CONCEPT

Directional Drilling, Extended Reach and Geosteering: Trajectory, Anti-Collision and Well Placement

16 – 27 May 2027
Jeddah - Corniche four-star



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Introduction:

Directional drilling choices decide how much reservoir a lateral contacts, whether the wellbore clears its neighbours and whether an extended reach section reaches target depth at all. Weak trajectory geometry, thin survey programmes and late steering calls leave laterals outside the pay zone, cause collision near-misses and lock up strings short of target. This Core Concept course moves specialists from trajectory geometry, surveying and anti-collision through steerable motors, rotary steerable systems and extended reach limits to live geosteering with LWD. Participants produce an ERD Trajectory and Geosteering Proposal.

Course Objectives:

- Engineer two- and three-dimensional trajectories with kick-off points, curvature and turn rates and a dogleg budget that tubulars and completions can pass
- Specify survey programmes with MWD and gyro instruments and quantify positional uncertainty using the ISCWSA error model and ellipses of uncertainty
- Run anti-collision scans, calculate separation factors and set mitigation actions for congested pads and platform slots
- Select deflection tools, steerable motors or rotary steerable systems and configure steering assemblies that deliver the intended curvature
- Model torque, drag, buckling, cuttings transport and ECD to judge extended reach feasibility and choose mitigation
- Execute geosteering with LWD, from pre-spud geological model to landing and staying in the pay zone, within a defined placement team workflow

Target Audience:

- Drilling engineers who engineer deviated, horizontal and extended reach trajectories and check their mechanical feasibility
- Directional supervisors who oversee motor and rotary steerable runs, slide sheets and survey quality at the rigsite
- Placement and operations geologists who maintain steering models and make landing and in-zone calls as data arrives
- Wellbore positioning specialists who own survey programmes and anti-collision reports
- Service company engineers who deliver steering, MWD and LWD services to operator asset teams

Course Outline:

Day 1: Deviated Wellbore Objectives and Trajectory Geometry

- Deviated Wellbore Drivers: Pad Development, Inaccessible Surface Locations, Fault-Parallel Targets and Relief Wells
- Tangent Build-Hold, S-Shape and Horizontal Profile Geometries
- Trajectory Geometry Inputs: Kick-Off Point, Curvature Rate, Tangent Inclination and Target Tolerance
- Dogleg Severity and Tortuosity Effects on Tubular Wear and Completion Running
- Three-Dimensional Trajectories with Turn Rates and Azimuth Changes

Day 2: Wellbore Surveying and Positional Uncertainty

- MWD Magnetic Survey Principles: Accelerometers, Magnetometers and Toolface
- North-Seeking Gyroscopic Surveys in Magnetic Interference Zones
- Survey Calculation Methods: Minimum Curvature versus Tangential and Balanced Tangential
- ISCWSA MWD Error Model Terms: Sensor, Misalignment, Geomagnetic Field and Depth Errors
- Ellipses of Uncertainty and Survey Programme Selection Along the Trajectory

Day 3: Anti-Collision Analysis and Wellbore Positioning Control

- Offset Wellbore Database Quality Check and Legacy Survey Validation
- Anti-Collision Scanning Methods: Closest Approach, Travelling Cylinder and Horizontal Plane
- Separation Factor Calculation and Minimum Allowable Separation Rules
- Collision Risk Mitigation: Offset Producer Shut-In, Gyro Surveys and Tighter Survey Intervals
- Wellbore Intercept and Relief Well Ranging Concepts at Overview

Day 4: Deflection Tools, Steerable Motors and Rotary Steerable Systems

- Deflection Tool Options: Jetting, Whipstock Kick-Off and Bent Sub Assemblies
- Positive Displacement Motor Anatomy: Power Section, Bent Housing and Slide-Rotate Ratio
- Rotary Steerable Systems: Push-the-Bit versus Point-the-Bit Mechanisms
- Steering Assembly Tendency: Fulcrum, Packed and Pendulum Stabiliser Layouts
- Toolface Control, Slide Sheets and Curvature Prediction from Assembly Modelling

Day 5: Integration Exercise: Deviated Trajectory Proposal

- Exercise: Converting a Reservoir Target Set into a Trajectory Profile
- Exercise: Survey Programme Selection and Uncertainty Envelope for a Pad Wellbore
- Exercise: Anti-Collision Scan Against a Congested Platform Slot Layout
- Exercise: Motor versus Rotary Steerable Selection for Curve and Lateral Sections
- First-Half Trajectory Proposal Review and Peer Challenge

Day 6: Torque, Drag, Buckling and Extended Reach Limits

- Soft-String versus Stiff-String Torque and Drag Models
- Friction Factor Calibration from Pick-Up, Slack-Off and Rotating Weight Broomstick Plots
- Sinusoidal and Helical Buckling Limits in Tangent and Lateral Sections
- ERD Classification by Step-Out to True Vertical Depth Ratio
- ERD Limit Mitigation: Tapered Strings, Rotating Liner Runs and Friction Reduction Tools

Day 7: High-Angle Cuttings Transport, ECD, Sidetracks and Multilaterals

- Cuttings Bed Formation at High Inclination and Cuttings Transport Modelling
- ECD Management in Long Laterals: Flow Rate, Pipe Rotation and Backreaming Practice
- Sidetrack Execution from Openhole Cement Plugs and Cased Whipstocks
- Multilateral Junction Complexity and Branch Construction at Overview
- ERD Risk Register: Wellbore Stability, Tubular Wear and Trouble Triggers

Day 8: Geosteering with LWD and Live Modelling

- LWD Measurements for Wellbore Placement: Gamma Ray, Propagation Resistivity and Density Images
- Deep Directional Resistivity Inversion for Bed Boundary Mapping
- Pre-Spud Geosteering Model: Offset Log Correlation and Structural Surfaces
- Forward Modelling While Steering and the Model-Compare-Update Cycle
- Borehole Image Dip Picking and True Stratigraphic Thickness Correction

Day 9: Landing, Staying in Zone and Placement Team Workflow

- Landing the Lateral: Pilot Wellbores, Marker Beds and Landing Point Decision Criteria
- Staying in Zone: Steering Responses to Fault Crossings, Dip Changes and Fluid Contacts
- Placement Roles: Operations Geologist, Geosteerer, Directional Driller and Drilling Engineer
- Steering Decision Protocol and Remote Operations Centre Communication
- Placement KPIs: In-Zone Footage, Dogleg Cost and Post-Lateral Lookback

Day 10: Capstone: ERD Trajectory and Geosteering Proposal

- Capstone Exercise: Target Set, Profile and Dogleg Budget for an ERD Horizontal Lateral
- Capstone Exercise: Survey Programme, Uncertainty and Anti-Collision Report
- Capstone Exercise: Steering Assembly Selection with Torque, Drag and Cuttings Transport Check
- Capstone Exercise: Geosteering Model, Landing Sequence and Steering Rules
- Trajectory and Geosteering Proposal Presentation and Technical Panel Review

Skills You Will Gain:

- Trajectory Geometry Engineering
- Survey Uncertainty Analysis
- Anti-Collision Assessment
- Steering Assembly Configuration
- Torque and Drag Modelling
- Extended Reach Feasibility Screening
- Geosteering Model Construction
- Live Lateral Placement

Why Attend This Course:

- Leave with an ERD Trajectory and Geosteering Proposal prepared for a lateral from your own development portfolio
- Challenge contractor trajectory, survey and anti-collision proposals with your own uncertainty and separation calculations
- Recognise when an extended reach section is mechanically out of reach and which mitigation moves the limit
- Agree steering calls with drilling engineers, directional supervisors and geologists before the bit exits the pay zone

Conclusion:

Deviated, horizontal and extended reach laterals succeed when trajectory, surveying, anti-collision, steering hardware and geology are treated as one system. Days one to five assemble the trajectory proposal from profiles, surveying and uncertainty, anti-collision and steering assemblies, closing with a guided exercise. Days six to ten add what a shorter course leaves out: torque, drag and buckling, high-angle cuttings transport and ECD, sidetracks and multilaterals, and geosteering with LWD from landing to staying in zone. The final day produces an ERD Trajectory and Geosteering Proposal ready for panel review.