

## **Acquisition of Ice-Tethered Profilers with Velocity (ITP-V) Instruments for Future Arctic Studies**

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<http://www.whoi.edu/itp>

### **LONG-TERM GOALS**

The PI group seeks to observe the upper Arctic Ocean using autonomous instrumentation and build understanding of the physical processes controlling the evolving thermohaline stratification, the ocean currents and air-ice-sea interactions on time scales of minutes to seasonal and longer.

### **OBJECTIVES**

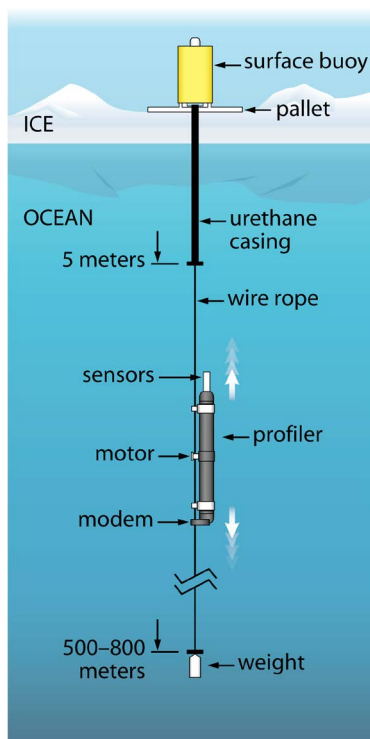
Build 3 Ice-Tethered Profiler with Velocity (ITP-V) systems for deployment in support of future Navy scientific investigations of the Arctic Ocean.

### **APPROACH**

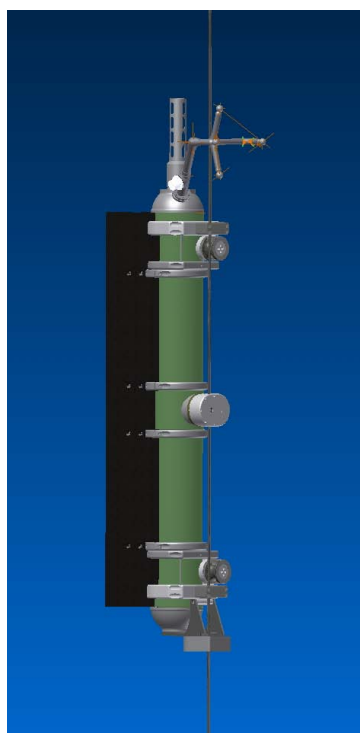
The instrument construction is based on prior developmental work and field testing of prototypes, and the subsequent successful use of 5 operational ITP-V systems during the Marginal Ice Zone DRI program. The ITP-V is assembled from subsystems constructed in house as well as from commercial vendors. Key personnel at WHOI involved in the construction and validation testing of ITP-V systems beyond the PIs include J. O'Brien, F. Thwaites, J. Kemp and C. Marquette.

The ITP-V is a variant of the ITP system that has contributed to sustained observations of the Arctic Ocean below sea ice since 2004. The ITP concept is, in short, Argo of the Arctic - a play on the international program maintaining an array of profiling floats throughout the temperate oceans. Briefly, the ITP system consists of three main components: a buoyant surface instrument package that

typically sits atop an ice floe, a weighted, wire-rope tether suspended from the surface package, and an instrumented underwater unit that travels up and down the wire tether (Figure 1). The current design of the ITP surface expression is a conical-shaped buoy that houses a controller, inductive modem electronics, a GPS receiver, and an Iridium satellite phone with associated antennae and batteries within a watertight aluminum housing capped by an ultra-high-molecular-weight polyethylene dome. The electronics case sits within a foam body designed to provide buoyancy for the plastic-jacketed wire rope tether and end weight should the ice fracture or melt, and to provide modest protection in the event of ice ridging. The profiler unit (much like an Argo float in shape and size) mounts on the tether and cycles vertically along it. Via an inductive modem, raw sensor and associated engineering data files are relayed from the underwater vehicle to the surface buoy at the completion of each one-way profile, which then transmits them by satellite to a logger computer at WHOI. The ITP-V instruments add a multi-axis acoustic-travel-time current meter and associated attitude/motion measuring unit to the standard ITP sensor suite to make direct, 3-D observations of ocean flow (Figure 2, 3).



**Figure 1. Schematic drawing of the Ice-Tethered Profiler instrument system.**



**Figure 2. Engineering drawing of the Ice-Tethered profiler with Velocity.**



**Figure 3. Right. Photograph of an MIZ ITP-V being deployed (top) and in a test jig used to validate sensor orientations (bottom).**

## **WORK COMPLETED**

This grant funding was received in the final days of the current evaluation period. Orders for materials and subsystem components are just now being issued. Construction/assembly and laboratory validation of the three new ITP-V systems are expected to be completed by this time next year.

## **RESULTS**

Nothing to report yet.

## **IMPACT/APPLICATIONS**

Observations and insights deriving from ITP-V instruments are advancing understanding of ice-ocean interactions and their representation in numerical models. In turn, improved predictions and assessments of the future state of the Arctic Ocean will result.

## **TRANSITIONS**

The WHOI Ice-Tethered Profiler group is poised to support a spring 2016 ice camp to be operated by NAVOCEANO by providing one ITP system, training Navy personnel in its set up and deployment procedures, and hosting the real-time data telemetry and processing.

## **RELATED PROJECTS**

Marginal Ice Zone DRI: <http://www.apl.washington.edu/project/project.php?id=miz>

Research to be carried out with the three new ITP-V systems builds on research carried out during the MIZ program.

Upper-Ocean Variability in the Arctic's Amundsen and Nansen Basins, Grant N00014-15-1-2547. <http://www.whoi.edu/page.do?pid=147016>. This research program focuses on data from an ITP-V instrument deployed this month near 81N, 171E.