

IODP Expedition 384: Engineering Testing

Week 1 Report (20–25 July 2020)

Operations

International Ocean Discovery Program (IODP) Expedition 384, Engineering Testing, began on 20 July 2020 at 1000 h (UTC + 2 h) with the arrival of 17 IODP JRSO personnel on the *JOIDES Resolution* (JR). The JR was tied up alongside Berth 16 in Kristiansand, Norway. On 21 July the remaining one IODP JRSO and seven crew members arrived.

All shipboard personnel followed protocols to minimize the risk of a COVID-19 infection on the ship, including quarantines and multiple PCR swab tests at home and after arrival in Kristiansand. All shipboard personnel are following social distancing guidelines such as wearing masks and restricted meal times.

Final ship maintenance and shipment deliveries were completed, including the replacement of the top drive motor and associated performance checks. The existing motor was sent off for repair in Norway.

The last line was released at 0730 h on 23 July, beginning the transit to proposed Site REYK-06A. The ship's clock was set back 1 h on 24 July to UTC + 1 h. Senior shipboard personnel met for final planning of drilling and coring operations. By midnight on 25 July we had completed 774 of the 1094 nmi transit to proposed Site REYK-06A at an average speed of 12.0 kt.

Background and Objectives

Expedition 384 is primarily dedicated to engineering testing as it relates to deep (>1 km) drilling and coring in igneous ocean crust. The primary objective of Expedition 384 is to drill a series of holes using three types of drill bits: a tungsten carbide insert (TCI) tricone bit that is more robust than what has been used so far on the JR, a polycrystalline diamond compact (PDC) bit, and a TCI/PDC hybrid bit. Additional tests include the deployment of a block type underreamer as well as a PDC coring bit to obtain samples for geotechnical testing. These drilling, hole opening, and coring objectives were the top priorities of the Deep Crustal Drilling Engineering Working Group, which convened in 2017 to discuss issues with crustal drilling, and follows the revised priorities set by the *JOIDES Resolution* Facility Board in 2018.

The site location for these tests has evolved over the past two years as a result of JR schedule changes. The current primary site is proposed Site REYK-13A (1520 m water depth) from postponed IODP Expedition 395 (proposals 892-Full12 and 892-Add), where

several holes will be drilled through the 210 m sediment section and ~100 m into basalt. A potential second site was Integrated Ocean Drilling Program Site U1309, where another hole would have been drilled into gabbroic rocks exposed at the seafloor. The most recent expedition postponements and resulting changes in the ship's track have removed that site from consideration. Operations at proposed Site REYK-13A are projected to take ~17 d.

Additional operating time had become available for Expedition 384 as a result of the previous JR schedule change dictated by the COVID-19 situation. A secondary objective had therefore been added: the assessment and potential improvement of current procedures for advanced piston corer (APC) core orientation. A total of ~5 d is allocated to triple-coring the top 70 m of sediment at proposed Site REYK-6A (postponed Expedition 395), located 54 nmi east of proposed Site REYK-13A.

To maximize operational efficiency, Expedition 384 will occupy the secondary objective proposed Site REYK-06A first, and then proceed to the primary objective proposed Site REYK-13A.

Science Results

In preparation for conducting core orientation experiments at proposed Site REYK-6A site, the three Icefield tools and the two FlexIT tools were thoroughly tested, including making measurements on the dock in Kristiansand to ensure they were recording the absolute declination accurately, and doing rotation tests aboard the ship to ensure they were accurately measuring relative changes in declination. In addition, Siem Offshore coring personnel provided a demonstration on the rig floor of how the core orientation tools are inserted in the APC core barrel assembly.

The superconducting rock magnetometer (SRM) was prepared for use after having been off for several months. The vacuum for the cold head was pumped down and a field was trapped in the superconducting shield to create a space around the SRM sensors that has a negligible or null field. The field was mapped along the SRM track and test measurements were made, confirming the SRM is fully functional.

Technical Support and HSE Activities

Port Call and Transit Activities:

- Crossover with one offgoing IODP JRSO person was completed on 20 July.
- All instruments to be used for coring activities were started up and tested.

- The X-Ray Imager image quality was tested. Data loss between the detector and the PC was indicated.
- The UPS for the Malvern Aeris X-ray Diffractometer (XRD) was installed. The Malvern XRD is running well.
- X-ray technicians discovered leaks in the connections of the chill water lines to the Haskris water chiller and a leak from the pump. Chill water lines were tightened up but the leak from the pump was due to the shaft of the pump being ground down and nearly destroyed. A new pump was installed. This problem occurred on previous expeditions. The X-ray technicians will consult with Haskris to find out how to prevent this from happening.
- The towed magnetometer cable was installed on the winch and tested.
- Extensive training was conducted on the SRM, including trapping a field and mapping the field profile along the track. Test measurements were performed to confirm the SRM is fully functional.
- Multiple core orientation tool experiments were conducted on the dock and on the ship. Three Icefield and two FlexIT tools were thoroughly tested to ensure they record absolute declinations and relative changes in declination accurately.
- Technical staff received an orientation by the Siem Coretech on the integration of the orientation tools with the APC coring assembly.
- A new conductivity-temperature-depth recorder was bench tested and its software set up.
- Ultra-low freezers were started up.
- Technical staff continued working on projects, including:
 - GEODESC programming and testing.
 - Catwalk Module testing.
 - Laserfiche implementation.
 - Diversity, Equity, and Inclusion staff discussions.

IT Support Activities

- Assisted with the restoration of missing content on the Confluence server.
- Restarted RigWatch and information displays (VDUs) systems.
- Created a temporary development server for the GEODESC project.

Application Support Activities

- Updates to several web services needed to support the Catwalk program.
- Deployed new versions of Coulometer and Cahn Balance program. A minor code change was needed to fix the loading of LabVIEW modules, possibly due to a Windows update.
- Fixed a problem with the Drilling Report (wrong value for days-since-accident being reported due to shutdown period not being accounted for).

HSE Activities

- An abandon ship drill was conducted.
- Safety shower and eye wash stations were tested.