Update from the
Ice Drilling Program Office

Mary Albert
IDPO Executive Director
March 2017

www.Icedrill.org
Vision
To enable scientific discoveries about changes in environment and climate, using evidence from glaciers and ice sheets, to inform environmental policy.

Mission
To conduct integrated planning for the ice drilling science and technology communities, and to provide drilling technology and operational support that will enable the community to advance the frontiers of science.
Ice Drilling Program Office
NSF Cooperative Agreement

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Ice Drilling Program Office
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Input to the plan comes from the SAB, the Working Groups, community members, and IDPO.

Prioritization of the drilling technology in the plan is established by the SAB.
Ice Drilling Program Office
Working Groups

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Outcome: White papers on
- Ice Shelves & Ice Streams: Thwaites Glacier Region
- Ross Ice Shelf and Ice Streams
- Subglacial Aquatic Environments
- Antarctic Continental Interior
Outcome: science drivers, target locations, & timelines for the next decade included in the IDPO Long Range Science Plan 2016-2026

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IDPO-IDDO
Community Outreach

IDPO-led AGU Town Halls:
Scientific Drilling in the Polar Regions

Participation:
IPICS, IDPO-IDDO, RAID, WISSARD, NSF
Ice Drilling Program Office
Long Range Science Plan: Multiple Fields of Science

• Climate Change
• Ice Dynamics and Glacial History
• Subglacial Geology, Sediments & Ecosystems
• Ice as a Scientific Observatory

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Science planning drives drill tech planning, development, and use.

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Long Range Plans drive our annual program
IDPO Science Requirements
for New or Upgraded Drilling Tech

Science requirements completed:
• Portable firn coring drill (<100 m)
• RAM drill (update)
• Ramara drill

Science requirements in prep for:
• Agile ice coring drill (400-900 m)
• Foro 3000 drill
• Clean scalable hot water drill
• Winch simulator

http://www.icedrill.org/equipment/development.shtml
Priority for US Antarctic Science

Box 1. The Committee’s Evaluation Criteria
The committee developed criteria to evaluate research ideas gathered through the community engagement process:

- Compelling science
- Potential for societal impact
- Time-sensitive in nature
- Readiness/feasibility
- Key area for U.S./NSF leadership

Additional factors considered:
- Partnership potential
- Impacts on program balance

Figure 1. The mass of the Antarctic ice sheet declined by 92 billion tons per year from 2003 to 2014. The color scale indicates change in land ice mass (equivalent to centimeters of
Thwaites: The Future of Thwaites Glacier and its Contribution to Sea-level Rise

PROGRAM Solicitation
NSF 17-505

National Science Foundation:
Directorate for Geosciences:
Division of Polar Programs

Natural Environment Research Council

Full Proposal Deadline(s) (due by 5 p.m., submitter’s local time):
March 01, 2017

IMPORTANT INFORMATION AND REVISION NOTES
Any proposal submitted in response to this solicitation should be submitted in accordance with the revised NSF Proposal & Award Policies & Procedures Guide [PAPPG] (NSF 17-1), NSF anticipates release of the PAPPG in the Fall of 2016 and it will be effective for proposals submitted, or due, on or after January 30, 2017. Please be advised that proposers who opt to submit prior to January 30, 2017, must also follow the guidelines contained in NSF 17-1.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:
Thwaites: The Future of Thwaites Glacier and its Contribution to Sea-level Rise

Summary of Program:
Considerable uncertainty remains in projections of future ice loss from West Antarctica. Reducing this uncertainty is an international priority that was recently underscored by the Scientific Committee on Antarctic Research in its "Addressing Event-driven Change in West Antarctica: The Need for a Strategic, Coordinated, and Intensive Research Strategy.

Proposers are encouraged to carefully read the NSF 17-1 PAPPG, as this solicitation will not contain all the revisions contained in the revised PAPPG.
Policy drivers:
1) Enhance the well-being of Arctic residents,
2) Advance stewardship of the Arctic environment,
3) Strengthen regional and national security,
4) Improve understanding of the Arctic as a component of planet Earth

**IARPC Agencies**

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<tr>
<th>National Science Foundation</th>
<th>Department of Transportation</th>
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<td>Department of Agriculture</td>
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<td>Department of State</td>
<td>U.S. Arctic Research Commission</td>
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Research Goals
Outlook

Ice drilling technologies are key to enabling science both in the Arctic and Antarctic

- Near-term and long-term high priority U.S. science requires ice drilling
- Logistics realities require increasingly agile field equipment
- Funding realities requires increasingly an agile & resilient ice drilling program
Funding realities creates challenges & opportunities for resilience
By design, IDPO-IDDO has used our CA funding to balance field support with tech development. When NSF funded less field science, IDPO-IDDO has created the new technology identified in the IDPO Long Range Science Plan, that fosters new science.
# Program Management Performance on Major NSF Drill Development Projects

<table>
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<th>Project</th>
<th>Results</th>
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<td>ICDS Wissard Project (2009-2011)</td>
<td>Significant external overrun, project competed by another organization</td>
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<tr>
<td>IDPO-IDDO Intermediate Depth Drill (IDD) (2011-2014)</td>
<td>On-budget, on-schedule but required funds from lower priority projects</td>
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<tr>
<td>IDPO-IDDO Agile Sub-Ice Geological (ASIG) Drill (2014 – Present)</td>
<td>On-budget, on-schedule (through North American Test)</td>
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<tr>
<td>Rapid Access Ice Drill (RAID) (2012 concept 2014 – present)</td>
<td>On-budget, on-schedule (through shipment)</td>
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## Progress!!

2011 Review Comments “From gut-feel project management” to “a IDPO-IDDO owned projected management system that is consistent with NSF and industry best practices”.

Ice Drilling Program Office / Ice Drilling Design and Operations
By design, IDPO-IDDO has used our CA funding to balance field support with tech development. When NSF funded less field science, IDPO-IDDO has created the new technology identified in the IDPO Long Range Science Plan, that fosters new science.
Challenge: reduce costs for NSF science budgets

Before: IDDO driller salary costs were charged to the science program

Now: IDDO driller salary costs come from our existing NSF Cooperative Agreement

This relieves stress on science projects but decreases our CA funds available for development projects.
Opportunity: Seek tech development funds through proposals

Example – pending proposal:
Collaborative Proposal for ScHWD
Mikucki, Albert, Mullilgan

Funding for new technology development projects will need to come from successful peer-reviewed proposals. We are cautiously optimistic.
Strategic Goals

• Improve grades 7-12 educator teaching and learning of ice science climate concepts. *IDPO live & web-based workshops for NSTA, NOAA, PEI, AMS*

• Increase public appreciation for and understanding of ice science research discoveries to inform their decisions. *Presentations at community meetings, museums, national media possibilities*

• Build a sustainable community of IDPO graduate students, scientists and engineers engaged in education and outreach. *AGU GIFT events, NOAA & NSTA webinars*
Strategic Goals (cont’d)

• Actively pursue collaborations and funding to develop high impact education and outreach products. *Partnership with Golden Apple summer institute, NOAA climate series, AMS*

• Encourage minority participation in STEM activities using ice science as the vehicle. *Led School of Ice for faculty at minority-serving institutions in Denver 2016 and in Hanover NH 2017, in collaboration with AMS.*
Much more info at:

www.Icedrill.org
Status of action on SAB Priorities from 2016-2026 Long Range Science Plan
Priority 1 (needed next year):

- Maintain existing agile equipment.
- Evaluate DISC vs IDD possibilities for Hercules Dome
- Repair, modify or acquire a very lightweight highly-portable drill for shallow ice coring to 100 m.
- Build a second Blue Ice Drill
- Create a conceptual design and cost estimate for adapting an agile coring drill to minimize logistical requirement for the drill, shelter, and fluid plan for ice coring up to ~ 700 m
- Develop and build the Lake Ice Drill for 5” holes thru 6 m of dirty ice
- Adapt or construct an agile shot-hole drill capable of drilling fifteen 10 cm diameter holes per day up to 100 m deep in both East and West Antarctica. This may include consideration of a RAM drill upgrade, or other means.
Ice Drilling Program Office
Priority Drilling Technology Needs

Priority 1 (needed next year):

• Develop IDPO Science Requirements for, and design and build, winch simulators.

• Evaluate practicality of acquiring WISSARD Drill system and operating it under IDDO.

• Develop IDPO Science Requirements for modular clean access capability for the Scalable Hot Water Access Drill for depths less than 1,000 m².

• Develop IDPO Science Requirements and a conceptual plan for a hot water drill, with modular clean access add-on, capable of creating access holes in ice depths of 2,500 m or greater for deeper targets (i.e. sites around Thwaites, interior sedimentary basins).

• Conduct Antarctic field trials of the Rapid Access Ice Drill (RAID)¹.

¹ This development is happening with DOSECC Exploration Services, LLC.

² The IDDO Conceptual Study for the ScHWD found that scalable capability deeper than 1,000 m would require different components that are not practical for use between 50-1,000 m.

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Priority 2 (needed within the next three years):

- Provide a cost estimate and conceptual design for adapting the existing Intermediate Depth Drill and infrastructure to minimize logistical requirement for the drill, shelter and fluid plan for ice coring to approximately 600-800 m, if weight and cube estimates indicate this should go forward.

- Evaluate if the agile shot-hole drill design could be used, and is desired, for 15 cm diameter boreholes (up to 220m, xx per day) for radio neutrino detectors as well.

- Build a Scalable Hot Water Access drill for creating access holes in ice from 50 m up to approximately 1,000 m depth with modular potential to be used for clean access.

- Upgrade the electrothermal drill to allow for coring to 300 m through temperate and poly-thermal firn and ice. The drill needs to be agile and light weight (transportable by helicopter).

- Continue to evaluate options for new drilling fluids.

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Priority 3 (needed within the next 3 - 5 years):

- Investigate rapid hole qualifier (temperature and caliper) for RAID boreholes
- Investigate potential of in situ probes for englacial and subglacial observations and sampling.
- Investigate potential for improved and more efficient site selection for ice core drilling projects.
Thank you, IDPO Science Advisory Board, for your service to IDPO-IDDO and to the community!

Thank you, NSF, for your continued support!