PROJECT SITUATION REPORT
DISC Drill 2011-12 Season

Project: T-350-M
Project Principal Investigator: Dr. Charles Bentley
Report No. 10 **for period:** 1-15-12 **through:** 1-21-12
Prepared by: Jay Johnson **Date:** 1-22-12

IDDO Personnel Onsite:

Josh Goetz
Mike Jayred
Elizabeth Morton
Chuck Zander
Chris Gibson
Jay Johnson
Nicolai Mortensen
Steffen Bo Hansen

ACTIVITIES DURING PERIOD

- The drip pan that goes from the winch to the slot was found to be rubbing on two of the hoses for the tower actuator. Snow was removed from under the pan to restore clearance.
- The first deviation is being run from 2976m 3001m. At this point we will start coring a partial diameter core. Full core diameter should be reached by 3003m. The target replicate core depth is from 3008m to 3048m “AIM 8”.
- Tested the broaching head with the three screen barrel. Using the side push method we were unable to get the head to cut even in the most aggressive cutting configuration. The screen barrel is a larger diameter than the upper portion of the drill, so we concluded that as the drill is pushed to the wall it flexes and the head ends up not contacting the wall. Different actuator forces were tried with no success.
- The broaching head was also tested using the initial angle (tilting the drill) approach. Again we were unable to initiate the cut. Overcoming the force of the bumper springs to get the cutter in contact with the wall is thought to be one of the factors. They were set as light as we were comfortable with to ensure the cutters do not contact the wall on the way down.
- Several test runs were done to determine the effects of the actuator forces and anti-torque setting on the tendency of the drill to stick slip. In a normal coring situation shoes are used to provide stable cutting by putting some of the drill weight on them. In the milling and broaching configurations for deviating there is no axial shoe, so we are relying on the drill to move smoothly at low cable speeds. The first tests were done with the anti-torques set up as they would be for coring and the actuators arms set up with ball end ends (these ends roll around the bore but slide axially). The initial angle approach was used and the cutter was not rotating. Different actuator force settings were tried. A cable speed of .2m/s was required for a smooth decent or accent. Next the ball ends were

replaced with rollers (made in the MECC) which roll axially. These reduced the stick slip only a slight amount. Then the upper actuator rollers were replaced with rollers that have a protruding knife edge for providing anti-torqueing. The anti-torque blades were loosened. This combination showed only slight improvements in stick slip, but greatly reduced how much the drill rotates while descending or ascending. The drill was rotating up to 120° in 25m and now it is no more than 25°.

The effect of the stick slip is that the cutter sees high intermittent loading which causes sudden orientation jumps (change in rotation of the sonde). The actuators are not able to react to such quick changes so the result is the orientation of the deviation changes. Using the final configuration described above, we were able to mill at .03m/s without the orientation of the sonde jumping around despite the stick slip.

- Tested the side milling head. Given the limited amount of time, we decided the best chance of success was to start with the initial angle approach. Side cutting depths of 2-4mm have been tried. Initially cable speeds of .1-.2m/s were tried. These high feed rates gave relatively smooth weight on bit (WOB), but they exceed the relief angle on the cutter teeth. With a cutter speed of 80 rpm the max feed rate should be .03m/s. This was also tried. With our current axial depth cut of 2mm little change in cutting performance was noticed over the .03-.2m/s feed range.
- For most of the runs we have been collecting fewer chips than expected. This means we are either not cutting as much as we think we are or we are not collecting the chips due to the high feed rates.
- A vacuuming run was done to see if there were chips left in the hole. The screens came back empty.
- Nicolai mapped the deviation on Friday night to try and determine how much cutting we have done. This was done by mounting the cutter mandrel with just a shoe directly to the sonde (no screen barrel). The short drill configuration makes it easier to see small angle changes. The drill is lowered to various depths in, above, and below, the deviation zone. At each depth the drill is tilted in a number of directions and the inclinations are recorded. He was not able to conclusively find a notch in the wall. There should have been a notch ~25mm deep if all milling passes were to depth. We believe this means the cutter head has not been engaging fully with the wall.
- On Saturday we again tested different actuator force settings to try and better place the cuter head against the wall. One milling pass was completed at .03m/s feed and we recovered the expected amount of chips.
- The hall sensor counts from the motors in the lower actuator section drift when the pump and cutter motors are running. These counts are used to determine the position of each arm. This means the drill will loss position over time. To get us by we are only running actuators in auto mode for one minute before retracting the arms and resetting the hall counts. We are working on trying to mitigate the problem.

- One of motor drives in the D actuator section locked up on Friday. We have not had a chance to open it up yet and determine what went wrong. The section was swapped out.
- While the sonde was on the bench to work on the hall sensor issue the MPS for the cutter and pump motors quit functioning. A space heater was being used to warm the wiring at the top of the motor section. Nicolai thinks the heat may have melted some the frost and ice chips around the motor wiring causing a short. The motor section was swapped out as a precautionary measure.
- Instrument section K was swapped in. This is the unit that the pump motor controller burned out in last week. It had been repaired but not tested yet since it has to be connected to the drill to do so. When swapped in it still was not working. Nicolai worked on it last night and found the problem wasn't in the instrument section, but was being caused by a shorted strain gage wire in the lower actuator section.
- On two different runs, the actuator arm fail safe mechanism on one of the lower arms was found tripped. We are trying to determine what is causing this.
- The cable vacuum has been set up and is working well. It is collecting about 13l per run.
- I am working on designing and fabricating a helical shoe for the face milling head.
- Mike and Elisabeth have completed drilling with the Eclipse drill. They got to 121.5m. They are now in the process of drying and packing the system.
- Josh did more testing of the prototype hand auger. It is drilling and transporting chips well, but having some difficulties collecting core. So far only the collet and tapered ID heads have been tested. Further testing will be done this next week.
- The replacement fiber optic transceivers have not arrived yet. They were to arrive on Thursday, but the flight was canceled due to weather. The parts are now scheduled for Monday. It would be very useful to have the camera right now to see what we have been doing.

SAFETY

-

COMMENTS
(Problems, Concerns, Recommendations, Etc.)

- The repair of the switch on the Glassman has been holding up. The backup unit was shipped from McMurdo and is here in case we need it.
- Jeff and I have settled on the fluid level being brought up to 36m from the surface at the end of the season.