Engineering Report
IODP Expedition 372 Freemantle to Christchurch
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PCS (Pressure Core System)

Latch Assembly: Each piece of the assembly had the threads cleaned and lubricated, and the two Quick Release connections were lubricated and function tested. The space out was measured and verified. The XCB latch was function tested to verify the Latch Dogs functioned properly, and then the drop ball was loaded in to the collet and the assembly was set aside in its 3 long sections.

Actuator Assemblies: The two actuators had been assembled and function tested good before shipping, but this was repeated on board. The outer barrels were removed, and the latch reset and the release reset tools were used to cycle the actuator. The data sub was attached to the bearing sub, and the outer barrel replaced and tightened. Each actuator was then set aside.

Pressure Barrel Assemblies: The three pressure barrels were assembled and tested good before shipping, but this was also repeated on board. Each assembly had its outer barrel removed and the seals inspected, then after reassembly each pressure barrel was pressure tested. Each barrel held pressure, and then were set aside. The three microsmart pressure transducer carriers, as well as the connection that would be used to attach to the degas manifold was also tested to 2500 psi and passed.

Degas Manifold: The degas manifold was set up and instrumented with pressure gauges and a flow meter. The arrangement of the manifold was changed several times at the direction of the attending scientist, and the final configuration was pressure tested using compressed Nitrogen and proved to be leak free.

Time did not permit running the PCS tools, and the assemblies were sent back to be disassembled for storage in College Station. The degas manifold was also disassembled and returned.

MDHDS (Motion Decoupled Hydraulic Delivery System):

The MDHDS was run twice to deliver the T2P tool for measurements. Prior to running the tool, the MDHDS was removed from its storage shuck and placed on the bridge deck. The latch assembly was removed from the tool and disassembled to verify the seals were good and that no deterioration was caused from storage in the shuck. The tool proved to be fine, and all o-rings and sealing surfaces were in excellent condition. The tool was reassembled, and latched using new shear screws, and placed back in its storage shuck.

For the initial deployment, the MDHDS was laid out on the rig floor, and the storage caps removed, and the latch cap was placed on the upper end of the tool. The T2P was attached to the

tool, and the flapper guide tube was put in place. There were no issues in the attachment of the ERS or running the tool down to the landing seat. The current deployment instructions call for a pressure of 750 psi to shear the screws, and then a maximum of 750 psi to push the T2P into the formation. The pumps were run until 750 psi was reached, and held for one minute, and then the pressure was bled off and two minutes were spent with the tool only seeing hydrostatic pressure. The pumps were then started again and brought up to 750 psi to push the tool into the formation. Circulation was never established, but the tool was still left for 45 minutes in the formation. During this time it was determined that 750 psi was not enough to shear the pins, and it was decided to repeat the test. The pumps were brought up to 1100 psi and held for one minute, and then bled off for a two minute dwell. The pumps were then started in order to push out the tool, and circulation was established at 500 psi. While pumping, the pressure would rise to 500 psi, and suddenly drop to 0; only to rise back to 500 psi and again drop to 0. No explanation could be determined, although this event did correspond with heave, and it was decided to raise the drill string 2 meters per the instructions. Full circulation was established after this, and the strange pressure variations disappeared. The tool was allowed to sit for 40 minutes to gather data.

At the conclusion of the dwell, the ERS was lowered to attach to the MDHDS. Many attempts were made, but there was no success in mating to the tool. The wireline operator concluded, based on his depth measurements that the ERS never got past the latch cap and into the MDHDS. The clearance between the OD of the ERS and the ID of the latch cap is approximately 1/8" per side, and allows practically no deviation from vertical in order for the ERS to pass through. It was then decided to retrieve the MDHDS in the fully stroked condition, using a 4" GS cup on the core line. The latch cap of the MDHDS has a mating profile for a 4" GS.

The core line and tool were lowered, and successfully mated to the MDHDS, but the trouble began as soon as the MDHDS was raised enough for the flapper guide tube to clear the flapper valve. The T2P has several diameter changes and square shoulders, and these were catching on the flapper as the tool was raised. It was initially thought that pumping hard could hold the flapper open, but a design problem was discovered. When fully stroked (the inner rod all the way down inside the barrel with the fishing neck landed on the outer barrel crossover) the MDHDS is sealed and circulation through it is not possible. As there was no way to pump enough volume around the outside of the tool, the only method of retrieving the T2P through the flapper was by using the sliding hammer jars above the GS cup as well as over pull. The T2P was eventually freed, after much effort, by using an over pull of 11,000 lbs as well as the jars.

When the MDHDS reached the surface, it was immediately obvious that the bottom tip of the T2P was missing. The MDHDS was placed in the shuck and a mechanical RS was lowered into the tool and in an attempt to attach to the inner rod. The inner barrel was found to be mostly filled with clay, and because of the seal formed when the inner rod is fully stroked, the inner rod was pushed up from the bottom to allow the clay and water to drain out. The mechanical RS could then be lowered and attached to the fishing neck of the inner rod, but the inner rod would not stroke completely up. The latch dogs of the MDHDS had also somehow lodged into the locked position and prevented the inner rod from stroking to the top of the tool. The MDHDS/T2 was then laid out on the rig floor. The T2P was removed and transferred to the lab for downloading of data. There was obvious damage to the quick connect used to attach the MDHDS to the T2P, and this was dressed using a hand file. The MDHDS was laid out on the rig floor and taken apart (outer barrel and the inner rod) in order to remove the latch section. The latch section was taken to the downhole lab, disassembled, and put back into running condition. The latch assembly suffered no apparent damage, and all seals were good.

The MDHDS was reassembled and cocked with shear screws. The second deployment of the second T2P (the initial tool being too damaged to reuse) went almost exactly as the first. The tool was lowered onto the seat in the BHA, and pressured to 1100 psi. After releasing the pressure and holding for two minutes, the tool was pushed into the formation. After raising the BHA 2 meters, full circulation was establish. The T2P was allowed to sit for 45 minutes with no rotation, and once again an attempt was made to use the ERS to retrieve the T2P. As before, the wireline operator was unable to get the ERS past the latch cap (per his depth measurements) at the top of the MDHDS, and the 4" GS on the coring line was used to attach to the MDHDS. Once again, the T2P got hung up in the flapper. The tool was finally freed by using almost 13,000 lbs of over pull and use of the sliding hammer jar. Once to the surface, the lower section of the T2P was missing, and upon closer examination it proved to have unthreaded. The lock dogs of the MDHDS were once again in the locked position, and disassembly of the MDHDS was required to fix this this. It was concluded that the jarring used to free the T2P had caused the shear screw head sleeve to move back to its locked position.

CDS/SET-P:

Two deployments of the SET-P were made using the Colletted Delivery System (CDS), and mechanically there were no issues. See Tech Report for information concerning dtat issues with these tools.

Conclusions/Recommendations:

1) The square shoulders and step diameter changes of the T2P quick connect needs to be addressed. These shoulders catch on the flapper, and damage to the flapper (as well as the T2P) was evident when the BHA was retrieved at the end of this leg.
2) The MDHDS fishing neck seals on the crossover when the tool is fully stroked, preventing any circulation. This needs to be corrected, possibly by adding flutes to the OD of the fishing neck?
3) The small clearance between the OD of the ERS and the ID of the latch cap makes the insertion of the ERS problematic, even more so when the MDHDS is fully stroked and the tool sealed. With the MDHDS sealed, the only path for the water to displace when the ERS is lowered is past the ERS OD, this acts to resist the ERS entering the tool.
4) The bottom face of the ERS and the top face of the latch cap are both square shoulders. Adding a taper to one or the other, as well as a modification to prevent sealing the tool, should allow the ERS to more easily enter the MDHDS.