NSF Ice Drilling Program

IDP Leadership Update

Mary R. Albert, PhD

IDP P.I. & Executive Director

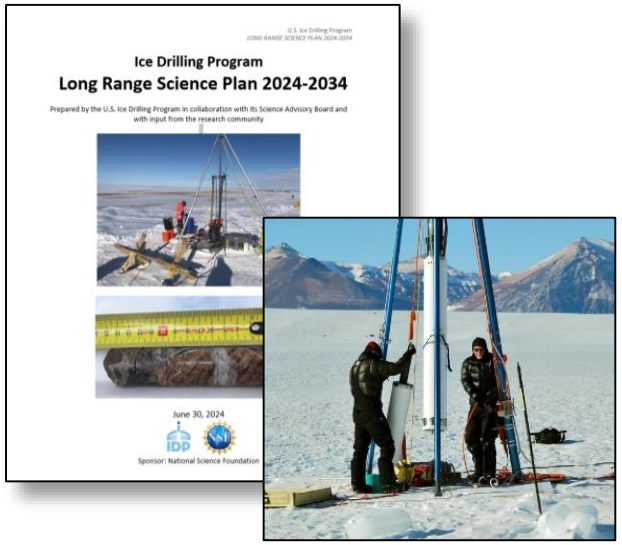
IDP-ESAWG meeting

8 April 2026

IDP Vision & Mission

Vision

To enable scientific discoveries using evidence from within and beneath glaciers and ice sheets.

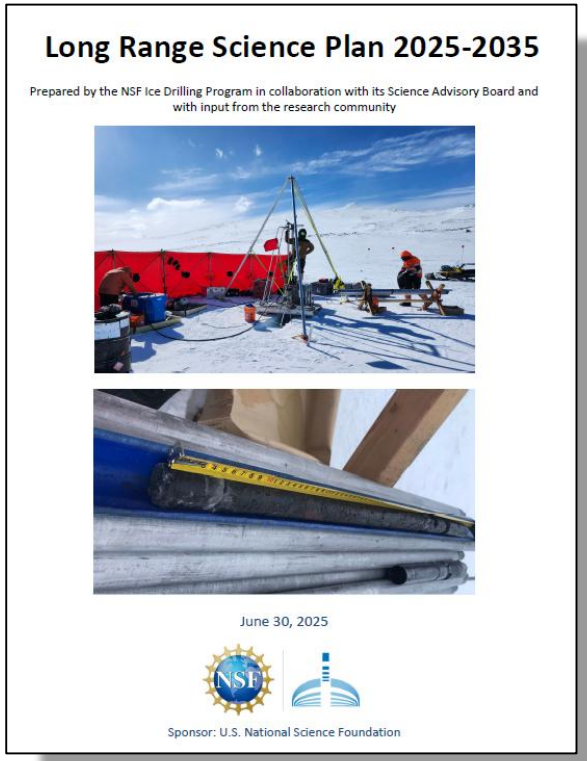


Mission

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.

IDP Long Range Science Plan

Inclusive planning to articulate the science vision for the coming decade



Past Climate

Ice Dynamics and Glacial History

Subglacial Geology, Sediments & Ecosystems

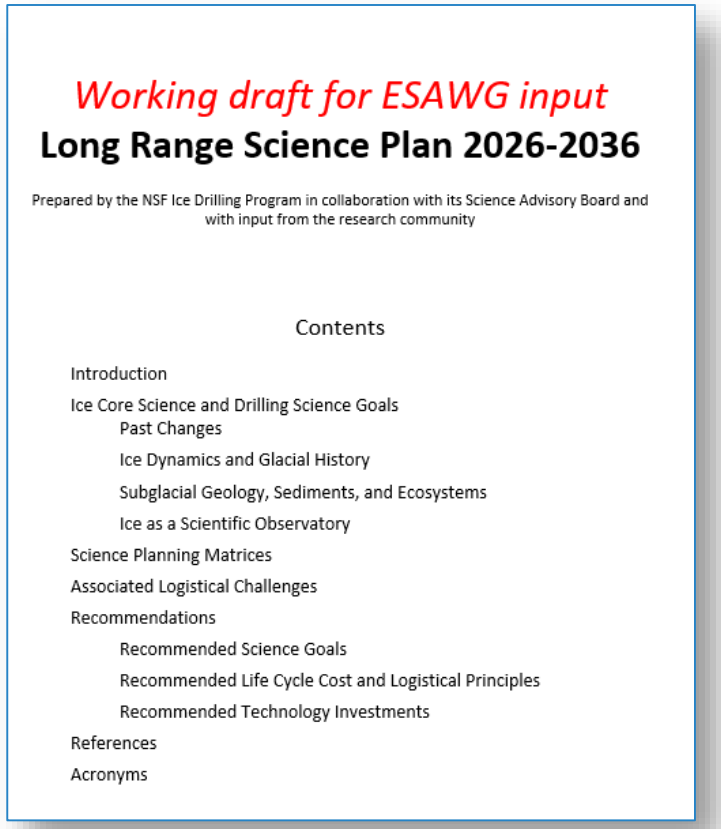
Ice as a Scientific Observatory

Science planning drives IDP drill tech development & use

https://icedrill.org/long-range-science-plan

IDP Long Range Science Plan

The working draft update is in the ESAWG google folder



Working draft for ESAWG input

Long Range Science Plan 2026-2036

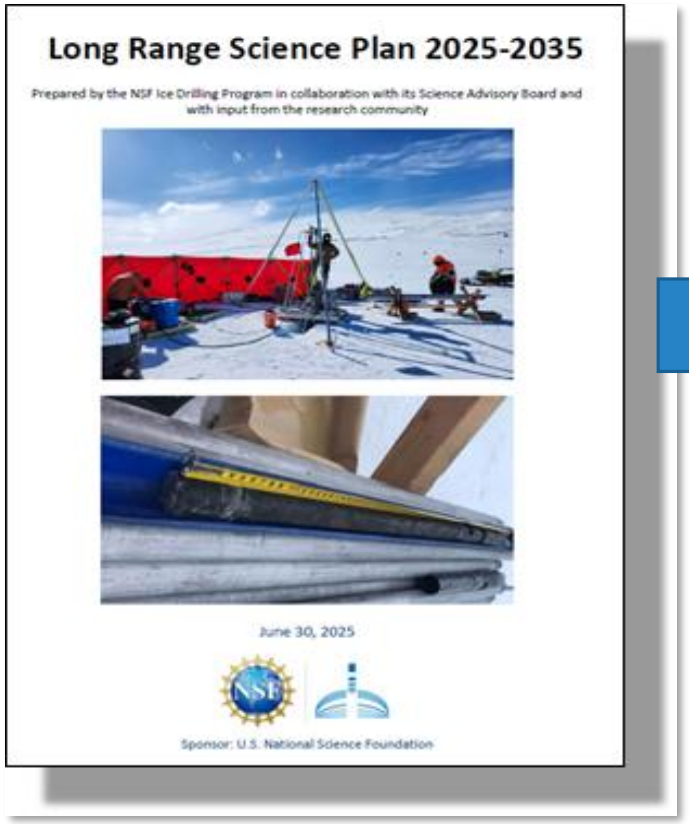
Prepared by the NSF Ice Drilling Program in collaboration with its Science Advisory Board and with input from the research community

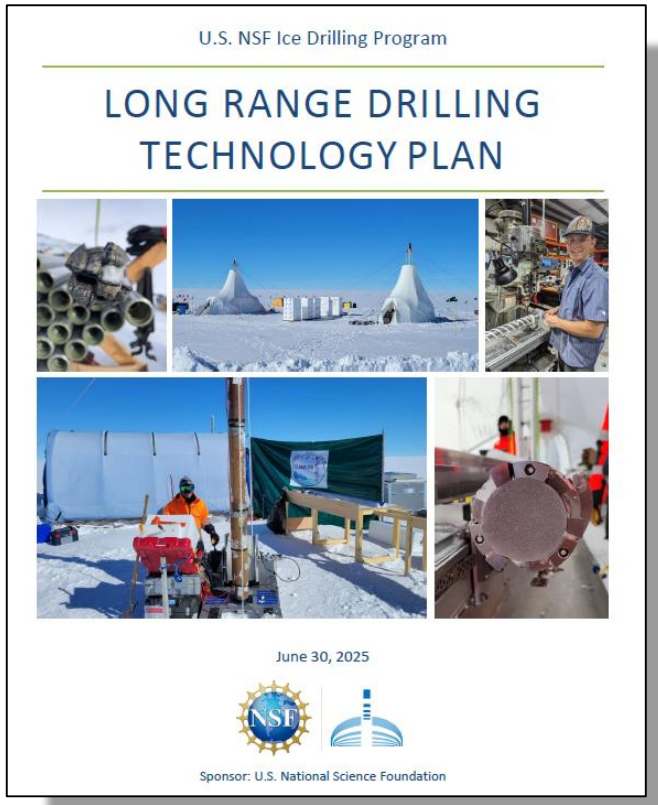
Contents

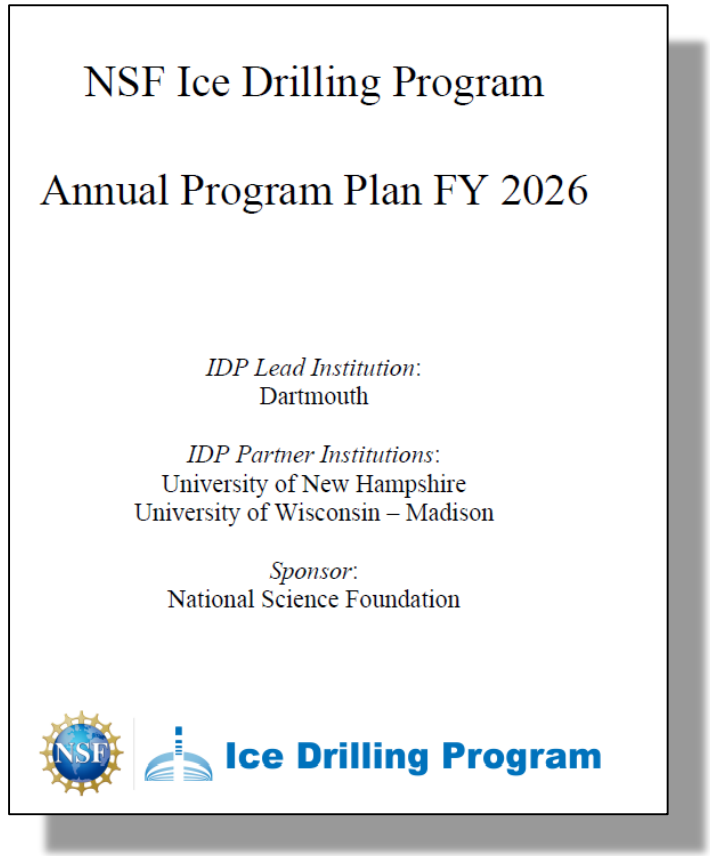
- Google doc is available in the ESAWG folder
- Please read through and suggest updates
- **Deadline for ESAWG input/edits: April 13**

IDP Integrated Science & Technology Planning

IDP integrated science and technology planning and NSF priorities drive our annual plans







IDP-ICWG
Community Consensus Priority for Ice Coring

- In 2014 an IDP community meeting led by the ICWG identified Hercules Dome as the priority site for the next U.S. ice core community drilling project. This priority has been reaffirmed by ICWG every year since.

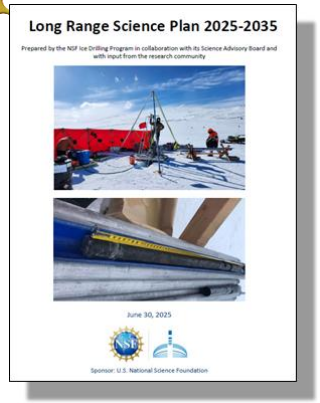
- Driving research question: How much ice was lost from the West Antarctic ice sheet during Earth's last prolonged warm period, about 125,000 years ago, when sea level was several meters higher than today?

- IDP is planning to set up the drill and begin drilling in the 2028/29 Antarctic field season with the Foro 3000 drill, thru 2031/32.

IDP-ESAWG
Community Consensus Priority for Subglacial Access

- **In December 2024, an IDP community meeting led by IDP-ESAWG identified ice sheet contribution to sea level rise, understanding grounding zone variability, and constraining bed conditions as the drivers for future subglacial access drilling.**
- **Driving research question: How will ice sheets contribute to sea level rise in the coming decades to century?**
- **Plans for specific future field endeavors TBD**

Recommended Drilling Tech Investments in the IDP Long Range Science Plan



* IDP working groups & SAB provide input

* IDP SAB prioritizes by mid-April

* Long Range Science Plan is updated annually in the spring

* Updated LRSP will be on Icedrill.org in early May, U.S. scientists invited to comment/provide input. LRSP 2026-2036 finalized in early June.

Note: The LRSP articulates community plans & priorities; NSF makes all decisions on what will occur.

Recommended Technology Investments

The following investments in drilling technologies are needed to accomplish science goals planned for the next decade. Investments prioritized by time (but not prioritized within each Priority level) from consensus of the IDP Science Advisory Board, include:

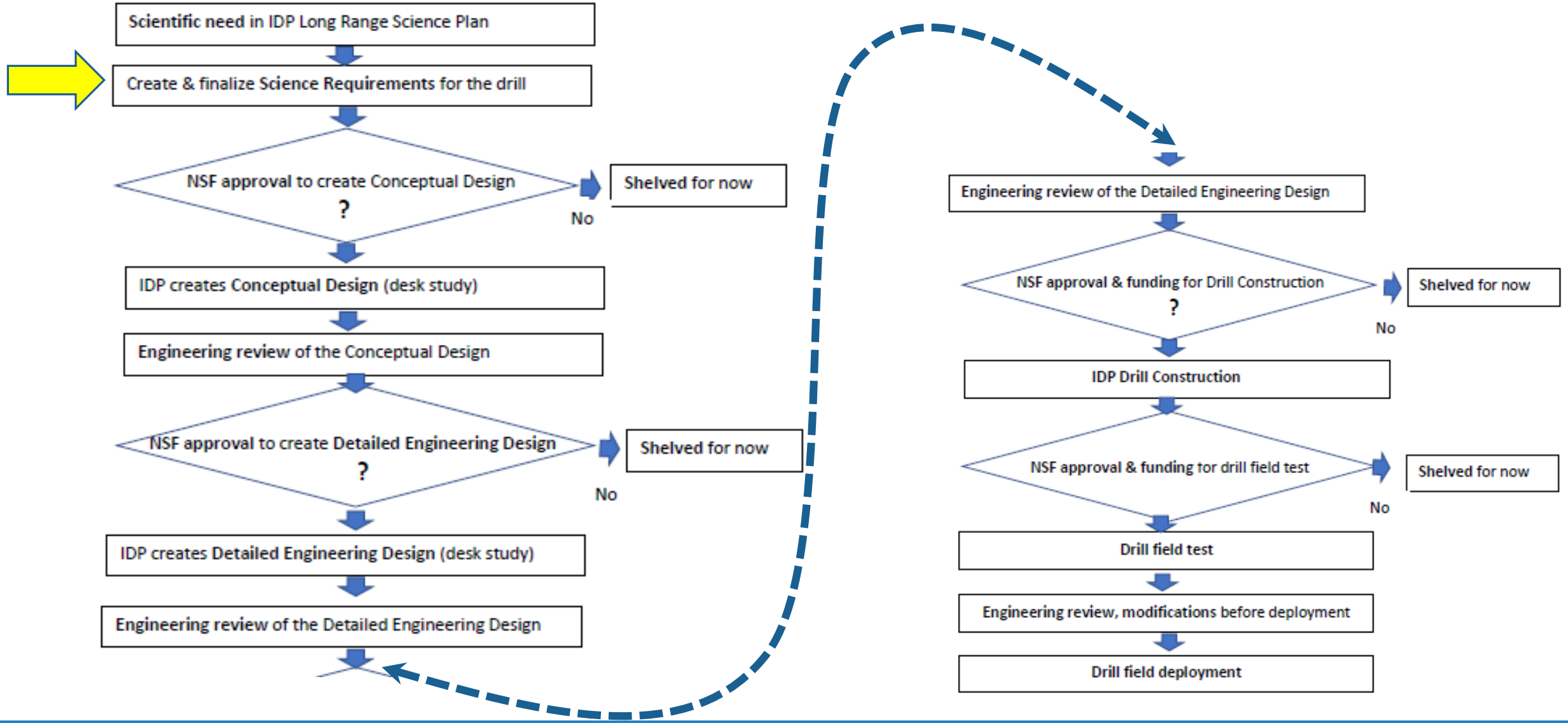
Priority 1 (needed in fiscal year 2025):

- Maintain and upgrade agile equipment in inventory, including: Hand Augers, Sidewinders, the Foro 400 drill, the 4" Electromechanical Drills, the 3" Electrothermal Drill, the 3.25" Eclipse Drills, the Stampfli Drill, Logging Winches, the Small Hot Water Drills (HWD), the Blue Ice Drill, the Prairie Dog, the Agile Sub-Ice Geological Drill (ASIG), the Rapid Air Movement Drill (RAM) Drill, and the Winkie Drills.
- Redesign the Blue Ice Drill electronics and fabricate spare components.
- Adapt a commercial drill rig for retrieving rock core from beneath 200 m of ice (BASE Drill).
- Finish construction of the 700 Drill.
- Return Joel Harper's drill from Greenland and transfer it to the IDP inventory for access (non-clean) hot water drilling.
- Conduct engineering feasibility study to evaluate and recommend longer-term drilling approaches to retrieve ice with good core quality down to 400 m depth in blue ice areas.

Priority 2 (needed in the next 3 years):

- Evaluate the design of the BAS and NZ scalable hot water drill for possible build of a clean modular hot water drill. Revisit the IDP Conceptual Design of the Scalable Hot Water Drill for a clean drill that minimizes its logistical footprint including fuel supply.
- Develop the Conceptual Design for collecting a small amount (chips to several cm) of sub-ice rock/mixed media/mud in a frozen regime using an intermediate or deep ice core drill

What is the IDP Drilling Technology Development Process?



Example IDP Science Requirements: Clean Deep Hot Water Drill

Ice Drilling Program

Dartmouth _ University of Wisconsin-Madison _ UNH

DOCUMENT IDENTIFICATION	
Title:	SCIENCE REQUIREMENTS: CLEAN DEEP HOT WATER ACCESS DRILL
Date: March 2026	Revision: Original

DOCUMENT APPROVAL	
Science Community:	R. Venturelli, T. Vick-Majors, T.J. Fudge, M. Siegfried, J. Talghader, J. Mikucki
IDP:	M. Albert

REVISION HISTORY (maintain last 3 versions)			
REV	DESCRIPTION	DATE	APPROVAL
1.0	Initial Science Requirements	*date*, 2026	Fudge, Mikucki, Siegfried, Talghader, Venturelli, Vick-Majors

Science Requirements: Clean Deep Hot Water Access Drill

Background:
Rapid changes in speed of fast-flowing tide-water glaciers, outlet glaciers and ice streams observed over the past decade create urgency to understand their dynamics. Properties of the ice-bed interface exert strong control on the flow of glaciers and ice sheets. Modular hot water access drills that are mobile and capable of drilling to the bed of glaciers and ice sheets in much less than one season and for drilling multiple holes per season are needed for measurements of temperature, heat flux, pressure, and microbiology sampling. The drill design should be similar to the deep clean hot water drill developed by the British Antarctic Society (BAS). The scientific requirements for a U.S. deep hot water clean access drill are:

Scientific Requirements

1. Produce access holes through ice to depths of up to 3,000 m.

2. The drill should be modular, with built-in redundancy, so that a drill appropriate for approximately 1,500 m would have additional components to reach depths up to 3,000 m.

3. For biologically clean applications, the drill should be consistent with the SCAR Code of Conduct for the Exploration and Research of Subglacial Aquatic Environments (SAE) and should have attributes consistent with the NRC 2007 Report. That would mean that the drill needs:

    a. Mechanisms to reduce the number of microbial cells in or on the volume of any instrument or material to less than the number present in the basal ice being passed through.

    b. Mechanisms to limit the introduction of chemical contaminants (e.g. toxic or biodegradable) to limit environmental impact.

4. Diameter of holes needed will vary, with most likely in the 10-30 cm diameter range.

5. The borehole diameter should be predictable over its depth, likely requiring the use of an instrumented drill head.

6. The design should include the ability to drill a 30 cm diameter, 3000 m deep hole and keep it open with occasional reaming for 24 hours after initial drilling.

7. The drill should be operable at 2,000 m altitude in borehole and/or ambient temperatures down to -30°C. The drill should survive winter storage at temperatures of -55°C

DRAFT

Looking ahead – what will the ESAWG community target for the IPY?

	2026				2027				2028				2029				2030				2031				2032				2033				2034				2035				2036			
Subglacial Geology, Sediments, & Ecosystems	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
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Bedrock geology																																												
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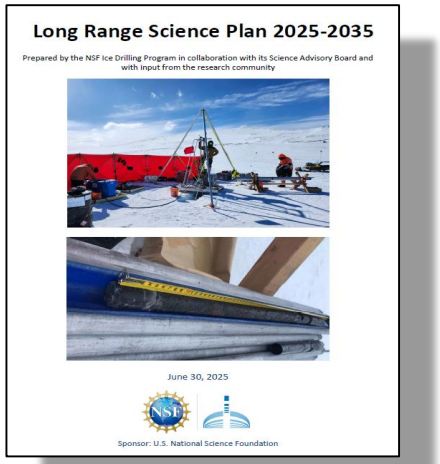
Subglacial hydrology & sediment dynamics																																												
South Pole lake[10]																								x	x																			
Microbial ecosystems & biogeochem																																												
West Antarctica / Siple Coast[7]								U	U																																		

Pease look at the Science Planning Matrices (p. 30-33) in the draft Long Range Science Plan & note any corrections.

Looking ahead – possible interdisciplinary astrophysics/cryomicrobiology project in the future?

- M. Albert & T. Benson discussions revealed potential opportunity for interdisciplinary science via upcoming IceCube drill upgrades
- But how ‘dirty’ is the IceCube deep hot water drill now?
- IceCube staff gathered samples from the 2025/26 IceCube drilling for analysis by A. Michaud, T. Vick-Majors & B. Christner

Timeline for updating the Long Range Science Plan



April 10 – ESAWG consensus on Recommended Tech Priorities in LRSP

April 13 – deadline for suggested ESAWG edits in the LRSP google doc

April 17 or earlier – SAB consensus on LRSP Recommended Tech Investments

May 4 – IDP will post the near-final updated draft LRSP to Icedrill.org, and issue an open call for comment/input

May 20 – final deadline for comment/input

June 29 – Final formatted LRSP submitted to NSF and also posted on Icedrill.org

Questions?