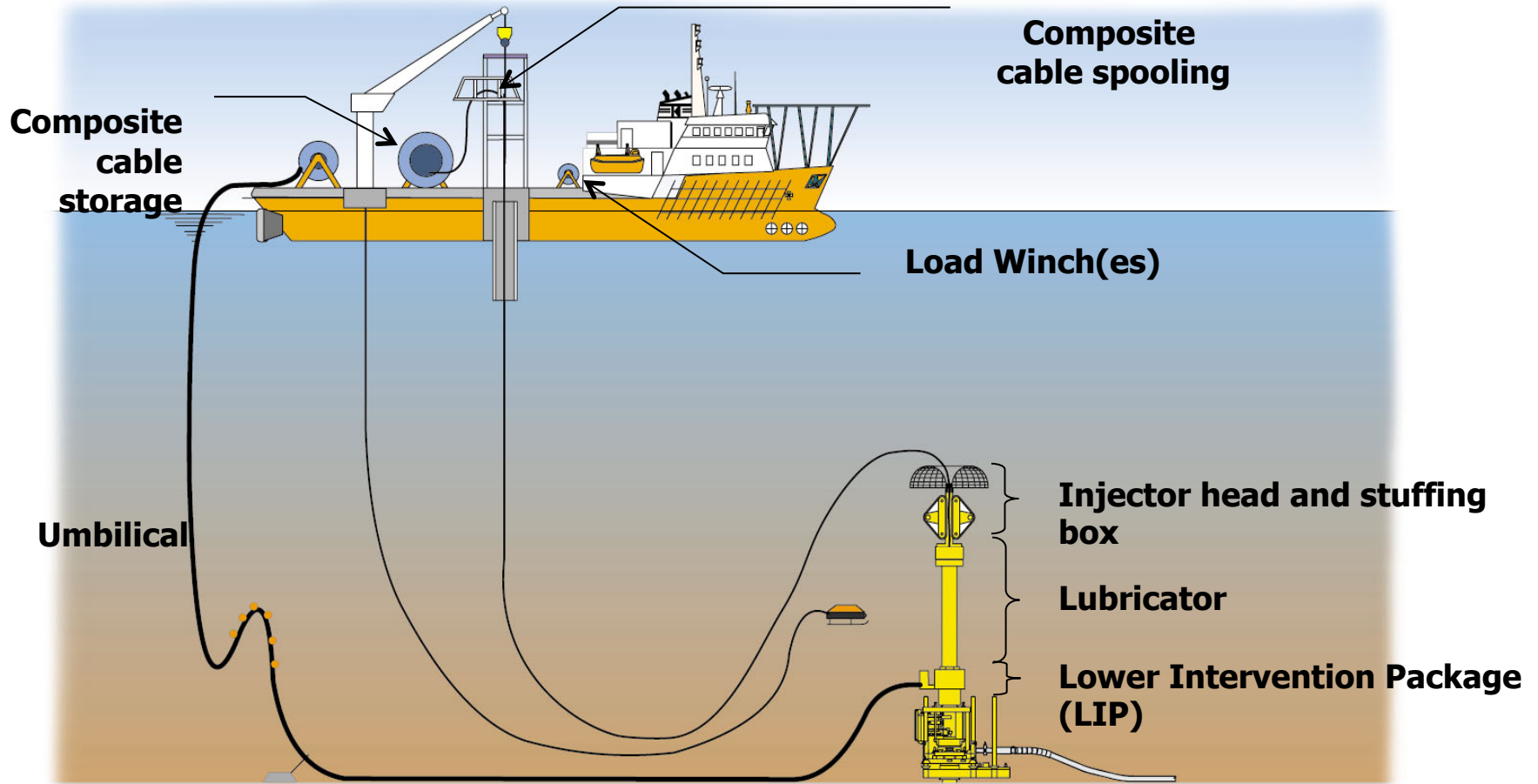
Using tooling to access the Well-bore
Using tooling to intervene not accessing the well-bore

Examples of Warm Interventions



Light Well Intervention System

New Alternative Technology and Operations



Examples of Cold Interventions

- Typical Operations
 - Removal/Replacement of Subsea Control Module
 - Removal/Replacement of Subsea Choke
 - Pressure Monitoring or Injection of Inhibitor
 - Installation of Intermediate Logic Cap (ILC)
 - Repair of Hydraulic Flying Lead
 - Manual Override of Valves
- Typical Tooling Required
 - Running and Retrieval Tool (ie, SCM or Choke)
 - ROV Tooling (Torque tool, hot stabs, HPU)
 - Winch or downline from boat or rig

Installation and Intervention Equipment

Vertical Tree System

- Tubing Head
 - Run on wire or drill pipe
- Tubing Hanger Landing String
 - THRT, BOP Spanner Joint (BOPSJ) or SSTT on drill pipe
 - Run through the Drilling Riser with Installation/Workover Control System (IWOCS) umbilical
- VXT
 - Run on winch, drill pipe, or CWOR
 - Completion/Workover Riser (CWOR) required for completion/flowback operations

Horizontal Tree System

- EHXT
 - Run on wire or drill pipe
- Tubing Hanger Landing String
 - THRT, Subsea Test Tree (SSTT)
 - Run through the Drilling Riser with Installation/Workover Control System (IWOCS) umbilical

Installation and Intervention Equipment

Purpose and Functionality

1. Provide a physical conduit to the surface to access well-bore
 - Initial installation of tree/hanger system
 - Well clean-up and flow-testing
 - Wireline work
2. Provide pressure barrier and well control capability
 - Pressure and Temperature Sensors for well monitoring
 - Circulation paths (thru annulus and cross-overs)
 - Emergency disconnect capability
 - Provide barrier to well fluids in a case

Installation and Intervention Equipment

Technical Considerations

- Equipment Specifications
 - Pressure (both annulus and production – 5ksi to 15 ksi range)
 - Water Depth rating (system valve/compensation system)
 - Temperature (up to 250 or 350)
 - Load capacity (weight of tree, water depth)
 - Drift (wireline plugs)
 - Flow rates capability (production and annulus)
 - Material compatibility (injection fluids, nitrogen, etc)
 - Well control requirements for open hole, wireline, or coiled tubing operations
 - Pressure barriers for each operational scenario
 - Disconnect capabilities for each operational scenario
 - Wireline/coil tubing shear capabilities
 - Planned/contingency recovery capability

Installation and Intervention Equipment

Technical Considerations – Vessel/Environmental

- Vessel type
 - Rig (dynamic positioned (DP) or moored)
 - Boat
- Vessel interfaces
 - Moonpool size and access, crane capacity, rotary access, derrick capacity (height and weight range), deck space, rig floor layout, pipe handling, winch size, tensioner type and size
- BOP Interfaces
 - ram types, space out, and sizes, orientation requirements, connector interface
- Environmental Variables
 - Currents, vessel motions, VIV potential, weather limitations

Completion/Workover Riser System

Vertical Tree System

System Types

- 3,000 ft capacity
 - Dual String Riser Systems
 - Composite Riser Systems
 - Integral Riser Systems
- 6,000 ft capacity
 - Concentric Riser Systems
- 10,000 ft capacity
 - Monobore Riser Systems
 - Drill Pipe Riser Systems

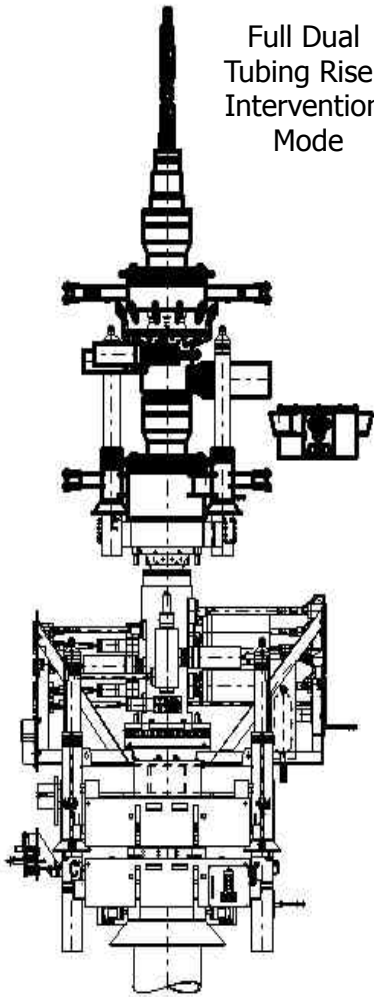
Typical System Components

- Control System (IWOCS)
- Surface Flow Tree (SFT)
- Tension Joint
- Production Riser Pipe
- Annulus Hose or Pipe
- Tapered Stress Joint (TSJ)
- Emergency Disconnect Package (EDP)
- Lower Riser Package (LRP)
- Tree Running Tool (TRT)

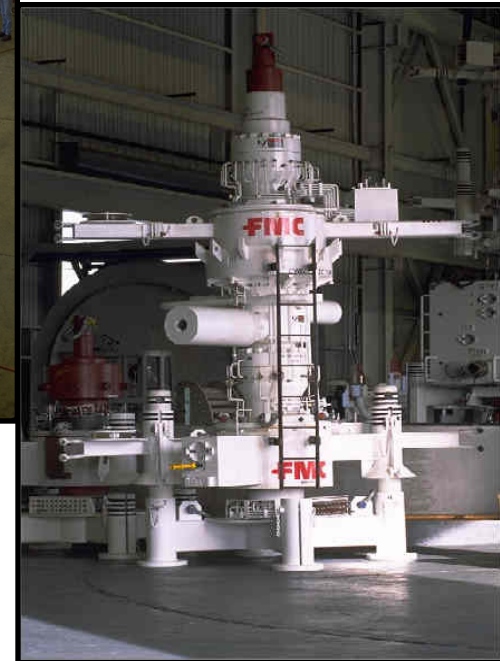
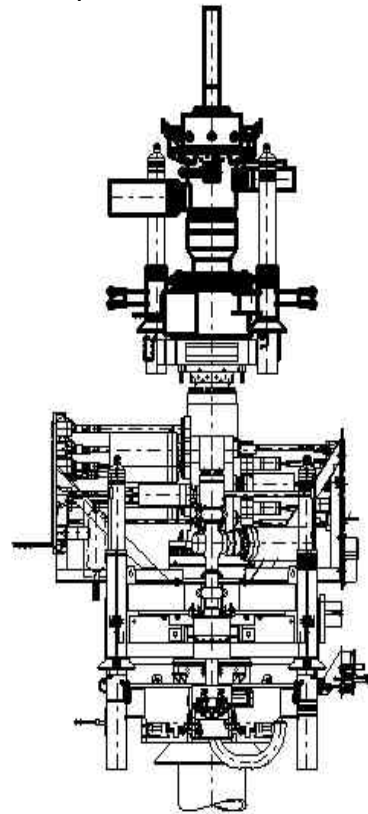
Dual Bore Riser System

3,000 ft Capacity

Full Dual
Tubing Riser
Intervention
Mode

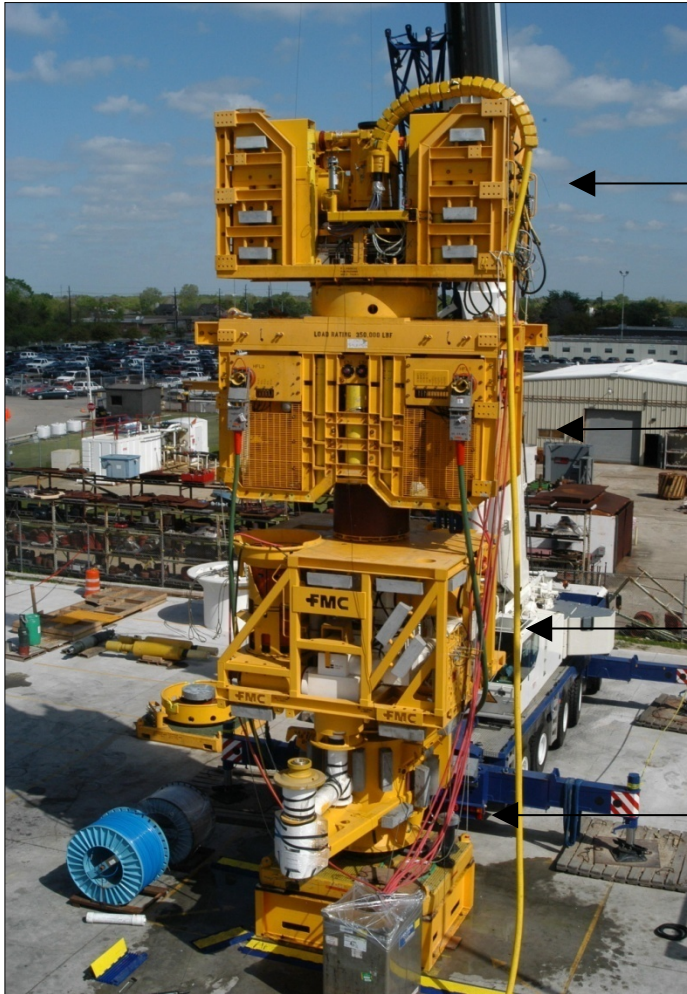


Quick Tree
Mode on Drill
Pipe



Monobore Riser System on VXT System

10,000 ft Capacity



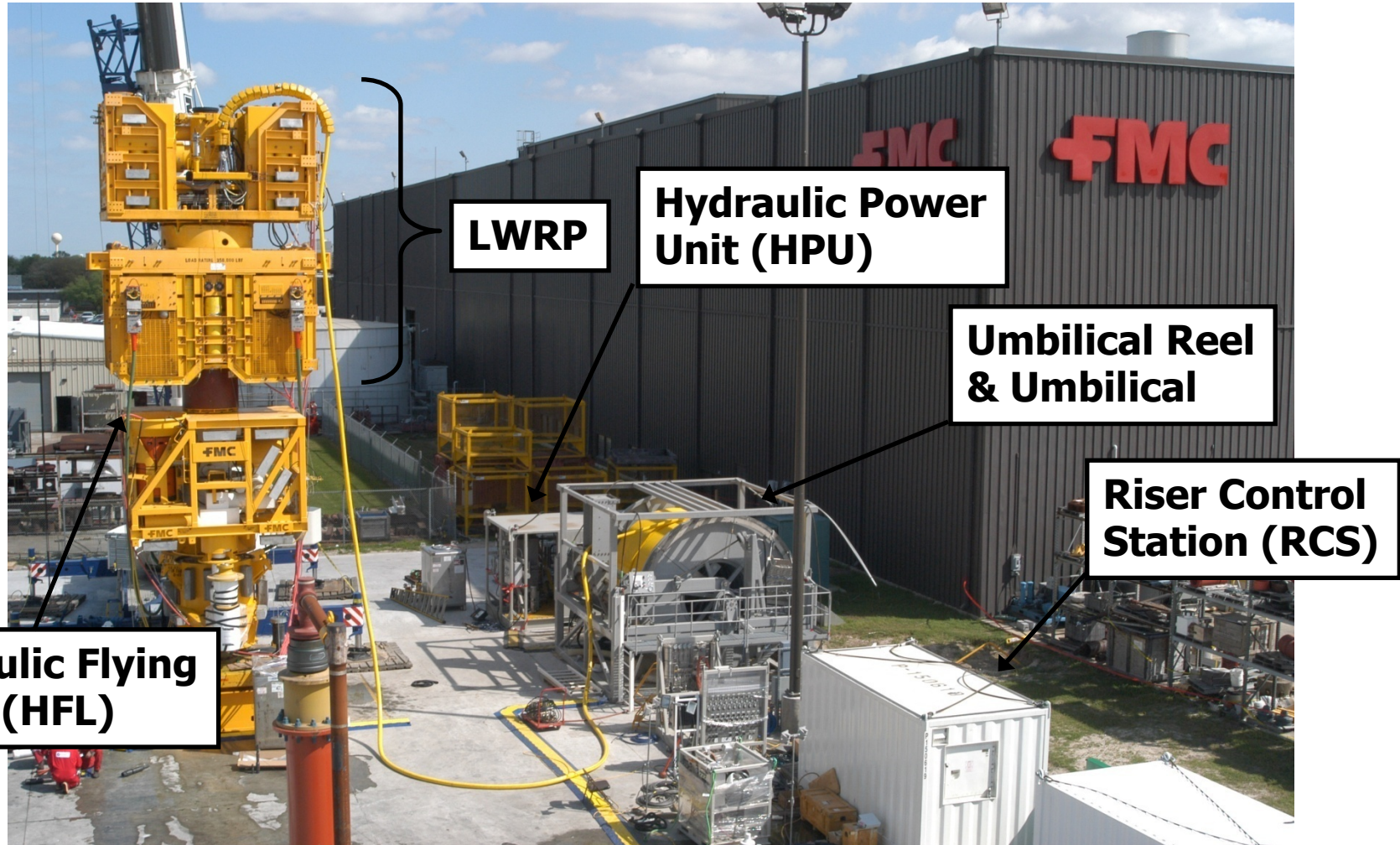
← **Emergency Disconnect Package (EDP)**

← **Lower Riser Package (LRP)**

← **Subsea Tree (XT)**

← **Tubing Head Spool (THS)**

Completion/Workover Riser System Including IWOCS



Monobore Riser System in Moonpool



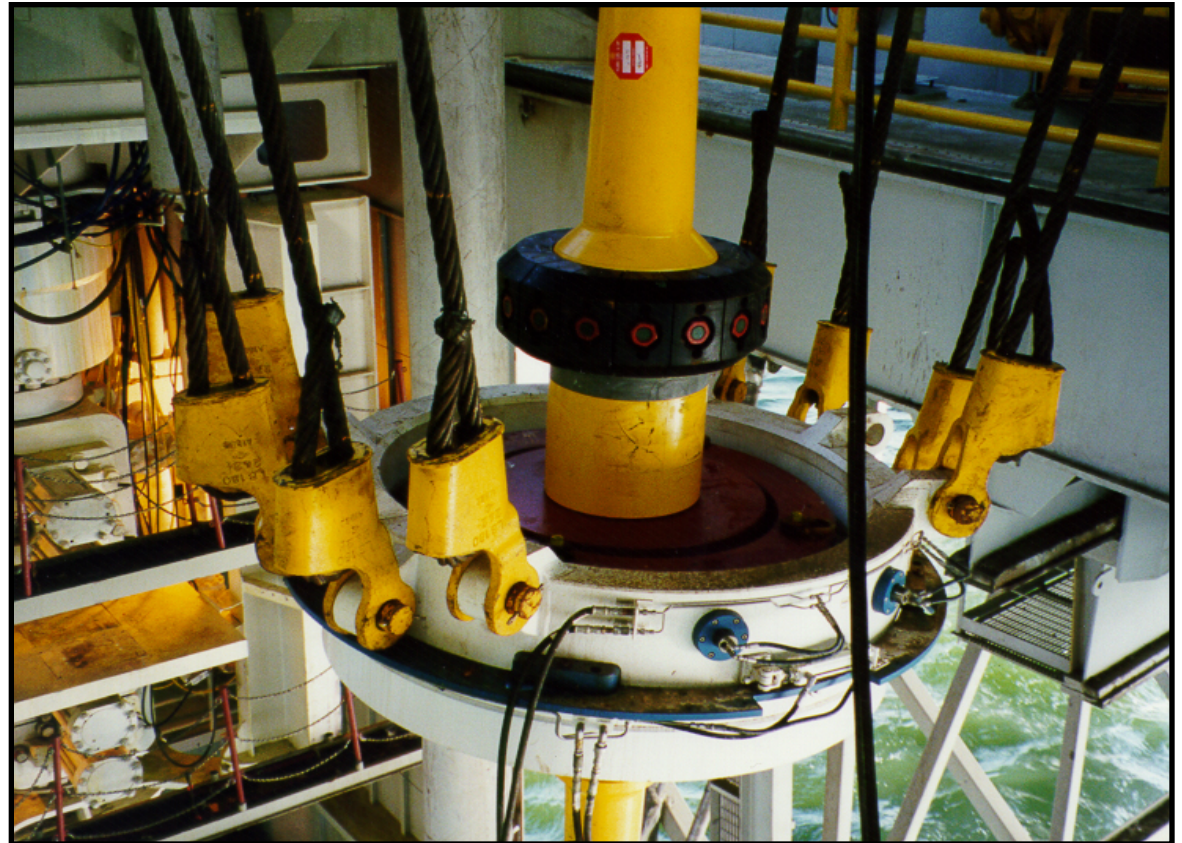
Surface Flow Tree in Derrick

- SFT Configuration
 - Vertical access for wireline and tubing
 - Annulus access for circulation
 - Production access for flow-testing
- Valves
 - Production Master and Swab
 - Production Wing
 - Annulus Wing
- Interfaces
 - Bails
 - Lubricator
 - Hoses/pipe from wings



Surface Tree & Tension Joint

**Tension joint
required to apply
top tension to open
water risers**



Riser Control Station



HPU

HP/LP Supply
HMI
Isolation



Riser Control Station

HMI, UPS, Software, EPU



Umbilical & Reel

HP/LP Hoses
Electrical Line
Isolation

Annulus and IWOCS Communication

Annulus

- Umbilical, Hose, or Pipe
 - Flow rate
 - Working pressure
 - Water Depth
- Top Side Termination
 - Rig choke/kill system
- Subsea Termination
 - Typically TSJ

IWOCS

- Hydraulic/Electric Umbilical
 - # of Hydraulic lines
 - # of Electrical lines
 - # of Fiber Optic Lines
- HPU
 - LP and HP Working Pressures
- ESD Panels
 - Location

Completion and Workover Systems

Horizontal Tree System

System Types

- 6,000 ft capacity
 - Direct Hydraulic SSTT
- 10,000 ft capacity
 - MUX SSTT

Typical System Components

- Control System (IWOCS)
 - Internal (SSTT)
 - External (Subsea Tree)
- Surface Flow Tree (SFT)
- Landing string (typically tubing or casing)
- Subsea Test Tree (SSTT)
- Tubing Hanger Running Tool

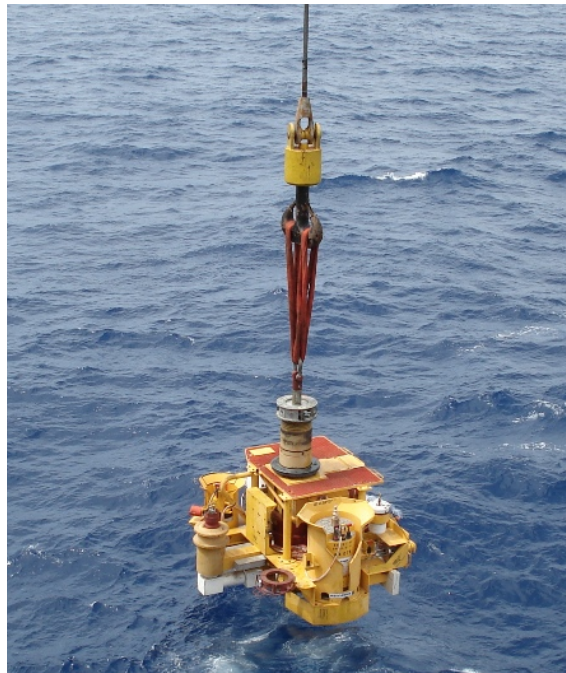
EHXT in Moon pool for Deployment on DP



EHXT Installation Tool Options



**18-3/4 Cam Tree
Running Tool**



**Mechanical Tree
Running Tool**



**Hydraulic Stab Tree
Running Tool**

IWOCS Equipment

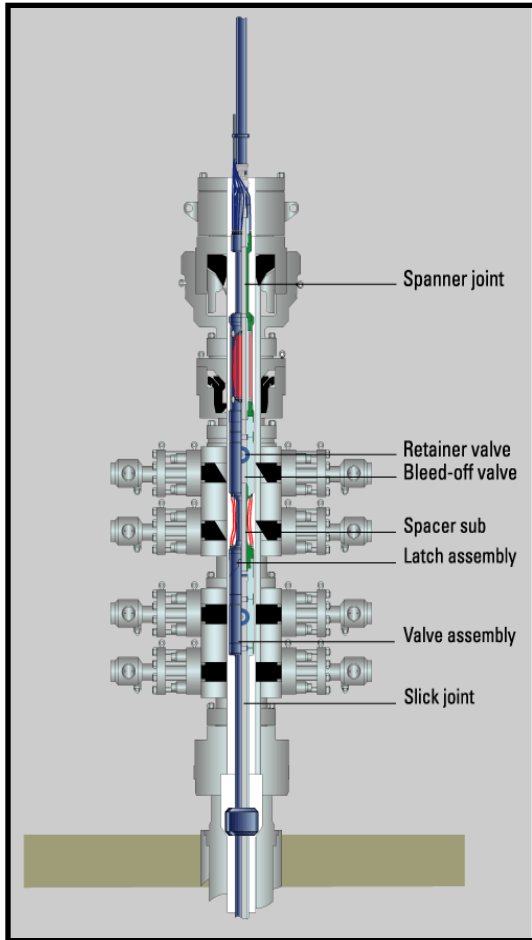


**IWOCS Boxes, Reel,
and HPU on Deck**

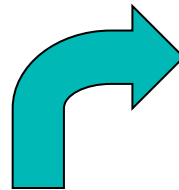
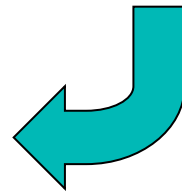


**IWOCS Boxes, Umbilical, and
Flying Leads installed to BOP**

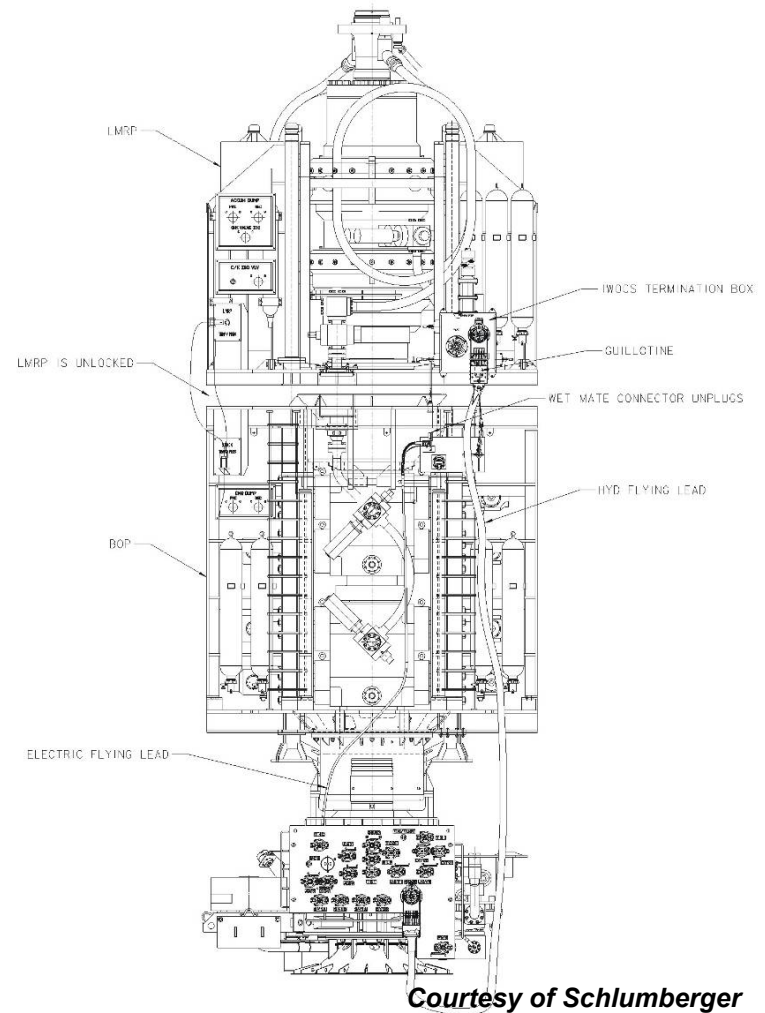
SSTT/THRT Interface to Subsea Drilling BOP



**SSTT/THRT
Inside
Drilling BOP**

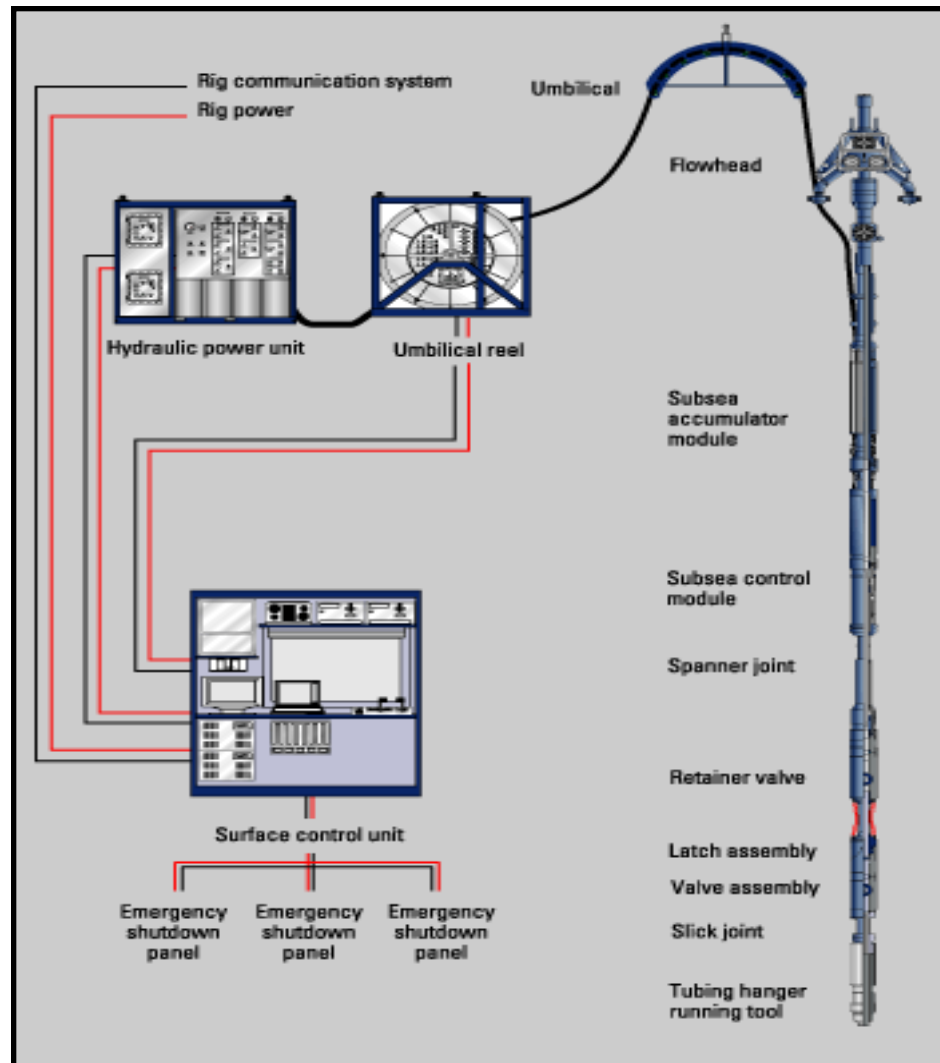


**Drilling BOP
Installed on
EHXT**



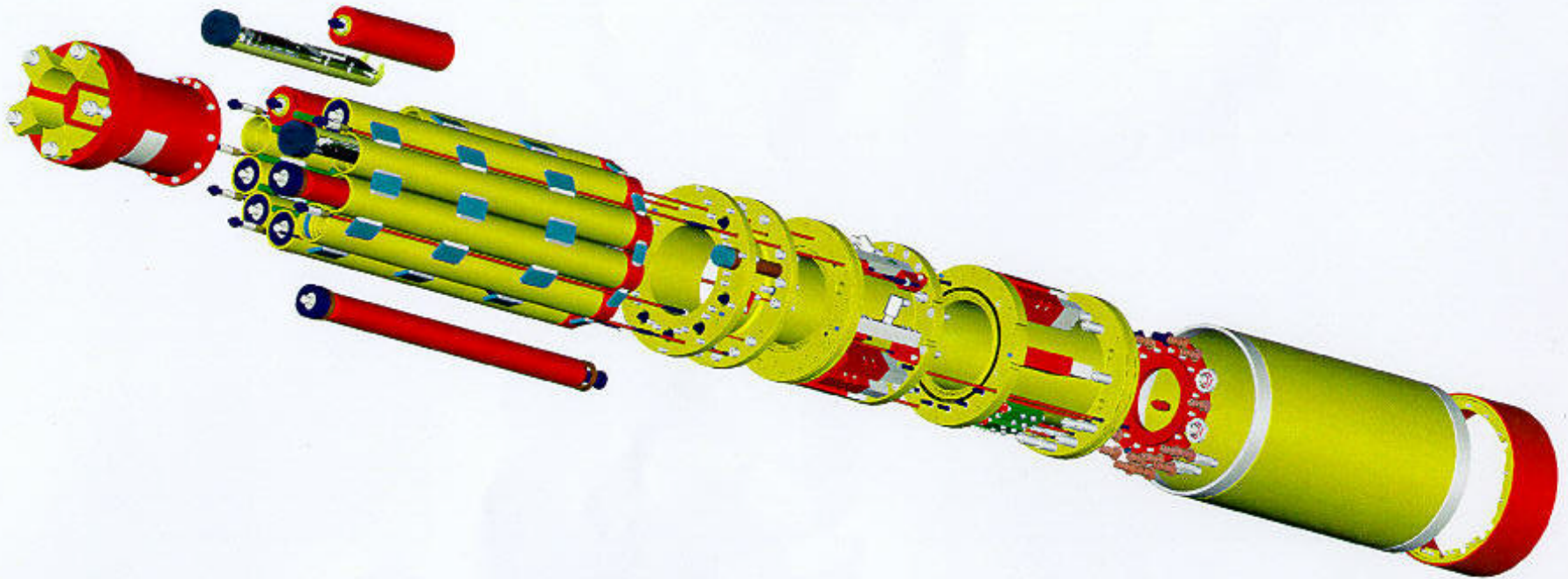
Courtesy of Schlumberger

MUX SSTT Completion System



Courtesy of Schlumberger

MUX SSTT Subsea Control Module (SCM)



Courtesy of Schlumberger

SSTT/THRT in Derrick

Spanner Joint

Retainer Valve

**Tubing Hanger
Running Tool**

Tubing Hanger



Additional Information

DESCRIPTION	API Standard	ISO Standard
Surface wellhead and tree equipment	Spec 6A	10423
Design and operation of subsea systems	RP 17A	13628-1
Flexible pipe	RP 17B	13628-11
TFL systems	RP 17C	13628-3
Subsea wellhead and tree equipment	Spec 17D	13628-4
Production control umbilical's	Spec 17E	13628-5
Subsea controls	Spec 17F	13628-6
Design & operation of completion/intervention risers	RP 17G	13628-7
ROV interfaces	RP 17H	13628-8
Unbonded flexible pipe	Spec 17J	13628-2
Bonded flexible pipe	Spec 17K	13628-10
ROT Intervention System	RP 17M	13628-9
Dynamic Risers	RP2RD	16389

Web Sites

- www.vetcogray.com
 - www.api.org
 - www.camerondiv.com
 - www.dril-quip.com
 - www.fmctechnologies.com
 - www.akerkvaerner.com
- Vetco Gray
American Petroleum Institute
Cameron
Dril-Quip
FMC Technologies
Aker Kvaerner

Questions

