

PROJECT SITUATION REPORT

DISC Drill 2012-13 Season

Project: T-350-M

Project Principal Investigator: Dr. Charles Bentley

Report No. 5 for period: 12-9-12 **through:** 12-15-12

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ACTIVITIES DURING PERIOD

- A few people worked on Sunday, 12/9/12, with a mid-morning start.
- Two shift operations started on Monday, 12/10/12, and continued through Tuesday, 12/11/12.
- Broaching passes were continued at a depth of 3001 meters. Between 4-8 passes of the target area can be completed per drill run in and out of the hole. Cable tension continued around 30kN for many of the drill runs.
- In an effort to reduce the cutting force during broaching, a 144mm diameter shoe was added above the broaching cutter. This reduced the depth of cut from 4mm to 2mm and decreased cutting force by approximately 1-2 kN.
- The Glassman high voltage power supply kicked out due to a short. Troubleshooting revealed the short was due to a loose m3 screw within the anti-torque section that holds the covers on the fiber optic termination cans. The screw had become lodged between the inner conductor of the cable and bore of the electrical slip ring. The screw was reattached to the cover.
- An old broaching head cuff was modified to improve the effectiveness of vacuuming runs. A length of a DISC Drill screen barrel segment was also attached to the end of the cuff. This will reduce the clearance between the barrel and borehole wall with hopes of achieving better pumping action and chip collection.
- The LVDT counts on instrument section K were found to be unstable due to data transfer rates when the drill was in the borehole. The weight-on-bit (WOB) reading was also exhibiting excessive noise in the signal, later found to be due to a circuit design problem. Both of these issues have been successfully resolved and instrument section J was modified for immediate use. The engineering

model was also updated. The WOB reading is now more stable than ever and only experiences fluctuation between 5-10 N.

- A cleaning run was done down to 3,200m with six screens available, but only one full screen was recovered. The chips were very fine and thus we may not be recovering all chips created during each broaching pass.
- A 142.5mm shoe was installed, producing additional positive results during broaching. With a 2.75mm depth of cut, this decreased cutting force, thereby decreasing cable tension.
- Completed the first logging tool test run combined with a camera run. The logging test passed by the deviation areas without any issues or concerns.
- Several camera runs have been completed, verifying the progress of broaching and the existence of any notches created by milling operations.
- Instrument section K was opened in order to diagnose an issue with the I2C bus. A small amount of drilling fluid was found in the section between the upper and lower bulkhead seals. One of the seals had a small nick on the outer edge which may have been the problem, however we are not sure if this is the point of entry for the fluid. The SAE plug o-rings were changed, the unit was reassembled and put back in service.
- The door on the control room was hyper-extended and the hinges were broken in half as the yellow gantry crane attempted to traverse by. The door was repaired by adding bar stock on the hinges. The door was re-installed and functions normally.
- Began three-shift operations on Wednesday, 12/12/12.
- When the desired depth notch of 100mm had been acquired through broaching, at least theoretically when calculating number of passes performed and accounting for theoretical depth per pass gained, milling operations were begun. The actuators were rotated into an inline configuration. Side push was initially tried as per the drill plan. The head was set up with a radial shoe for a 1.5mm deep cut and an axial shoe for 1mm feed per tooth.
- Stick-slip tests were done in side push mode with the camera running to determine our inability to create a ledge through milling. With upper and lower actuators set at 90% effort, the drill slips at a rate of about 1m/s. It was determined that this is the cause of why the milling cutter could not successfully form and maintain a ledge initially.
- Changing actuator arm efforts to 60%, changing feed rate to 0.15 m/s and changing cutter speed to 110 rpm proved successful during milling. After 20 passes were performed during one run between 2998 meters depth and 3001 meters depth, a ledge was formed as verified by WOB during a subsequent touch off. Through a camera run, the size of the ledge was estimated to be approximately 25mm.
- During milling, a few instances occurred where the winch would not stop slow speed payout upon command. The e-stop had to be used to stop the winch each time. This issue was witnessed during the 2011-2012 season, but its cause has not been determined.
- While the ability to produce a ledge via milling was verified, the initial notch produced by broaching was only found to be about 50mm, half the size of the

100mm depth notch desired for milling, so the drill was again reconfigured for broaching operations.

- The sonde control computer is rebooted periodically, as the LabView software stops communicating on occasion. This issue is manageable with computer restarts.
- The dowel pins that had been added to the pump section for use of the drop ring were found to be protruding .125" from the barrel. They were, in essence, acting like a shoe, which would hold the barrel off of the wall. The pins are now removed for milling operations and are reinstalled for broaching.
- Mike Jayred returned to McMurdo on Thursday, 12/13/12, for minor dental work and returned to WAIS Divide the next day on Friday, 12/14/12.
- Received 12 drums of Isopar K drilling fluid.
- Fabrication of a ratchet ring was completed and the ring was installed on the pump. This ring will allow the strings holding the drop ring during ascent to rotate one way (clockwise), thereby allowing for broaching with rotation, but will ratchet when the cutter motor is turned the other direction (counter clockwise), thereby cutting the strings and releasing the drop ring to slide down on top of the broaching cutter for smoother and faster ascent out of the hole. The ring was tied on with two strings during its initial drill run.
- Broaching with rotation was subsequently tested. This method stabilized crown sheave tension and WOB, though it appeared as though the strings were cut at some point during the third pass, as no additional cutting was experienced.
- The broaching cutter was moved to the lower position on the mandrel to allow for better chip clearance and the drop ring was subsequently attached to the ratchet ring with four strings.

SAFETY

- Held brief safety meetings for all Arch staff on both Monday, 12/10/12, and Tuesday, 12/11/12. Locations of safety equipment were discussed as well as protocol for Arch emergencies. Also demonstrated use of the Kendrick extraction device used for patient extraction from the slot if necessary.
- Performed troubleshooting on large DISC Drill air monitor, as two lines were troubling. The line running to the screen cleaning area was pulled back into the control room for drying and should be re-installed on Monday. A backup handheld air monitor arrived from McMurdo, but the monitor is for CO and not O₂. McMurdo has been contacted for a monitor swap.

COMMENTS

(Problems, Concerns, Recommendations, Etc.)

- The second 225 kW (backup) generator is still not operational, though additional parts were just received late this week. The 225 kW generator in use experienced two shutdowns this week. The first occurred on 12/12/12 when the main breaker on the generator partially melted down. Power was down for 1.5 hours while the breaker from the inactive generator was swapped in. The second power failure occurred on 12/15/12, registering an undervoltage condition. The causes of the two failures have not been determined. A

contingency plan was developed with camp staff to prepare a 40 kW generator for powering the Arch/drill operations in the event both 225 kW generators go down.

- Terry Wilson, the PI for the Polenet project, gave a Wednesday night science lecture that was well attended.