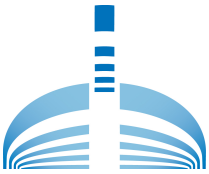

Ice Drilling Program Office

Dartmouth – University of New Hampshire

DOCUMENT IDENTIFICATION		
Title:	**SCIENCE REQUIREMENTS: AGILE SUB-ICE GEOLOGICAL DRILL**	
Date: 1-13-2014		Revision: 1.0

DOCUMENT APPROVAL	
Science Community:	Stone, Putkonen, Brook
IDPO:	Albert, Twickler

REVISION HISTORY (maintain last 3 versions)			
REV	DESCRIPTION	DATE	APPROVAL
1.0	Initial Science Requirements	1-13-2014	See Above

Science Requirements: Agile Sub-Ice Geological Drill

Background:
The IDPO Long Range Science Plan 2013 identified science goals for ice drilling that spanned a wide range of science targets. One of the goals is to develop a better understanding the extent and volume of ice sheets under paleoclimatic conditions warmer than the present (e.g. Eemian). Cosmogenic nuclides in rock beneath ice sheets can reveal former ice sheet extent and the timing and duration of past exposure periods. Under ice less than 700m thick, nimble methods for reconnaissance recovery of small rock cores are needed for use near outcrops and near the ice margins. From virtual discussions initiated by IDPO in November 2013 with follow-up teleconferences and discussions with the research community and with IDDO staff, the following are the science requirements for the drill:

Scientific Requirements
1. Produce 700 m borehole to base of ice with drilling and retrieval of 10 m of bedrock core and / or unconsolidated frozen sediment core.
2. Ice drilling will include the possibility that the ice is entrained with rocks.
3. Ice drilling will be to dry, frozen-bed conditions, and will not be done in areas where there is subglacial water.
4. Retrieve several short ice cores (~50 cm long) at up to 700 m depth.
5. Ice drilling may be in ice that is within 2.0 C of the pressure melting point.
6. Required ability to drill at ice borehole temperatures as low as -40 C, and surface temperatures as low as -30 C.
7. Retrieve 10 m of bedrock cores of maximum 33 mm (1.3”) diameter beneath the ice sheet.
8. Maximum site altitude for the design should be 2,500 m.
9. Maximum time at a site, including set up and core retrieval, should be 6 days.
10. Stand-alone capability is needed for operation at small field camps at remote sites.
11. Minimal staff (4) for drilling operations in the field; other field camp staff in support of drilling operations to be provided separately.
12. Drilling fluid or a fluid “system” (to be determined) will be immiscible with water.
13. Drilling fluid should not be a boron-rich fluid.
14. Drill system must be transportable by Twin Otter, or helicopter with sling load.
15. Drilling depth of each core collected should be determined and recorded.
16. Drilling and core handling history should be recorded.

Discussion: Dry drilling up to 400 m is possible but represents a significant risk and could only be attempted in clean ice. Englacial material and subglacial till represent major challenge. The feasibility study may consider both cable-tethered and light weight rigid pipe systems but, will primarily address the system that provides the best likelihood of meeting the science requirements. Transport by either Twin Otter or helicopter may require more than one flight.