ARI: Polar Profiling Floats: An Autonomous Observational Array for the International Polar Year and Beyond

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In recent years, oceanographers have employed torpedo-shaped instruments called floats that drift, nose pointed up, at various depths through the oceans taking measurements of the water's physical properties like temperature and salinity. Along with my colleagues, I have developed a profiling float that is designed to work in both open water and under ice. Although I had received funding from the National Science Foundation to build eight of these floats, the grant did not support the labor required to assemble the floats, prepare them for sea, and ship them to the icebreakers for deployment in the Arctic Ocean. The Arctic Research Initiative provided the necessary support for these tasks.

The eight floats all had sensors to measure temperature, salinity, dissolved oxygen, and pressure from the depth of 1,000 meters to the sea surface. These floats were set up to drift at approximately 300 meters below the surface, where the core of the warm sub-polar waters flows into the Arctic Basin. After drifting for four and half days, the floats submerge to 1,000 meters, collecting measurements as they slowly return to the surface. At the surface, the floats attempt to find a break in the ice and communicate with an Iridium satellite system (a global satellite voice and data communications system with complete coverage of the entire Earth including the polar regions) to send their data. If they cannot find a hole in the ice, they sink to 50 meters, wait an hour and then retry to connect with the satellite. The floats will repeat this process up to 100 times for each dive. If the floats are still unsuccessful, they assume that there is no break in the ice, go back to depth and start the next dive cycle. If they successfully reach the surface, they identify their positions from the Global Positioning System (GPS) and send their data to the iridium system, which delivers it to my lab at WHOI as a set of emails.

In the summer of 2008, three floats were shipped to the Canadian Icebreaker, *Louis-St-Laurent,* and deployed by WHOI's Rick Krishfield in the Beaufort Gyre, north of Alaska. Two of the floats were deployed between 76° and 78° N, and the third was deployed near the continental slope at 72.5° N. Five floats were shipped to the Russian Icebreaker, *Federov,* for WHOI's Kris Newhall to deploy further to the east, north of Siberia. The Beaufort Gyre floats were lowered to the open water in a protective cardboard box with water soluble tape. Unfortunately, the boxes drifted away before we could confirm that they opened. We also could not establish communication with the

Figure 1: A polar profiling float drifts nose-up at various depths through the Arctic Ocean while measuring water temperature, salinity, dissolved oxygen and pressure. The floats are programmed to rise to the surface periodically and send data via satellite antenna to scientists on shore.

floats after they were launched. We had similar results with the first three floats on the *Federov*. Newhall then gently launched the fourth float without a box into the ocean. Fortunately, we were able to establish communication with this float after the initial dive. We elected to ship the two remaining floats back to WHOI and will try again this summer to launch these floats in open water near the continental slope. In February 2009, we received communications from one of the other *Federov* floats. It had completed 15 profiles – all under ice without a GPS fix. Fortunately, the Iridium system provides a course position when the transmitter sends the data, so we do know approximately where the float is located. As this circumstance suggests, we may also hear from the other floats later this year, as open water develops. Since this system of profiling floats is somewhat of a prototype, the fact that we received any data is a positive result.

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