

ICE CORE WORKING GROUP

VIRTUAL MEETING
 MARCH 8, 2021

IDP OPERATIONS UPDATE

KRISTINA SLAWNY – IDP DIRECTOR OF OPERATIONS

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TEAM UPDATES

- Anna Zajicek started in April 2020 as the new Field Support Manager. Zajicek has 10+ years Arctic/Antarctic experience and was most recently the Allan Hills Camp Manager during the 2019-2020 season.
- Project Manager/Mechanical Engineer Chris Gibson departed IDP-WI in January 2021 to pursue another local opportunity.
- Mechanical Engineer Grant Boeckmann assuming Project Management responsibilities.
- Kudos to Project Manager/Engineer Jay Johnson for covering day-to-day operations during Krissy's maternity leave in summer 2020.



Anna Zajicek



Grant Boeckmann



Chris Gibson



Jay Johnson



Harper

COVID-19 IMPACTS

CAMPUS/OFFICE OPERATIONS

- All staff transitioned to working from home in March 2020.
- Engineering team successfully switched gears to focusing on a backlog of necessary paperwork such as CAD drawings, Operations and Maintenance Manuals and Hazard Analyses.
- The Space Science and Engineering Center (SSEC) administrative staff worked with IDP to continue limited purchasing and shipping/receiving tasks, to keep project work on schedule.
- Limited electrical engineering development work occurring on campus at SSEC.

WAREHOUSE OPERATIONS

- In June 2020, IDP received approval from UW to expand warehouse access while following robust hygiene protocols to limit the spread of COVID-19.
- Currently approved to have five people in the warehouse, nearly up to normal capacity.
- All IDP-supported field work postponed for the 2020 Arctic and 2020-2021 Antarctic seasons.

FIELD SUPPORT

- Working with NSF, ASC and PFS to re-plan delayed fieldwork.
- IDP designed and is fabricating a cargo ramp for safe loading and unloading of Twin Otter aircraft through consultation with Kenn Borek Air.
- An Operations and Maintenance Manual was released for the **Mast Anchored Suspended and Tensioned (MAST) tents** which were designed collaboratively by Fabricon LLC and IDP. IDP has two of the tents in inventory, which are available to deploy with a number of different drill systems (e.g. Blue Ice Drill, Foro 400 Drill, 4-Inch Drill).
- Herc Dome planning telecons are underway with ASC and the Science Coordination Office (SCO).
- Pre-season planning meetings are being held with PFS and the science team for PIs Joe McConnell and Sarah Das for planned Greenland work.
- IDP continues to receive requests for field support assistance and drafts Letters of Support for inclusion in PI proposals.
- Currently supporting one field project in the continental U.S.

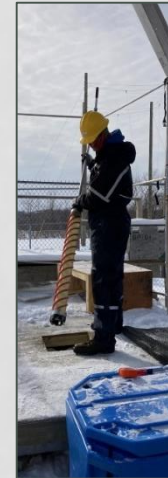


PI	NSF Award No.	Location	IDP Equipment	IDP Personnel
Zoet	1916179	Lake Michigan & Superior	SIPRE HA & Stihl Engine	NA

DRILL TESTING/OPERATOR TRAINING

FEBRUARY 2021

ICE WELL - STOUGHTON, WI



March 8, 2021

SHALLOW CORING

Thermal Drill

- Designed a sediment collector vacuum.
- Collaborated with Dave Ferris (ASC) on the 3D printing of several nozzle prototypes.
- Modifying the magnetic core dog collar design.
- Designed a shipping box w/ integrated core processing tray.

Hand Augers/Sidewinders

- Purchased a Kovacs Sidewinder for evaluation.
- Sorted equipment/removed components that are beyond their useful life.
- Designed and fabricated a cutter head cover.

4-Inch Drill

- Procured new winch crates and secured internal mounts.
- Calibrated the readout boxes.

Stampfli Drill

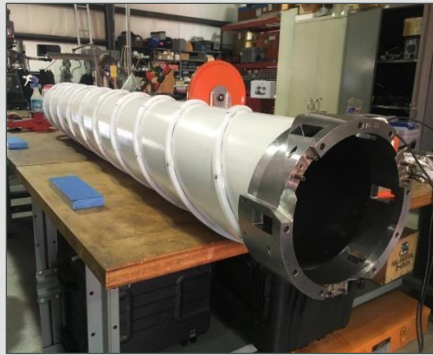
- Received spare anti-torque and motor section from Stampfli.

Foro 400

- Fabricated new barrel set with aluminum outer tube.
- Modifications made to existing core barrels to address chip transport issues at Allan Hills; successfully tested in Madison in February 2021.
- Drill recovery loops and Slam Stick mounts procured.



SPECIALTY SYSTEMS



Logging Winches

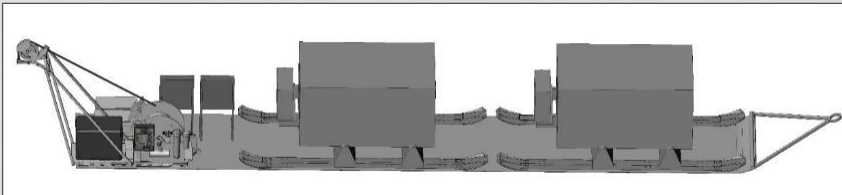
- Purchased and received a new cable for the Intermediate Depth Logging Winch (IDLW).

Cable Tensioner

- Implemented improvements to mitigate the risk of cable damage during spooling.

Blue Ice Drill

- Finished fabricating the new cable connection.
- Painted both outer barrels white.
- Tent modifications made.



RAM Drill

- Implemented steel fittings to address a galling issue with the RAM 2 Drill air treatment assembly.
- System is currently staged in Antarctica for the GHOST project on Thwaites Glacier.

FORO 3000 DRILL



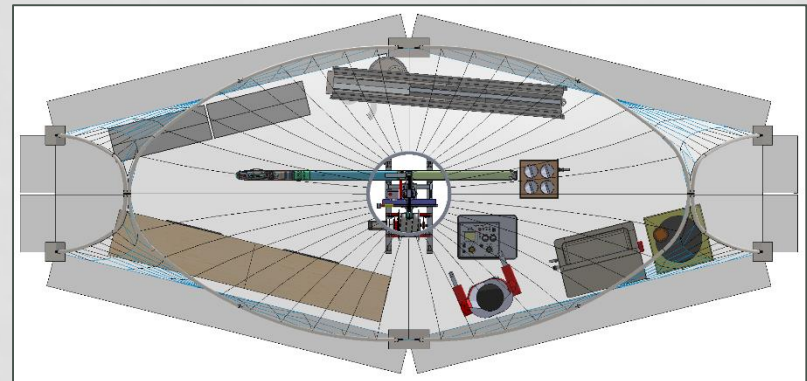
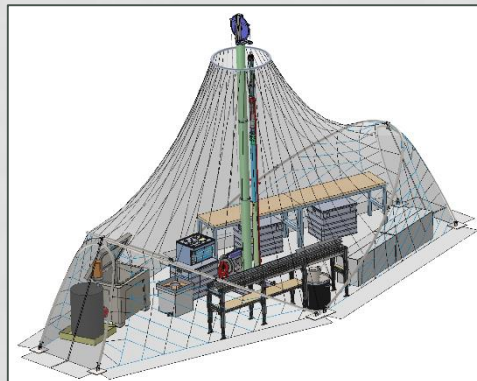
- Fabrication continues:
 - Flights installed on the core barrels.
 - Anti-torque assembly complete.
 - Ordered structures (drill tent, control room, power distribution equipment).
 - Continued electronics and software development.
 - Assembling the core processing and fluid handling systems.
 - Good synergy between IDP and the Australian Antarctic Division (AAD), as AAD works to build a near copy of the Foro 3000 system.
 - Adapted the casing fusion welder for use in a vertical arrangement in a drill slot.
 - New scoop and scoop step cutters designed.
- Current schedule:
 - Complete fabrication/assembly/testing by April 2022.
 - Ship to Port Hueneme in October 2022.
 - Resupply vessel delivers drill to McMurdo in January 2023.
 - Traverse equipment to Herc Dome late 2023.

700 DRILL

- Iterated with science community members on different core diameters (98mm, 81mm, 70mm, 64mm).
- Compiled various weight and logistics estimates for core, core boxes, fluid and fuel.
- Identified off-the-shelf tubing options for core diameters between 64-81 mm.

Completion Date	Milestones
June 2016, June 2017	IDP Long Range Science Plans recommend a portable ice coring drill for depths up to 700 m
March 2018	Complete IDP Science Requirements for Foro 700 Drill
August 2019	Complete IDP Conceptual Design for Foro 700 Drill
August 2019	Complete IDP Review of the Foro 700 Conceptual Design
May 2020, updated Jan 2021	Revise IDP Science Requirements from Foro 700 Drill to 700 Drill
Sept 2020	Update IDP Conceptual Design from Foro 700 to 700 Drill
Jan 2021	Complete IDP Review of the 700 Drill Conceptual Design
March 2021*	Seek NSF approval of creation of the Detailed Design for the 700 Drill
July 2021*	Complete Detailed Design for 700 Drill
September 2021*	Complete IDP Review of the Detailed Design
February 2023*	Complete 700 Drill Fabrication, Integration Testing & Drill Documentation
April 2023*	Complete Final Review and Acceptance; 700 Drill ready for issue

* Pending NSF approval



March 8, 2021

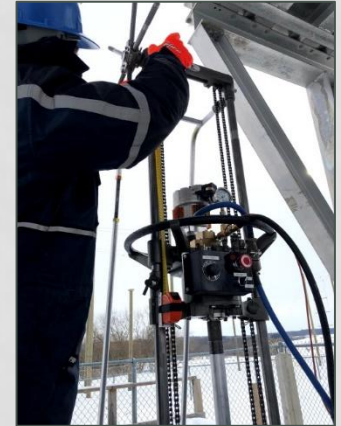
ROCK DRILLS

Winkie Drill

- Winkie 2 Drill fully assembled.
- Plumbed the new fluid chiller and conducted preliminary testing.
- Tested a new full-face ice bit to create access holes in blue ice going forward.
- Both systems are tentatively scheduled for use during the 2021-2022 Antarctic season.

ASIG Drill

- Reviewed and finalized fluid pressures table.
- Preparing for the GreenDrill project in northern Greenland in 2022 and 2023.
 - Finalize chip filtration upgrades.
 - Purchase additional drill rod.
 - Finalize pressure accumulator system.
 - Inspect packers and inflation systems.
 - Incorporate new chips bailer (4-inch drill) into ASIG system.
 - Purchase additional drill bits for expected formations.
 - Engine maintenance and preparation for expected temperature/altitude.



ANNALS OF GLACIOLOGY

Recently published four articles in the Annals of Glaciology stemming from the 8th International Ice Drill Symposium held in Copenhagen, Denmark, September 30 – October 3, 2019.

- Grant Boeckmann, Chris J Gibson, Tanner W Kuhl, Elliot Moravec, Jay A Johnson, Zachary Meulemans, Kristina R Slawny (2020) **Adaptation of the Winkie Drill for subglacial bedrock sampling**. Annals of Glaciology, 1-9. doi: 10.1017/aog.2020.73.
<https://doi.org/10.1017/aog.2020.73>
- Chris J Gibson, Grant Boeckmann, Zachary Meulemans, Tanner W Kuhl, Jim Koehler, Jay A Johnson, Kristina R Slawny (2020) **RAM-2 Drill system development: an upgrade of the Rapid Air Movement Drill**. Annals of Glaciology, 1-10. doi: 10.1017/aog.2020.72.
<https://doi.org/10.1017/aog.2020.72>
- Tanner W Kuhl, Chris J Gibson, Jay A Johnson, Grant Boeckmann, Elliot Moravec, Kristina R Slawny (2020) **Agile Sub-Ice Geological (ASIG) Drill development and Pirrit Hills field project**. Annals of Glaciology, 1-14. doi: 10.1017/aog.2020.59.
<https://doi.org/10.1017/aog.2020.59>
- Jay A Johnson, Tanner W Kuhl, Grant Boeckmann, Chris J Gibson, Joshua Jetson, Zachary Meulemans, Kristina R Slawny, Joseph M Souney (2020) **Drilling operations for the South Pole Ice Core (SPICEcore) project**. Annals of Glaciology, 1-14. doi: 10.1017/aog.2020.64.
<https://doi.org/10.1017/aog.2020.64>

DISC DRILL – DECOMMISSION?

DISC Drill vs. Foro 3000 Drill Analysis

October 2017



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- DISC Drill vs. Foro 3000 Drill Analysis available in the Library section on Icedrill.org.
<https://icedrill.org/library/disc-drill-vs-foro-3000-drill-analysis>
- Remaining Antarctic cargo returned to Madison in April 2020.
- System requires a large amount of storage space.
- Most functionality being replaced by the Foro 3000.
- Would require a complete overhaul of electronics prior to redeployment.



DISC DRILL – DECOMMISSION?

ID	Drill System parameter	DISC		Foro 3000	
1	Core length, m	3.2	4 ^a	2	3 ^a
2	Core diameter, mm	122		98	
3	Replicate coring capability	Yes - active system		In development	
4	Time required for setup/takedown, single shift days	71	71	28	24
5	Drilling days required to drill to 2,800 m [including a pilot hole and casing]	122	100	165	125
6	Number of seasons to reach 2,800 m [based on a 50 day field season]	3.9	3.4	3.9	3.0
7	Drilling crew size, people	10		7	
8	Core handlers/scientists [based on T.J. data, 3/25/2016]	7		4	
9	Drilling fluid required, drums [53 gallons per drum]	385 ^b		210 ^c	
10	Power requirements, kW [at sea level]	135		35	
11	Fuel requirement, gallons	26,000	22,400	9,900	7,500
12	Additional cost for repairs/modifications to be ready for deployment, \$K	550 ^e	714 ^e	800 ^f	1040 ^f
13	Onsite personnel	17		11	
14	Number of work days (items 5 and 6 above)	193	171	193	149
15	Ice core processing equipment, lbs.	5,000	5,000	Included in cargo wt. & vol.	
16	Drill and core processing buildings	21,000 lbs., 1,300 ft ³		Included in cargo wt. & vol.	
17	Core storage area (below -20° C)	Required		Required	
18	Cargo volume, cu. ft.^d [includes MECC shop for DISC and Bicon shop for Foro 300]	8,600		2,900	
19	Cargo weight, lbs.^d [includes MECC shop for DISC and Bicon shop for Foro 3000]	136,300	136,300	40,500	40,500
20	Drill fluid weight, lbs. (assuming 423 lbs. per drum)	162,900	162,900	88,900	88,900
21	Diesel weight, lbs. (fuel weight only)	184,900	159,300	70,400	53,400
22	Ice core weight, lbs., (heavy only on the way out)	72,200	72,200	46,500	46,500
23	Total Weight, lbs.	582,300	556,700	246,300	229,300

THANK YOU!

DISCUSSION