NSF Ice Drilling Program

IDP Leadership Update

Mary R. Albert, PhD

IDP P.I. & Executive Director

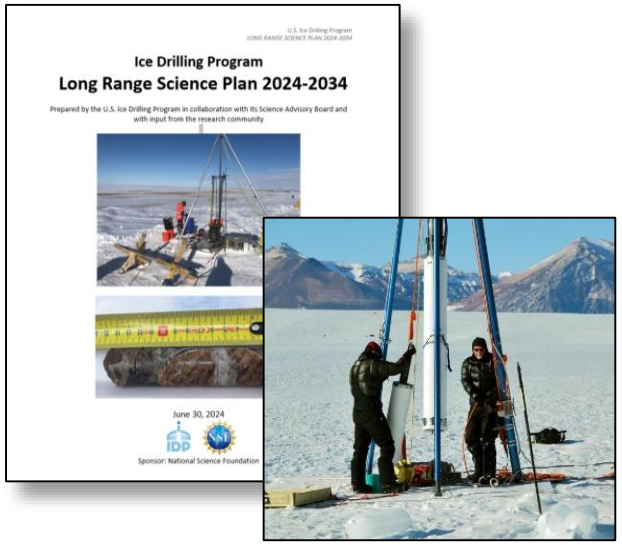
ICWG meeting

23 Februrary 2026

IDP Vision & Mission

Vision

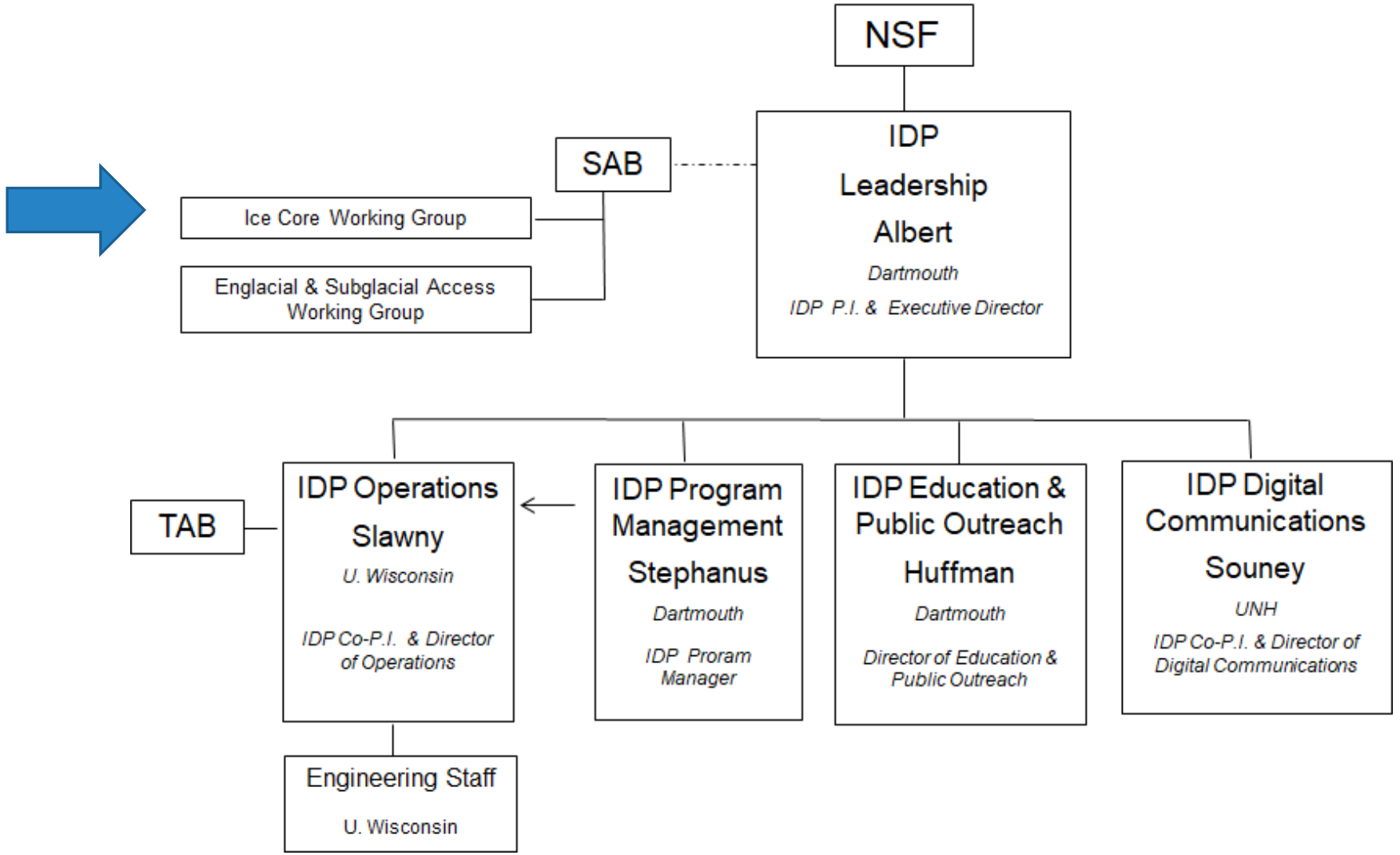
To enable scientific discoveries using evidence from within and beneath glaciers and ice sheets.



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.

ICWG within the IDP Organization



IDP Science Advisory Board

Community representatives from ice core science, subglacial science & glaciology

Sarah Shackleton – Woods Hole Oceanographic Inst (Chair)

Joel Harper – University of Montana

Matt Siegfried – Colorado School of Mines Geophysics

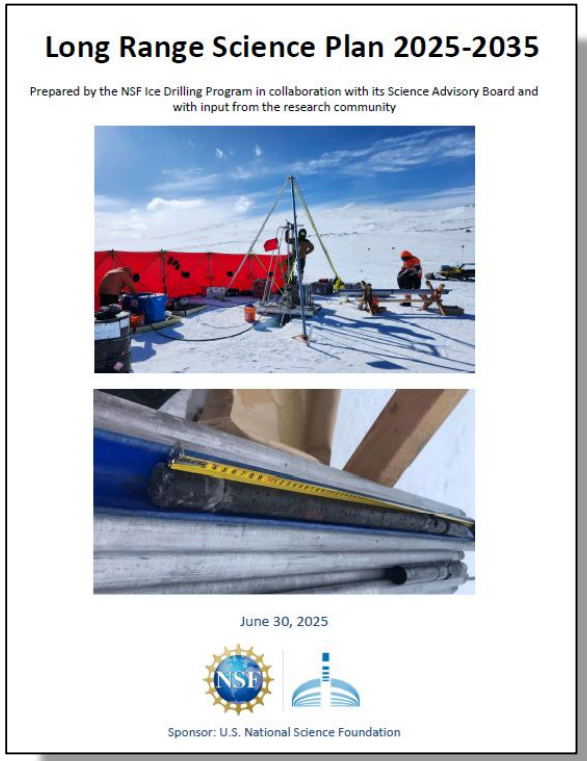
Ryan Venturelli - Colorado School of Mines Geology

Trista Vick-Majors – Michigan Tech University

TBD *SAB currently discussing nominees*

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

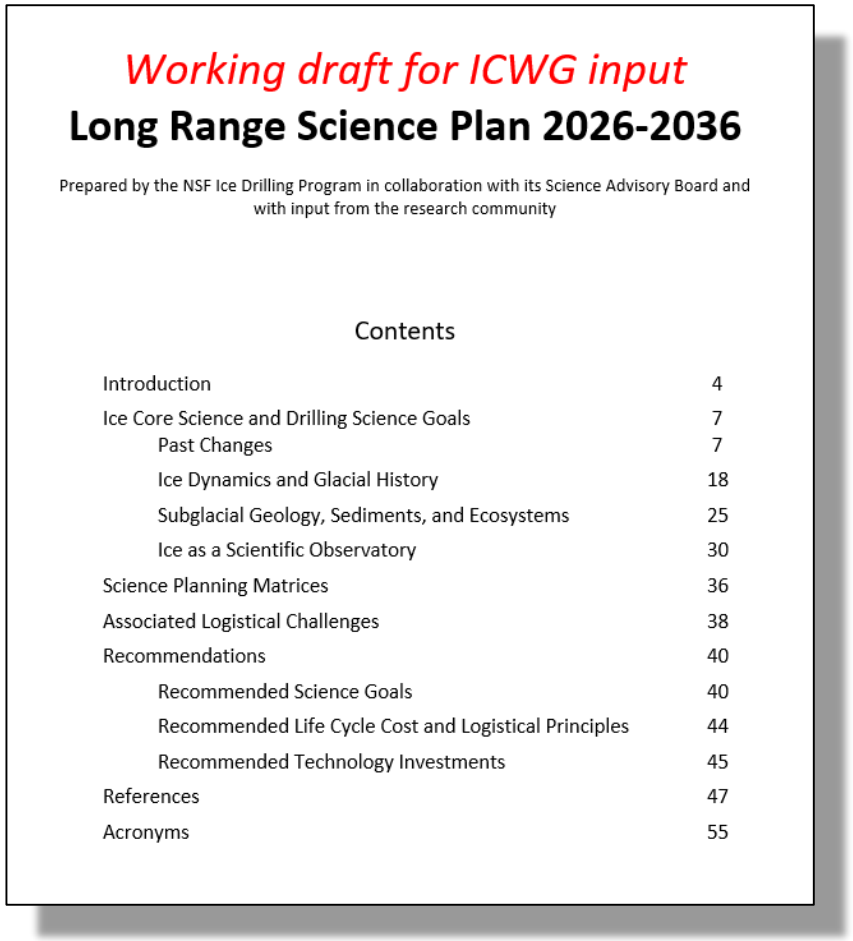
Ice as a Scientific Observatory

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 ICWG google folder now



Working draft for ICWG 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

- Available now in the google folder for this meeting
- Please read through and make suggestions at your earliest convenience.
- **Deadline for ICWG input/edits: April 10**

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.

Community Consensus Priority for Subglacial Access

- In 2024, an IDP community meeting led by 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 future field endeavors TBD

Recommended Drilling Tech Investments in the IDP Long Range Science Plan

* IDP working groups provide input

* IDP SAB prioritizes according to timeline

* Updated annually in the spring

* List of community wishes; NSF makes all decisions

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

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

Recommended Drilling Tech Investments in the IDP Long Range Science Plan

Recommended Technology Investments (*from LRSP 2025-2035, updated)*

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

Priority 1 (needed in 2025-2026):

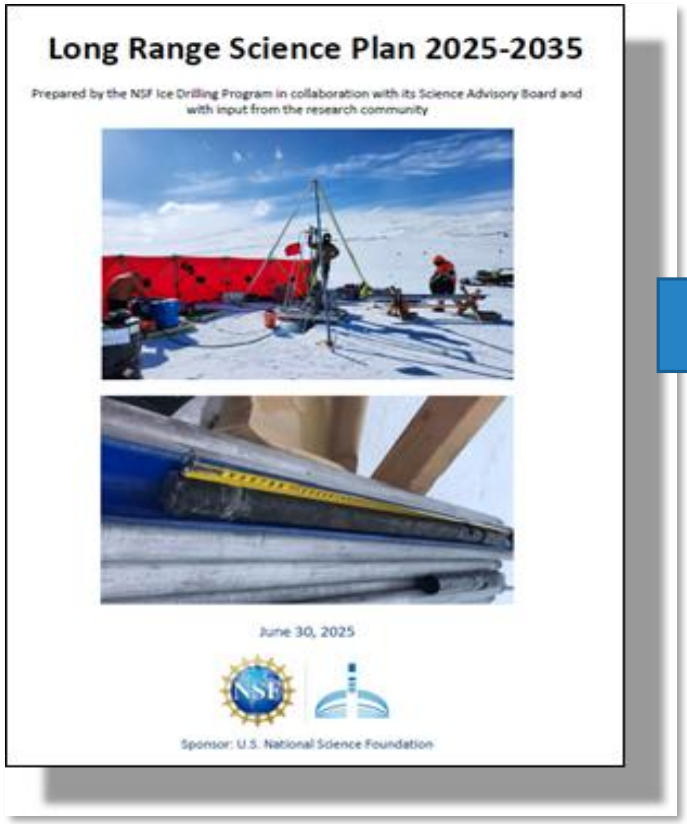
- Maintain and upgrade agile equipment in inventory, including: Hand Augers, Sidewinders, the 700 Drill, the Foro 400 Drill, the 4" Electromechanical Drills, the 3" Electrothermal Drill, the 3.25" Eclipse Drills, the Stampfli Drill, Logging Winches, the Small Hot Water Drills (HWD), the Blue Ice Drill, the Prairie Dog, the Agile Sub-Ice Geological Drill (ASIG), the Rapid Air Movement Drill (RAM) Drill, the Winkie Drill, and stand-alone components for use as the Shallow Wet Drill.
- ~~Complete the Science Requirements and Conceptual Design of next generation Blue Ice Drill~~ *(Will be finished August 2026)*
- ~~Make minor improvements (stainless steel core barrel, extra cutters) to the existing Blue Ice Drill~~ *(Finished)*
- ~~Describe/adapt the design and develop a cost estimate for the future build of a clean modular hot water drill (e.g. replicate the BAS/NZ modular drill for holes appx 200 - 1,000 m depth) that minimizes logistical footprint including fuel supply.~~ *(Will be finished August 2026)*
- ~~Field test shallow wet ice core drilling capability at Allan Hills in the 2025-26 field season~~ *(Finished)*

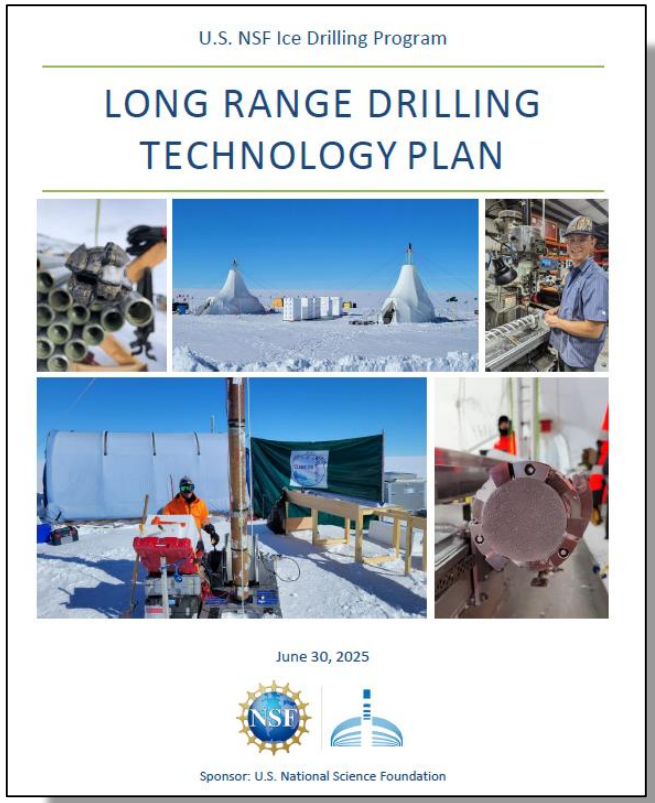
- **Priority 2 (needed in the next 3 years):**
- Build a scalable hot water drill for clean modular subglacial access drilling that minimizes its logistical footprint including fuel supply (e.g. replica of the BAS/NZ drill)
- Finish the Conceptual Design and begin the Detailed Design for replicate coring capability for the Foro

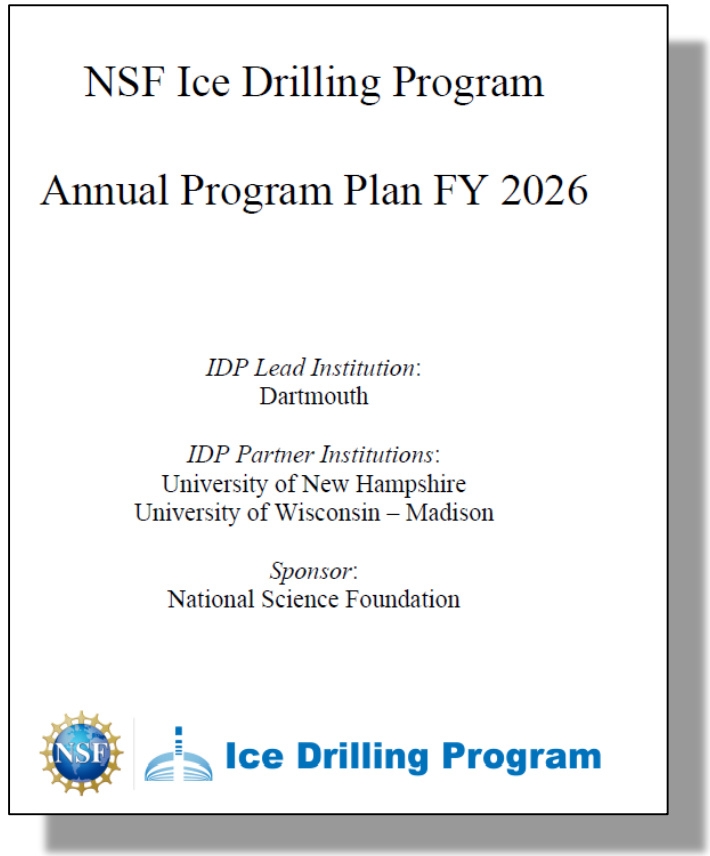
- Available now in the google folder for this meeting
- On the Agenda for discussion later in today's ICWG meeting
- Please reach ICWG consensus on updates for drilling tech investments today/soon

IDP Integrated Science & Technology Planning

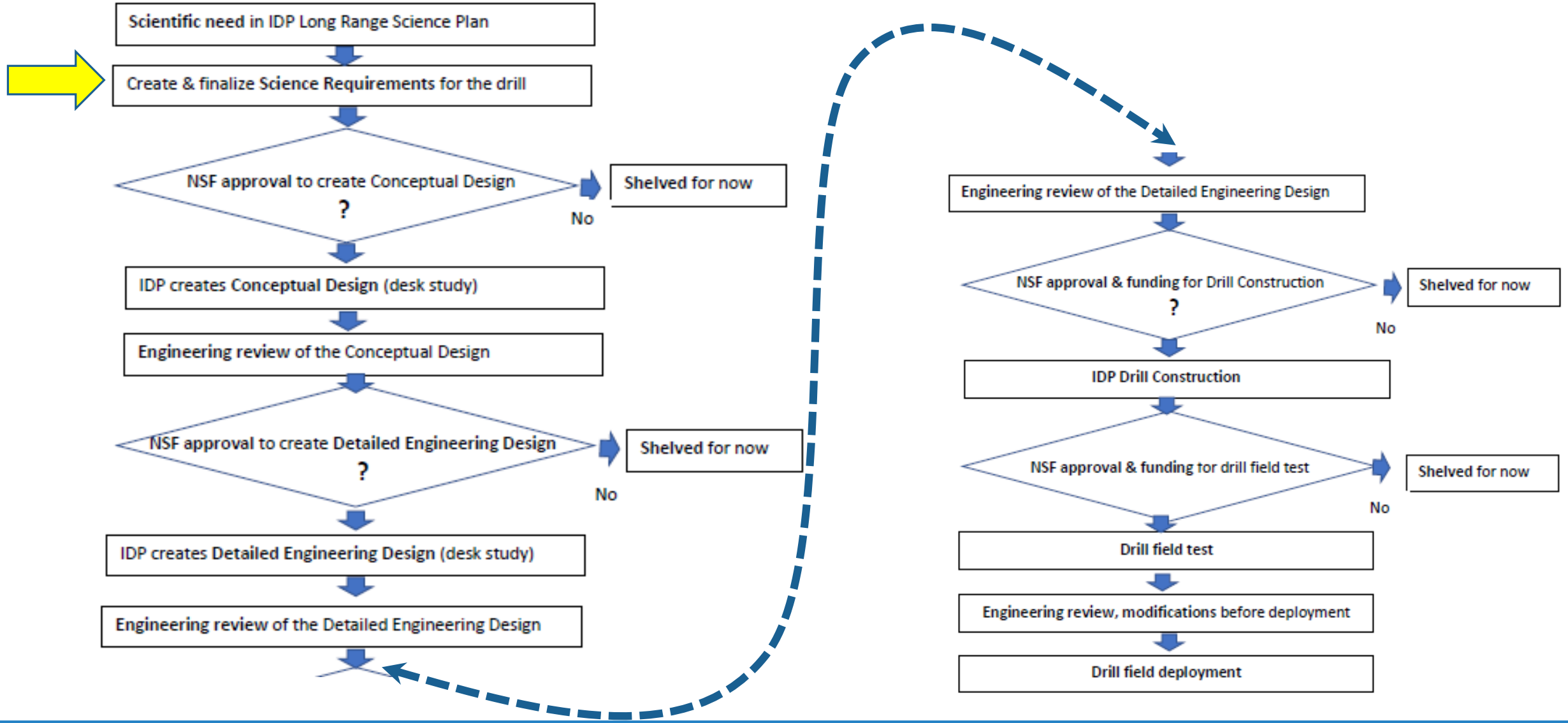
IDP integrated science and technology planning and NSF priorities drive our annual plans







What is the IDP Drilling Technology Development Process?



Example IDP Science Requirements: Wet Shallow Ice Coring Development

Ice Drilling Program

Dartmouth _ University of Wisconsin-Madison _ UNH

DOCUMENT IDENTIFICATION		
Title:	**SCIENCE REQUIREMENTS: Wet Shallow Ice Coring Development**	
Date: Oct 16, 2024		Revision: Final

DOCUMENT APPROVAL	
Science Community:	Ed Brook, Christo Buizert, John Higgins, Sarah Shackleton
IDP:	Mary Albert

REVISION HISTORY (maintain last 3 versions)			
REV	DESCRIPTION	DATE	APPROVAL
1.0	Initial Science Requirements	October 2024	See Above

Long Range Science Plan 2024-2034, a SAB-endorsed priority for drilling technology development is to *"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."* Using drilling fluid in these shallow blue ice boreholes is the most obvious strategy to improve core quality. After evaluating a number of options, the approach that will be most useful within the coming field seasons is to adapt components of the existing IDP 700 Drill for use with a Foro sonde (core diameter 98 mm). Note that borehole casing is not needed in these settings owing to the absence of a firn layer. From discussions between representatives of the research community and with IDP, the following are the minimum scientific requirements for wet shallow ice coring drill:

Scientific Requirements

The following are the minimum scientific requirements for a wet shallow ice coring drill.

1. The upgraded or newly developed drill should be developed and ready for use by the 2025-2026 Antarctic field season at the COLDEX Allan Hills drill site.
2. Minimum ice core diameter is 98 mm.
3. The targeted core length per drill run is 100 cm.
4. Core quality requirements:
   a. Core recovery over the entire borehole, as close as possible.
   b. Ice pieces fit together snugly without any gaps.
5. Each 1-meter core should contain no more than two pieces/a single break.
6. The minimum design depth for the drill is 400 m.
7. Surface equipment should be operable in ambient temperatures from -20º to -40°C.
8. Down hole equipment shall be operable in ice temperatures down to -40°C.
9. Drill fluid and chip processing equipment should be provided with the drill system, and operable within the space of the drill tent.
10. Set up and drilling of a 400-meter core should be possible in 40 days.
11. Drill components (when broken down) should fit in a twin otter aircraft, though multiple flights may be required.
12. Drill tent should be able to be set up in winds up to 18 knots.

Example IDP Science Requirements: BOLD drill

Ice Drilling Program

Dartmouth _ University of Wisconsin-Madison _ UNH

DOCUMENT IDENTIFICATION	
Title:	**SCIENCE REQUIREMENTS: NEXT-GENERATION BLUE ICE DRILL – BOLD DRILL**
Date: January 2026	Revision: Rev.2

DOCUMENT APPROVAL	
Science Community:	Ed Brook, Christo Buizert, John Higgins, Sarah Shackleton
IDP:	Mary Albert

REVISION HISTORY (maintain last 3 versions)			
REV	DESCRIPTION	DATE	APPROVAL
1.0	Initial Science Requirements	August 2025	Brook, Buizert, Higgins, Shackleton
2.0	Revised Requirements	January 2026	Brook, Buizert, Higgins, Shackleton

The purpose of establishing these science requirements is to identify aspects of a next-generation wide-diameter drill that could provide the quantity and quality of ice needed for scientific analysis, while also minimizing the logistical requirements for the drill, drilling fluid, and ice transport to and from blue ice areas. Through iterative discussions with IDP management, engineers, and representatives of the ice core science community, the scientific requirements for the next-generation large-diameter ice core drill are the following:

1. The target ice core diameter should be nominally 162 mm (6 ⅜ inch).
2. The target ice core length is 100 cm.
3. The target depth for the drill is 250 m for dry drilling, or 400 m for wet drilling.
4. The design process should compare the associated drill complexity and logistical burden between dry drilling to 250 m depth and wet drilling to 400 m depths.
5. The newly developed drill would be available for use in the 2027-28 field season, pending NSF approval for design and funding for construction of the drill.
6. The drill should be rated for storage down to -40 degrees C, and operational at ambient surface temperatures down to -30 degrees C.
7. Drill liquid and chip management equipment should be customized for agile use at shallow coring sites where the only shelters would be tents.
8. Set up and drilling of a 250-meter core should be possible in 21 or less single-shift operational days.
9. The complete drill system (not including generators) and tent packed for shipping should have a target weight of 6,000 lbs. or less, and individual components need to be moveable without using heavy equipment.

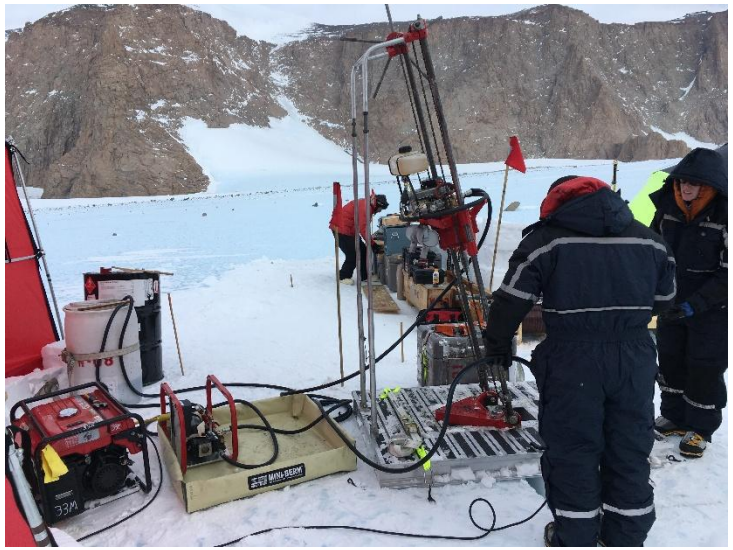
Looking ahead – what's next for the ice coring community after Herc Dome?

	2026				2027				2028				2029				2030				2031				2032				2033				2034				2035				2036			
Past Conditions	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
Industrial period and glaciology																																											
AON Greenland firn[1]		x	x																						IPY																	
Paleo climate in alpine ice patches[2]		x	x			x	x																																			
Utquigvik permafrost[3]		x	x			x	x																																			
Summit Ice characterization for neutrinos[7]		x	x			x	x																																			
Dye-2 Firn Evolution[4]		x	x			x	x			x	x																															
RNO-G[12]		4	4			4	4			4	4																															
Summit black carbon[2]										x	x																															
Pre-industrial baseline & dynamics																																											
Eclipse Icefield Canada[8]										s	s			7	7																											
Alpine 14ky record France[9]																																											
IceCoreHub[13]						I	I			I	I			I	I																											
Large scale global climate change																																											
Hercules Dome[10]																																											
Ice coring at Herc Dome												F	F			F	F			F	F			F	F																	
Replicate coring at Herc Dome																								R	R																	
Borehole logging at Herc Dome																								L	L																	
Ancient ice: 3 Ma and greater																																										
COLDEX Intermed core Allan Hills[11]																I	I				I	I																				
COLDEX shallow cores (SWD)[11]	B			S	S			S	S			S	S			S	S																									

Questions?


DARTMOUTH
University of New Hampshire
WISCONSIN
UNIVERSITY OF WISCONSIN-MADISON

IDP Englacial and Subglacial Access Working Group (ESAWG)



Ryan Venturelli - Colo Mines (Chair)

Jason Briner – SUNY Buffalo

Brent Christner – U. Florida

Britney Schmidt - Cornell

Jeff Severinghaus - UCSD

Heidi Smith – Montana State

Joseph Talghader – U. Minnesota

IDP Ice Core Working Group

Becky Alexander, Chair – U. Washington

Christo Buizert – Oregon State

TJ Fudge – U. Washington

Alex Michaud – Ohio State

Summer Burton Rupper – U. Utah

Sarah Shackleton - WHOI

Dom Winski - U. Maine

ICWG prioritized Hercules Dome as the next U.S. deep drilling site