Cruise Summary for R/V *Kilo Moana* KM-21-07:
ALOHA Cabled Observatory Service
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The ALOHA Cabled Observatory 100 km north of Oahu at Station ALOHA is the deepest (4728 m) power and internet node on the planet, returning oceanographic data from the seafloor in realtime to shore. The ACO is coming up on its 10-year anniversary of operation with plug-and-play capability, on 6 June 2021.

On this NSF-funded cruise, we serviced the infrastructure and instrumentation. Specific objectives with outcomes were:

- Deployed and connected a new Basic Sensor Package 5 (BSP5; $CTDO_2$ -conductivity, temperature, depth/pressure, oxygen) to the Observatory (OBS);
- Deployed and connected CAM2 (video camera, two lights, and hydrophone) to Secondary Node 1 (SN1);
- Deployed the memorial plaque for Fred Duennebier in view of CAM2;
- Partially cleaned the sea electrode (removing aragonite deposits), dressed some of the cables, and conducted a video survey of all the bottom packages and cables. We were unable to accomplish a quantitative survey due to low currents with sediment clouds;
- Recovered LIGHT1, LIGHT4 and 1 hose reel using the Elevator (ELEV) in two trips;
- We were unsuccessful in biological sampling of megafauna including holothurians and echionids due to ROV damage; and
- We participated in Research Experiences for Undergraduates (REU) with students, realtime streaming and interviews to the web, collecting material for a Voice of the Sea documentary and to support our Anniversary events.

Installing the BST5-$CTDO_2$ was especially critical to maintaining the 10-year temperature and salinity time series (both Essential Ocean Variables), especially since after the OBS CTD failed in December 2020 (after 10 years), we were left with only one remaining $CTDO_2$ (BSP4). The installation of CAM2 restarted video after LIGHT4 (illuminating CAM1) failed in December 2020.

We used Port Extension Assemblies (PEAs, long hoses/cables with ODI flying wet mate connectors) to effectively move the node ports out radially 25-50 m to connect between the instruments and the nodes, and thereby reduce congestion around the nodes.

The ROV *Lu'ukai* is the *sine qua non* for performing this service work. The ACO work was accomplished during two dives with the ROV working flawlessly (LK-142 and LK-143, bottom/total times: 16.3/24.1 hr and 25.9/32.2 hr).

Support from the ship's crew and the ROV *Lu'ukai* team was exemplary. ROV *Lu'ukai* proved again it is dependable - ready to go on schedule and has the endurance to operate without technical fault.