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Beaufort Gyre Exploration Project: Dispatch 18: The O-buoy Project

John W. Halfacre (Purdue University, Indiana) and Carlton Rauschenberg (Bigelow Laboratory for Ocean Sciences, Maine)
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The O-buoy Project is an NSF funded research project involving the collaboration of Bigelow Laboratory, Purdue University, University of Alaska – Fairbanks, the U.S. Army Cold Regions Research and Engineering Laboratory, Environment Canada, Monterey Bay Aquarium Research Institute, SRI and CH2M HILL Polar Services. The O-buoy is an autonomous, multi-instrument, sea-ice tethered buoy with the ability to measure surface level ozone, carbon dioxide, bromine oxide, meteorological conditions, and its own location using a GPS device. The goal of the project is to deploy a large network of O-buoys across the Arctic to further our understanding of current Arctic ozone and carbon dioxide chemistry, both important greenhouse gases, and to help us predict how that chemistry might change as the Arctic environment changes.

Ozone has been observed to precipitously decrease from background levels of ~30 ppbv to near zero levels during the Arctic spring time when the sun rises. It is believed that bromine plays the major role in Arctic ozone depletion chemistry, and bromine oxide (a product of the reaction between bromine radical and ozone) provides evidence of ozone destruction. Long term ozone, bromine oxide, and meteorological measurements over the ocean will help us understand the conditions that initiate, contribute to, and terminate ozone depletion events.

When Carlton and I first got on the *Louis*, we thought it would be a good idea to find our stuff. Aside from our tools and cold weather gear, all of our equipment (tube + mast + parts box, flotation collar, solar panel box) was found on the upper deck above the ship's hanger. The O-buoy essentially consists of three sections: the tube, the mast, and the solar panels. The tube is fairly long and pretty heavy, so we decided the best option would be to prop it on a conveniently placed, empty boat cradle. The tube, however, was inconveniently placed in its box, so we had to get it out using the ship's crane.

Next, we assembled the mast. We mounted the mast on saw horses near the main tube so we could easily make connections into the instrument panel. Assembly of the mast consisted of attaching the DOAS scanhead (used to take in sunlight to measure BrO), the wind instrument, GPS instrument, and the Iridium satellite communications device. The instrument cables / tubing that ran through the mast were connected to the instrument panel, and the mast was subsequently bolted onto the tube. The buoy was now assembled enough such that it could be tested.

We turned on the buoy by plugging in the power cord on the exterior of the mast. We then connected a laptop to the communications port and logged into the O-buoy's supervisory computer. We then verified that the buoy was both powered and that the instruments seemed to be operating as they should. Now that the buoy was powered, a last bit of instrument work on our end was calibrating the ozone instrument.

We left the buoy powered for a period of two days so that it could transmit data using the Iridium device, thus allowing proper instrument function to be checked remotely by each instrument's corresponding team. Once we received verification that the instruments were functioning satisfactorily, we powered down the buoy, unbolted the mast, and disconnected the instrument connections from the instrument panel. Because of the fragility of the DOAS scan head, we disconnected it and kept it with us to be reattached on deployment day.

The next step was to mount the flotation collar. This required moving the heavy base of the buoy from the inside of the boat cradle to the outside, such that we would be able to lift it up and slide the collar on. Once accomplished, we bolted the collar to the tube, bolted the solar panel mounting plate into the collar, and covered the instrument panel on the tube and the instrument connections in the mast to protect them from moisture. We turned the buoy around again and secured the mast, tube, and flotation collar to the boat cradle. Finally, we screwed the mounting screws for the solar panels into the mounting plate and attached lead weights to the base of the buoy. We were now ready to deploy.

Finally, on August 5, 2011 (see Dispatch 16), it was time to deploy. After our 16" hole had been drilled in the ice, the tube and flotation collar were airlifted by helicopter and placed in the hole. When the mast arrived, the DOAS scan head was reconnected to the top of the mast, and the mast was then bolted on top of the tube. We then mounted the solar panels. The final step was to turn it on. We verified that the instrument was powered using our handy laptop, and checked with the different O-buoy teams to verify if instruments were still functioning properly. So far, everything's gravy.

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Mail: Woods Hole Oceanographic Institution, 266 Woods Hole Road, Woods Hole, MA 02543, USA.
E-Contact: info@whoi.edu; press relations: media@whoi.edu, tel. (508) 457-2000
Problems or questions about the site, please contact webdev@whoi.edu