



Ice Drilling Program Office

Dartmouth – University of New Hampshire

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Title:	SCIENCE REQUIREMENTS FOR A DEEP LOGGING WINCH
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DOCUMENT APPROVAL

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Science Requirements for a Community Deep Logging Winch

Mechanical

- The deep logging winch must be capable of logging holes 4,000 m deep; the winch should be transportable by a single LC-130 flight.
- The winch must allow full-range speed control down to a complete stop, and allow logging speeds from 1 cm/s to 60 cm/s.
- The winch must be able to operate at temperatures as low as -45 C. A higher temperature rating would be adequate for operation in a heated shelter, and should be considered if this specification drives up cost significantly.
- The winch system must allow for automatically respooling of the cable, using a level-wind system, fleet-angle compensator, or some other means.
- The drum should be larger than minimally necessary for a perfectly spooled cable, to allow the cable to respooled quickly in an emergency.
- The winch should have LeBus groove configuration on the spool.
- The design should allow for spooling cable directly down into a hole with a short casing, or laterally to a logging tower attached to a tall casing.
- The brake must work in the event of a power failure.

Electrical

- Since this winch is intended for general purpose use, the best cable choice is standard four-conductor logging cable (Rochester 4-H-181A or Schlumberger 4-18-ZT or equivalent).
- Teflon insulation should encase the conductors for use in nearly all drilling fluids, and the winch should be designed to handle Teflon FEP insulated cable.
- The cable should be headed with a standard 1" O.D. Gearhart-Owen variant, 4-conductor.
- The winch must have a broadband high quality slip-ring connector to transmit both analog and high speed digital signals from DC to ~10 MHz.



- The inter-conductor leakage along the entire signal path from the cable-head to the output of the slip-ring connector should be 0.1 ns (nano-siemens) or less.
- Winch power must be compatible with commercially-available portable generators.

Readouts

The winch must include a digital depth measuring system using a bi-directional counter, with a precision of 1 cm or better. Depth accuracy should be at least 500 ppm. Higher depth accuracy is desirable if it can be achieved at reasonable additional cost.

- The winch must include an accurate cable-tension measuring system. For safety, there should be a cut-out for the motor on overtension. Ideally, there would also be an alarm on undertension.
- Depth and tension values must be available via serial communication to a computer, and also clearly displayed for the operator in case of computer failure.

Assembly at the Field Site

- The winch should require at most minimal assembly (or no assembly) at the field site.
- Skids to facilitate dragging the winch over snow should be at least 12” wide with curved ends. The winch should have attachment points to facilitate dragging by a small vehicle.
- A mechanism for leveling the winch once it is in place at the field site should be included.

Accessories

- A portable shelter that can be quickly set up by several people for use of the winch in the field should be identified, specifications provided, and possible purchase source identified. The shelter should require minimal logistics for transport and assembly.
- Specifications for suitable generators should be provided to power the winch at any height between sea level and 4,000 m.
- The winch must be packaged for shipping in a way that protects against damage during loading/unloading for transport. When the winch is shipped via LC-130, it



should be packed so that it would not be damaged in the case of a combat offload.

Clarifications/modifications to science requirements

- IDDO will identify issues and opportunities arising from the science requirements that significantly impact the function, cost, or associated logistics of the winch, and that could be resolved by modifications of the science requirements. Resolution of the issues will be coordinated with IDPO and users of the logging winch.
- The design process for the winch should be mindful that the winch will be used at sites in the deep field that have minimal field support.