

**TAB Meeting 2019  
Centre for Ice and Climate  
Copenhagen, Denmark  
Friday, October 4, 2019**

**Technical Advisory Board Members present:**

Steff Bo Hansen	University of Copenhagen
Keith Makinson, Chair	British Antarctic Survey
Marshall Pardey	QD Tech, Inc.
Alex Pyne	Antarctic Research Centre Victoria University of Wellington
Jakob Schwander	University of Bern
Frank Wilhelms	Alfred Wegener Institute for Polar and Marine Research

**Other**

Trevor Popp	University of Copenhagen
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**Ice Drilling Program - UNH**

Joe Souney	University of New Hampshire
Mark Twickler	University of New Hampshire

**Ice Drilling Program - WI**

Anna de Vitry	Space Science & Engineering Center University of Wisconsin – Madison
Chris Gibson	Space Science & Engineering Center University of Wisconsin – Madison
Jay Johnson	Space Science & Engineering Center University of Wisconsin – Madison
Tanner Kuhl	Space Science & Engineering Center University of Wisconsin – Madison
Kristina Slawny	Space Science & Engineering Center University of Wisconsin – Madison

**Welcome**

- Thank you to Steff, Dorte and the Centre for Ice and Climate for hosting our abbreviated TAB meeting as well as an excellent 8<sup>th</sup> International Ice Drill Symposium
- This year's abbreviated TAB meeting will consist of short ~20 minute discussions on topics of particular relevance to IDP-WI operations

**Solicitation of Ideas for TAB Renaming**

- Krissy noted there is sensitivity within the U.S. government regarding the influence of foreign persons or governments on the direction of U.S. science and technology development
- In discussions with NSF, IDP has agreed to rename the group to remove the term 'advisory'. The term 'working group' should also be avoided, so as not to be confused with the IDP Science Advisory Board (SAB) Working Groups who do advise on the direction of U.S. science and technology development. The charge of the TAB will remain the same, that is, to keep IDP informed of global ice drilling activities and technology, but should not include an advisory component.
- Names suggested at the meeting:
  - TAB Chair Keith Makinson showed a slide with ideas for brainstorming
  - IDTF – Ice Drilling Technical Forum
  - IDTG – Ice Drilling Technical Group

### **Online Equipment Summary/Ideas Forum**

- TAB Chair Keith Makinson presented the idea and examples of an online equipment forum
  - The forum could provide a brief summary of tried and true equipment, vendor information and who to contact for additional information
  - IDP personnel unfortunately do not have the bandwidth to set up and manage such a site, but agree it would be a valuable resource
  - Jakob will inquire if such a forum could be manned by the technical side of IPICS
  - Krissy noted that this could possibly be set up as a part-time graduate student project, though this likely would not provide the desired continuity going forward
  - The platform is yet to be determined, but a number of online packages are available such as SolidWorks Forum or something similar to the Diesel Engine Forum
  - The forum should require low effort for user input, or people likely won't use it
  - Form fields with character limits are advised; links and contact information could provide additional detail; a combination of a discussion forum style and database style could prove most useful
  - Should include a proviso that contributors only submit equipment to the forum that they have first-hand experience with
  - The forum could also be used to document failures, challenges and ineffective products
- Our Chinese colleagues discussed a number of new electronics components and suppliers during the Symposium

### **Drilling With a Short Fluid Column**

- Amount of fluid head needed likely depends on the site; Trevor suggests an 18 bar differential
- Continuous top off of the column is required as core quality starts to deteriorate
- Fluid level needed will depend on the type of fluid being used
- Could try using only a densifier during a short window of coring
- A 141B replacement may have been identified by the Chinese
- Steff noted that chips melting is superior to centrifuging in recapturing fluid
- Cable vacuums work well

### **Foro 700**

- Frank suggested that Jay ask Matthias Huether about the jointed sonde design that IDP is exploring for the Foro 700; the joint should be lockable for drilling
- Fluid deployment to the borehole was discussed
  - Keith noted fluid could be run down along the cable, but this requires a straight borehole
  - The chips chamber or core barrel could be filled with fluid before entering the hole
  - Layflat hose is a quick deployment method

### **Foro 400**

- (See also the 'Drilling With a Short Fluid Column' section above)
- Tanner asked if the HT-style shallow drills allow for use of a short fluid column, as IDP will use the new Foro 400 in NE Greenland in summer 2020 to a depth of 450 m
  - Steff noted the HT drill has a separate chips chamber with hollow shaft, so it works for wet drilling. The chips transport method used in the Foro 400 Drill, where cuttings are transported up the flights and then fall back into the top of the core barrel, likely would not work well for wet drilling.

- Jay noted IDP would only likely try 1 m of fluid, as the drill is not set up to process wet chips

### **RAID/ASIG Bailer**

- Re-drilling leftover chips after casing setting has proven difficult
- The idea is similar to the BAS RAID
- Currently, the IDP design does not spin the outer barrel while holding the inner auger stationary, as recommended by Julius Rix
- Could make the auger progressively smaller toward the top or cut scallops into the flights
- Steff noted it is important that the barrel have a nice smooth interior; it also depends on what kind of chips you're making; this is a good approach and is better than using a filter sock
- Jakob suggested RAID should eventually vacuum the chips from the pilot hole
- Chris mentioned the Ion Ice Auger, a battery operated auger
- Alex mentioned that Makita battery-powered tools work well in the field

### **Diesel Engine Regulations**

- New diesel, off-highway engines that are exported from/imported back into the U.S. now need to be Tier 4 compliant
- High pressure fuel rail; exhaust cleaning and exhaust recovery
- DEF = Diesel Engine Fluid; have to add this, and it is about 10% of your fluid volume; it freezes at 12°F
- A new fuel has been created for the Tier 4 engines, but it is not what the Hercs fly with and transport in bulk around the polar regions
- CPS (U.S. Arctic Logistics Provider) is trying to buy up old equipment that was certified as compliant when it was built
- Tanner asked if you strip off the emissions equipment, could you can run the new engines on JP8 or AN8?
  - Alex said it depends on the lubricity or cetane rating of the fuel; lubricating filters were originally designed for old Cummins engines, but don't work in the cold unless inside a heated enclosure, as they have a wax ring and capillary tube
- Alex noted they are buying 2011 Tier 2 German engines with a 6-month lead time; designed for remote locations
- Chris noted that Multi Power Products Ltd. (manufacturer of the base rig for the ASIG Drill) is still selling Kubota Tier 3 engines; claim you should run a cetane rating of 45, but JP8 is only rated at 40
- Alex noted that CPS inadvertently bought a Tier 4 engine that wouldn't run on JP8
- Matthew Kippenhan provided IDP with some feedback from NSF that the U.S. polar program likely would not get a military exemption to continue to export/import Tier 2 or 3 engines, though the military/cold exemption would be ideal
- Can still purchase Tier 3 engines if we provide a letter than we'll send the unit out of the U.S.
  - Alex suggested IDP could have their engines remain and be serviced in NZ during the off-season
- Keith noted that you could use gasoline, but it is much more difficult to transport

### **Sewer Outfall at Summit Station, Greenland**

- NSF has noted that there are continued issues with the Summit Station sewer outfall
- PI Zoe Courville has asked for IDP assistance in drilling a 12-inch hole to 30-40 m

- Ideas for the project include:
  - Adapting 12-inch augers to the ASIG Drill, which will already be onsite at Summit in 2020 for another project
  - Alex mentioned a 12-inch tube with a cutter and bucket on the end could be used, similar to a lake ice cutting bit; Tanner mentioned this might be similar to soil sampling augers

### **Rock Drilling**

- Keith asked if there are any environmental issues when contacting the ice/bedrock interface?
  - Krissy noted that so far, the IDP field projects for the Winkie and ASIG Drills have been conducted at cold sites with frozen ice/bed interfaces, but that IDP will likely be asked to drill warmer areas with wet ice/bed interfaces in the future
  - 'Clean' access of subglacial material at wet-bed sites would likely require hot water drilling for the access hole, as it is likely infeasible to clean the ASIG/RAID/Winkie systems sufficiently to comply with clean requirements for entering the subglacial environment. A sealed casing between impermeable bedrock and the rig would be needed for the drilling fluid circulation necessary to core rock with these rigs. This greatly increases the size and duration of operations and would require extensive development.
- Borehole swabbing/bailing discussion
  - Jakob noted that RAID wanted to bail their holes using compressed air; several people noted this might be dangerous or too fast with a large hole, but may be ok with a small hole
  - Marshall asked if one could use a dual tube with airlift?
  - Chris asked if one could run two hoses down in parallel?
  - Alex noted that the science community may not want us to bail deep holes in order to keep them open for borehole logging purposes; swabbing/bailing may only apply to intermediate depth or shallow holes where you want to recapture and reuse the fluid on subsequent holes
  - Marshall wondered if you could cement the bottom of the hole using a material activated by a water catalyst

### **Next TAB Meeting**

- Plan for March or April; should avoid Easter
- Several people expressed that midweek days are best, to avoid weekend travel
- Please fill out the Doodle poll to indicate your availability:  
<https://doodle.com/poll/b33xdskwce2ud9e6>

### **Meeting Adjourned**