On Arctic Ice Floes

by David Mainwaring

The Cambridge doctoral students Till Wagner and Nick Toberg spent a month last summer surveying the dimensions and properties of the thin floating ice floes in the wilds of the Arctic between Svalbard and Greenland aboard the Greenpeace ship Arctic Sunrise. The aim of the expedition was to collect data that would provide firsthand insights into local ice conditions in September, the period of most rapid melt. The gathered data will also be helpful to remote sensing scientists to validate satellite measurements and to global climate modelers to provide more accurate input for their simulations. To ensure success, they needed just the right total station to tie in snowdepth readings, aerial imagery, and drilling sites with their 3D laser scanner data, and to produce low resolution surveys of the ice topography.

When scientists Till Wagner and Nick Toberg needed a total station to take with them on an ice-surveying expedition to the Arctic, they turned to UK's Leica Geosystems authorized dealer Opti-cal Survey Equipment Ltd for some advice on what to take. Opti-cal Surveying Equipment Ltd provided the pair with a Leica TPS1200+ total station for their mission, working with a Leica Viva Controller. Since completing the expedition and beginning the process of making sense of the measurements, Till has said that the device – and the support they got – was absolutely invaluable, and they certainly know where to turn for equipment for their next expedition.

The right Surveying Equipment

"The total station was exactly what we needed," Till said. "We're not trained surveyors, so to be able to essentially 'plug and play' with it was really important. We were able to use the total station in snowy conditions, on moving ice floes, and in temperatures of as low as -12 °C (10 °F). Despite the conditions, it was able to reference our positions and provide us with scan points."

The scientists received guidance and training on the equipment from Opti-cal Surveying Equipment. Till explained, "Before the expedition, David from Opti-cal came up to us in Cambridge and showed us exactly how it worked and what we needed to do with it to take the specific measurements we needed."

Measuring the Thickness

Experts say the thinning of ice over the past decades may lead to an ice-free summer in 2020. "What the satellite radar sees is just the part of the ice that is above water. Since about nine tenths of the ice is underwater there is a huge margin of error," said Till Wagner. "That's what we went there for: to get a better handle on how thick the ice actually is."

The simplicity of the total station meant they were able to easily switch off its standard auto leveling facility. On solid ground the auto leveling is a huge

Nick Toberg sets up a Leica TPS1200+ Total Station in front of the "Arctic Sunrise".

help for most surveyors but, when the ground is a constantly moving ice floe, the option to switch it off came in very handy. They were using the total station to match up the different depth measurements they had taken with the GPS positions to give them the information necessary for their studies into the mechanics and evolution of thin sea ice sheets.

The detailed survey of the structure of broken up and refrozen ice sheets will make it possible to better understand the effects of winds and currents on their motion and deformation. The study provides a link between the micro scale physics of ice crystals and the large scale physics of vast ice fields.

An Enriching Expedition

The measurements were taken on ice floes within a mile of the open water edge, which meant the survey sites were subject to significant wave motion. Add dense fog, interspersed with heavy snowfall and chilling winds and you are working in challenging conditions. Conditions that called for a steady supply of hot tea, warm gloves, and robust scientific equipment.

But ship's crew and scientists were richly rewarded for their efforts, not merely with the success of their measurements but equally by the stunning beauty of the arctic ocean; the endless fields of untouched ice; and encounters with dolphins, ivory gulls, and polar bears (the latter thankfully always from the safety of the ship).

With another arctic expedition planned for next year, Till said that the TPS1200+ is an instrument that they would certainly consider taking again, as it afforded them many advantages that other brands of device had fallen down on, including being easy to use, light-weight, and very durable. ■

About the author:
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