

Drilling the Limit

Directional Drilling

NEW Technologies & Processes

IAPG, Neuquén 2001

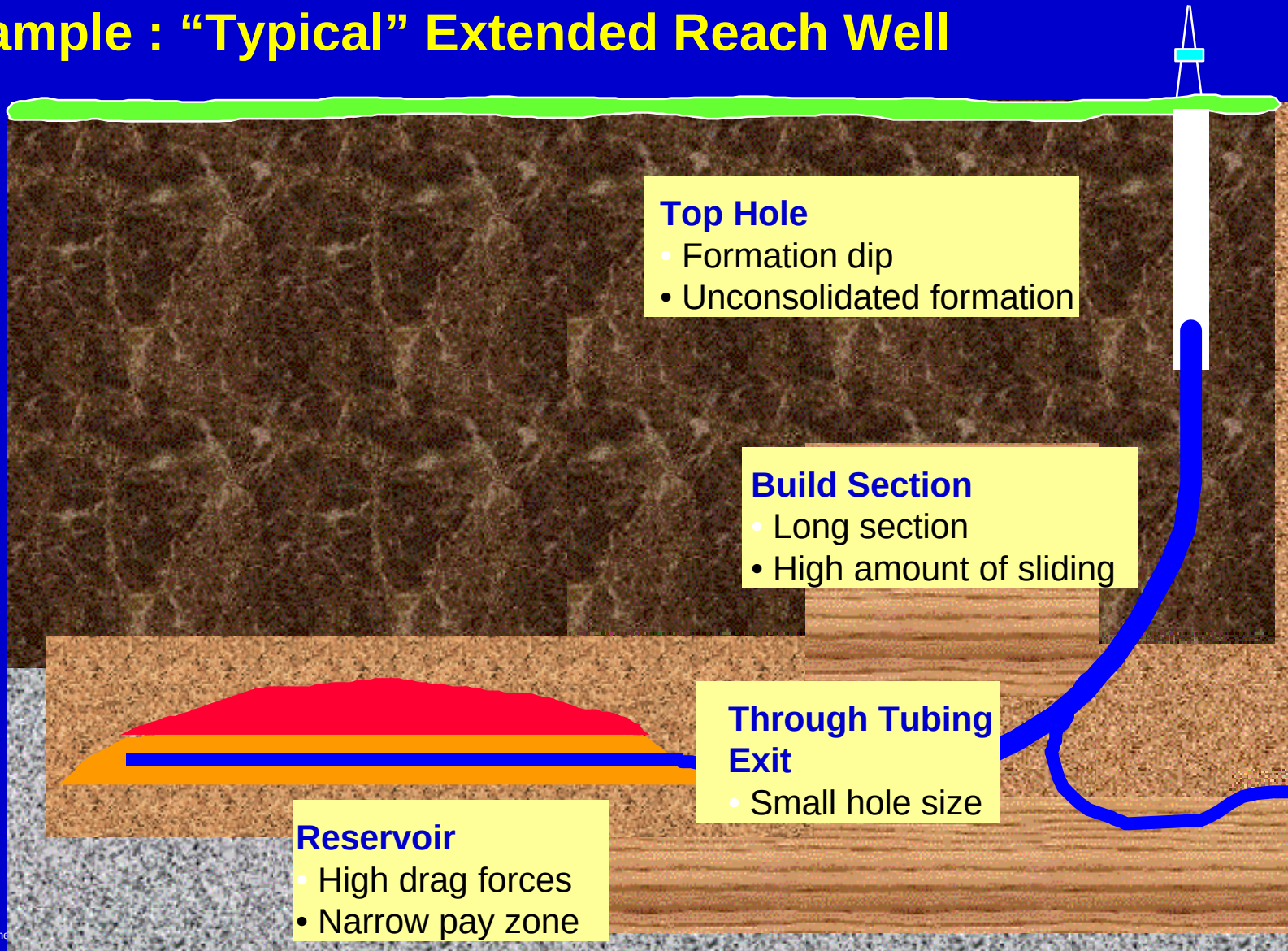
Drilling the Limit

Summary:

- A “typical” well
- Problems and Challenges
- Modern Drilling Systems
- System Approach
- Drilling Optimisation

Drilling the Limit

Example : “Typical” Extended Reach Well

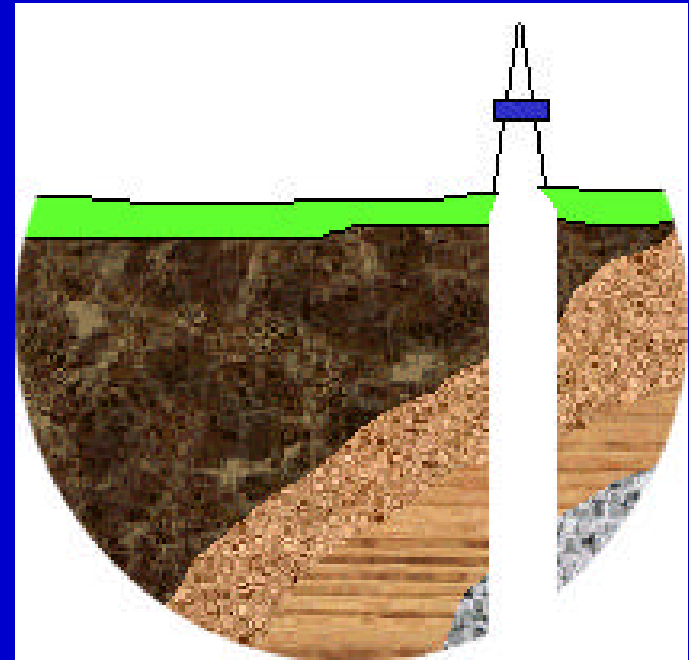


Drilling the Limit

Top Hole Section

Requirements :

- Straight, true vertical hole
 - Minimize torque and drag and string wear in the following sections
 - “Lean Profile” well
- Fast ROP
 - No correction runs
 - Use of as aggressive bits as possible
- Hole Stability



Drilling the Limit

Vertical Drilling System “VertiTrak” for 12 1/4” - 28” Hole Size

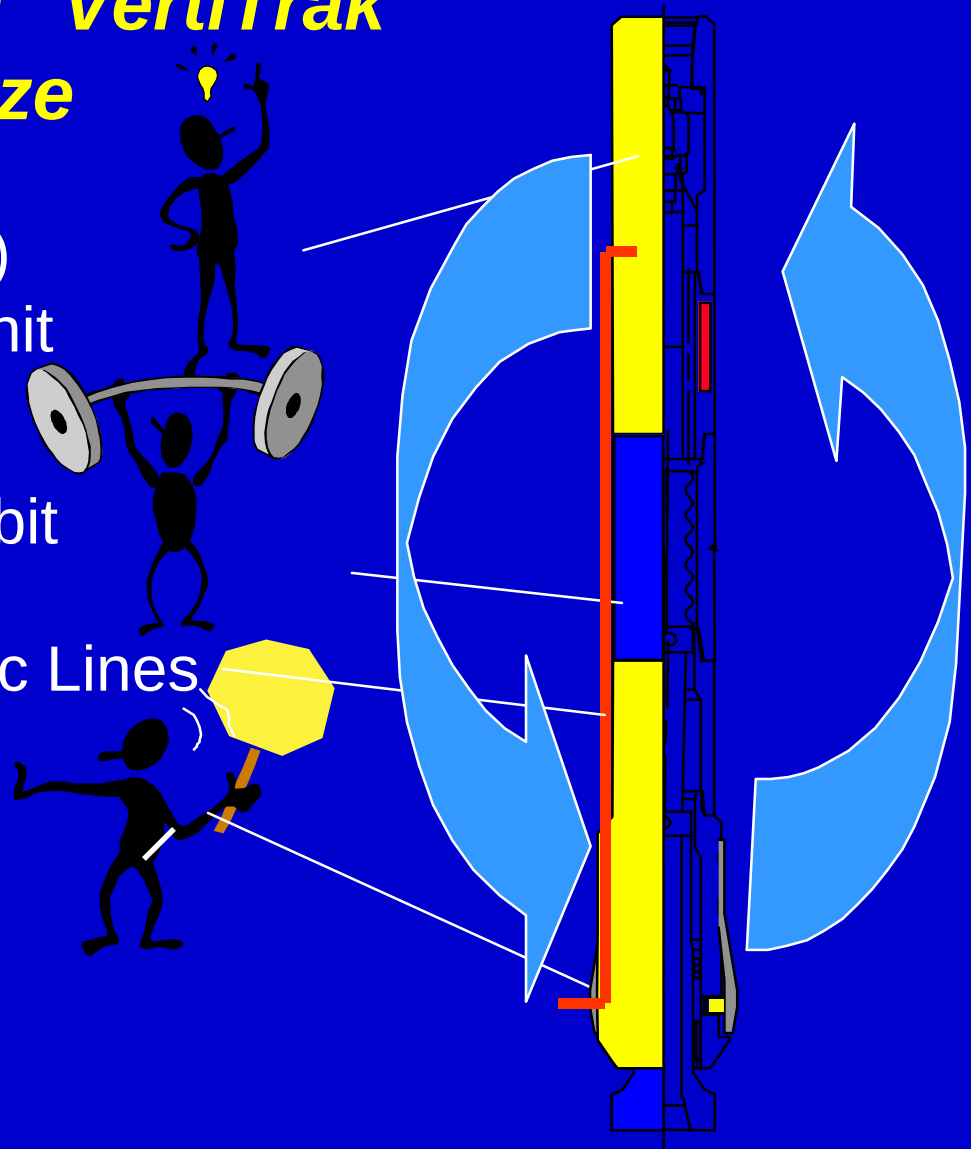
“Brain” : MWD (inclinometer)
with Pulser and Hydraulic Unit

“Power Plant” : X-treme
Power Section to rotate the bit

Hydraulic Lines

Steerable Stabilizer to keep
the well vertical

Closed Loop System



Drilling the Limit

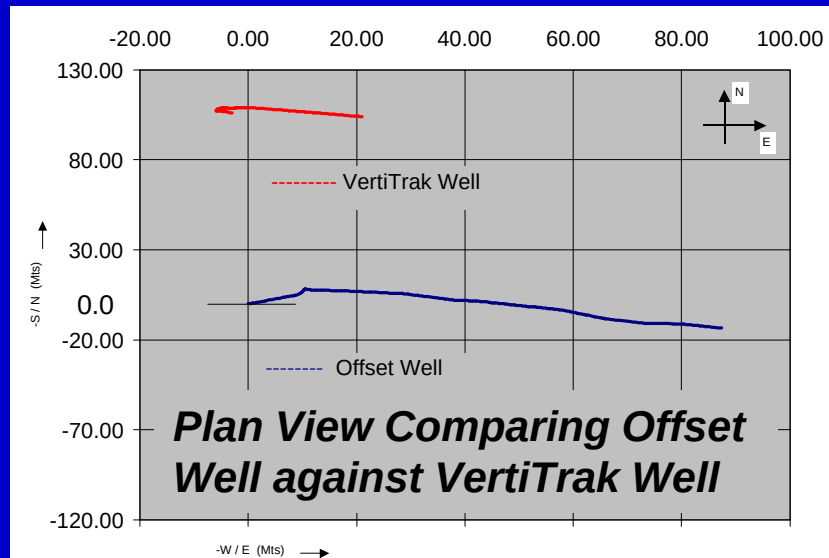
Local Experiences I

Date : March-May 2000

Hole Size : 22" & 16" (1210-8350ft)

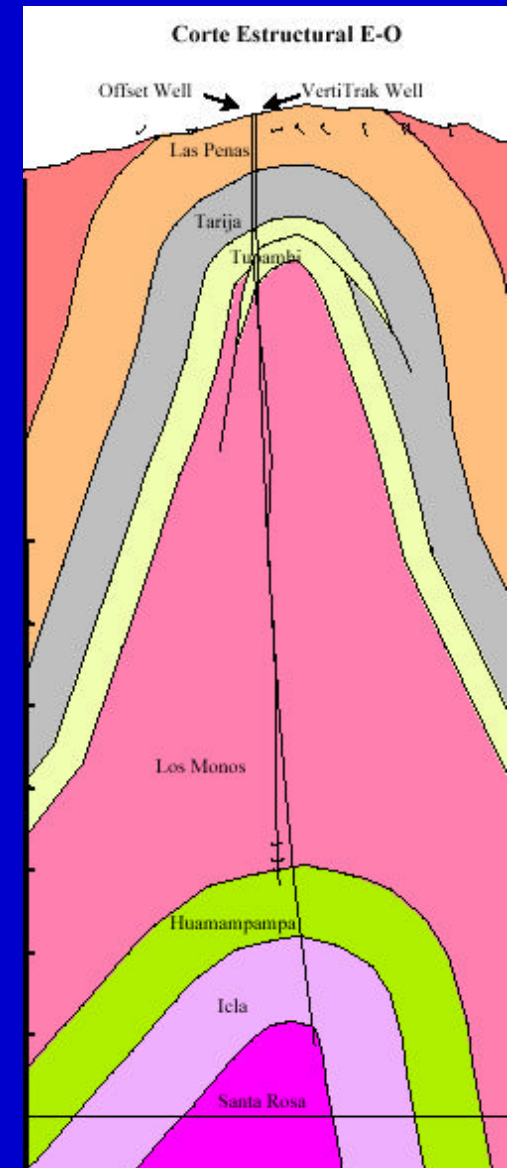
Well Type : Vertical Hole

Lithologies : Diamictite / Shale



Results:

- ➡ Vertical Well Path
- ➡ Drill "Best In Class" Well
- ➡ Smooth Casing runs
- ➡ No Back reaming required
- ➡ 300-400% ROP increase in 16"
- ➡ 28 drilling days Saved against best offset well
- ➡ Over 1,5 MM\$us in Savings!!!



Drilling the Limit

Local Experiences II

Date : Oct - Nov 2000

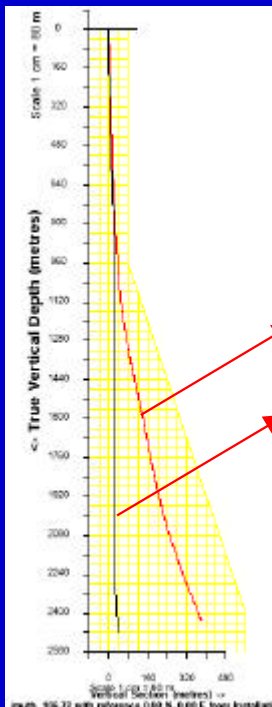
Hole Size : 22" & 16"

Well Type : Vertical Hole

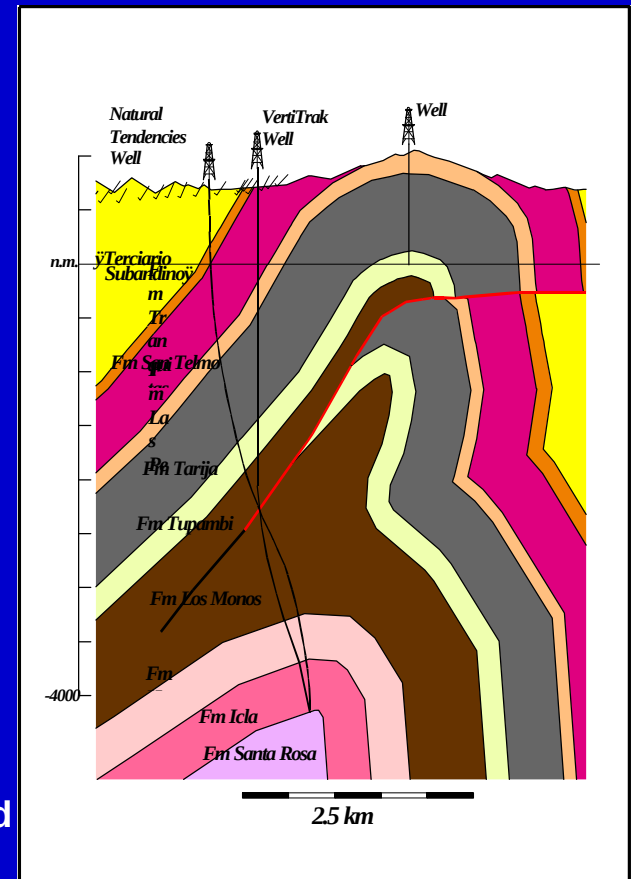
Formation : Diamictite / Shale / Sandstone

Results:

- ➡ Vertical Well Path
- ➡ Drill "Best in Class" Well
- ➡ Smooth Casing runs
- ➡ No Back reaming required
- ➡ 300% ROP increase in 22" Section
- ➡ 100% bearing seals reliability with MX Bits in 16"
- ➡ Saved 63 Operating Days compared with last well drilled in the area
- ➡ Over 1,3 MM\$us in Savings!!!



Offset Well
Natural Tendencies
VertiTrak Well



Drilling the Limit

Build Section

Requirements :

- Easy Steering
 - Stable Tool Face in O-mode
 - No motor stalling
- Fast ROP
 - High torque capability
 - Use of as aggressive bits as possible
- Controlled Downhole Dynamics
- At Bit Inclination (optional)



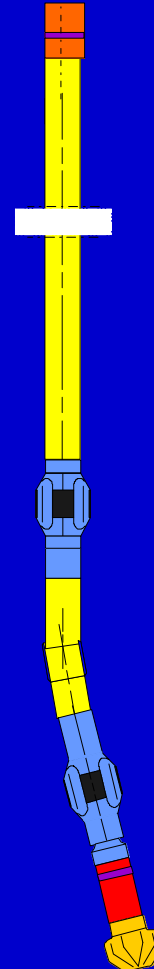
Drilling the Limit



X-treme Power Section

- High power and torque output
 - 60% higher than conventional mud motors
- Higher efficiency
- Proprietary contoured stator manufacturing process
- 90% reduction in rubber content
 - Lower friction
 - Lower distortion

*Delivers reliability improvements
and extended run times*



Drilling the Limit

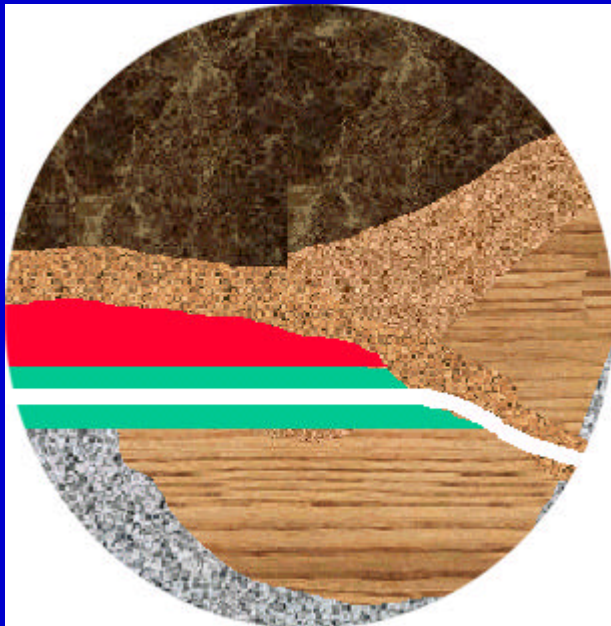
Thrusters

- Constant WOB
 - Easy oriented
 - High ROP
- Absorption of uncontrolled sliding of BHA
 - use of PDC bits in O-mode possible
- Absorption of shocks and (axial) vibration
 - Less motor stalling
 - Less motor, bit and MWD failures



Drilling the Limit

Reservoir

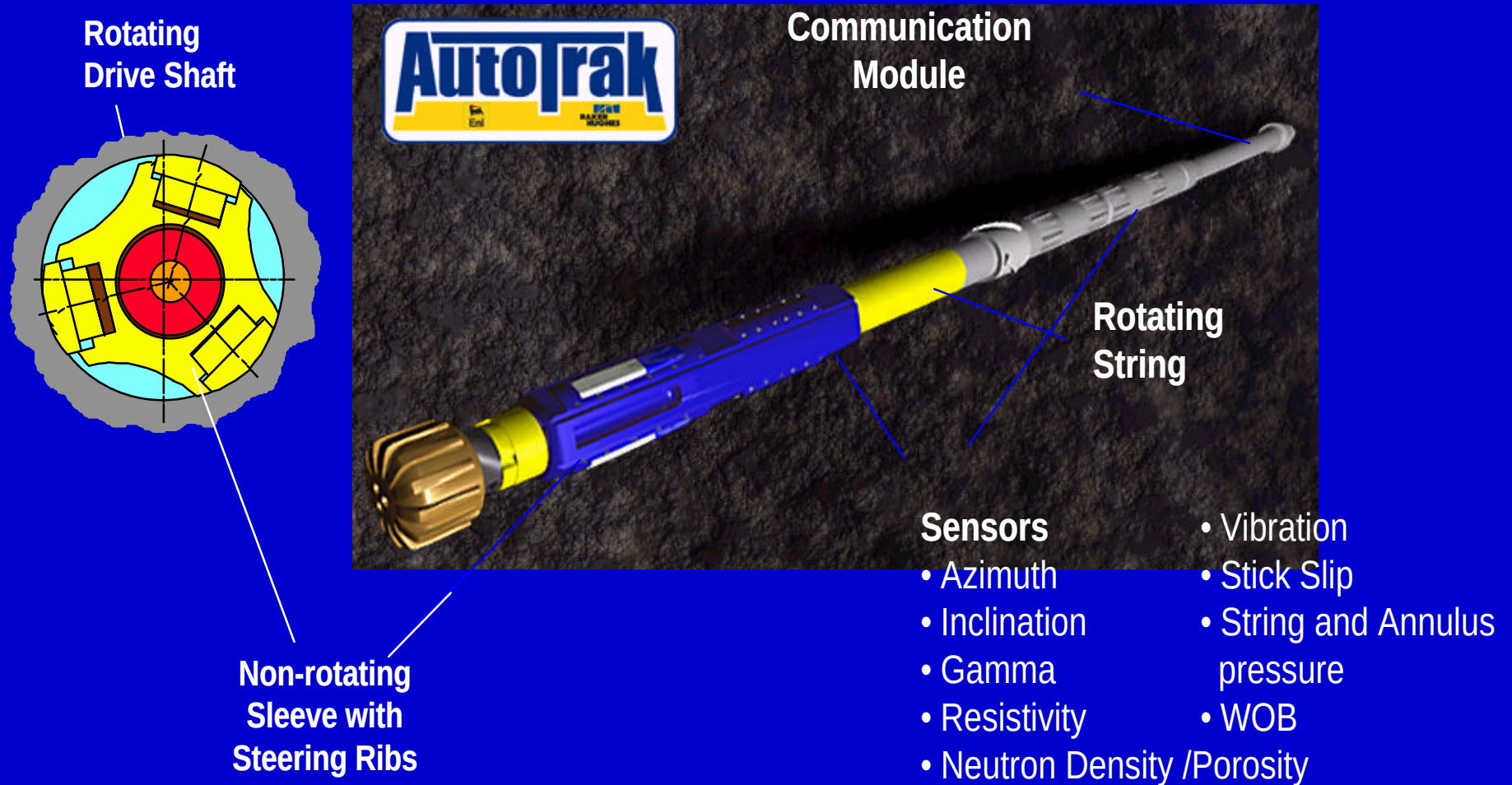


Requirements :

- Drilling in Rotary Mode
 - WOB control
 - Hole Cleaning
- Precise Steering
 - Smooth wellpath
 - FE capabilities
- Fast ROP
 - High torque capability
 - Use of as aggressive bits as possible
- Controlled Downhole Dynamics

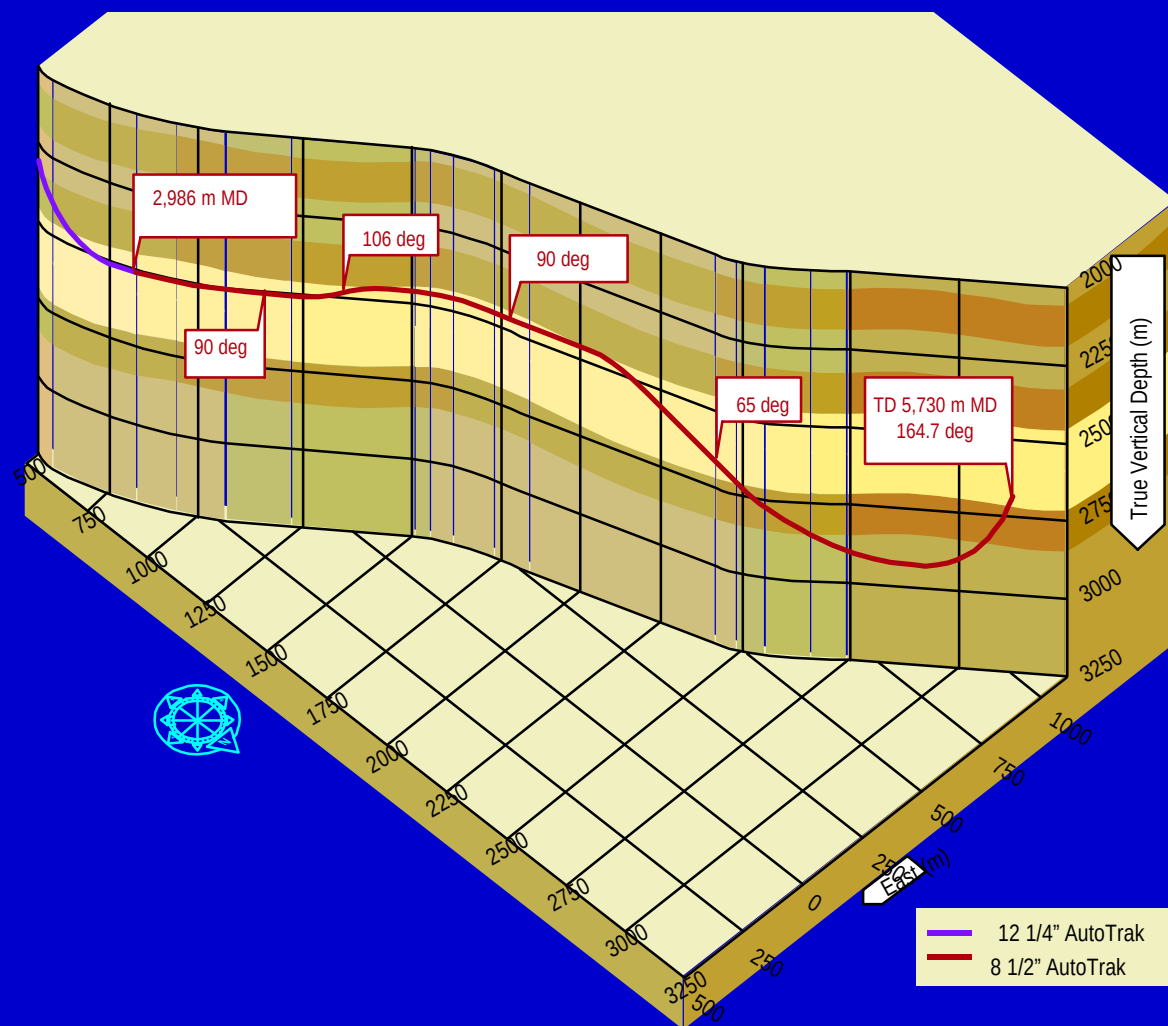
Drilling the Limit

AutoTrak



Drilling the Limit

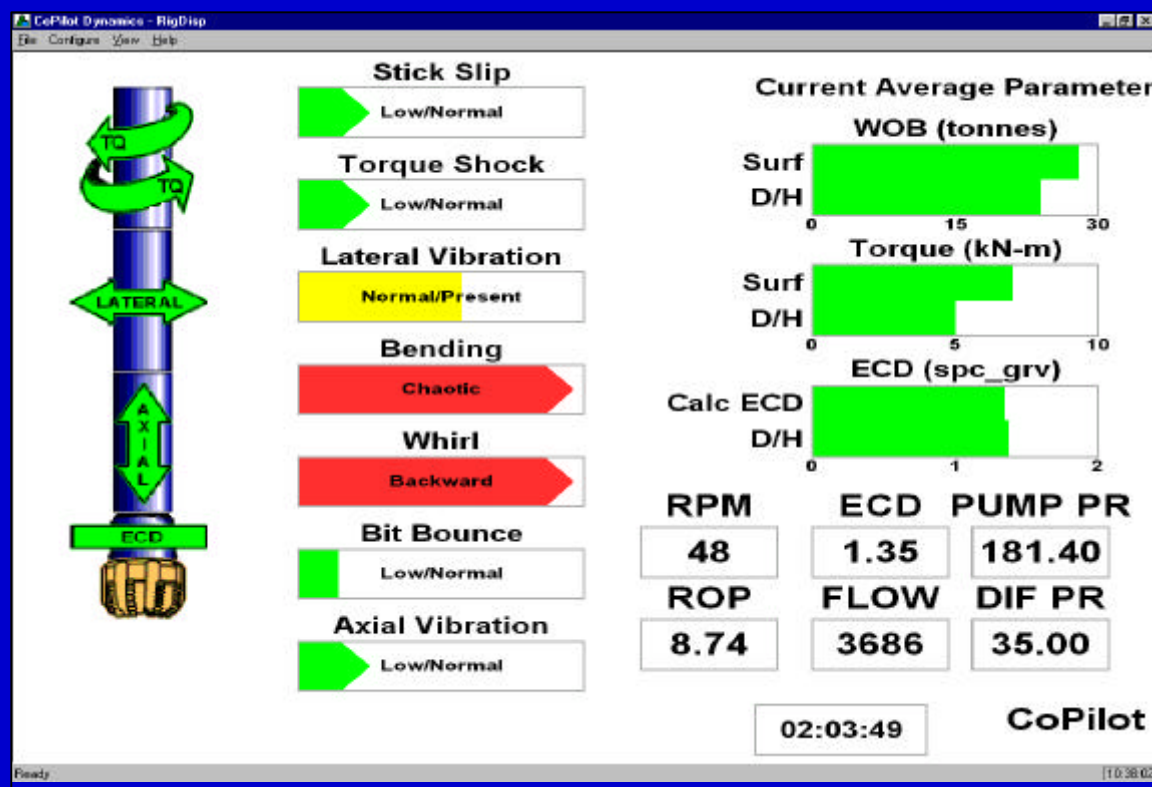
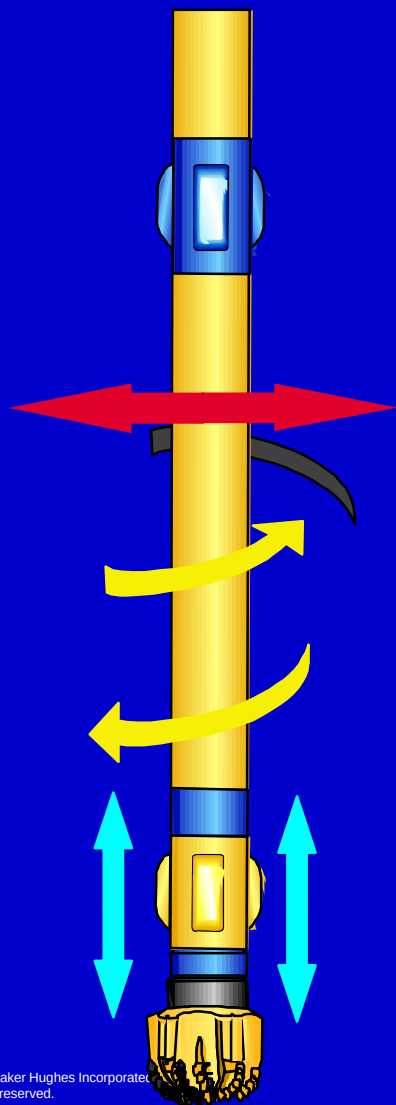
Case History



Drilling the Limit



CoPilot



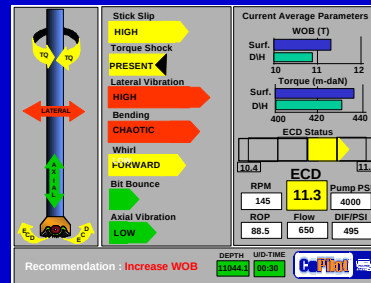
Drilling the Limit



CoPilot

Key Points

- High Data Rate Sampling
- Downhole Data Analysis
- Diagnostics Transmission
- Real-Time Rig Floor Display
- Real-Time Control



Rig Floor
Display

Drilling
Control

MWD Diagnostics
Transmission

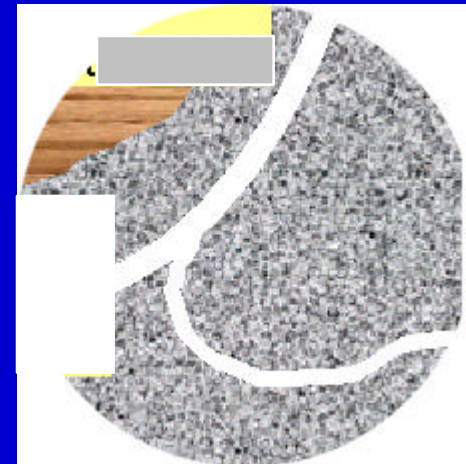
Sensed
Drilling
Motions

Drilling the Limit

Through Tubing Exit

Requirements :

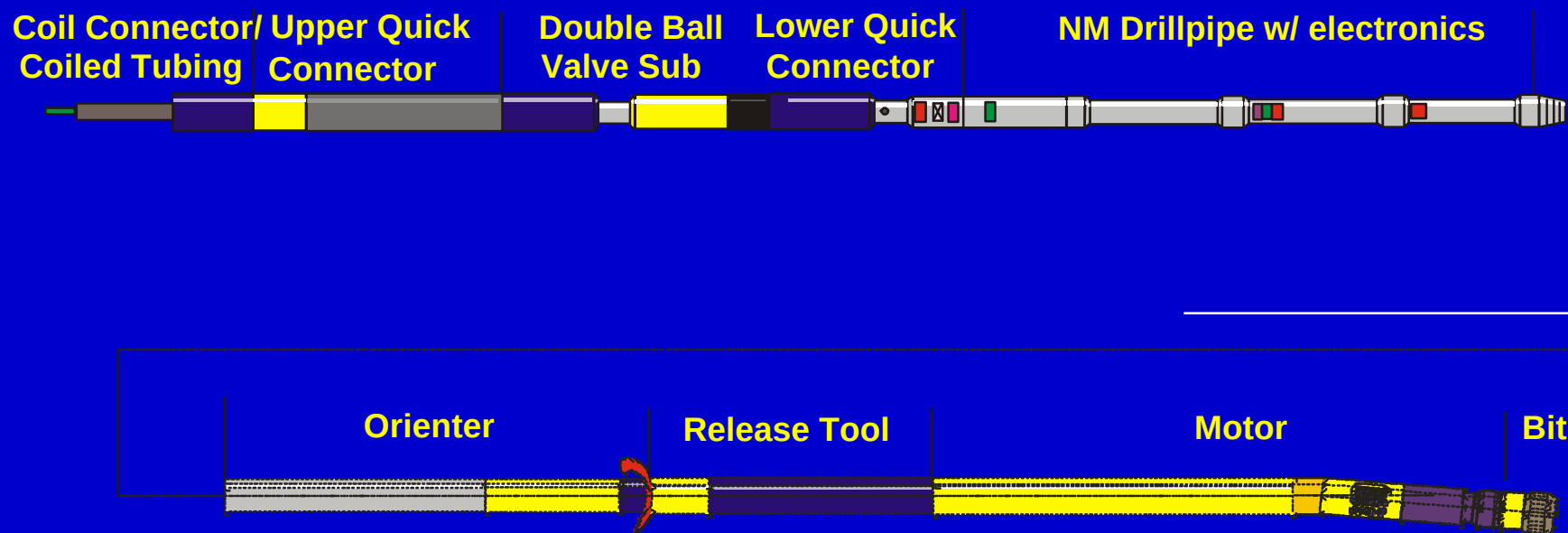
- Small Hole Size
 - 2 7/8" - 4 1/8"
- Under-balanced Drilling
 - increased production
 - increased ROP
- Fast tripping, small Rig
 - Coiled Tubing



Drilling the Limit

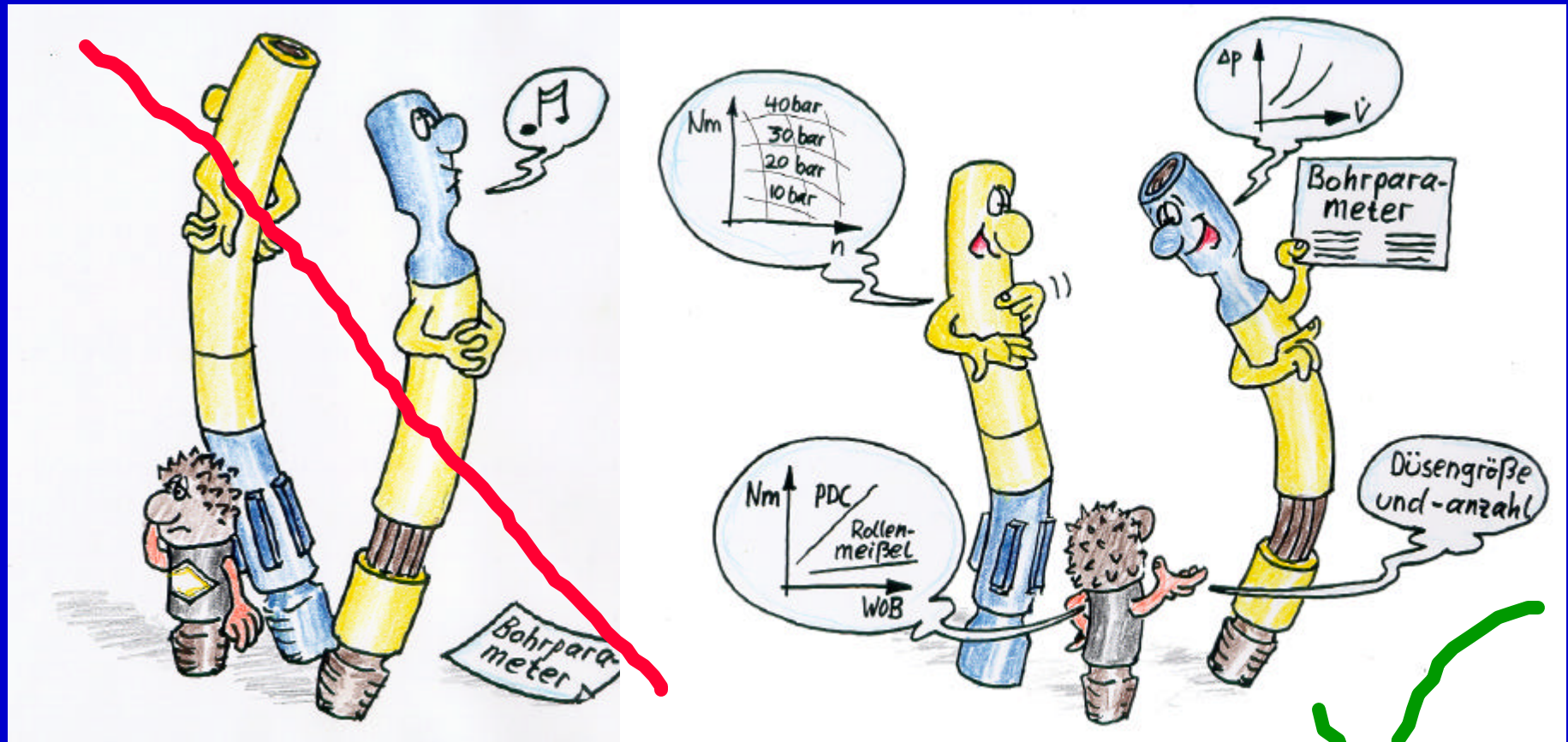


OrientXPress



Drilling the Limit

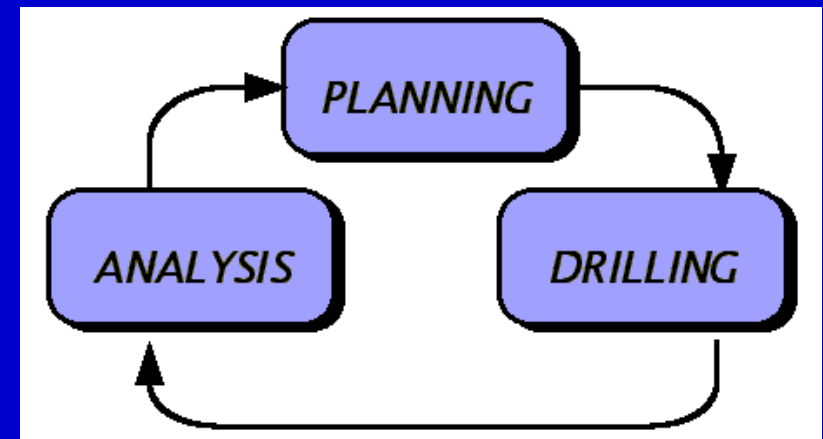
System Approach



Drilling the Limit

Service Focused on Drilling Optimisation

- Decision support for all three phases of the continuous improvement cycle
- Integrated with the client drilling team
- Focused on benchmarking, root cause analysis and solution construction.
- Targets technology fit
- Supports Client initiatives :-
- BPA's - World Class Drilling Process
- Shell's - Technical Limit Drilling

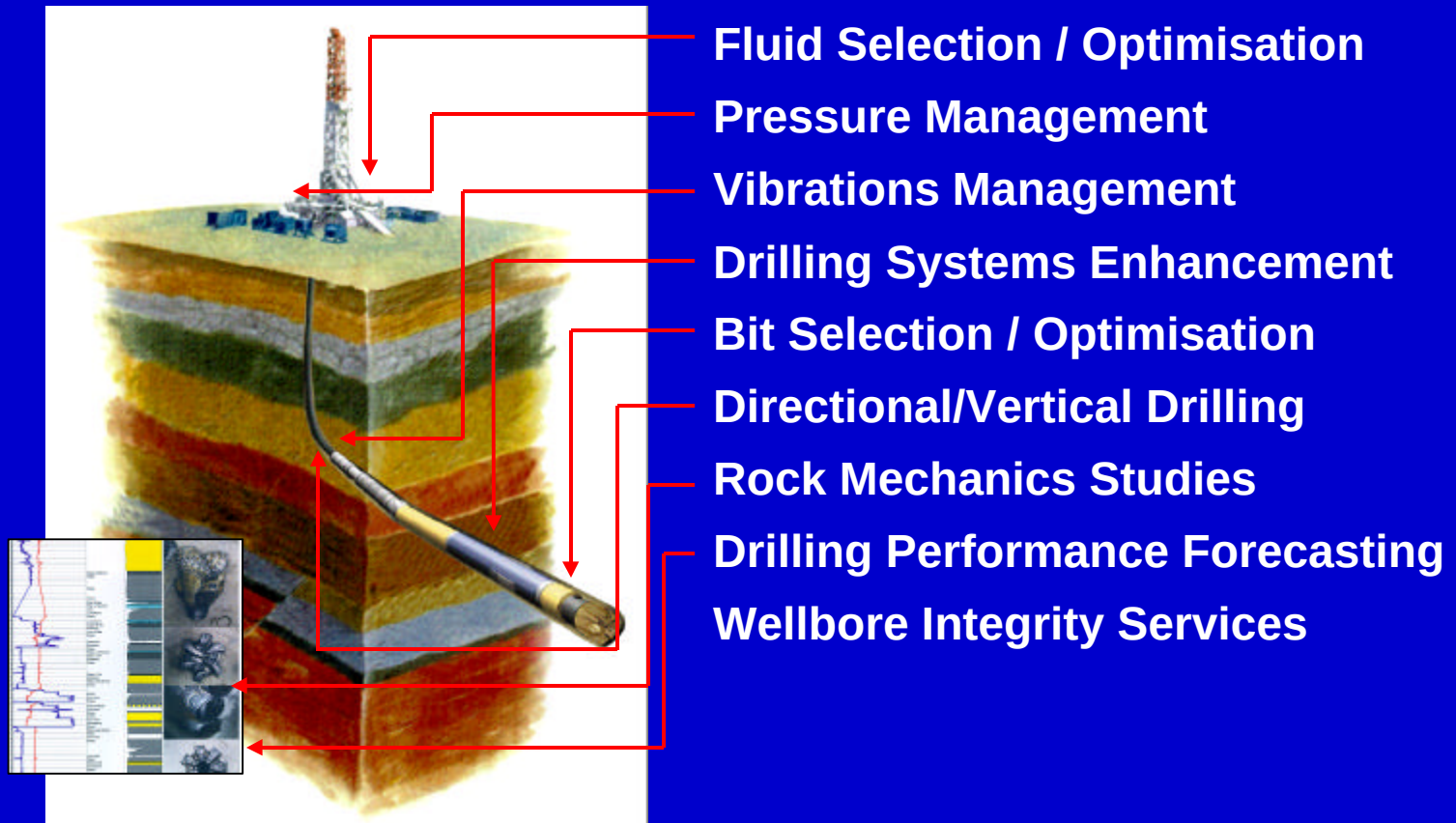


Continuous Improvement Cycle

Drilling the Limit

OASIS

The drilling optimisation plan addresses any aspect of the drilling operation that has opportunity for performance improvement



Drilling the Limit

THE END

