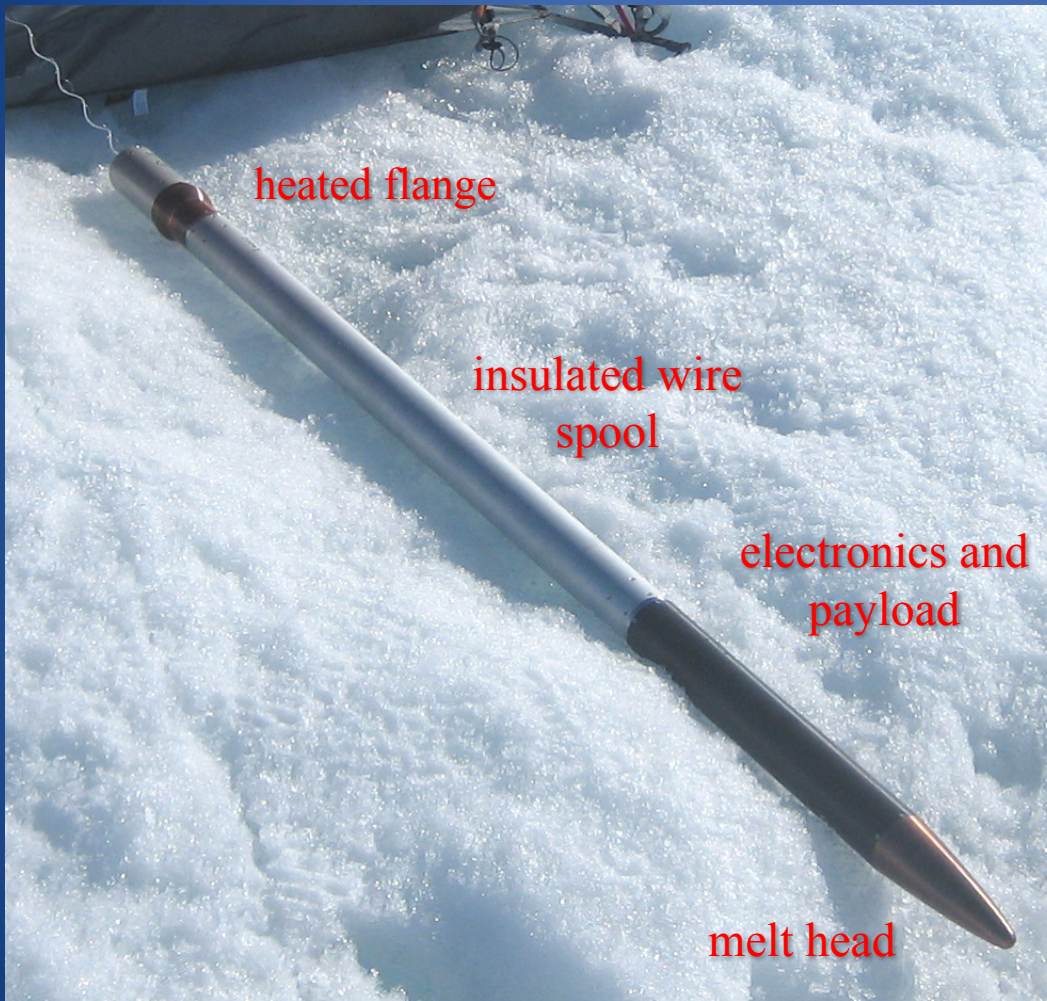


Applied Physics Laboratory Ice Diver



Barrel diameter 6.5 cm (flange 1.3x), length 1.7 m

Initial operation at 1100 V, 700 m of 20-gauge, FEP-insulated wire

27 cartridge heaters in 3 parallel banks

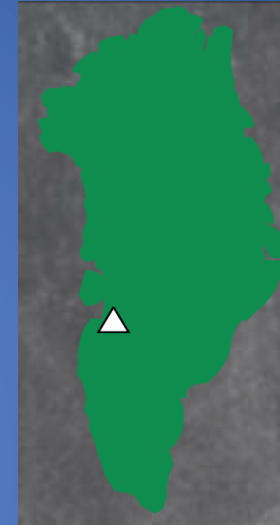
thermostatic control, 2-way comms/control using inductively coupled modem

2.5 KW total power in heaters

Pressure-sensor payload

Ice Diver 2013 Field Test, July 2013

(100 km from Ilulissat, Greenland, elev. 1000 m, T_{ma} -15C, melting surface – objective: 500 m depth)

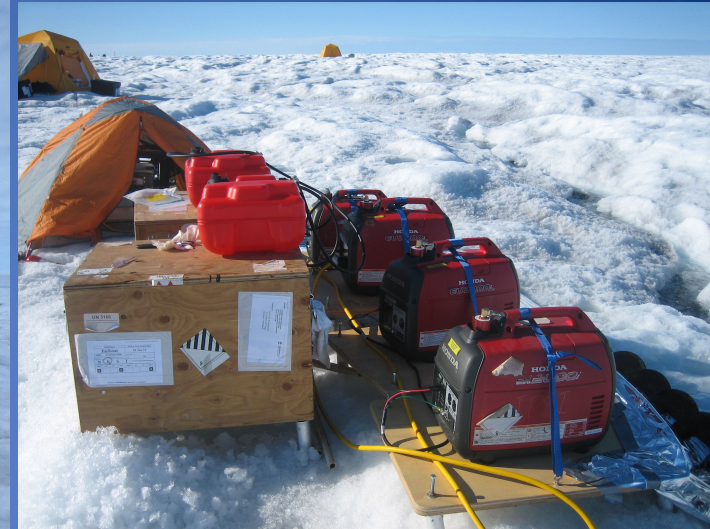
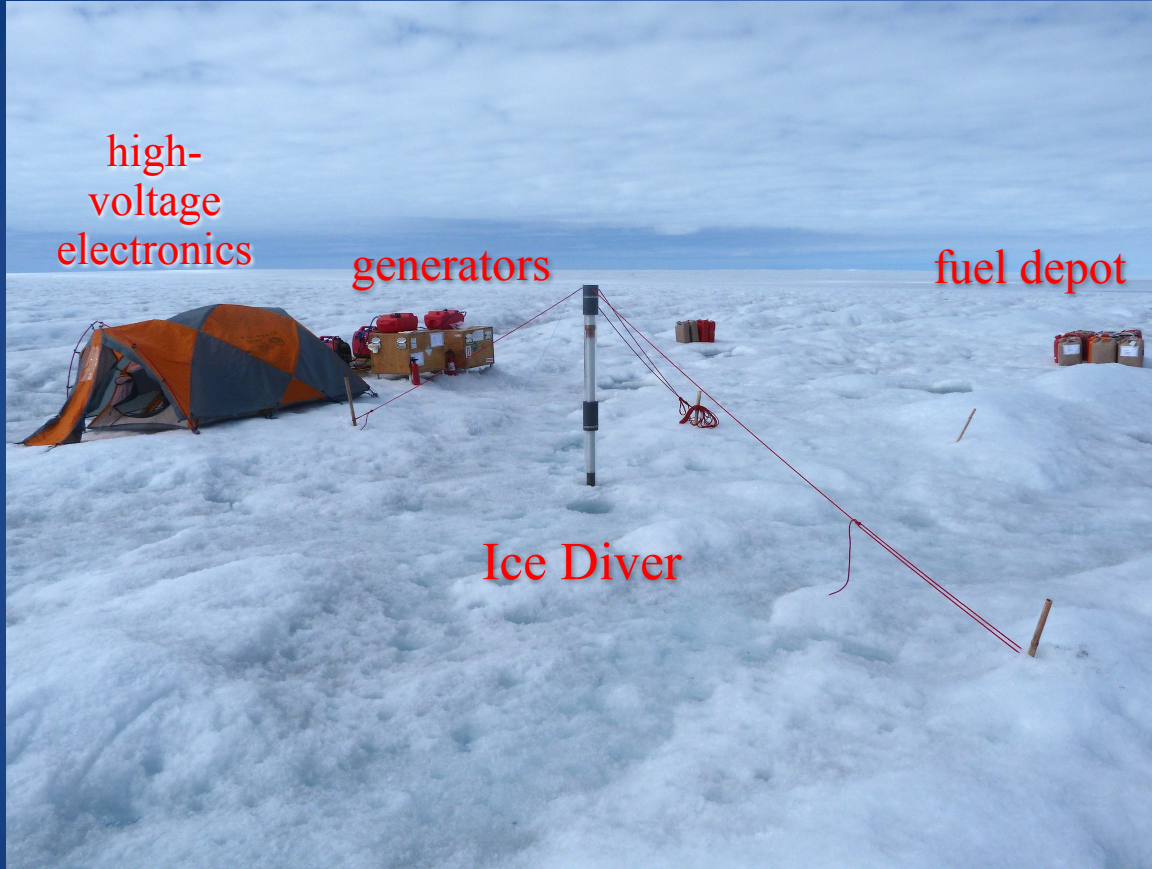


First probe – operation at 900V for 2 hours, power-transistor failure due to inadequate heat sink

Second probe – 2 false starts to find and fully address problems in power-tap for electronics, **turned probe off at 80 m depth**



2014 Field Test, SW Greenland ablation zone, elev. 1000 m



-15C ice temperature at
10 m depth

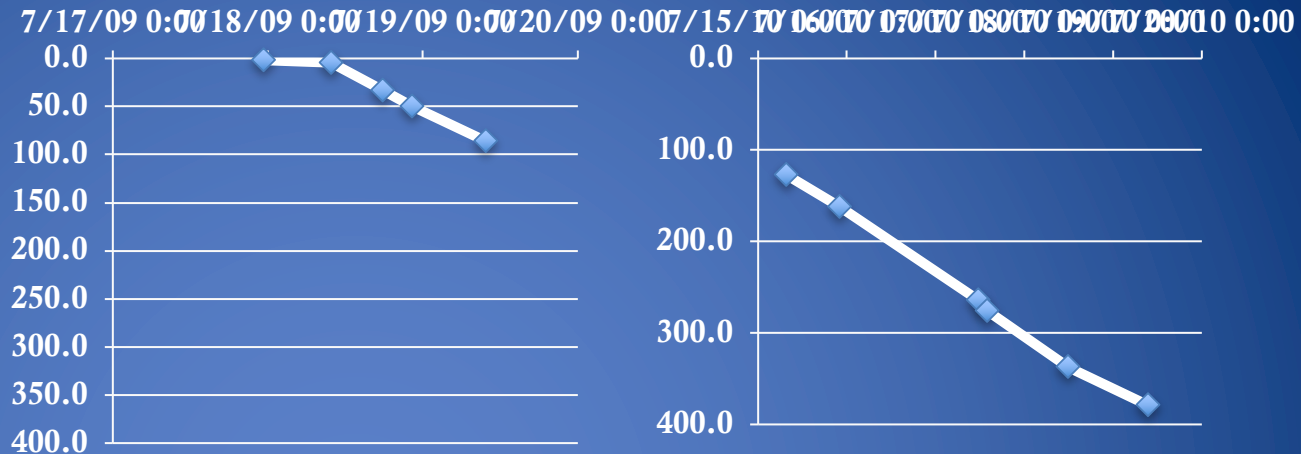
2014 Field Test Experience

4.5 kW/2000 V
probe 14-15 July
2014

- tilt \cong varied within 1 degree
- near-autonomous

operation

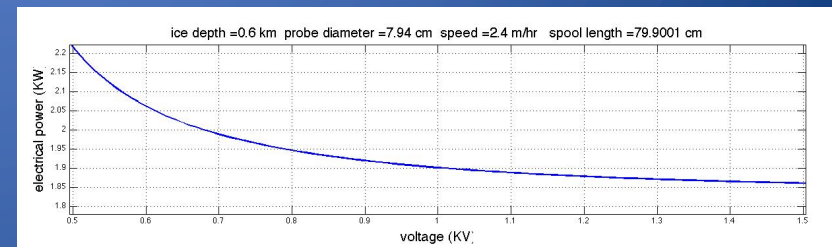
- 6.6 m/hr descent speed (modeled)
- electrical fault in heater after 7 hrs



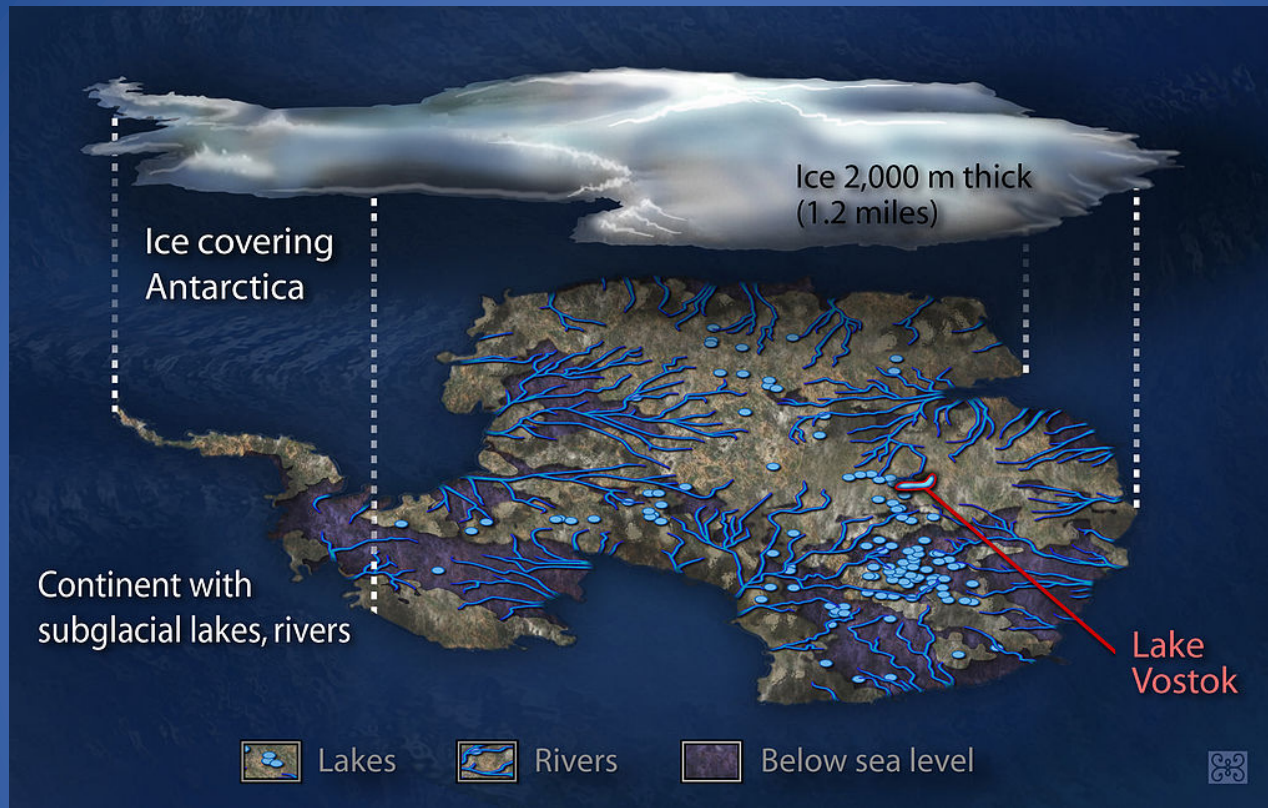
2.15 kW/1050 V probe 19-20 July 2013 & 16-20 July 2014

- Restart after 1 year hiatus
- Final depth 400 ± 50 m, consistent with TDR (436 m)

2014 descent speed 2.4 m/hr, consistent with modeling



Diverse, Unexplored Earth Analogs



- Ca. 400 subglacial lakes beneath kilometers of ice in Antarctica
- Diverse in size (up to Lake Ontario-sized)
- Diverse in glaciation history (~35 My to ~100 Ky)
- Diverse in geochemical settings. e.g., oxidant flux due to melting at lids, possible methane reservoirs [Wadham et al. 2012]