Case History of using Continuous Circulation with Air/Foam

Improving Operational Efficiencies
10 Years of Drilling Optimization.

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Summary

• Overview of the technique
• History of the implementation in Papua New Guinea
• Start-Up → Early Lessons → Pushing Boundaries → Optimize
• Redesigns and management of change
• Review
Continuous Circulation while making a connection

Video
10 years of using CCS in PNG

• 24 Wells Completed using CCS with Air & Foam

• Each of the 12-1/4” / 17 ½” sections drilled to date were Air/foam drilled with a range from ±40m to 2100m (Average 1088m interval)

• ROP average 2-8m/hr through Karstic Limestone using Tapered Mill.

• Some sections drilled directionally with AKO and EM MWD

• The injected air/foam fluid was made up of 1500-3000 scfm air, 30 gpm of water and 1-2% foaming agent (Inhibifoam) and 1 lb/bbl polymer (Barazan D).

• The maximum standpipe foam injection pressure was maintained at 1600 psi.
Advantages of using CCS

• Early justification for using a new technology
• Prevent stuck pipe
• Increase ROP
• Enable the section to be drilled to TD maintaining foam circulation and cuttings return.
• Enable the wells to be drilled directionally
• Reduce connection times from 40mins to 10 mins
FIG 2: HISTORICAL GRAPH FOCUSING ON THE 17 ⅝” HOLE SECTION DEPICTING THE VARIOUS WELLS DRILLED SINCE 2005. WASUMA 1 STANDS OUT AS ACCOMPLISHING A SECTION TD IN RECORD TIME.
Start-Up → Early Lessons →

• Rig Survey
• HAZID/HAZOP/DWOP/Pre-Section Meetings
• Contingency Planning
• Critical Design Testing
• First Well Lessons
• Second Well Lessons
• Focus on Drilling and Operations Optimisation
Lessons Learned
Photos of early design changes
Pushing Boundaries → Optimize

Once the rig is comfortable with the technique then push boundaries

- Increasing the depth of this section.
- Drill faster.
- Adjusting the trajectory of the well to land at a higher angle.
- Keeping crews occupied.
- Working through the downturn.
- Implementing the next generation of design changes.
- Getting to the end of the working life of equipment.
Results of Optimization

- Deepening the wells meant initial issues with stuck pipe
- Using Drilling Dynamics Sub to help plan faster drilling
- First attempts at drilling faster lead to BHA LIH and ST
- Keeping equipment on location for long periods without maintenance led to high failure rates.
- AFE’s and performance expectations changed.
- Changes in conditions meant lower ROP’s due to water.
Conclusions

Drilling optimization through the implementation of a new technology

• Initial lessons learned bring quick improvements to the process.
• Contingency planning gives confidence to proceed through failures.
• Trying to go farther and faster can mean marginal results for the well.
• Maintaining crews long term has +/- effect, frequency of operations is better.
• If budgets are cut then cutting new technology is not an option.
• Always keep optimizing.
Acknowledgements

*Drilling optimization through the implementation of a new technology*

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IADC Well Technology Conference Committee

Attendees – Thank You, Questions?