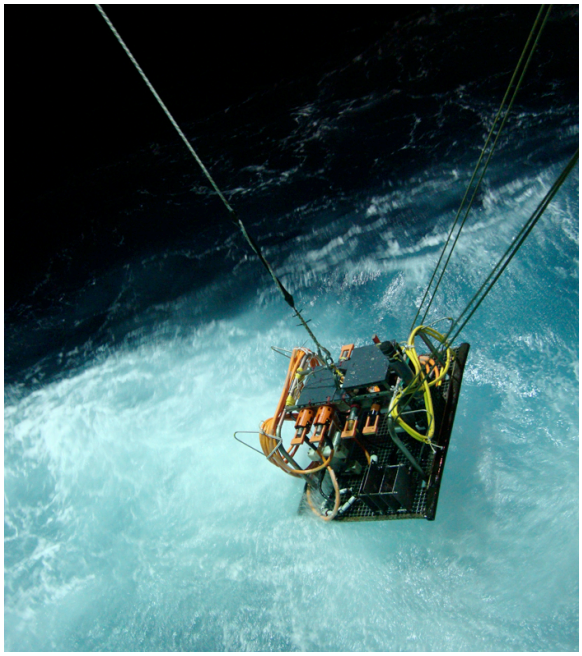
Illuminating the Deep Sea: First light at the ALOHA Cabled Observatory

Honolulu, HI – At 10:23 am on June 6th, the University of Hawaii ALOHA Cabled Observatory (ACO) came to life, extending electric power and the Internet over a retired seafloor telecommunications cable from Makaha to Station ALOHA, 60 nautical miles north of Oahu, Hawaii. Turning on the observatory lights illuminated the three-mile-deep seafloor. A video camera and hydrophones plugged into the ACO provided eyes and ears to witness the Woods Hole Oceanographic Institution's remotely-operated vehicle JASON finish its work of installing the ACO and connecting experiment modules, and then lift off to the UH research vessel Kilo Moana above for the journey back to Honolulu. "After 18 days of hard work at sea, and months of preparations, the ship's crew and science groups were elated with our success in establishing the world's deepest cabled ocean observatory," noted Roger Lukas, Oceanography Professor in the School of Ocean and Earth Science and Technology at the University of Hawaii – Manoa.



The junction box which connects the power and data cable to the sensors at the ALOHA Cabled Observatory being deployed at Station ALOHA, north of Oahu, Hawaii. Image courtesy Cameron Fumar, SOEST/UHM.

ACO is literally shining new light on the darkness of the ocean at depth. Sensors now connected to the ACO provide live video of the surrounding seafloor, sound from local and distant sources, and they measure currents, pressure, temperature, and salinity. Measurements of pressure indicated when tsunami waves or surface wind waves are passing through the upper ocean. Listening to ocean sound allows detection of ships, earthquakes, whales, cetaceans and even rain events on the surface ocean. Video and audio highlights are available to the public here: http://aco-ssds.soest.hawaii.edu/ACO/media.html. Spare slots are available to plug in additional sensors and science experiments. The deep ocean is a long-term recorder of surface climate changes, but it is particularly under-observed – observations have been limited by lack of electrical power and the necessity to store information or communicate small amounts of information by satellite. Sustained, continuous recording of deep ocean conditions will enable better understanding of ocean acoustics, circulation, chemistry and ecosystem behavior, including the testing of ideas and numerical models.

ACO is funded by the National Science Foundation and the School of Ocean and Earth Science and Technology at UH Manoa to extend observational capabilities at the long-running Hawaii Ocean Time-series site, Station ALOHA. The ACO was conceived by UH Manoa professors Fred Duennebier, Roger Lukas, Bruce Howe and David Karl. It was designed and built by Dave Harris, Jim Jolly, Jim Babinec, Grant Blackinton and other staff of the SOEST Engineering Support Facility, along with Mark Tremblay, a retired AT&T engineer. Network communications were designed and implemented by Brian Chee, Chris Zane, Ross Ishida, Pat Townsend and

Sharon Stahl. Key data systems were provided by the Monterey Bay Aquarium Research Institute, along with those developed in-house by Jolly and Fernando Santiago-Mandujano. Corporate donations of equipment, software and services were an important factor in successful system integration and installation. For a complete list of corporate donors, visit http://aco-ssds.soest.hawaii.edu/ACO/acknowledgements.html.

FAQs about the ALOHA Cabled Observatory

What is the ACO?

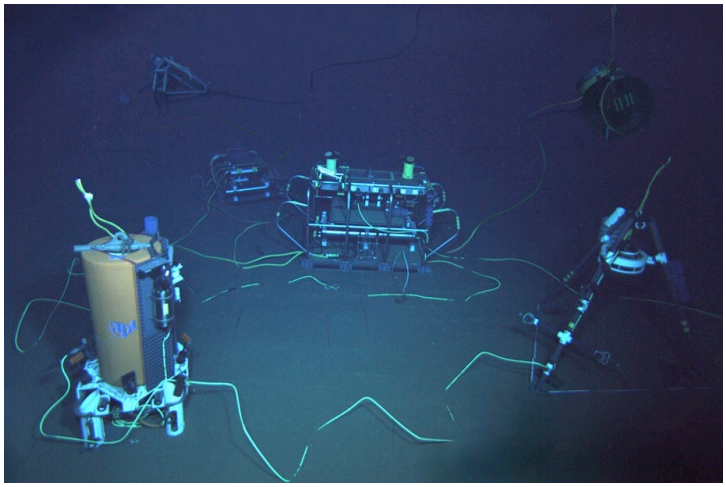
The ALOHA Cabled Observatory (ACO) is a system of hardware and software that extends electric power and the Internet offshore, supporting sustained real-time observations in the deep ocean. The ACO is connected to Oahu, Hawaii by the HAW-4 telecommunications cable that was transferred to the project by AT&T in 2007.

Where is the ACO?

On June 6th, 2011, the ACO was deployed on the ocean bottom (depth ~ 5 km – 3 miles) at Station ALOHA, 100 km (60 nautical miles) north of Oahu, Hawaii. Station ALOHA is the site of the long-term Hawaii Ocean Time-series (HOT) (http://aloha.manoa.hawaii.edu) open ocean measurement program, visited by research vessels 10-12 times each year since October 1988.

What is there?

There are five modules that are connected together on the seafloor. The Junction Box is connected to the HAW-4 cable and to the Observatory module. Together, they supply 1200 watts of power and 100 Mb/s of Ethernet communications to sensor systems on these two modules, and to the other three modules. The other modules are the Camera tripod, the AMM bottom node, and the TAAM mooring. Sensors provide live video of the ocean bottom around the ACO, sound from local and distant sources, currents, pressure, temperature, and salinity. View the layout of the ACO (same as at right) and additional information here: http://aco-ssds.soest.hawaii.edu/Module_Layout.html.



A composite image showing the components of the ACO including the main observatory node (center) with current, temperature, and salinity sensors; camera tripod (lower right) and secondary node with additional sensors (lower left) north of Oahu, Hawaii.
Image courtesy of SOEST/UHM.

Why is the ACO there?

It is difficult to make sustained measurements in the deep ocean. Systems lowered on cables from research ships can use power from the ship, but ships (and people) cannot remain on station without reprovisioning. Systems that are moored in the ocean can make measurements for a longer period of time, but they are limited by the battery power that can be contained in pressure-resistant cases. Moored measurements are typically not available until the mooring is recovered a year or more after deployment. With a surface buoy and special subsurface cabling, moorings can transmit limited amounts of data by satellite to shore with relatively little delay. The ACO provides continuous power and fast two-way communications between shore and a

variety of oceanographic instruments, allowing scientific research to be done continually. These capabilities allow scientists to modify sampling as we learn more about the ocean environment surrounding the ACO.

Why are sustained deep ocean measurements important?

Deep ocean measurements are important for testing ideas and numerical models of ocean circulation, climate and ecosystem behavior. Long-term changes in the deep ocean are particularly difficult to observe for technical reasons given above, and because short-term variations obscure them.

Research Contact: Bruce Howe, Research Professor and Department Chair, Ocean and Resources Engineering, University of Hawaii – Manoa, bhowe@hawaii.edu, (808) 956-0466

SOEST Media Contact: Marcie Grabowski, (808) 956-6556, mworkman@hawaii.edu

---