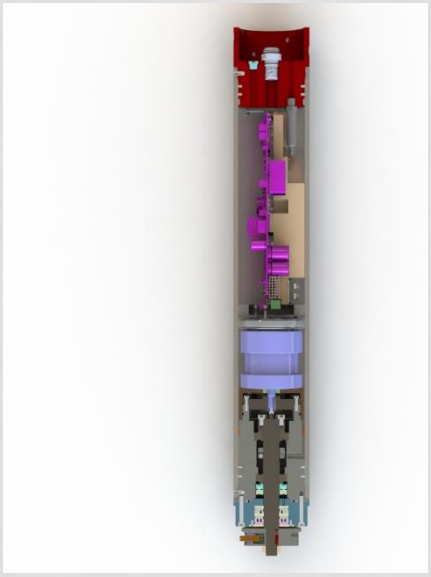


IDP OPERATIONS UPDATE

APRIL 2025

KRISTINA SLAWNY – IDP DIRECTOR OF OPERATIONS

2025

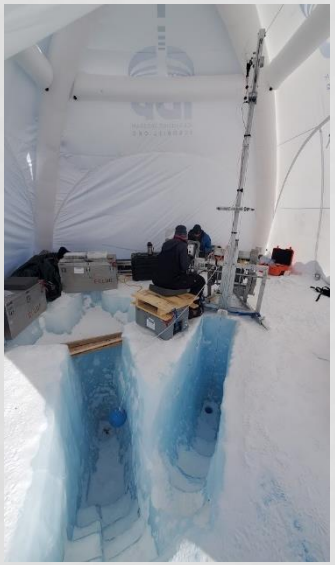
Ice Drilling Program

RECENT FIELDWORK

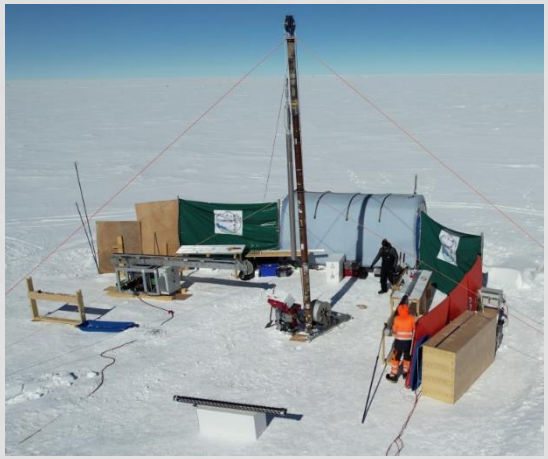
COLDEX – ALLAN HILLS

Blue Ice Drill, Eclipse Drill, IDDO Hand Auger, & New Sidewinder

- 54 days on site, 34 days of drilling
- Reentered the 23/24 Blue Ice Drill (BID) borehole at 144 m and drilled to bedrock at 188m.
- Reentered the 23/24 Eclipse hole to attempt to get past the "rock" that stopped progress at 89m. A hole drilled next to this was also stopped at 89 m (bedrock?).
- Challenges:
  - Rocks are difficult to cut through and rocks internal to the cores may be facilitating fractures.
    - Carbide inserts helped improve core quality but still struggle.
    - Ice structure (large crystals, stressed ice) are also a challenge.
  - 20 knot average wind makes tents critical, but setup is tricky.
  - Inflatable Axion tent required significant maintenance, especially with regular 30+ knot gusting winds.



ICE CORING AT DOME C



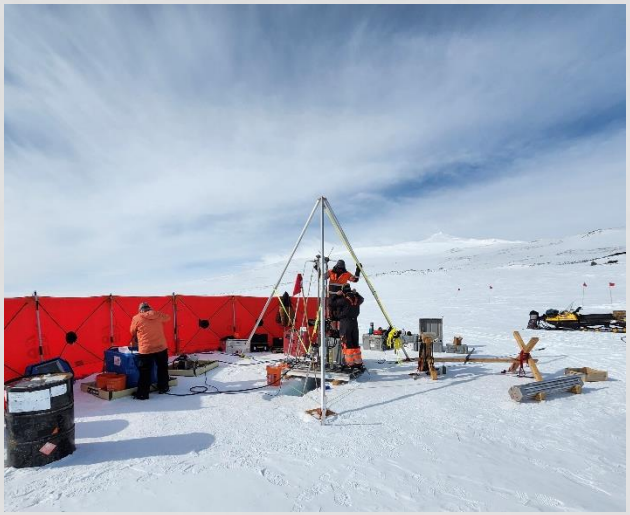
4-Inch Drill

- Joint U.S. and French project
- Objectives:
  - Collect two 300 m deep ice cores.
  - Melt 20 m sections of each core on site and collect the air.
  - Save discrete samples from each core for later analysis.
- Time onsite allowed for a total of five holes to be drilled.
  - 4-Inch Drill: Two hole - 302.5 m deep & 195 m deep
  - French Drill: Three holes - 286 m deep, 176 m deep, 130 m deep (at Little Dome C site)
- No delays getting to Dome C (3-4 days from leaving CONUS!), consistently good weather, and no lost days due to weather made it possible to drill the additional, unplanned holes.

CORING SUBGLACIAL LAVA FLOWS – MT. WAESCHE

Winkie Drill, Eclipse Drill, Chipmunk Drill

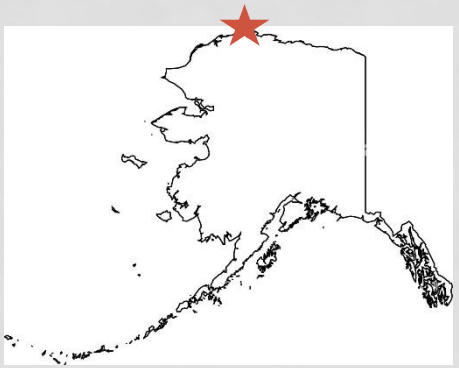
- Onsite 28 of the planned 42 days.
- Full Transect of Subglacial Cores Collected from Site A (Blue Ice)
- Hole 1 – 61.63 m depth; 92 cm of lava core recovered.
- Hole 2 – 49.88 m depth; 78 cm of lava core recovered.
- Hole 3 – 85.60 m depth; 57 cm of core recovered.
- Beneficial upgrades:
  - Custom Full Face PDC Drag Bit
  - Consistent penetration in ice & mixed media
- 439 cores collected across a 4.1 km transect with the Chipmunk Drill.
- Volcanic rock can be highly permeable and lead to fluid loss.
  - Rapid downhole fluid loss can easily stick the drill string due to settling cuttings.



UPCOMING FIELD PROJECTS

ARCTIC 2025

Location	IDP Equipment	Timing	# of IDP Drillers
Utqiagvik	SIPRE Hand Auger	May-Sep 2025	0



Location	IDP Equipment	Timing	# of IDP Drillers
Ilulissat	IDDO Hand Auger, Sidewinder	May-Jun 2025	0

ANTARCTIC 2025-2026

Location	IDP Equipment	Timing	# of IDP Drillers
Allan Hills [1]	Blue Ice Drill Shallow Wet Drill Hand Augers Sidewinder	Nov 2025 – Jan 2026	3
Taylor Dome [2]	Eclipse Drill	Nov 2025 – Jan 2026	2
Seymour Island [3]	Shaw Backpack Drill SIPRE Hand Auger?	Feb 2026 – Mar 2026	1-2
South Pole Station [4]	Deep Logging Winch	Dec 2025 – Jan 2026	0
Flask Glacier [5]	IDDO Hand Auger	Nov 2025 – Jan 2026	0

OUT YEARS

Location	IDP Equipment	Timing	# of IDP Drillers
Hercules Dome [1]	Foro 3000	2026-2030	4-7
Seymour Island [2]	Winkie Drill or BASE Drill	2027-2028	2
Allan Hills & Elephant Moraine [3]	Blue Ice Drill Shallow Wet Drill Hand Augers Sidewinder Foro 1650	2026-2031	2-7

- Many other projects are currently under consideration at NSF for fieldwork in the U.S., Greenland, and Antarctica between 2025-2031.

MAINTENANCE & UPGRADE

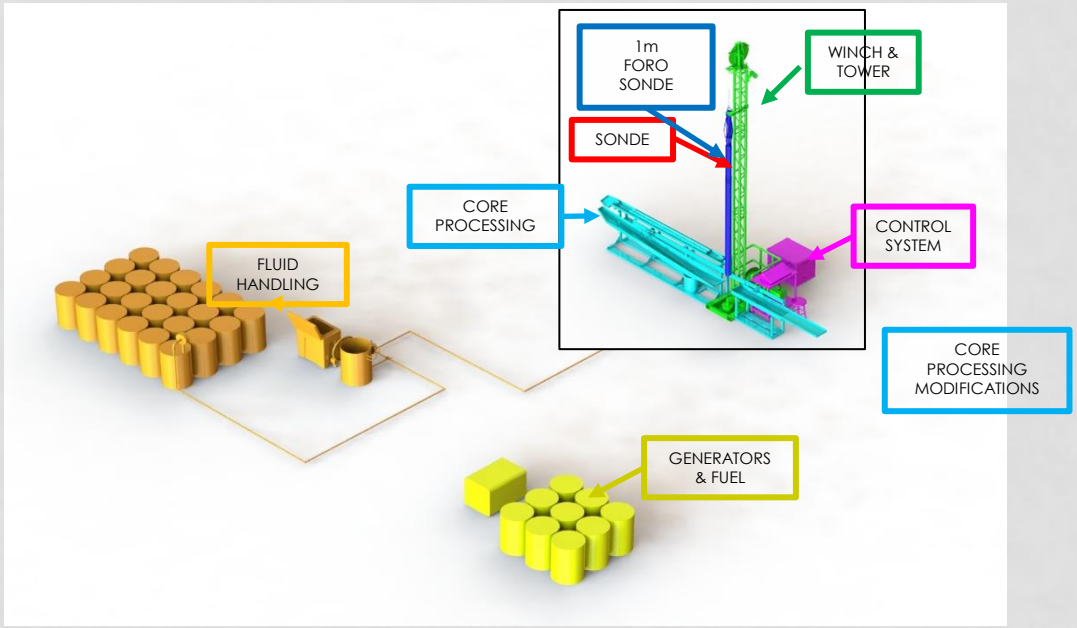
MAINTENANCE & UPGRADE

- 700 Drill
  - Devised a safer method of raising and lowering drill towers using chain fall.
  - Improving the barrel clamp design.
  - Designing a hollow shaft warming/drying system.
- Foro 400 Drill
  - Inspecting sonde components that sustained fall damage.
  - Updating the Operations and Maintenance Manual.
- Hand Augers
  - Designing/fabricating carbide inserts and holders.
  - Plan to fabricate additional Sidewinder kits.
  - Plan to fabricate additional Stampfli-type barrels and couplers for the Chipmunk Drill.
- Small Hot Water Drill
  - Worked to troubleshoot the heaters and thermostats and test run the system.
  - Ordered replacement and spare burner nozzles.

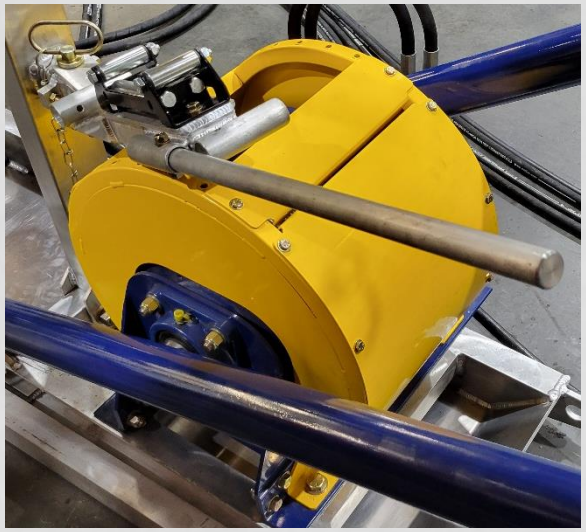
EQUIPMENT DEVELOPMENT

SHALLOW WET DRILL

- IDP was asked to implement wet drilling at Allan Hills to improve core quality.
- 700 Drill + 1m Foro (98 mm) Sonde = Shallow Wet Drill
  - Borrow Anti-Torque from Foro 400 Drill
  - Borrow Motor Section from Foro 1650
  - Build new 1 m barrel set; copy Foro 1650 design
  - Borrow cutter head and cutters from other Foro series drills
  - Fabricate carbide insert cutters
  - Modifying the 700 Drill barrel clamp to accommodate larger barrel diameter; this drill lays down while the tower stays vertical.



BASE (BASAL ACCESS & SUBGLACIAL EXPLORATION) DRILL



- Subglacial rock coring drill with 200 m depth capability.
- Current work:
  - Procured downhole tooling
  - Designing chip filtration equipment and researching fluid handling options.
    - Use existing ASIG Drill filtration equipment and test upgrades to the shale shaker system, OR
    - Replace shale shaker system with rotary drum screen or simple gravity filtration.
- Upcoming work:
  - Fabrication of remaining auxiliary components
  - Drill tent procurement
  - Procure tools and supplies
  - System integration and testing
- System likely ready for issue in spring 2026.

RECOMMENDED TECHNOLOGY INVESTMENTS IN THE LONG RANGE SCIENCE PLAN

- Each year, the IDP Science Advisory Board (SAB) and it's Working Groups prioritize Recommended Technology Investments for the coming ~5 years.
- IDP-WI works to develop and/or maintain equipment to meet those priorities.
- NSF approval is sought prior to any new equipment development projects.

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 2024-2025):

- 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 an 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 in a fluid filled hole, for example with the Foro 3000 drill.
- Investigate a lighter weight source of power to replace generators for drilling systems, in order to ease demand on logistics, including renewable energy.
- Finish the Conceptual Design and begin the Detailed Design for replicate coring for the Foro 3000 drill.
- Identify procurement source and cost for potential purchase of a rapid hole qualifier (temperature and caliper) for field scientist use in borehole logging applications.
- Evaluate options for new drilling fluids for future ice and rock drilling projects, in collaboration with international partners.

Priority 3 (needed in 3 to 5 years):

- Develop the Detailed Design for a clean hot water basal ice coring sonde for a hot water drill.
- Establish the IDP Science Requirements for identification and planning of borehole maintenance and fluid maintenance over time, including removing (or lowering) drilling fluid from a borehole (for example for freezing in a sensor).
- Create a second, updated Blue Ice Drill.
- Build a Scalable Hot Water Access drill for creating access holes in ice that has modular capability for clean access.
- Continue investigation and modifications of the RAM 2 Drill to achieve the 100 m depth goal reflected in the system Science Requirements.
- Establish the Science Requirements for retrieving sidewall ice samples at specific depths in an existing borehole without using an ice coring drill.
- Write a draft feasibility paper outlining the potential for using shallow drill fluid columns for ice coring.

CHALLENGES

- Lengthy/unexpected delays due to weather, aircraft, training requirements, etc. This increases burnout risk.
- Driller recruitment/training/retention. Our international polar colleagues and the drilling industry in general are also navigating these challenges.
- Ice drilling in mixed media is challenging. Ice drills don't like rocks, and rock bits destroy ice.

THANK YOU

Don’t hesitate to contact Krissy Slawny with questions:

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https://icedrill.org/