

U.S. Ice Drilling Program

Ice Drilling Program Office | Ice Drilling Design and Operations

*Quarterly update of Ice Drilling Program Office (IDPO) and Ice Drilling Design and Operations (IDDO) activities***Winkie Drill System Tested at IDDO Warehouse**

During the quarter (May 1 – July 31), IDDO transitioned from the design and fabrication phase of Winkie Drill development to the in-depth system testing phase. Using multiple test set ups and simple testing apparatus assembled by IDDO engineers, full scale system testing was conducted in solid ice, solid granite and in ice ingrained with various sizes of granite chunks. The cutting ability of a number of bits with varying geometries was tested. In late July, IDDO invited Earl Maynard to Madison to assist with the testing. Mr. Maynard has decades of international experience using the Winkie Drill. His participation served as a very beneficial training opportunity for engineer Grant Boeckmann, as he is scheduled to deploy with the drill to the Ohio Range in Antarctica this coming 2016-2017 field season.



(L) Winkie Drill testing set-up at IDDO. Credit: Grant Boeckmann (M) Engineer Grant Boeckmann shows a Winkie Drill rock core. Credit: Alex Shturmakov (R) Close-up view of core collected with the Winkie Drill during ice/rock interface testing at the IDDO warehouse. Credit: Grant Boeckmann

IDPO Hosts Successful Subglacial Access Science Community Planning Workshop in Herndon, VA

On May 22 – 23, IDPO held the Subglacial Access Science Community Planning Workshop in Herndon, Virginia, which was a science-planning meeting organized by IDPO Director Mary Albert and was open to the community and to NSF. The goal of the meeting was to identify community consensus on the major community science projects in the coming decade that would need subglacial access drilling. Attendees at the workshop included 30 scientists, four NSF program managers, and one representative of Antarctic Support Contract. IDPO Subglacial Access Working Group (IDPO-SAWG) members Jill Mikucki, Ross Powell, and John Goodge led the discussions at the meeting, facilitated by Mary Albert of IDPO. IDDO Program Director Kristina Slawny and Terry Benson (Physical Sciences Lab, University of Wisconsin – Madison) also participated in the workshop. Four draft white papers were produced from the meeting, which are currently being finalized by the authors for posting on the Icedrill website:

- *Access Drilling Priorities in Ice Shelves and Ice Streams – Thwaites Glacier Region;*
- *Access Drilling Priorities in the Ross Sea Sector of the Antarctic Ice Sheet;*
- *Access Drilling Priorities in Subglacial Aquatic Environments;*
- *Access Drilling Priorities in the Antarctic Continental Interior*

GreenTrACS Successfully Uses IDDO Hand Auger and Sidewinder to Collect Shallow Ice Cores

In May and June, PI Erich Osterberg's Greenland Traverse for Accumulation and Climate Studies (GreenTrACS) field team had excellent success with an IDDO hand auger and Sidewinder on a snowmobile traverse between Raven Camp and Summit Station in Greenland, collecting seven ice cores measuring 20-30 meters in length each. The ice cores will be used to help determine the patterns of snow accumulation in Western Greenland over the past 20-40 years, and to evaluate surface melt refreeze and englacial meltwater storage in the Western Greenland percolation zone over the past 20-40 years. For more information about the project, visit:

<http://greentracs.blogspot.com/>



PI Erich Osterberg drills with the IDDO Hand Auger & Sidewinder system in Greenland. Credit: GreenTrACS Team/Dartmouth College

Equipment Development

Agile Sub-Ice Geological Drill

During the third quarter, IDDO worked to complete system modifications, repairs and upgrades identified during testing performed in the second quarter. The system is expected to ship to Antarctica in September. Validation and verification are now underway and documentation will be completed in the fourth quarter.

Winkie Drill

During the third quarter, IDDO completed an internal system design review as well as all necessary fabrication, assembly, and modifications of the Winkie Drill. Multi-round system testing was completed, including ice drilling with a newly-designed air chip transport system and modified Forstner and Irwin bits, coring through an ice/rock interface with multiple layers of ice and different sizes of granite rocks using two different types of mixed-media coring bits and a range of Isopar K temperatures, and coring solid granite with three different types of coring bits and two types of drilling fluid (Isopar K and water). System

testing was very successful and helped inform selection of drilling/coring bits for a variety of ice/rock conditions the drill may encounter in the field. In conjunction with system testing, IDDO completed two days of operational training, conducted by Earl Maynard, a Winkie Drill expert, in Madison in July 2016. IDDO continued minor system modifications and started final procurement of replacement and spare parts.

Rapid Air Movement (RAM) Drill

During the quarter, IDDO continued researching multiple approaches for RAM Drill modification and decided to primarily focus on a dual walled pipe drill design that looks more promising than a dual walled hose design or a design based on a new standard hose reel assembly. IDDO started reviewing the existing sled design and its suitability for use with a reverse circulation dual walled pipe drill.

MAGIC Drill/Intermediate Depth Drill-Light

During the quarter, IDDO continued working with IDPO and community scientists to refine science requirements for a drill based on the 1,500 m Intermediate Depth Drill (IDD), but with a depth target between 400-700 m and with a much-reduced logistics burden to allow for coring on remote glaciers. IDDO sent the next round of comments/edits of the IDPO Science Requirements to IDPO on 6/20/16. A decision on the naming of the new system, and whether or not it will be built, is ongoing.

Foro Drill

IDDO procured several major drill components during the quarter as planned, including a Lebus core for the winch drum, a winch motor, a winch motor gearbox, a motor VFD and a pre-fabricated cable assembly for the winch control loop. IDDO finalized the design and ordered a new four-conductor cable in early August. All components for testing of the winch control loop were received. IDDO completed a dimensional report on the winch Lebus core. This core was sent to Innovative Machine Specialists for final assembly, including heat treatment, anodizing and machining. The control box layout was reviewed, and IDDO began finalizing the mechanical design of the box.

Deep Ice Sheet Coring (DISC) Drill

Any further development work for the DISC Drill remains on hold, until the science community identifies if/when the system will next be deployed.

Long Range Science and Long Range Drilling Technology Plans Updated

The IDPO Science Advisory Board, IDPO, IDDO, and the science community, under Mary Albert's leadership, updated the IDPO Long Range Science Plan. The purpose of the Long Range Science Plan is to articulate goals and make recommendations for the direction for U.S. ice coring and drilling science, and for the development of drilling technology, infrastructure and logistical support needed to enable the science. The companion Long Range Drilling Technology Plan, updated by IDDO, identifies the drills and technologies needed to successfully implement the science in the Long Range Science Plan. Both plans are revisited and revised as appropriate each spring.

IDPO Involved in Multiple Education and Outreach Events

School of Ice

In May, twelve nationally selected college professors attended the second "School of Ice" held in Denver, Colorado. Senior researchers presented the latest scientific and engineering content via live and virtual presentations, while IDPO led the Leadership Team including Lockheed's Antarctic Support Contract, Polar Field Services, National Ice Core Laboratory (NICL), and University of Colorado Boulder's INSTAAR also contributed to the packed four-day agenda. One of the participants from the first School of Ice contributed to the agenda by attending and leading a hands-on activity she has used successfully with the students at her institution. Created by IDPO, the project was the result of a partnership with the American Meteorological Society. Funding was provided to IDPO by Lockheed Martin.

Education and Outreach Event at Montshire Museum, Vermont

On May 11, 2016, six Dartmouth graduate students worked with IDPO Director of Education & Public Outreach Louise Huffman to plan an outreach event for the public at the Montshire Museum in Norwich, VT. Students and their parents from local school districts were invited to spend an evening exploring polar science including specific activities about ice core science. Students tried on Extreme Cold Weather (ECW) gear, “swam” in the Southern Ocean wearing blubber gloves, operated an ice core drill model, touched a real Greenland ice core, looked at cross polarization in ice crystals, and using “glacier goo”, raced glaciers down different surfaces to explore how a glacier moves.



School of Ice participants and facilitators at the NICL in Denver, CO.

Summer Inquiry Science Workshops for Inner City Chicago Public School Teachers

In July, workshops for K-12 teachers who teach in Chicago public schools were held at Oak Park and River Forest High School, the University of Chicago and the Chicago Field Museum. Ice core science was incorporated into the existing curriculum. In the introductory inquiry science week, the story of how ice cores were shipped from WAIS Divide, Antarctica, to the National Ice Core Laboratory in Denver, CO, USA was used as the ‘hook’ before participants were challenged to build an “ice core shipping container” that would keep their ice core frozen with the least mass lost. In the advanced inquiry week, IDPO’s Louise Huffman presented a climate change day based on ice core activities. The resources and activities were well received by the teachers. Workshops were paid for by the Golden Apple Foundation.



Visitors to the Montshire Museum on May 11, 2016, became Antarctic explorers while trying on ECW gear, and learned about ice core science (pictured).

IDDO Field Support Manager Vacancy

IDDO’s Field Support Manager, Rory Holland, recently resigned to take another position within the University of Wisconsin-Madison. A position vacancy listing for IDDO Field Support Manager will be posted shortly on the UW-Madison employment web page. You may also check [Icedrill.org](http://icedrill.org) for updates on this vacancy, once it is posted.

Requesting Ice Drilling Support

If you are preparing a proposal that includes any kind of support from IDPO-IDDO, you must include a support letter and cost estimate from IDPO-IDDO in the proposal. Researchers are asked to provide IDPO-IDDO with a detailed support request six weeks prior to the date the support letter and cost estimate are required. Early submissions are strongly encouraged.

For further information on requesting IDPO-IDDO support, visit our website at <http://www.icedrill.org/scientists/scientists.shtml> or contact us at IceDrill@Dartmouth.edu.

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