NSF Ice Drilling Program

IDP Leadership Update

Mary R. Albert, PhD

IDP P.I. & Executive Director

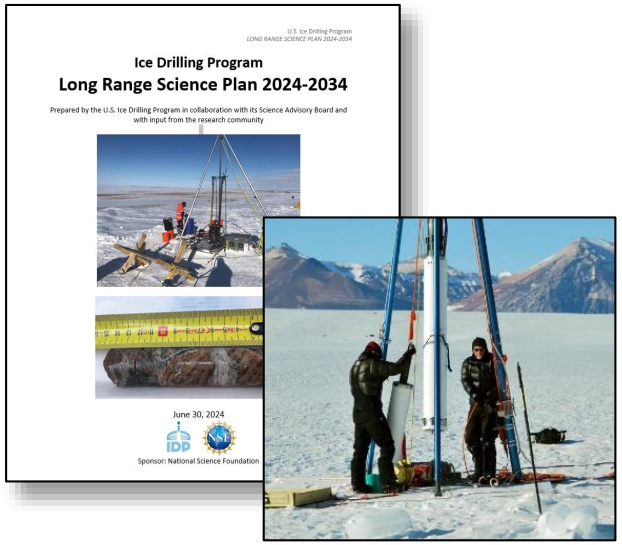
ICWG meeting

8 April 2025

IDP Vision & Mission

Vision

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

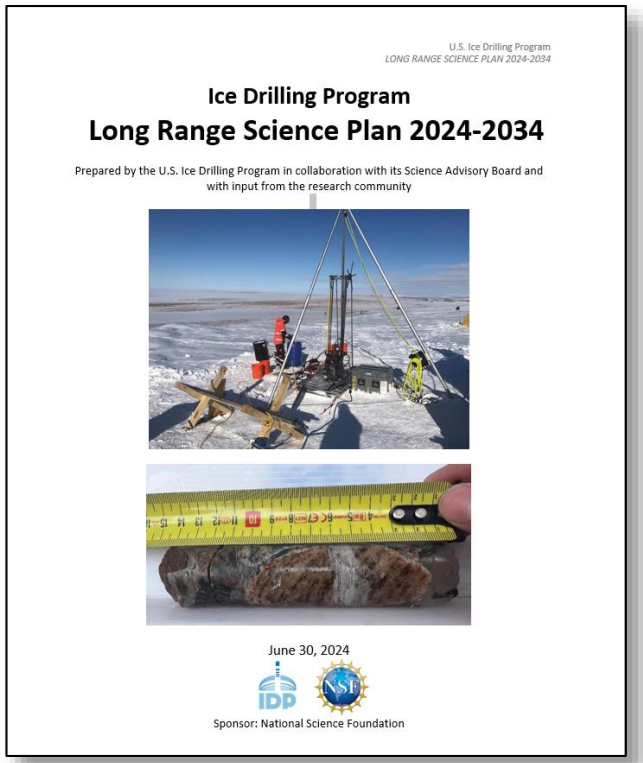


Mission

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

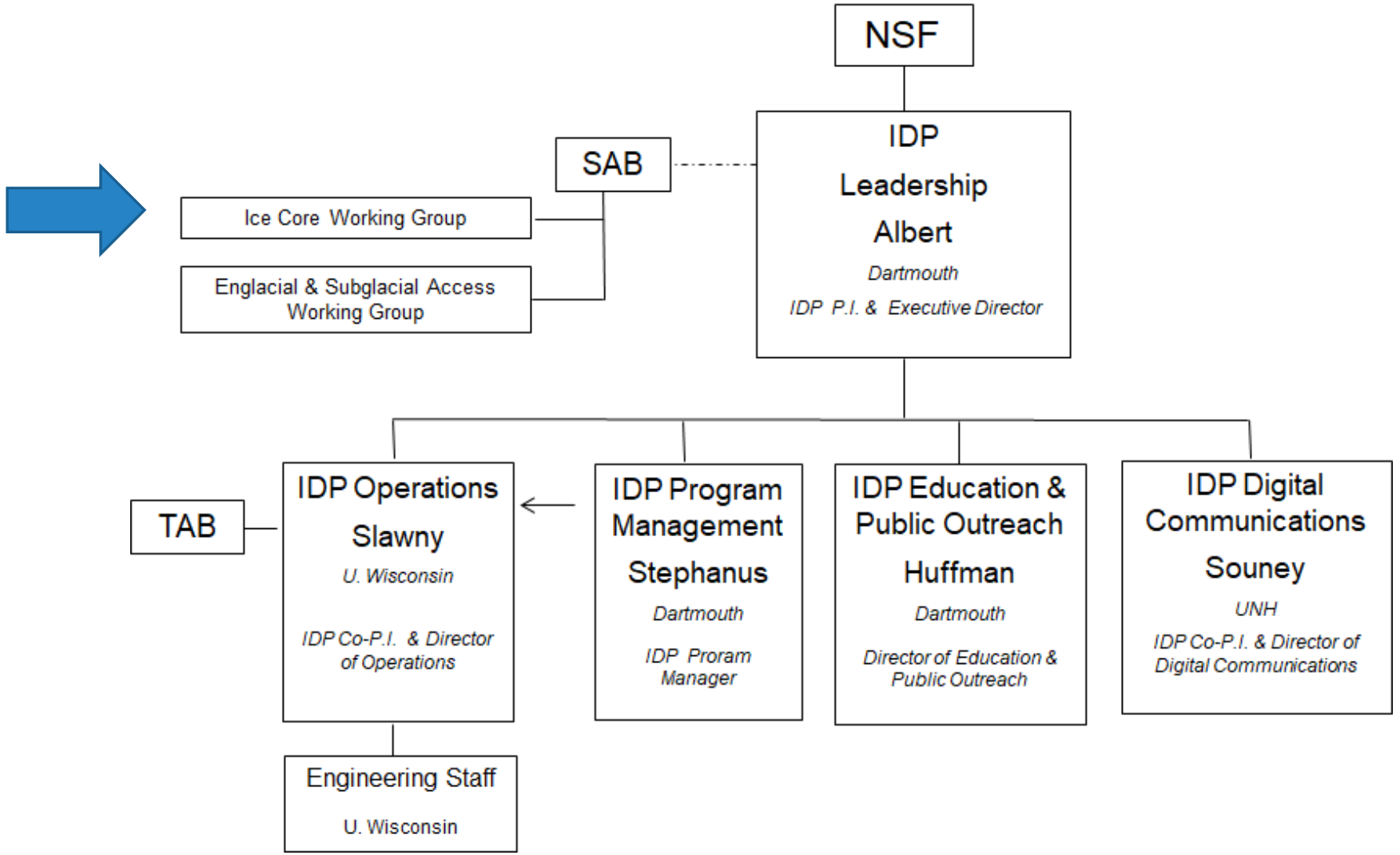
Subglacial Geology, Sediments & Ecosystems

Ice as a Scientific Observatory

Science planning drives IDP drill tech development & use

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

ICWG within the IDP Organization



IDP Science Advisory Board

Community representatives from ice core science, subglacial science & glaciology

T.J. Fudge – University of Washington (Chair)

Joel Harper – University of Montana

Matt Siegfried – Colorado School of Mines Geophysics

Sarah Shackleton – Woods Hole Oceanographic Institute

Martin Truffer – University of Alaska Fairbanks

Ryan Venturelli - Colorado School of Mines Geology

Trista Vick-Majors – Michigan Tech University

IDP Ice Core Working Group

Becky Alexander, Chair – U. Washington

Christo Buizert – Oregon State

TJ Fudge – U. Washington

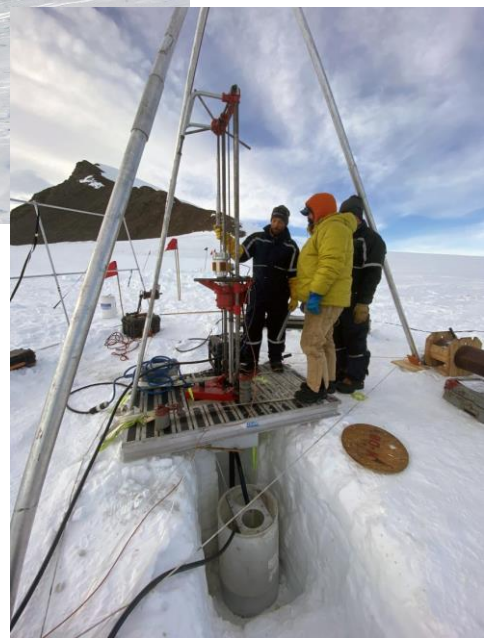
Alex Michaud – Ohio State

Summer Burton Rupper – U. Utah

Sarah Shackleton - WHOI

Dom Winski - U. Maine

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

ESAWG Science Planning Workshop

December 8, 2024 Alexandria VA

Outcome: draft white papers on subglacial science for the coming decade, for inclusion in the IDP Long Range Science Plan

Consensus from the ESAWG meeting
Driving Research Questions

- How will ice sheets contribute to sea level rise in the coming decades to century?
- What drives grounding zone variability over tidal to millennial timescales?
- How can we constrain bed conditions to better understand basal sliding?

ESAWG Consensus on Drilling Priorities

- Access to the subglacial environment upstream and downstream of modern grounding zones
- Deep subglacial access to test for smaller ice sheet configurations in both Greenland and Antarctica
- Development of a smart hot water drill that enables deep (>3km) drilling and sample recovery from wet beds
- Development of technology to enable long-term subglacial observatories.

ICWG Consensus for Deep Drilling

- In 2014 (and annually reaffirmed), the ICWG identified Hercules Dome as the priority site for the next U.S. ice core community deep drilling project.

- 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 begin drilling in the 2026/27 Antarctic field season with the Foro 3000 drill, reaching bedrock in the 2029/30 field season.

Looking ahead - what's next for the U.S. ice coring community after Herc Dome?

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	2025				2026				2027				2028				2029				2030				2031				2032				2033				2034				2035			
Past Climate	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			x	x																																	
Paleo climate in alpine ice patches[2]		x	x			x	x			x	x																													
Utquigvik permafrost[3]		x	x			x	x			x	x																													
Taylor Dome firnification[4]				b	b																																			
Meltwater Flask Glacier[6]	x			x	x																																			
Seymour Island[5]				x	x																																			
Pre-industrial baseline & dynamics																																								
Eclipse Icefield Canada[8]										s	s			7	7																									
Alpine 14ky record France[9]						x	x																																	
Large scale global climate change																																								
Hercules Dome[10]																																								
Ice coring at Herc Dome								F	F			F	F			F	F				F	F																		
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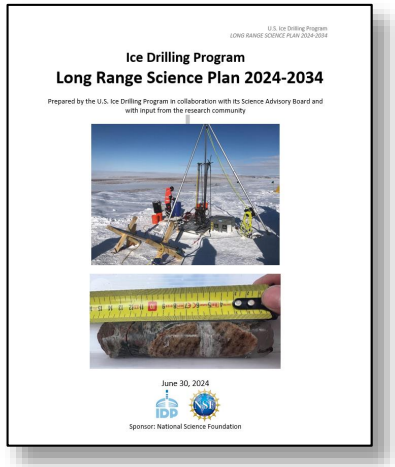
Ancient ice: 3 Ma and greater																																								
COLDEX Intermed core Allan Hills[11]																				I	I			I	I															
COLDEX shallow cores (BID & 4")[11]	B			B	B			B	B			B	B			B	B			B	B																			

Drilling Technology Recommended 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):

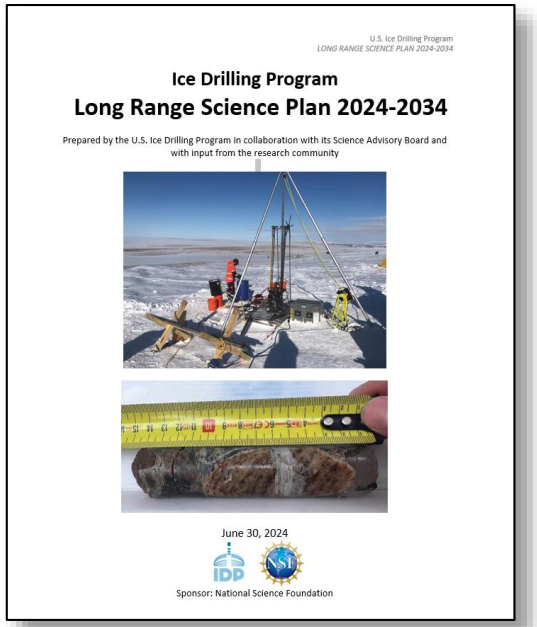
- Maintain and upgrade agile equipment in inventory, including: Hand Augers, Sidewinders, the Foro 400 drill, the 4" Electromechanical Drills, the 3" Electrothermal Drill, the 3.25" Eclipse Drills, the Stampfli Drill, Logging Winches, the Small Hot Water Drills (HWD), the Blue Ice Drill, the Prairie 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.

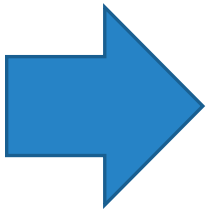
Priority 2 (needed in the next 3 years):

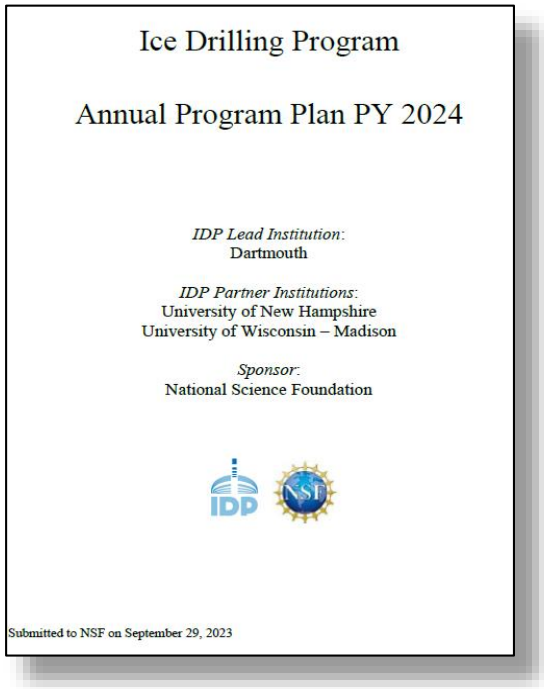
- Evaluate the design of the BAS and NZ scalable hot water drill for possible build of a clean modular hot water drill. Revisit the IDP Conceptual Design of the Scalable Hot Water Drill for a clean drill that minimizes its logistical footprint including fuel supply.
- Develop the Conceptual Design for 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

Integrated Science & Technology Planning

IDP integrated science and technology planning drives our IDP annual action plans.







Science planning drives IDP drill tech development & use

IDP 2024-2028

The IDP grant covers base activity with a small staff.

NSF science program managers would supplement IDP to support science projects that they choose to fund.

IDP strives to be agile and forward-looking!

DARTMOUTH

University of New Hampshire

WISCONSIN
UNIVERSITY OF WISCONSIN-MADISON

NSF Ice Drilling Program

Thanks for listening!

Questions?