The APL-UW Ice Diver

Putting Sensors Under a Kilometer-Thick Ice Sheet

Narrator: Seen on the surface, the polar ice melt is self-evident. But what's happening ***under*** the ice is the focus of a project underway at the Applied Physics Laboratory at the University of Washington.

Tim Elam: This is the APL Ice Diver. It's a thermal ice penetrator. Also called a thermal melt probe. And it melts its way down through the ice using electrical heating to melt the ice so then it can reach to the bottom of large ice sheets. And that allows us to put instrumentation at the bottom of those ice sheets. It's like a rocket going down instead of up.

Narrator: The APL thermal ice diver is about 6 feet long. The tip – the nose cone – is heated to melt through the ice. The power to heat the nose cone comes from small generators on the surface.

Elam: Our early probes used like one thousand watts. This one will be like three thousand watts that will enable it to go several meters per hour.

But to get to the bottom – a glacier in Greenland is about one thousand meters thick. And so to get to that in four days, which is a reasonable field time, we need to go more like 10 meters per hour. So to do that, we're going to have to have like six thousand watts.

Narrator: The descending probe will unspool hard wire connections for both the scientific instruments on board and the electrical power for the heating elements.

Elam: The wire has to be carried down by the probe. As it goes down through the ice, the ice freezes in behind it, so we can't feed the wire in from the surface.

Narrator: Hundreds of meters of wire are tightly wound on a spindle carried by the probe.

Trina Litchendorf: As this probe descends, this wire has to uncoil perfectly so it doesn't snag within this spindle. So the wire has to be wound on here very precisely and very carefully, so the top layer of wire rests perfectly in the groove of the wires beneath it.

Narrator: APL's thermal ice probe is meant to be less costly, less complex, and more efficient than hot-water drilling.

Elam: Where they heat water on the surface and pump it down to drill a hole and of course to keep pumping it down and to keep drilling the hole, they have to keep the hole open so they can pump hot water all the way down to the point where it's drilling. By using electricity to carry the heat down instead of hot water, we can be much more efficient about that.

Narrator: The APL thermal ice probe is set to undergo field testing in Greenland this summer.

Elam: We believe that this kind of data is very important to determine what goes on at the bottom of the ice sheets rather than just observing intruments on the surface or from satellites. To get both ground truth data to verify and also to get more information into the models so that we can understand what's going on, we believe that's a critical need and that's why we're trying to develop an inexpensive probe so we can get a lot more of that kind of data. Any kind of climate or weather data is dramatically improved by having more data points.

This is APL The Applied Physics Laboratory at the University of Washington in Seattle.