Deep Water Drilling: Advanced Technologies to Increase Safety, Protect Environment and Reduce Time and Cost.

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SOLUTIONS FOR THE FUTURE

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WHY DEEP WATER ?

- Production from mature basins onshore and in shallow water declines, development of DW and UDW reserves has become increasingly vital
- Oil price decline has intensified pressure on operators, continuous improvement in **safety**, **operating performance** and **costs** is necessary
- In this environment, older and less capable assets are more likely to be permanently retired in the next years

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EFFICIENCY WILL BE CRUCIAL

- Need to become more efficient in order to facilitate investments in UDW drilling programs with depressed market prices
- Improvements required within both drilling performance and HSE issues (workers' safety, energy efficiency, environmental performance)
- Development of new designs, processes and equipment that will enhance efficiency and provide advanced technological solutions

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SAFETY IS PREVENTION, BETTER THAN CURE

Human and environment safety and health protection remains the number 1 priority for the oil and gas industry.

It's important to emphasize that safety requirements are the same in every phase.

What we do is enough?

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LESSONS FROM THE PAST

- Accident is not single cause but a combination of factors.
- Not single solution but a combination of key factors to avoid accident:

Processes

- *Design to ensure safety during all phases*
- *Best practices application*
- *No derogations to Procedures*

Equipment

- *Best available technologies from exploration to production*
- *Development and application of new technologies*

Strategy

- *Strategies focused at HSE QA/QC aspects*
- *Cooperation*

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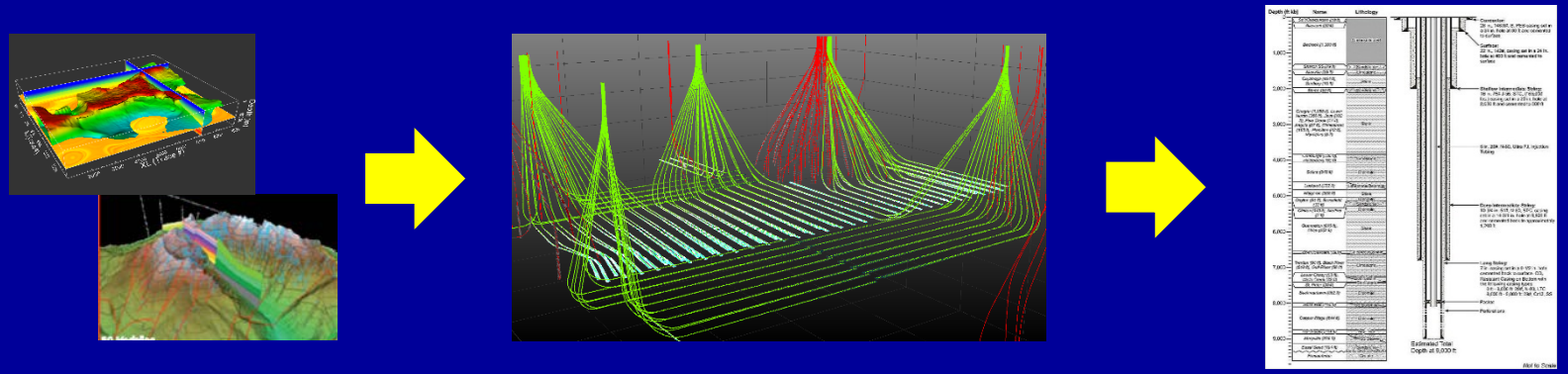
DRILLING ACTIVITIES

- Success in drilling operation start from:
  - *Exploration phase (seismic analysis)*
  - *Well design*



- Respect of some golden rules can make the difference during operations:
  - *Ensure the redundancy of safety barriers*
  - *"One run, one phase". Do not carry out wiper trips unless strictly necessary*
  - *…*

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DRILLING ACTIVITIES

- Rig staff and heavy machinery operating in the same tight space.

No personnel on the drill floor and "hands-off" operations

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DRILLING ACTIVITIES

- Operating conditions even more challenging as DW & UDW and HP/HT require:
  - *Continuous presence of double barrier on the well*
  - *Continuous and accurate well barriers monitoring*

- A complete drilling package integrated with the drilling rig is necessary to guarantee continuity during drilling phases.

Discontinuity is one of the main causes of the typical drilling problems, that could be more or less severe depending on the well conditions.

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A DRILLING ENIGMA

"Why on earth, for a hundred years, we stopped the circulation of drilling fluids, every time we wanted to make a connection; and disconnected the top drive from the drill string when connection kicks could occur, is an enigma".

"The answer is that we had no reliable means of maintaining circulation until now.

Today the enigma could be solved to invest on efficient Continuous Circulation System".

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CONCLUSIONS

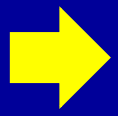
25% of kicks happen during drilling and circulating

25% of the time kicks are related to making connections

50% of the time kicks are related to tripping the DP in and out of the well

Source: SPE, *JPT August (Shell)*

Continuity of hydraulic barrier
+
accurate well barriers monitoring



Kicks related to making connections and tripping phases could be avoided

Kicks happen during drilling could be immediately detected and mitigated

Thanks for your attention