

## Beaufort Gyre Exploration Project: Dispatch 21: Tiny Torpedoes

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So far this cruise, nearly 60 expendable conductivity-temperature-depth probes (XCTDs) shaped like tiny torpedoes have been launched from the stern of the *Louis* into the Arctic Ocean, with perhaps another 40 more to go. The probe measures the seawater temperature and salinity while sinking to a depth of 1000 m (over 3000 ft) in only about 10 minutes. The data is communicated back to a deck unit and computer onboard the ship by a fine wire which breaks when the probe reaches its maximum depth.

One advantage of the XCTD observation is the short amount of ship time that it takes to make a measurement (compared to a CTD rosette cast which takes several hours). Consequently, it is suitable to capture fine scale ocean structure between CTD casts, such as mesoscale eddies and frontal boundaries. Sometimes, the XCTD is also a powerful tool for a preliminary survey for the CTD (which measures not only temperature and salinity but also oxygen, turbidity, and fluorescence in the sea water). The XCTD data may suggest the best location where a CTD cast should be conducted.

Combining the XCTD with the CTD observations, we investigate ocean circulation and water mass distributions to understand the relationships of those variables to recent climate change, which appears to be most prominent in the Arctic region. Recent sea ice retreat in summer in the Pacific sector of the Arctic Ocean could be related to the inflow of warm water that originates from the Pacific and enters via the Bering Strait. Furthermore, this so-called Pacific Water carries nutrients to the Arctic Ocean, and therefore, influences the Arctic ecosystem. Cold water formed in winter in polynya (open water) regions of the Arctic shelf sinks into the deep basins accompanied by the transport of nutrients and carbons, which are important for biogeochemical element cycles (biogeochemistry describes the interactions between biological primary production, ocean chemistry, and geological particle deposition). In addition, a significant warm anomaly of Atlantic water has been observed in the Canada Basin far from the Fram Strait source where the Atlantic water flows into the Arctic Ocean.

[Scientists from JAMSTEC](#) have been conducting XCTD surveys (and other work) from the *Louis* (and other vessels) over the past several years to address these issues in collaboration with IOS/DFO under the JWACS (Joint Western Arctic Climate Studies) project.

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The author loads an XCTD into the hand-held launcher and then initializes the data acquisition computer program. *Photo by Rick Krishfield, WHOI.*



While the XCTD and launcher are carried out to the stern, Terry Rhyno feeds the serial communications cable through the passage. *Photo by Rick Krishfield, WHOI.*



The XCTD is launched by pulling a restraining pin, and descends quietly into the ocean. The thin wire must be kept clear of nearby icefloes to ensure that it is not broken prematurely, so that all of the data down to 1000 m may be received. *Photo by Rick Krishfield, WHOI.*

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