Subsea Production Systems
Subsea Forum - Young Engineers Day
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GE imagination at work
vetcogray
a GE Oil & Gas business
Agenda

Typical Subsea Development Overview
• The Building Blocks

Subsea Xmas Trees
• Overview
• Conventional Dual Bore
• Horizontal

Production Control Systems
• System Overview

Manifolds
• Overview

Connection Systems
Questions
Subsea Development Overview
Exploration and Production Frontier
Xmas Trees
Xmas Tree Overview

Provides a pressure containing method to safely cap the Well via its interface with the subsea Wellhead

Xmas Tree features:

• Control, monitor and condition either produced or injected media. (Designs for either 5000, 10000 or 15,000 psi wp)
• Provides normal and failsafe methods of shutting the Well at the mudline
• Provides a interface to re-enter the Well at any time during the life of the field
• Provides a platform/interface from which to monitor down hole pressure temperature or ‘smart well’ systems & applications
• Provides a platform/interface from which to inject chemicals either down hole or at the Xmas Tree
Subsea Production Systems

Tree Systems

Dual Bore Tree
Deepwater

Diverless

Horizontal Tree
Deepwater

Mono Bore Tree
Shallow Water

Mono Bore Tree
Deepwater

Mono Bore Tree
Deepwater
Horizontal vs Conventional Tree

- Tree Cap
- Crown Plugs
- Tubing Hanger
- Treehead
- Tree Connector
- Wellhead
- Tree Cap
- Master Valve Block
- Tree Connector
- Tubing Hanger
- Wellhead

= Gate Valves
Controls
Subsea Production Control Systems

Multiplexed Electro-hydraulic Control Systems

- Control system fully integrated with host facility
- Deepwater diver less intervention (retrievable)
- Fieldbus comms and instrument architecture
- Long Offset (200km +)
- Qualified to 3000m Water depth
- Combined or separate comms and power
- Intelligent (smart well) Completion interfaces
- Optional Fiber Optic comms
- HP/HT compatible
Subsea PCS Functional Requirements
System Overview - Topsides

Topside Equipment

- Master Control Station
- Hydraulic Power Unit
- Methanol / chemical injection skids
- Accepts platform ESD signals
- Topside Umbilical Termination Unit
System Overview - Subsea

Subsea Equipment

- Umbilical Termination Assembly
- Control Pod on Tree / Manifold
- Readback of pressure / temperature / choke position / downhole data
Master Control Station

Typical well page on MCS
Manifold Systems
Subsea Manifold Systems

A large variety of Subsea Manifold configurations, based on standard building blocks:

- Template Manifolds
- Cluster Manifolds
- Internal or External Pigging Loops
- Vertical or Horizontal Jumper Connections
- Skirt, Monopile or Suction Anchor Foundations
- Moonpool Installable Manifolds
- Pipeline End Manifolds (PLEM), Pipeline End Terminations (PLET) and Riser Bases
- 5, 10 or 15k Pressure Ratings
- Insulation Systems to meet Flow Assurance requirements
- Distribution System based on hard piped, multibore connections or ROV Jumpers
Product Overview / Key Features

Foundation Structures

Seven Heads

Mudmat – Hard to medium soil conditions. Large areas required, high slamming loads in splash zone.

Piles – not very commonly used. Special equipment needed during installation.
Product Overview / Key Features

Foundation Structures (cont’d)

Suction Pile, robust foundation concept from soft to “ultra soft” soil conditions (typical West Africa).

Guide mast on suction pile interfaces centre column on manifold.

Levelling possible by adjustment of position of guide cone.
Product Overview / Key Features
Foundation Structures (cont.)

Suction Piles (Lobito)

Suction Pile (Bonga)

PLEM Foundation Kuito 1B
Product Overview / Key Features

Production Templates

Wellheads w/trees and manifold located on one common foundation structure.

Cost effective; infield jumpers not required, connection between tree and manifold normally through a Choke Bridge Module.
Connection Systems
Connection Systems
Main type of connectors

Collet

Mandrel (dogs)

Clamp
Connection Systems
Subsea connection systems

Subsea Connection Systems features diverless connectors and tooling systems for most applications:

Rigid Jumpers and Tie-in Spools
Flexible Flowlines
Umbilicals
Single bore and Multibore Hubs
Clamp, Mandrel and Collet Connectors
Horizontal and Vertical Configurations
Subsea Winch Systems
Stab & Hinge Over Systems
ROV Jumper / “Flying Lead” Systems
Vetcogray Experience – Subsea Production Systems

Subsea Trees – 900 (300 pcs Horizontal & 600 pcs Conventional)
Subsea Controls – 500 pcs
Subsea Manifolds – 80 pcs
Subsea Connections 1000
Questions?
Thank YOU for attending!