The need for a modular drill system

Ice Drilling Science Community Planning Workshop

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By Andrei Kurbatov

Potential investigators at the CCI

- Daniel Dixon
- Gordon Hamilton
- Karl Kreutz
- Andrei Kurbatov
- Paul Mayewski

Projects that CCI investigators were involved

- Deep Cores: GISP2, Taylor Dome, SDMA, WAIS Divide
- ~100-200 m: RIDS, ITASE, Everest, Pamir, Altai, Detroit Plateau, Dry valley, Allan Hills
- Tupungatito, Denali, Tasman Glacier

Potential future drilling activities

- Extend array of Antarctic core to 2000 years
- Collect fast disappearing paleoclimate records
  - Asia
  - Antarctica
  - Chile
  - Canada
  - Greenland
  - New Zealand

Asia

- Fedchenko Glacier, Pamir (1000 m)
- Altai (200 m)

Antarctica

- Detroit Plateau (350m)
- US ITASE sites (300-400m)
- South Pole (400 m)

Chile/Argentina

- Tupungatito (150 m)
- Several sites in Patagonia (500 m)
- Cord. Darwin area (<150 m)

Alaska/Canada/Greenland/Russia

- Renland
- Devon
- Logan
- Penny Ice Cap on Baffin Island

New Zealand

- Tasman glacier and several sites in Southern Alps

Shipping out of the country

- Easy to ship by air (fuel, batteries, plastic)
- Boxes integrated with a drill system
- TSA /Customs friendly

Transport to the field

- Small boats (Chile)
- Helicopters (Antarctica, Chile, Greenland, Russia, New Zealand)
- Pilatus Porter (New Zealand)
- Twin Otter (Antarctica, Canada)
- Mules, Yaks (Argentina, Chile, Asia)
- Snow mobiles (Antarctica)
- Backpacks (Optional)

Operations

- Conditions: cold, high elevation
- Safe (no heavy parts to lift, electricity)
- Easy to assemble and take apart
- Easy to pack and transport

Design requirements

- Modular system 0-1000 meters
- Integrated with hot water drill system for fast and easy access in warm (melting) ice conditions
- Interchanging components (cutters, barrels, control boxes)
- Several sets of cutters (firn, ice, +)
- Easy and fast replace/modify the system components
- Contamination free materials and operation
- Minimalistic repair tool box
- Minimize reloading time at the surface
- T range -50 to +15 °C
- Wind up to 100 km/h

Integrated with a drill system

Control box, shelter, core processing, ice core boxes

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Minimize number of people required to operate the drill

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Development

- Evaluate existing drill systems
- Discuss engineering design compromises with the user community (stronger/lighter, contamination vs. price)
- Have driller involved in the design in early stages

Open source hardware design

- http://en.wikipedia.org/wiki/Open-source_hardware
- The term usually means that information about the hardware is easily discerned. Hardware design (i.e.schematics, bill of materials and PCB layout data) in addition to the software that drives the hardware are all released with the FOSS approach.
- ``free hardware design'' means a design that users are free to copy, modify, and convert into hardware. Richard Stallman

Denmark: Dorthe Dahl-Jensen, Niels Bohr Institute

Swiss System: Margit Schwikowski, Paul Scherrer Institute

New Zealand: Nancy Bertler, Antarctic Research Centre

Easy to use system

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