

# Core Handling for the WAIS Divide Ice Core Project

Joseph Souney<sup>1</sup>, Geoffrey Hargreaves<sup>2</sup>, Brian Bencivengo<sup>2</sup>, John Rhoades<sup>2</sup>, Eric Cravens<sup>2</sup>, Matthew Kippenhan<sup>3</sup>, Kendrick Taylor<sup>4</sup> and Mark Twickler<sup>1</sup>

<sup>1</sup> Institute for the Study of Earth, Oceans and Space, University of New Hampshire, Durham, NH, USA (joseph.souney@unh.edu)

<sup>2</sup> National Ice Core Laboratory, U.S. Geological Survey, Denver, CO, USA

<sup>3</sup> Antarctic Support Contractor, U.S. Antarctic Program, Denver, CO USA

<sup>4</sup> Desert Research Institute, Nevada System of Higher Education, Reno, NV, USA

www.waisdivide.unh.edu

## Background

- Final depth of 3,405 meters reached on Dec 1, 2011
- Longest U.S. ice core to date
- Highest quality U.S. deep ice core, including brittle ice

## Core Handling Operations

### 1. Receiving

- Arch temperature between -20 and -30°C; no thermal shock to core
- ~3.2 m long runs of ductile core from DISC Drill received
  - In brittle ice zone, DISC Drill used to break core into 1 m sections down hole where ice was still under pressure and not brittle
- Very rigid and optically aligned push-out table
- Fluid Evacuation Device (FED) for removing drill fluid
- Laser Balluff system for measuring and logging core
- Brittle ice pushed directly into elastic netting

### 2. Cutting

- 3.2 m (ductile ice) drill runs cut into 1m long cores; no need to cut 1 m brittle ice runs
- Circular saw w/ tungsten carbide tipped 14" blade
- 1m cores stored in extruded aluminum trays
- Aluminum trays stored on roller racks

### 3. Drying

- Roller racks rolled into drying booths
- Active air drying (800 cfm) for drill fluid removal
- Typically < 24 hours

### 4a. Packing

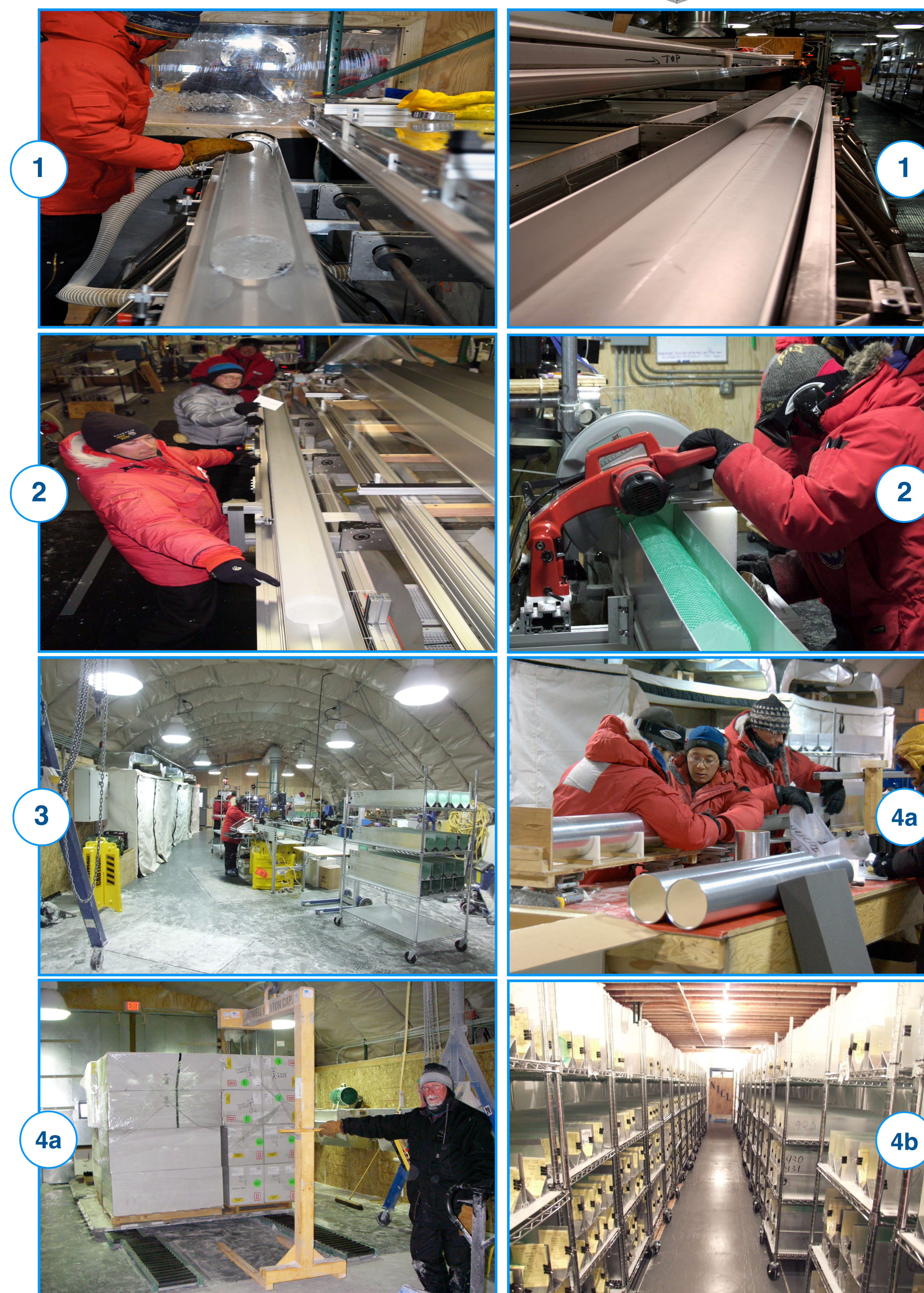
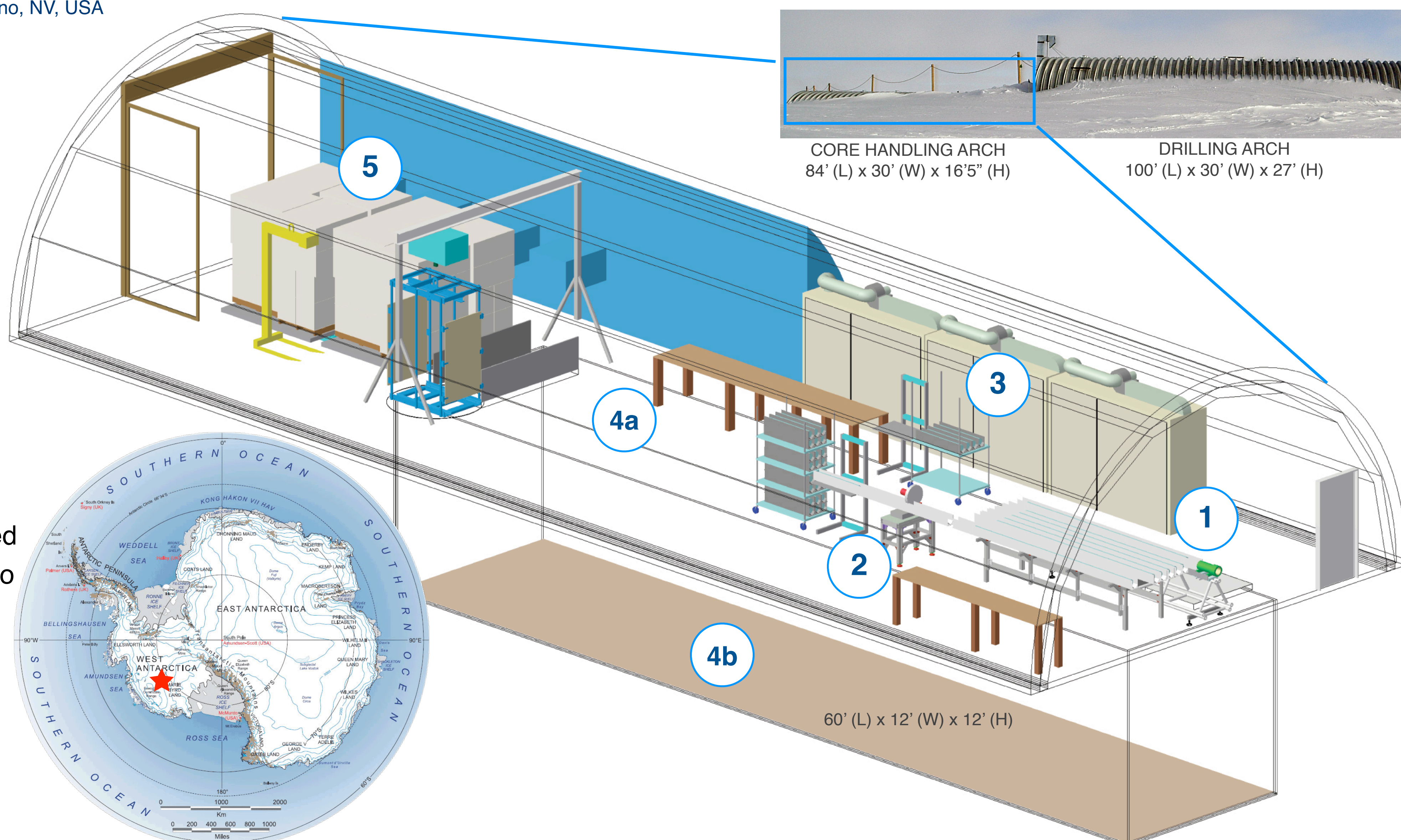
- 1m cores into 6-mil layflat and then into Al-coated cardboard core tubes
- 4 core tubes (packed in snow) / ISC box
- 8 ISC boxes / wood skid
- 4 wood skids / Air Force Pallet (AFP)
- HOBO temperature loggers inside ISC boxes & on each skid
- 1"-thick, quilted custom made insulated blanket under AFP netting

### 4b. Storage

- 60' (L) x 12' (W) x 12' (H) core storage basement
- Gantry crane for lowering/raising roller racks or ISC boxes into/out of basement
- All brittle ice allowed to relax over winter in basement
- Basement served as storage buffer as well

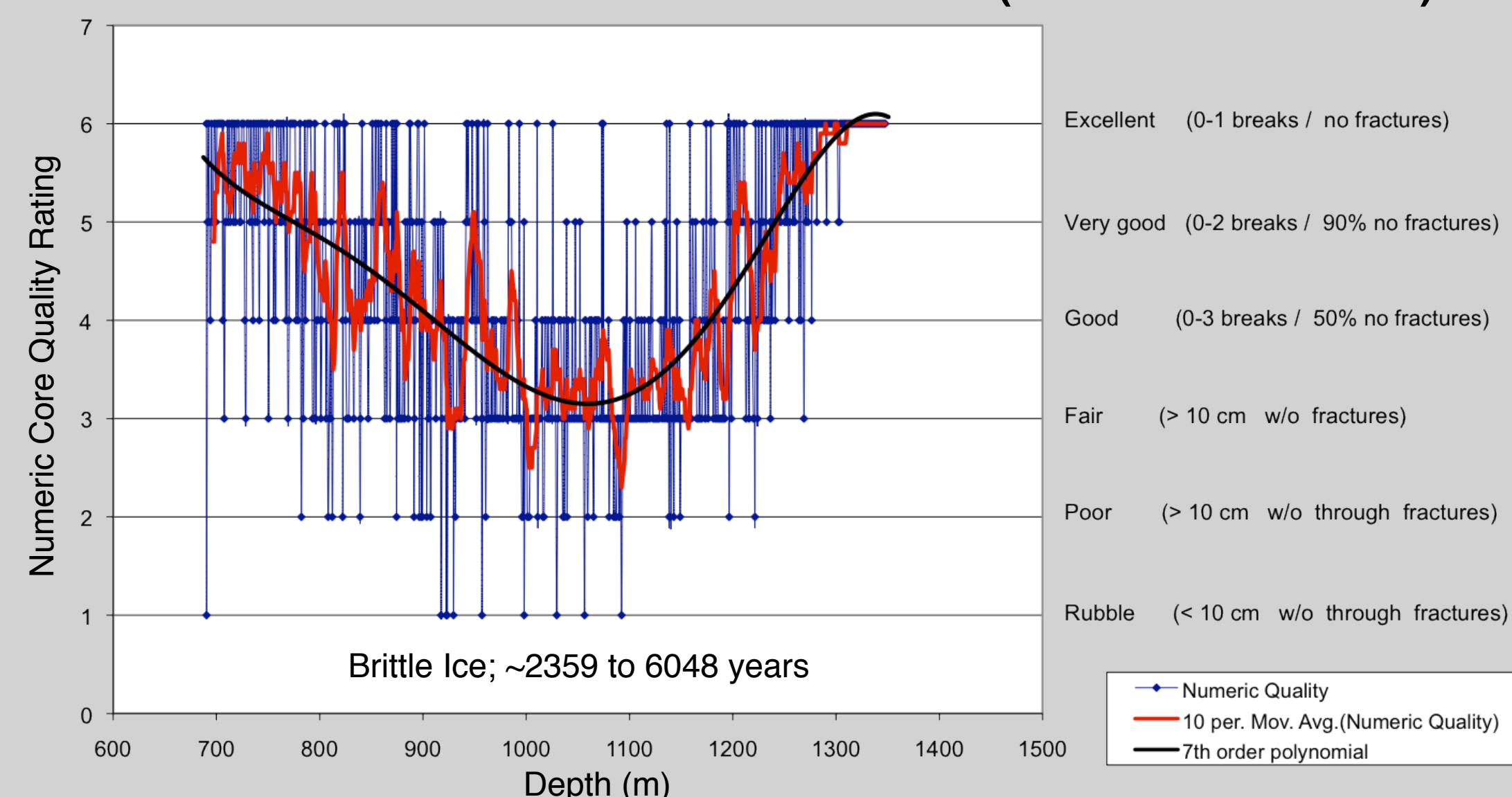
### 5. Shipping

- Palletized ISC boxes from WAIS Divide to National Ice Core Laboratory (NICL)
- Cold-deck LC-130 flights from WAIS Divide to McMurdo
- -30°C SAFECORE shipping containers w/ dual cooling & power systems
- Refrigeration technician escorted ice from McMurdo to NICL
- Most secure shipments of ice core U.S. has ever had



| Season  | Depths Drilled (m) | Meters Drilled | Drilling Days | Depths Shipped (m) | Meters Shipped |
|---------|--------------------|----------------|---------------|--------------------|----------------|
| 2006-07 | 0-114              | 114            | 5             | 0-114              | 114            |
| 2007-08 | 114-577            | 463            | 17            | 114-577            | 463            |
| 2008-09 | 577-1514           | 937            | 37            | (none/brittle ice) | 0              |
| 2009-10 | 1514-2564          | 1050           | 45            | 577-2001           | 1424           |
| 2010-11 | 2564-3331          | 767            | 43            | 2001-3331          | 1330           |
| 2011-12 | 3331-3405          | 74             | 7             | 3331-3405          | 74             |

LOGGED ICE CORE QUALITY vs DEPTH (BRITTLE ICE ZONE)



#### Acknowledgements:

This work is supported by the National Science Foundation under awards OPP-0440817 and OPP-0944348 to the Desert Research Institute, Nevada System of Higher Education, and OPP-0944266 to the University of New Hampshire. Core handling at WAIS Divide would not have been possible without the support and expertise from the following WAIS Divide Science Coordination Office Field Representatives: Trevor Popp (2007-08), Anais Orsi (2008-09 and 2009-10), Bruce Vaughn (2008-09 and 2009-10), Gifford Wong (2010-11) and Donald Voigt (2010-11, 2011-12 and 2012-13).