







IDDO UPDATE SAB MEETING 2012

4-INCH DRILLS

GREENLAND

4-INCH DRILL

GLISN SEISMOMETER DEPLOYMENT

- P.I. Kent Anderson
- IDDO Drillers Beth Bergeron and Tanner Kuhl
- 300.43m dry borehole drilled in 17 days
 - All core was collected for analysis
- Seismometer successfully deployed





4-INCH DRILL

ACT 11 – ARCTIC CIRCLE TRAVERSE 2011

- P.I. Rick Forster
- ■IDDO Driller Terry Gacke
- ■700+ kilometers traveled on snow machine
- 209.8 meters of core recovered across 5 sites
 - High-quality core
 - Unexpectedly encountered water at two sites at depths of 11.2 meters and 25.4 meters
 - Recovered high quality IPR survey data from the east coast site back to the GLISN site

MCCALL GLACIER

HAND AUGERS ARCTIC

- P.I. Matt Nolan
- McCall Glacier, Alaska
- PICO 3" and 4" drilling to explore processes of internal accumulation of ice within firn

NORTHERN GREENLAND NEAR SURFACE SNOW CORE

- P.I. Bob Hawley
- Thule, Greenland
- Collected 20.2 meters of core with a PICO 4" hand auger and Sidewinder system
 - Depth goal of 30 metes not met due to CPS generator failure

GREENLAND CORE ARRAYS

- P.I.'s David Noone and David Schneider
- Summit Camp, Greenland
- Firn core collected for isotopic analysis using a PICO 3" hand auger and Sidewinder system

HAND AUGERS ANTARCTIC

- Antarctic hand auger use is requested through the P.I.'s Support Information Package (SIP) submitted to the Antarctic logistics provider
- Hand augers for Antarctic projects are packed and shipped by IDDO to the Berg Field Center (BFC) in McMurdo for further distribution
- Hand augers deployed for the 2011-2012 field season:
 - PICO 3" P.I. Sridhar Anandakrishnan
 - PICO 3" P.I. Howard Conway
 - PICO 3" (quantity 2) P.I. Leo Peters
 - PICO 3" (quantity 2) and Sidewinders (quantity 2) P.I. Jeff Severinghaus
 - SIPRE P.I. Joseph Levy
 - SIPRE P.I. David Marchant
 - SIPRE Kevin Pettway (RPSC)



DISC DRILL Borehole Logging





- First round: 12/3/11 through 12/21/11
- Second round: 1/1/12 through 1/4/12
- IDDO Driller Josh Goetz designed and installed rooftop and floorlevel logging sheaves
- IDDO Driller Elizabeth Morton served as a winch operator with Gary Clow and Frank Rack
 - "Elizabeth Morton is an exceptionally competent and cooperative field hand. (IDDO should) clone Elizabeth Morton." Ed Waddington

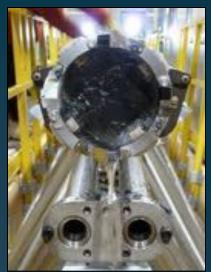
DISC DRILL

MAIN BOREHOLE COMPLETED ON DECEMBER 31, 2011

- New 4200 meter cable installed and terminated at season start up
- Driller's final depth: 3405.077 meters
 - 73 meters drilled this season
- Drill performed well in rapidly warming ice
 - 2.3-2.4 meter cores retrieved all the way to the finish







All core will be processed at the Core Processing Lab (CPL) held at NICL later this summer.

DISC DRILL Replicate Coring Test

CUTTING HEADS



Broaching head



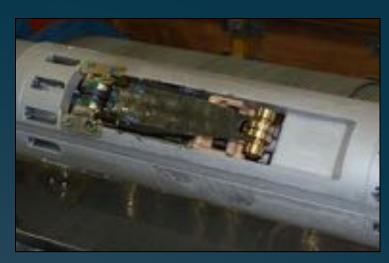
Milling head

Milling head with cutters

DISC DRILLReplicate Coring Test

ACTUATOR SECTIONS







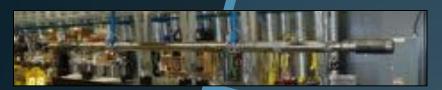
DISC DRILL Replicate Coring Test

LESSONS LEARNED



- Stick slip of the drill made it difficult to achieve stable cutting
- Milling head worked to create chips
- Upper sonde is too small to allow for side push cutting method
 - System can reliably find high side of borehole
 - Actuator failsafes trip out at lower force in the borehole than on the surface
 - Actuator oil leaks to be repaired
 - More reliable method of arm positioning is needed
 - More rigid barrels needed
 - Larger diameter cutters may be needed to compensate for drill deflection

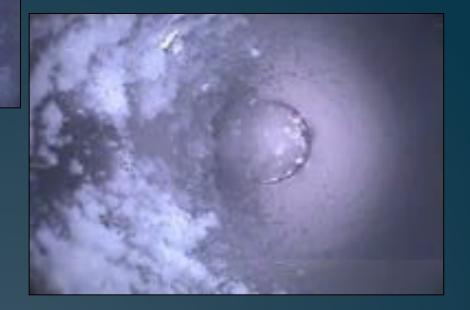






DISC DRILL Borehole Camera

- New for 2011-2012 season
- DISC Drill anti-torque section plus weight stack and pressure vessel



ECLIPSE DRILL

DRILLER TRAINING
WAIS DIVIDE, ANTARCTICA





DRILLER TRAINING

- IDDO was granted permission by NSF to deploy a Badger-Eclipse Drill for driller training purposes
- 120 meter hole drilled outside of WAIS Divide camp
- IDDO Drillers Mike Jayred and Elizabeth Morton operated the drill and are currently revising the operating procedures document
- Visiting Drill Engineer Steffen Bo Hansen assisted with drilling and troubleshooting

BLUE ICE DRILL

TAYLOR GLACIER
ANTARCTICA

BLUE ICE DRILL

SECOND PRODUCTION SEASON

- Large diameter, large volume ice cores collected for in-field gas analysis
- 64 holes drilled over 32 days
- Over 930 meters drilled
- Most modifications made after 2010-2011 season proved successful
 - Cord reel
 - Reflective barrel coatings
 - Drill platform sled
- Operated by IDDO DrillerTanner Kuhl



PORTABLE HOT WATER DRILLS WHILLANS ICE STREAM ANTARCTICA

WHILLANS ICE STREAM

- P.I. Paul Winberry
- 20 meter shot holes drilled for deployment of seismic charges
- Over 9 km of high-quality data collected
- Drill operated by science team



PORTABLE HOT WATER DRILLS



WISSARD SURFACE GEOPHYSICS

- P.I. Sridhar Anandakrishnan
- Field Leader Huw Horgan
- ■280 shot holes drilled to 27 meters for deployment of seismic charges
- Drill operated by science team

CURRENT DEVELOPMENT

HAND AUGERS

NEXT GENERATION HAND AUGER

- Using P.I. feedback, IDDO designed a next generation hand auger prototype
- Prototype tested at Taylor Glacier and WAIS Divide





HAND AUGERS

TAYLOR GLACIER TESTING

- Blue ice drilled at -5°C ambient temperature
- 3 holes drilled to 3 meters each
- Good penetration, chip transport and flight design
- Heavy poker chipping and no core recovery in barrel

WAIS DIVIDE TESTING

- 1.25, 2, 5 and 13-meter holes drilled
- Firn of varying density drilled at -15°C ambient temperature
- Good penetration, chip transport, flight design, and core recovery with certain configurations; poor core recovery and penetration with others



INTERMEDIATE DEPTH DRILL (IDD)

- Proposal submitted to NSF by P.I. Eric Steig and P.I. Eric Saltzman
- Retrieval of cores to depths down to 1500 meters in two field seasons
- 98 mm core diameter
- Similar in design to the Danish Hans Tausen Drill
 - IDDO collaborating with the Centre for Ice and Climate in Copenhagen and Victoria University in Wellington
- Portable by Twin Otter or larger aircraft



INTERMEDIATE DEPTH LOGGING WINCH

INTERMEDIATE DEPTH LOGGING WINCH

- Part of Long Range Science Plan
- 1500 meter depth capability
- Transportable by Twin Otter
- Both analog and digital transmission capability
- IDDO to procure and modify winch in 2012
- Will be operated by IDDO
- First anticipated deployment at Siple Dome in 2014-2015 (Bay)
 - Potential use during 2013-2014 at Dome Fuji (Muto)

RAID

RAPID ACCESS ICE DRILL (RAID)

- Proposal being submitted to NSF by P.I. John Goodge and P.I. Jeff Severinghaus
- Feasibility study conducted by IDDO and concept developed
- Fast access drilling through ~4 km of ice in one week's time
- Minimal core sampling along the way
- Recover up to 25 meters of bedrock core
- Many holes to be produced for borehole logging



REPLICATE CORING

- Cargo returning from Antarctica in late April
- Designing detailed test setup and procedures to test drill deflection and cutterheads this summer in Madison
- Greater rigidity/diameter needed in certain components
- Cutter modifications to be made
- Actuator oil leaks and failsafe issues being explored
- Looking to collect 252 meters of replicate core during the 2012-2013 season per the direction of Chief Scientist Jeff Severinghaus