Update from the

# Ice Drilling Program Office


Mary Albert

IDPO Executive Director


March 2017

www.Icedrill.org

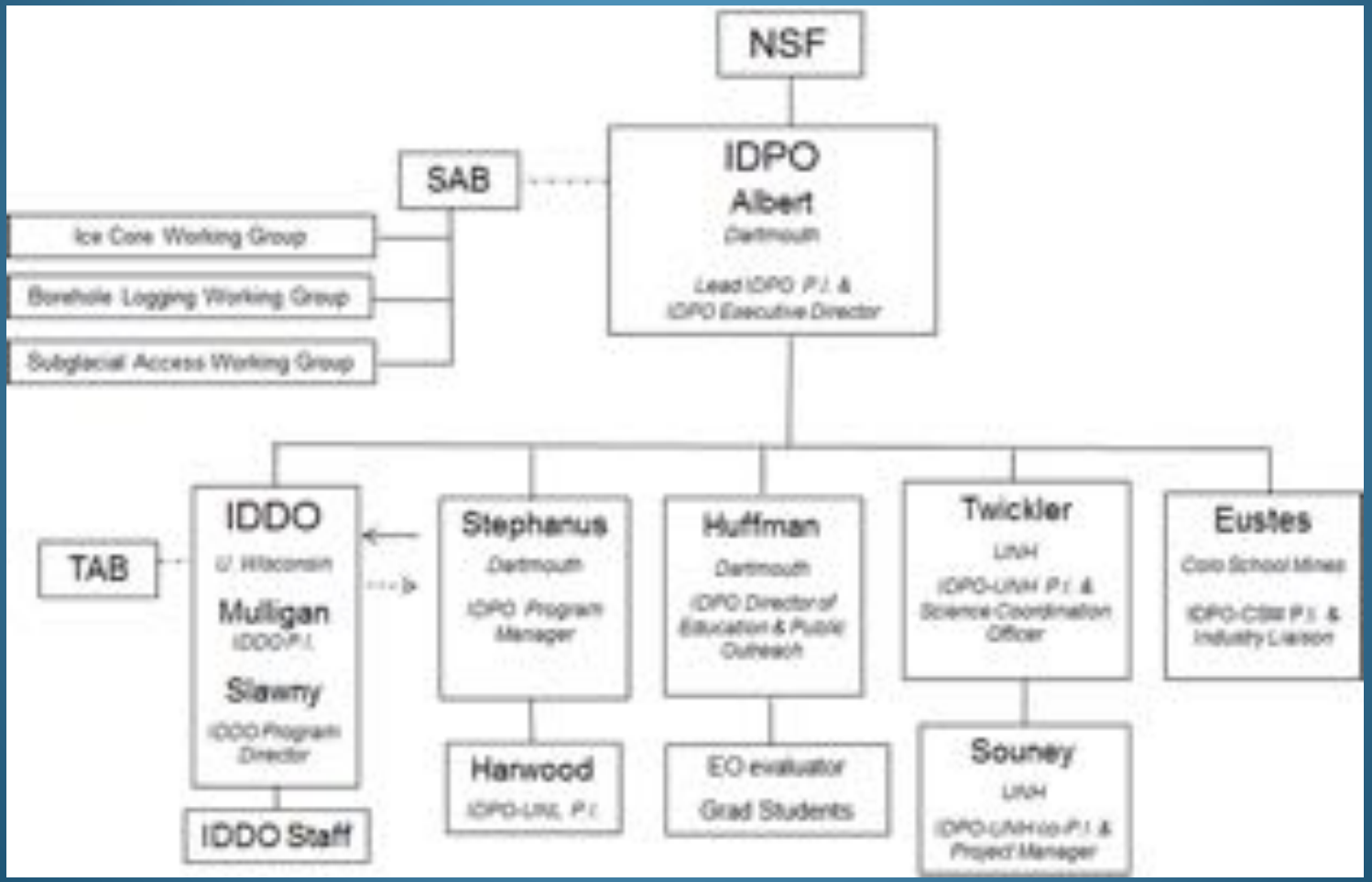
# Vision

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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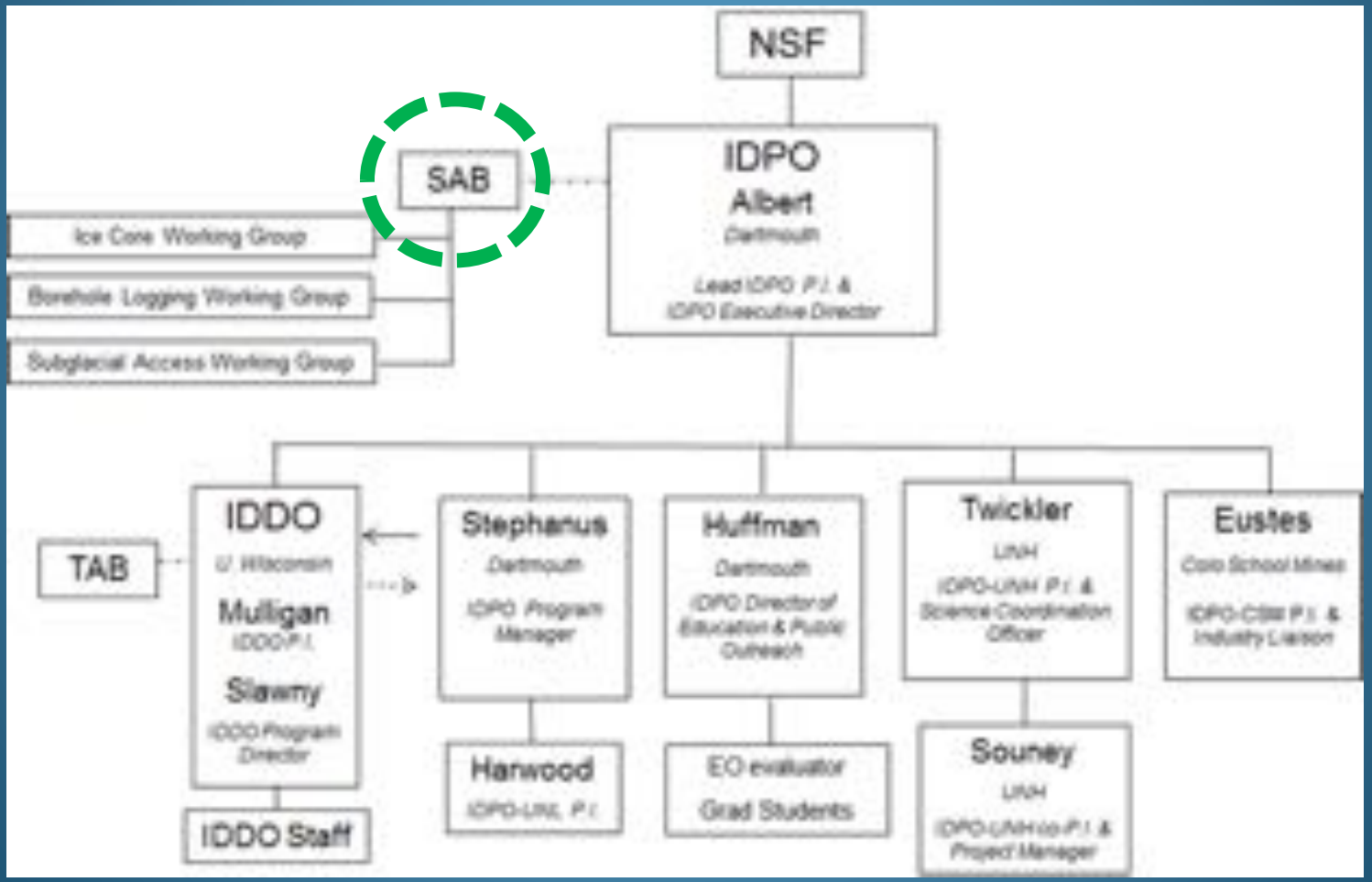
# Ice Drilling Program Office
# **Science Advisory Board**

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# Ice Drilling Program Office
# **Science Advisory Board**

Jim White (UC Boulder), Chair
Ryan Bay (UC Berkeley)
Ed Brook (OSU), Past Chair
Jill Mikucki (UTK)
Erich Osterberg (Dartmouth)
Slawek Tulaczyk (UC Santa Cruz)
Paul Winberry (CWU)
Eric Wolff (Cambridge)

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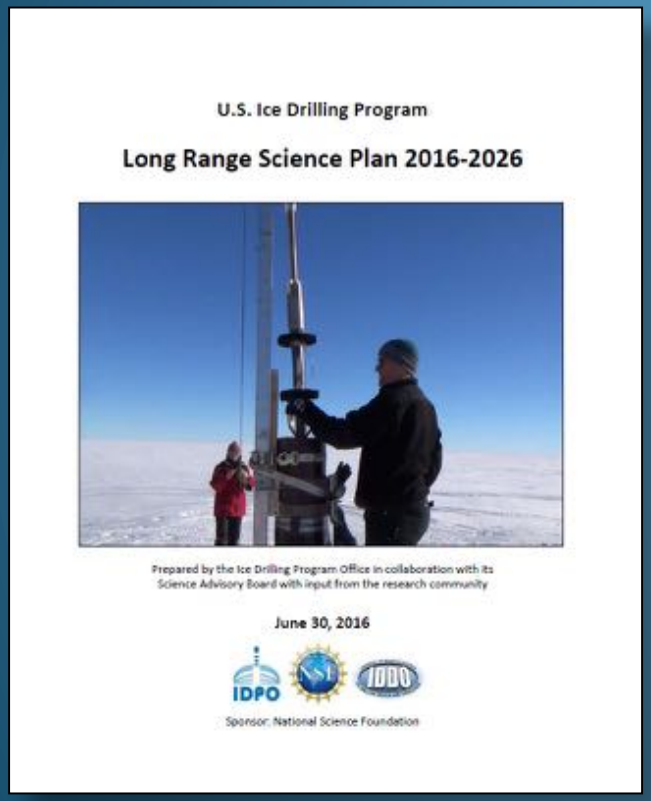
# Ice Drilling Program Office
# **Long Range Science Plan**




**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.**

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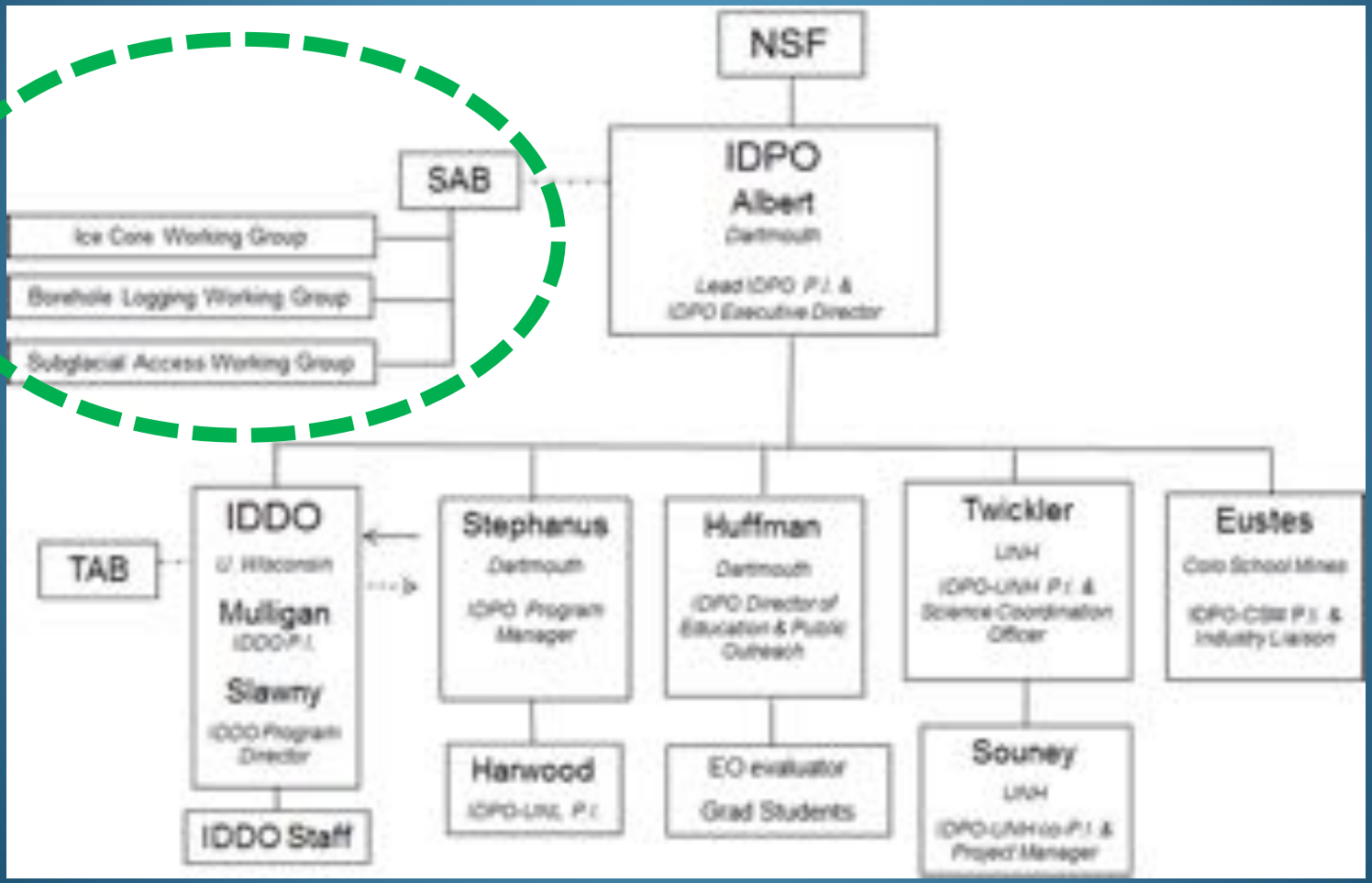
# Ice Drilling Program Office
# **Working Groups**

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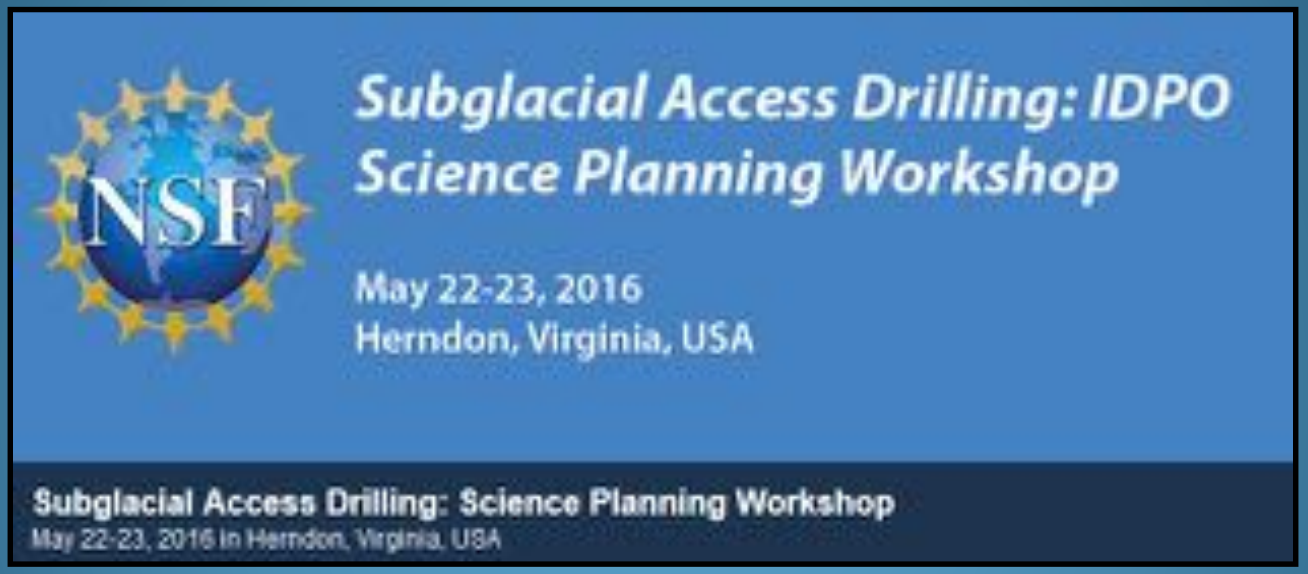
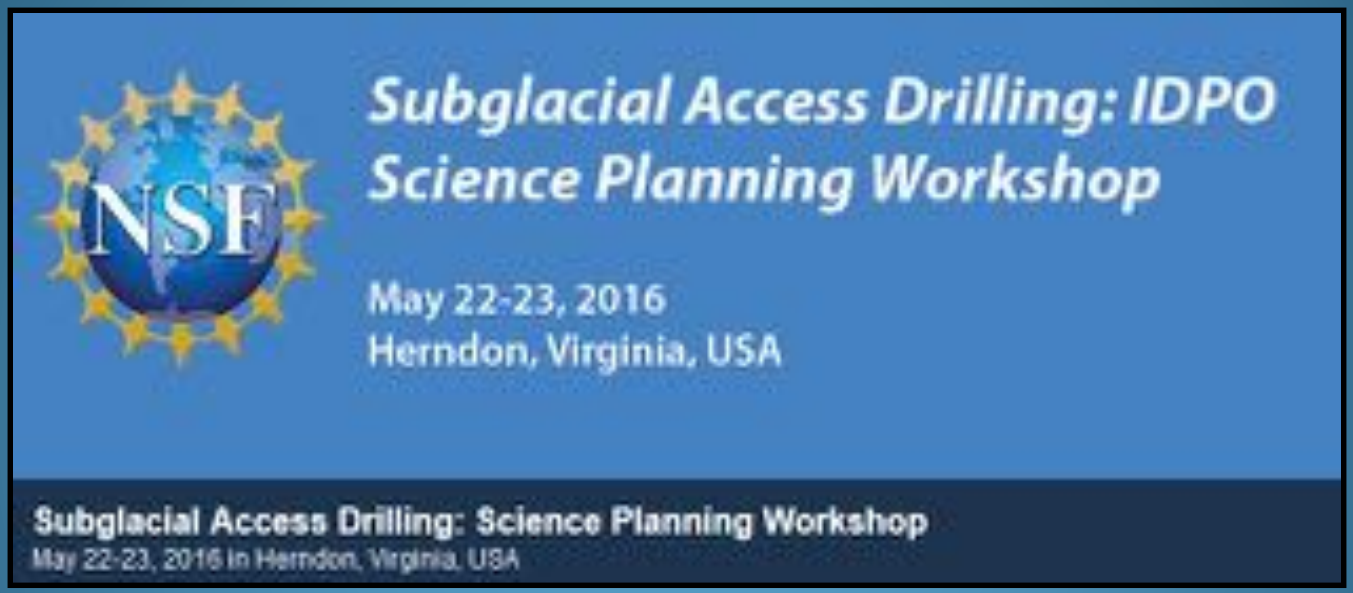
# Ice Drilling Program Office
# **Community planning workshops**




Outcome: White papers on

- Ice Shelves & Ice Streams: Thwaites Glacier Region
- Ross Ice Shelf and Ice Streams
- Subglacial Aquatic Environments
- Antarctic Continental Interior

# Ice Drilling Program Office
# **Community planning workshops**




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

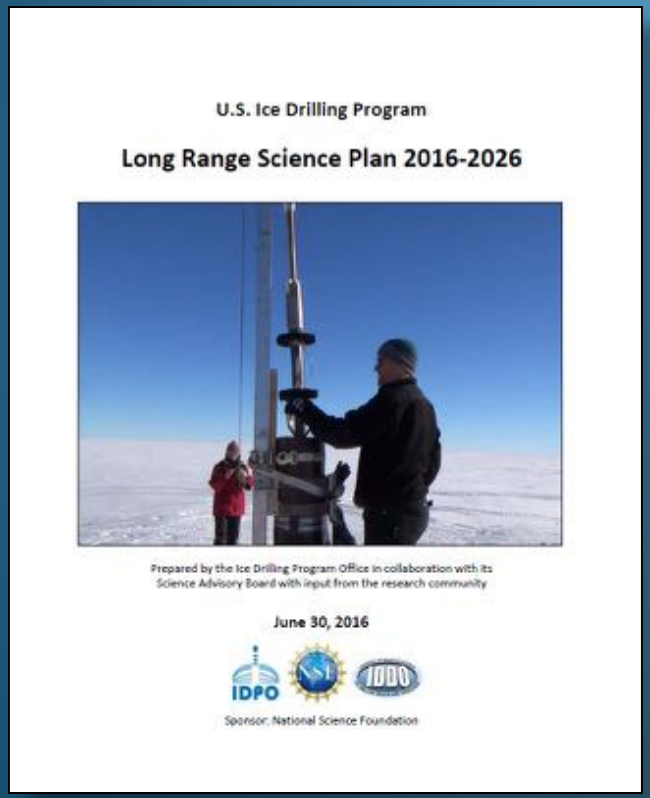
AGU
American Geophysical Union

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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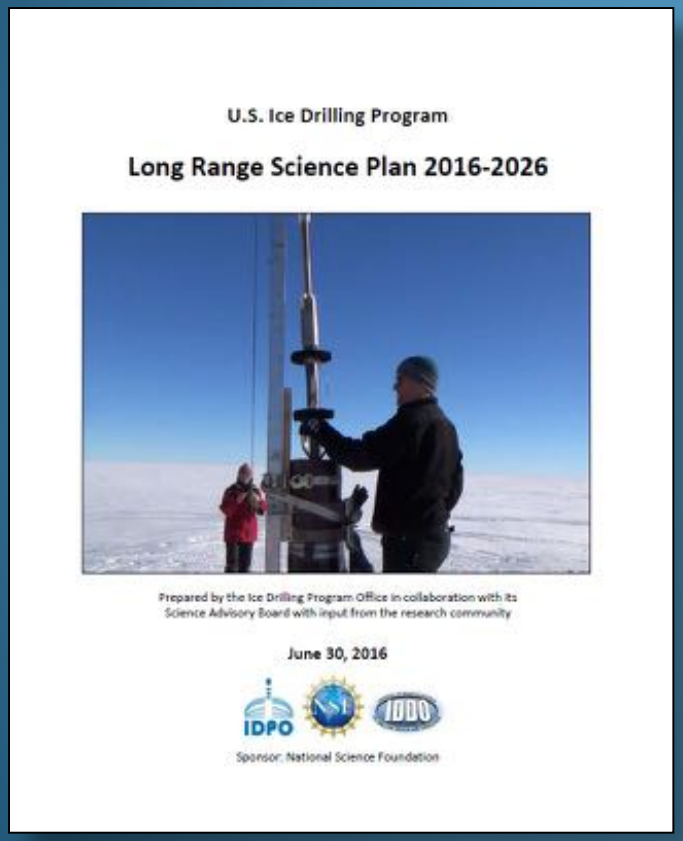
# IDPO-IDDO
# Integrated Science &Technology Planning

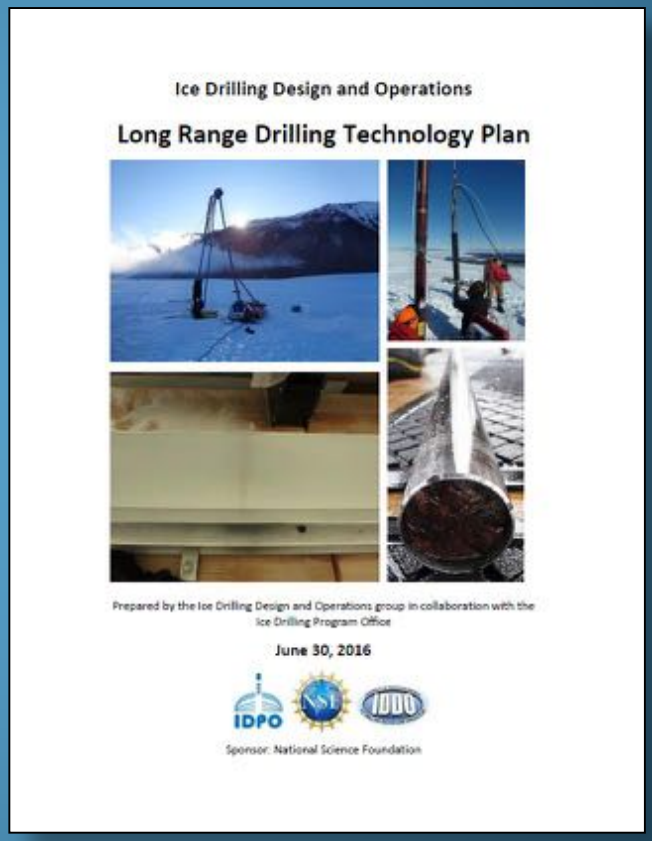

U.S. Ice Drilling Program

Long Range Science Plan 2016-2026

Prepared by the Ice Drilling Program Office in collaboration with its Science Advisory Board with input from the research community

June 30, 2016

Sponsor: National Science Foundation


Ice Drilling Design and Operations

Long Range Drilling Technology Plan

Prepared by the Ice Drilling Design and Operations group in collaboration with the Ice Drilling Program Office

June 30, 2016

Sponsor: National Science Foundation

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

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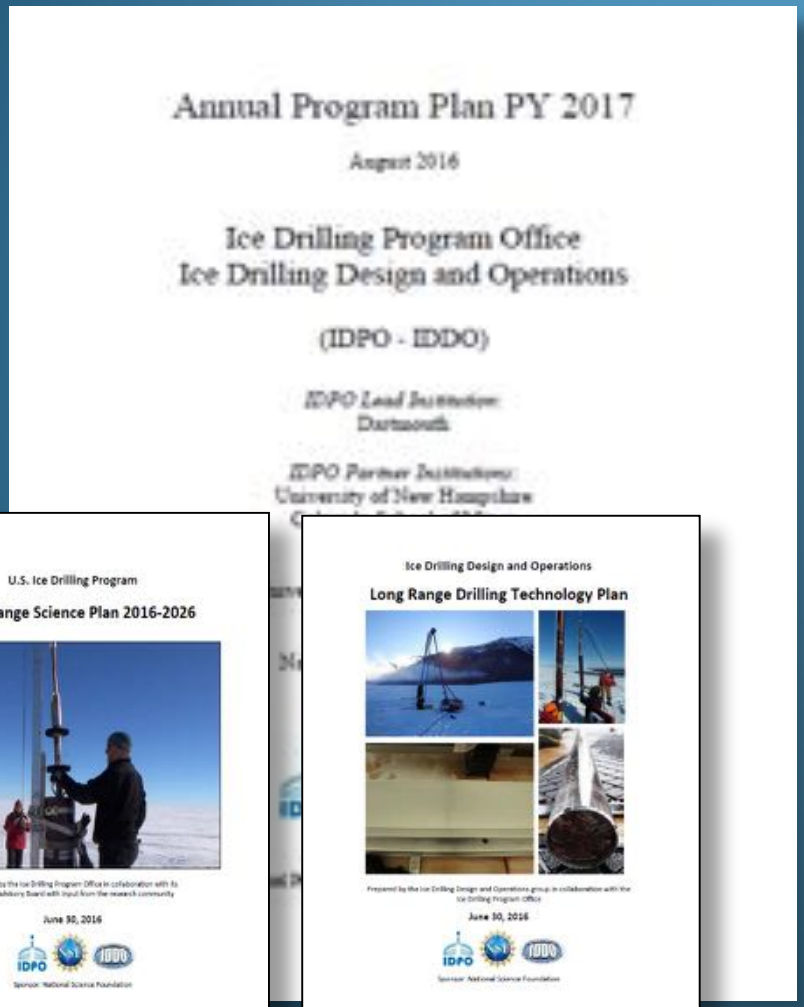
# IDPO-IDDO

## Long Range Plans drive our annual program



Annual Program Plan PY 2017

August 2016

Ice Drilling Program Office
Ice Drilling Design and Operations

(IDPO - IDDO)

*IDPO Lead Institution:*
Dartmouth

*IDPO Partner Institutions:*
University of New Hampshire



U.S. Ice Drilling Program

Long Range Science Plan 2016-2026

June 30, 2016



Ice Drilling Design and Operations

Long Range Drilling Technology Plan

June 30, 2016

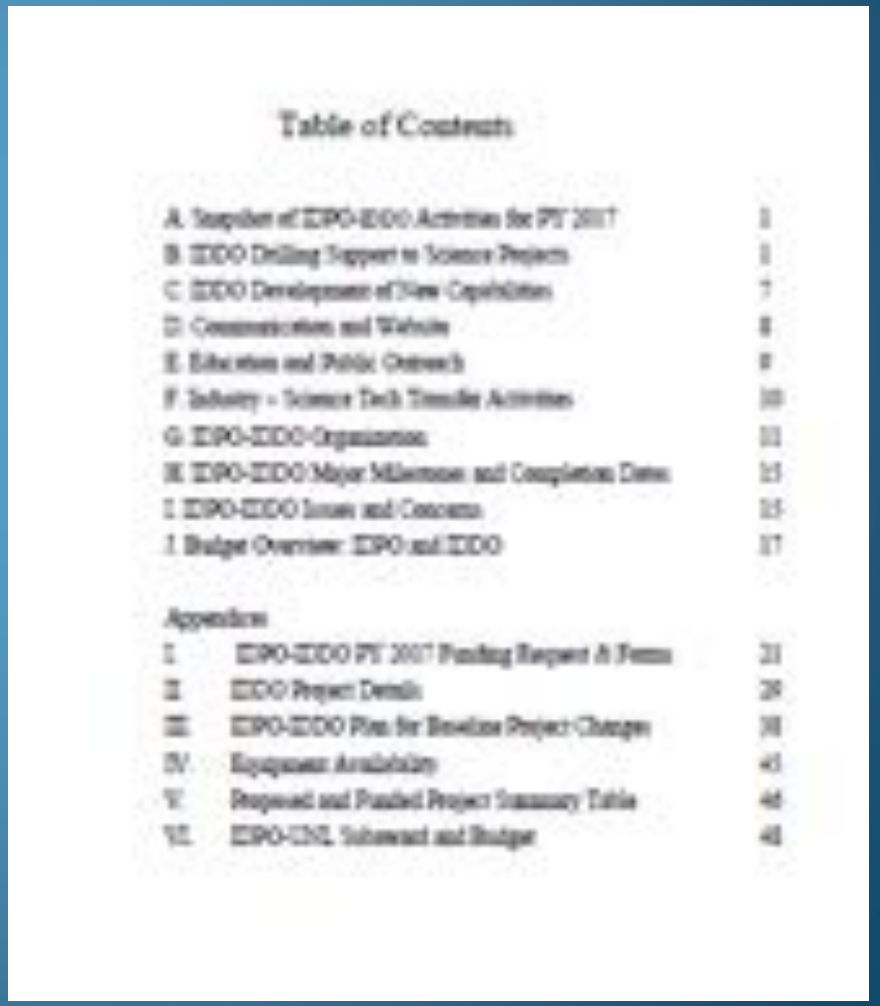


Table of Contents

# Ice Drilling Program Office

## IDPO Science Requirements
## for New or Upgraded Drilling Tech

Ice Drilling Program Office

IDPO Science Requirements: RAM Drill

Background

Scientific Requirements

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

# National Academy Report
# **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

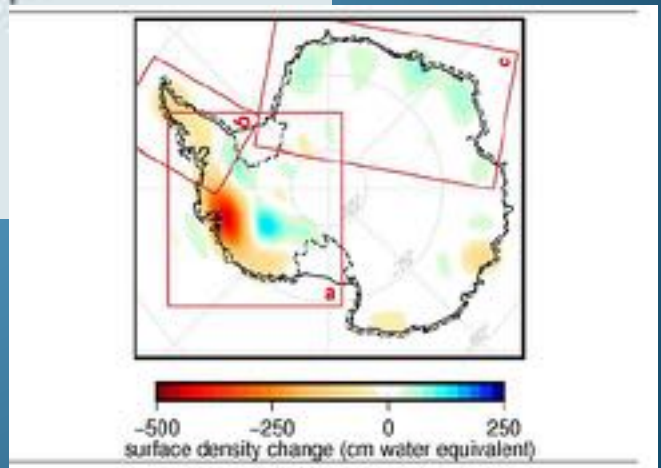



*Figure 1. The mass of the Antarctic ice sheet declined by 92 billion tons per year from 2003 to 2014. The color scale indi-*

# NSF – NERC Joint Program in Antarctica

**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

Synopsis 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

# Arctic research policy from the Interagency Arctic Research Policy Committee

| IARPC Agencies | |
|---|---|
| National Science Foundation | Department of Transportation |
| Department of Agriculture | Environmental Protection Agency |
| Department of Commerce | Marine Mammal Commission |
| Department of Defense | National Aeronautics and Space Administration |
| Department of Energy | Office of Management and Budget |
| Department of Health and Human Services | Office of Science and Technology Policy |
| Department of Homeland Security | Smithsonian Institution |
| Department of State | U.S. Arctic Research Commission |
| Department of the Interior | |

Policy drivers:

1) Enhance the well-bring 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

Interagency Arctic Research Policy Committee

# **U.S. Arctic Research Plan** 2017-2021

## 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

# IDPO-IDDO

Funding realities creates
challenges  & opportunities for resilience

# IDPO-IDDO

## Balance between field support & tech development

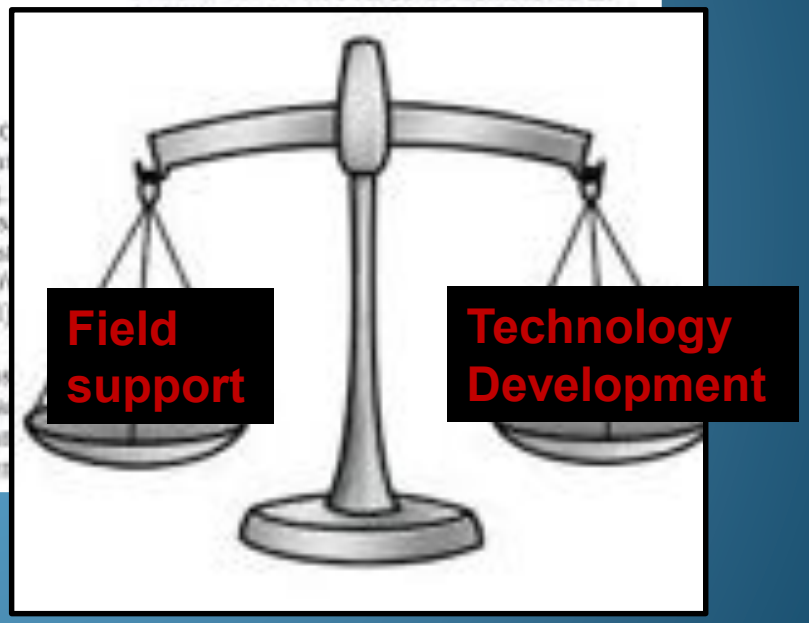
*Eos, Transactions, American Geophysical Union*, Vol. 91, No. 39, 28 September 2010, Pages 345–346

### A New Paradigm for Ice Core Drilling

The search for answers to questions about the changing climate has created an urgent need to discover past climate signatures archived in glaciers and ice sheets, and to understand current ice sheet behavior. Recognizing that U.S. scientific productivity in this area depends upon a mechanism for ensuring continuity and international cooperation in ice coring and drilling efforts, along with the availability of appropriate drills, drilling expertise, and innovations in drilling technology, the U.S. National Science Foundation

they have community support, are inc
in the next version of the science pla
which is updated yearly in the spring.
To request specific drilling services
tists must download a support reque
from the IDPO/IDDO Web site (http://
.icedrill.org/scientists/scientists.shtml)
out, and submit it at least 4 weeks in
advance of any given research propos
date if the proposal is for the use of a
ing drill, and at least 6 weeks in advan
the proposal involves the developme

achieve their science objectives. SAB composition is representative of the varied areas of science in those research communities.




*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.*

# IDPO-IDDO

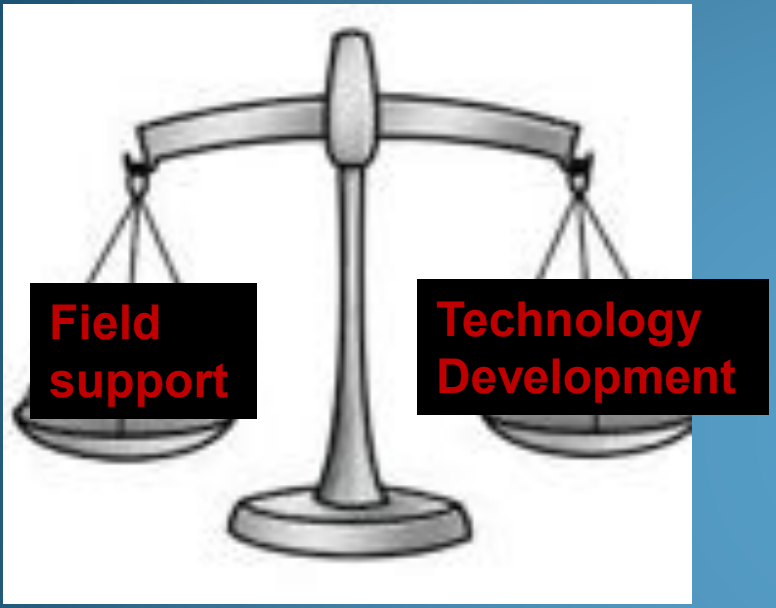
## Program Management Performance on Major NSF Drill Development Projects

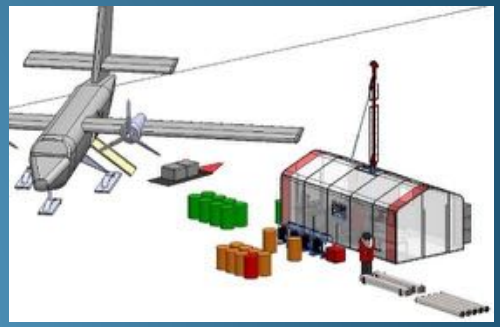
| Project | Results |
|---|---|
| ICDS DISC Drill (2003-2008) | Significant external overrun |
| ICDS Wissard Project (2009-2011) | Significant external overrun, project competed by another organization |
| IDPO-IDDO Intermediate Depth Drill (IDD) (2011-2014) | On-schedule, no external overrun but required funds from lower priority projects |
| IDPO-IDDO Agile Sub-Ice Geological (ASIG) Drill (2014 – Present) | On-budget, on-schedule (through North American Test) |
| Rapid Access Ice Drill (RAID) (2012 concept 2014 – present) | On-budget, on-schedule (through shipment) |

***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".*

# IDPO-IDDO
## Example: ASIG Drill



*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.*

# IDPO-IDDO

## Challenge: reduce costs for NSF science budgets

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

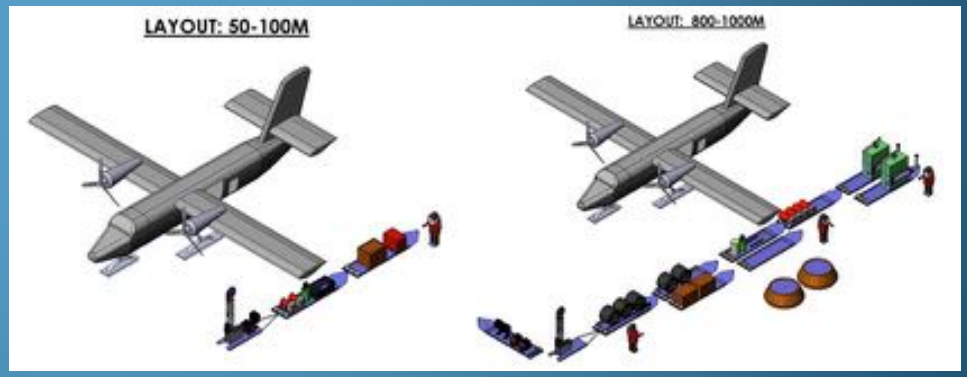
**Now: IDDO driller salary costs come from our existing NSF Cooperative Agreement**

***This relieves stress on science projects but decreases our CA funds available for development projects.***

# IDPO-IDDO
## Opportunity: Seek tech development funds through proposals

**Proposal** → **?** → **Technology Development**

*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.***

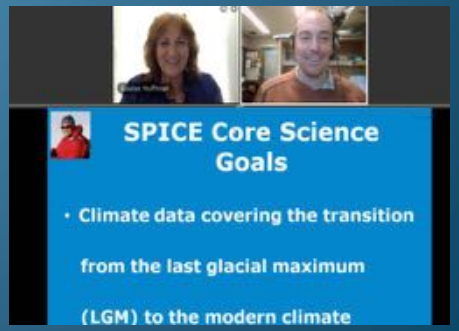
# IDPO
# Education & Public Outreach

## 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*



# IDPO
# Education & Public Outreach

## 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*

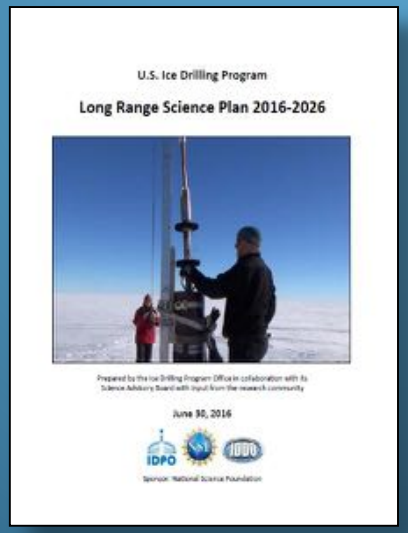
- Encourage minority participation in STEM activities using ice science as the vehicle. *Led **School of Ice** for faculty at minority-serving institutions in Denver 2016 and in Hanover NH 2017, in collaboration with AMS.*

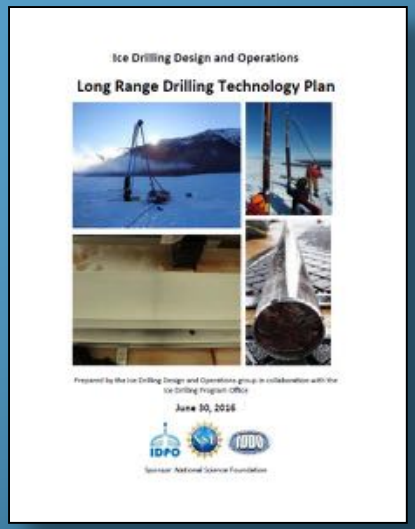
# Much more info at:

# www.Icedrill.org

# IDPO-IDDO

## Status of action on SAB Priorities from 2016-2026 Long Range Science Plan



# Ice Drilling Program Office 2016
# Priority Drilling Technology Needs


**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 m[2].
- **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.

# Ice Drilling Program Office
# Priority Drilling Technology Needs


**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[2] 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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# Ice Drilling Program Office
# Priority Drilling Technology Needs


**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!