



Subsea Production Systems and Controls

Course: Trees, Manifolds, SCM/MCS and Umbilical Termination



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Introduction:

Subsea production systems and controls, covering wet trees, manifolds, SCM/MCS units and umbilical termination, is a 2-week course for subsea systems, controls and integrity units that ends with a Subsea Control System Integrity and Obsolescence Plan for a case field. Producing fields lose output when a failed control module, a leaking hydraulic coupler or an unsupported topside computer shuts in healthy wells. Nominees already maintain or monitor subsea equipment, and learning is by inspection walkthrough of tree, manifold, control and termination drawings, test records and fault logs. CoreConcept Training Center delivers this subsea production systems and controls course.

Course Objectives:

- Trace the subsea production system architecture from wet tree and manifold through jumpers, flying leads and umbilical termination to the topside master control station
- Read vertical and horizontal tree schematics, valve functions, choke duty and tree-mounted sensors against API 17D and API RP 17A terminology
- Verify electro-hydraulic multiplexed control functions, including SCM valve sequencing, HPU supply pressure, EPU power and communications on the umbilical
- Plan FAT, EFAT and SIT steps and acceptance records for trees, manifolds, control modules and termination assemblies
- Diagnose control faults from MCS alarms, insulation resistance trends, hydraulic consumption and sensor drift, and select SCM change-out or tree intervention
- Prepare a Subsea Control System Integrity and Obsolescence Plan that ranks equipment by failure consequence and sets spares, monitoring and upgrade actions

Target Audience:

- Subsea systems units responsible for tree, manifold and jumper performance on producing fields
 - Subsea controls and instrumentation units responsible for SCM, MCS, HPU and EPU operation and fault finding
 - Subsea integrity units responsible for condition monitoring, anomaly registers and life extension of seabed equipment
 - Offshore production operations units that run wells through the subsea control system and manage shut-in and start-up
 - Maintenance planning units responsible for subsea spares, change-out campaigns and vendor support agreements
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Course Outline:

Day 1: Subsea Production System Architecture and Field Layouts

- API RP 17A Subsystem Breakdown From Wellbore to Host
- Satellite Wells, Templates and Cluster Manifold Field Layouts
- Production, Injection and Chemical Flow Paths Through Seabed Equipment
- Control, Power and Communication Paths From Host to Tree
- Subsea Equipment Register and System Boundary Drawing Review

Day 2: Wet Trees, Tree Valves and Production Chokes

- API 17D Vertical Versus Horizontal Tree Configuration Comparison
- Master, Wing, Crossover and Annulus Valve Functions on Wet Trees
- Tubing Hanger Orientation, Penetrators and Downhole Safety Valve Lines
- Subsea Choke Trim Selection, Erosion Duty and Actuator Stepping
- Tree Pressure, Temperature, Sand and Erosion Sensor Arrangement

Day 3: Manifolds, PLEMs, Jumpers and Seabed Structures

- Production Manifold Header, Branch Valve and Pigging Loop Layout
- PLEM and PLET Structures as Flowline End Interfaces
- Rigid and Flexible Jumper Connection With Collet and Clamp Hubs
- Manifold Isolation Logic and Valve Status Tables for Well Routing
- Protection Structures, Foundations and Retrievable Insert Module Access

Day 4: Electro-Hydraulic Multiplexed Control Equipment and Umbilical Termination

- Direct Hydraulic, Electro-Hydraulic and All-Electric Control Philosophy Comparison
- Subsea Control Module Directional Control Valves, Accumulators and Electronics
- Master Control Station Screens, Well Control Sequences and Event Logs
- Hydraulic Power Unit and Electrical Power Unit Supply Settings
- Topside and Subsea Umbilical Termination Assemblies With Flying Lead Routing

Day 5: Guided Case Study on a Multi-Well Subsea Control Layout

- Case Field Control Schematic With Trees, Manifold and Termination Units
 - Hydraulic Supply and Return Balance Check for Case Wells
 - Electrical Power and Signal Budget Along the Case Umbilical
 - Valve Opening Sequence Walkthrough for a Case Well Start-Up
 - Week-One Architecture Note for the Case Field Controls Lead
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Day 6: Subsea Communications, Instrumentation and Shutdown Logic

- Communication on Power Versus Dedicated Copper and Fibre Links
- Subsea Electronics Module Redundancy and Dual Channel Switchover
- Multiphase Meters, Sand Detectors and Downhole Gauge Data Integration
- Process Shutdown and Emergency Shutdown Logic Through the MCS
- Hydraulic Bleed-Down Times and Fail-Safe Valve Closure Verification

Day 7: Testing, Qualification and Quality Assurance of Subsea Controls

- FAT Procedures and Acceptance Records for Control Modules
- EFAT of Trees and Manifolds With Representative Control Equipment
- SIT Planning for Tree, SCM, Termination and MCS Interfaces
- Hydraulic Fluid Cleanliness Classes and Flushing Acceptance Records
- Non-Conformance Handling and Punch List Closure Before Load-Out

Day 8: Life-of-Field Interventions, Change-Outs and Operations Interfaces

- SCM Retrieval and Replacement Procedure With Isolation Steps
- Tree Intervention Options for Choke Insert and Valve Repair
- Hydraulic and Electrical Flying Lead Replacement Planning
- Production, Controls and Vendor Handover Notes for Intervention Campaigns
- Management of Change Records for Control Software and Logic Updates

Day 9: Reliability, Condition Monitoring and Obsolescence Management

- RAM Analysis Inputs From Subsea Failure Rate Records
- Insulation Resistance and Line Impedance Trending on Umbilical Circuits
- Hydraulic Consumption Trends as Valve and Coupler Leak Indicators
- Topside Computer, Electronics and Software Obsolescence Risk Ranking
- Spares Strategy and Retrofit Paths for Legacy Control Systems

Day 10: Inspection Walkthrough Capstone on the Subsea Control System Integrity and Obsolescence Plan

- Case Field Tree, Manifold and Termination Drawing Walkthrough
 - Case MCS Alarm History and Monitoring Trend Review
 - Case Equipment Criticality Ranking and Anomaly Register Build
 - Case Spares, Change-Out and Obsolescence Action Schedule
 - Subsea Control System Integrity and Obsolescence Plan Completion
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Skills You Will Gain:

- Subsea Architecture Mapping
- Wet Tree Schematic Interpretation
- Multiplexed Control Fault Finding
- Umbilical Termination Checks
- Subsea Integration Test Planning
- Control Module Change-Out Planning
- Subsea Condition Trending
- Obsolescence Risk Ranking

Why Attend This Course:

- Hand the subsea integrity lead and the operations manager a Subsea Control System Integrity and Obsolescence Plan for a case field
- Decide whether a control fault calls for continued monitoring, a module change-out or a tree intervention
- Avoid deferred production from unplanned shut-ins caused by unsupported control electronics or missing spares
- Coach controls and operations colleagues with the tree, SCM and termination checklists built during the course

Conclusion:

Back at work, the participant gives the subsea integrity lead and the operations manager a Subsea Control System Integrity and Obsolescence Plan that ranks trees, manifolds, control modules, terminations and topside units by failure consequence. Maintenance planners use it to set spares holdings and change-out campaigns, and the controls unit uses its monitoring limits to judge MCS alarms and trend data. After the first intervention campaign or control system upgrade, the unit should review fault findings, spares usage and obsolescence actions against the plan and revise it.

Frequently Asked Questions FAQ:

What should participants know before a subsea production systems and controls course?

Participants should already work with subsea equipment, production operations or control and instrumentation systems and be able to read piping and instrument diagrams. Bringing a field layout, control schematic or recent fault log helps them apply the inspection walkthrough to their own equipment.

How does a subsea production systems and controls course differ from a subsea pipeline and riser design course?

This course follows the equipment that controls each well: wet trees, manifolds, control modules, power and hydraulic units and umbilical termination. Pipeline and riser design courses size the seabed pipe and riser, and drilling courses cover the blowout preventer used before the tree is installed.

Why do subsea production systems and controls need an obsolescence plan?

Seabed equipment is designed to stay in service for many years, while topside computers, electronics and communication parts go out of support far sooner. Without a plan, one failed unsupported board can shut in several wells while replacements are sourced or redesigned.

What does a participant take back from the subsea production systems and controls course?

Each participant takes back a Subsea Control System Integrity and Obsolescence Plan for a case field, with an equipment criticality ranking, anomaly register, monitoring limits and a spares and change-out schedule that can be adapted to their own field.
