Science Requirements for a Hot Water Drill

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The main science targets envisioned are:

a. Ice shelf drilling for ocean access for emplacing oceanographic instruments (e.g. CTD), similar to the PIG project, sediment sampling and geothermal gradients. Example; LarISSA, Thwaites Glacier.

b. Basal access to fast-flowing ice streams (e.g., Kamb/Engelhardt) and outlet glaciers (Iken + on Jakobshavn), and alpine glaciers (e.g. Amundsen/Truffer on Black Rapids); basal access drill for sediment sampling, water pressure, temperature, temperature gradients, till deformation measurements, englacial properties, strain rate measurements, etc (Caltech/Lissard-like drill);

c. Basal access to bedrock beneath slow moving ice for sampling sediments and rock for lithology and exposure age dating;

d. Ice shelf access for ROV deployment, sediment sampling and geothermal gradients, similar to WISSARD/RAGES project

There are a few main technical drivers: hole diameter, transport requirement, and a clean-access requirement.

We anticipate that the items (a), (b), and (c) can be addressed by one "class" of drill, and that (d) may require a different class. In particular, if the ROV/AUV requires a larger diameter hole (1m), that would be incompatible with the transport requirements and energy transmitted down hole (volume of hot water). Both classes of drill are required for different science targets.

Technical Specifications:

1. Target Depths: (a,b,d) 1000m; (c) 2000m
2. Diameter: (a,b,c) 10-25cm; (d) 1m
3. Coring: (a,b,c,d) optional coring head for targeted sampling.
4. Surface temperature: -30C
5. Transport: (a,b,c) Twin Otter, Helicopter sling load or Light Ground Traverse; (d) ground traverse or LC-130
6. Agility on site: (a,b,c,d) multiple holes within 500m of emplacement. (a,b,c) possibly ability to do skidoo "traverse".

7. Speed: (a,b,c) setup in 48 hrs, drilling speeds of 1000m/24hrs; (d) setup in 48-72 hrs, 1m diameter hole, 1000m deep achieved in ~48hrs
8. Fuel usage: NN gallons/hour. (a,b,c) It is likely that the fuel requirements will dictate an LC-130 or Basler landing, with subsequent final transport by Twin Otter or Helicopter.
9. Total equipment weight not to exceed XXXX lbs, with no individual item exceeding YYYY lbs.
10. Crew: (a,b,c) 4 pax for setup, 2/shift for drilling and reaming (d) 4-6 drillers depending on shift schedule
11. Instrumentation: PI responsibility.
12. Modular. Add more depth capability by adding more modules and swaging extra lengths of hose.
13. Retrieving an instrument package or biological sample after a period of time. (Das, Rack)
14. The possibility of adding a module to drill "clean"

Main "differentiators" between the narrow- and wide-hole drills:

	(a) Ice Shelf	(b) Ice Stream	(c) Inland Ice	(d) ROV
Diameter	10-25cm	10-25cm	10-25cm	1m
Transport	Otter/Helo	Otter/Helo	Otter/Helo	Traverse/LC
Clean Access	No	Yes	Maybe	No

Working on this!
Name of Project

One sentence science goal
Field Location:
Field Dates
Funding Status
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