



Early Career Science Program Overview of the NDSF



Exploring the Deep Ocean
NATIONAL DEEP SUBMERGENCE FACILITY VEHICLES

Alvin
Human Occupied Vehicle
Accommodates: 1 Pilot and 2 Scientists
Depth Capability: Phase 1: 4500m, Phase 2: 6500m

Sentry
Autonomous Underwater Vehicle
Depth Capability: 6000m (20,000 feet)

Jason
Remotely Operated Vehicle
Depth Capability: 6500m (21,450 feet)

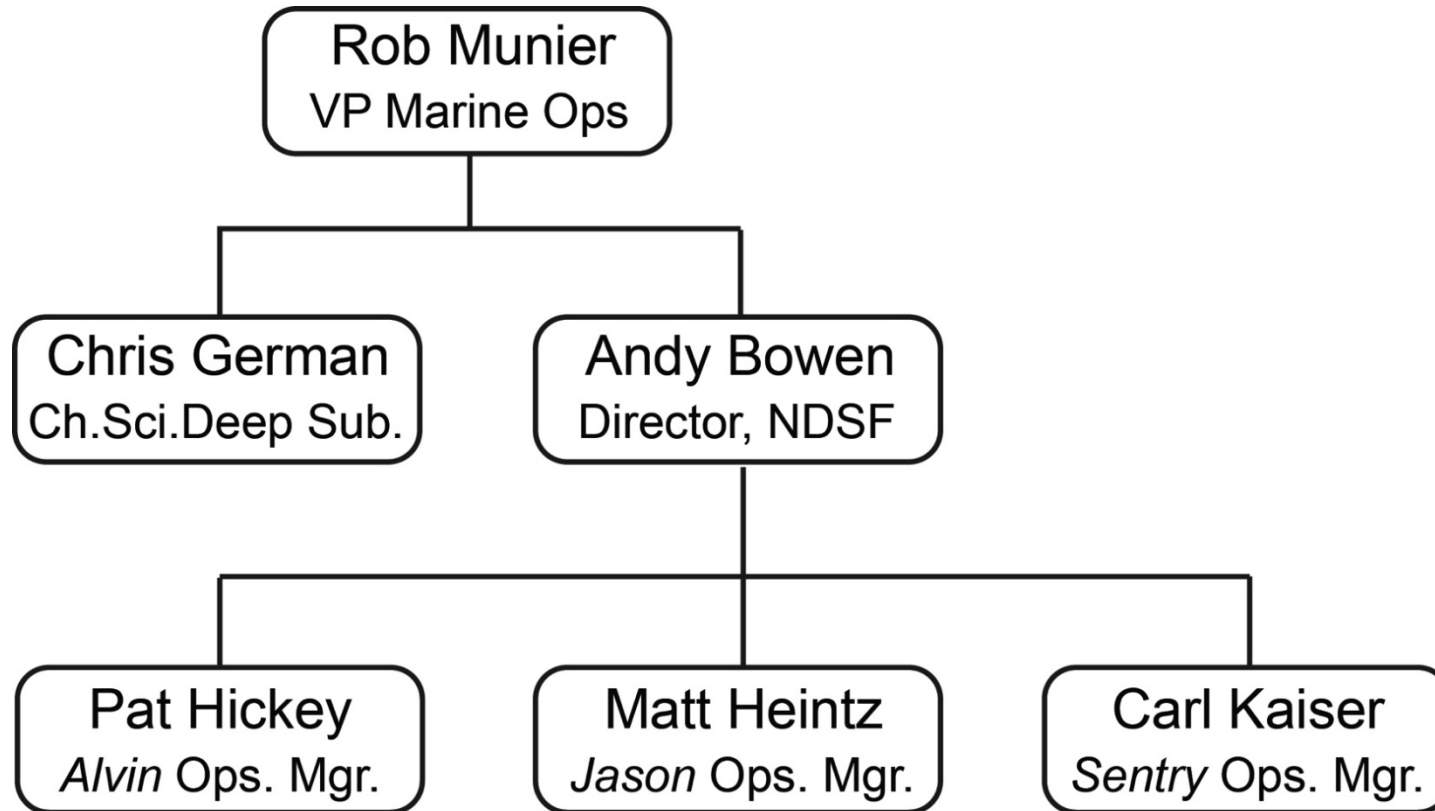
Medea

Logos: Woods Hole Oceanographic Institution (1930), University-National Oceanographic Laboratory System, NSF, NOAA, Office of Naval Research, Department of the Navy Science & Technology.



Early Career Science Program

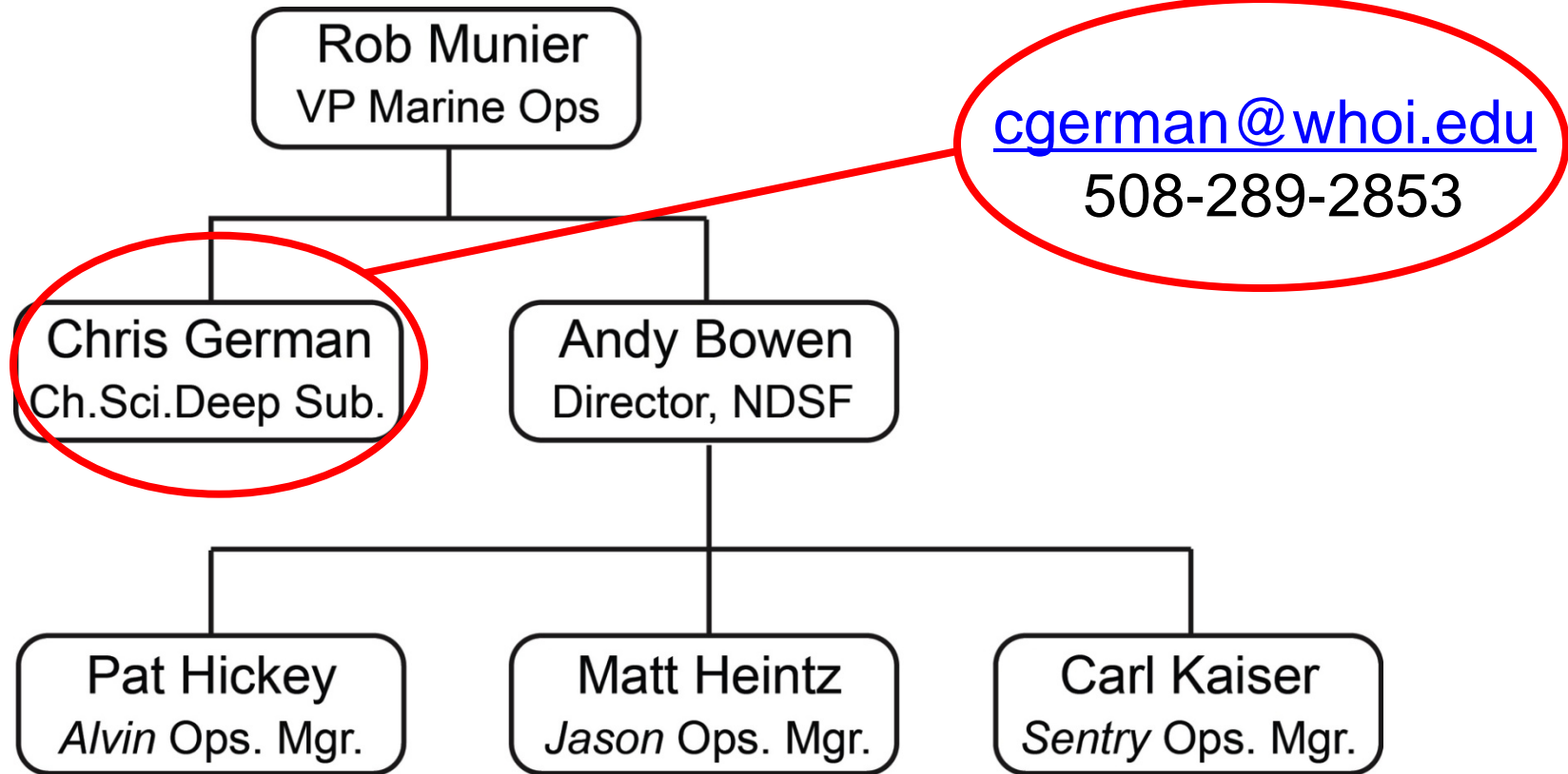
A: Structure of the NDSF





Early Career Science Program

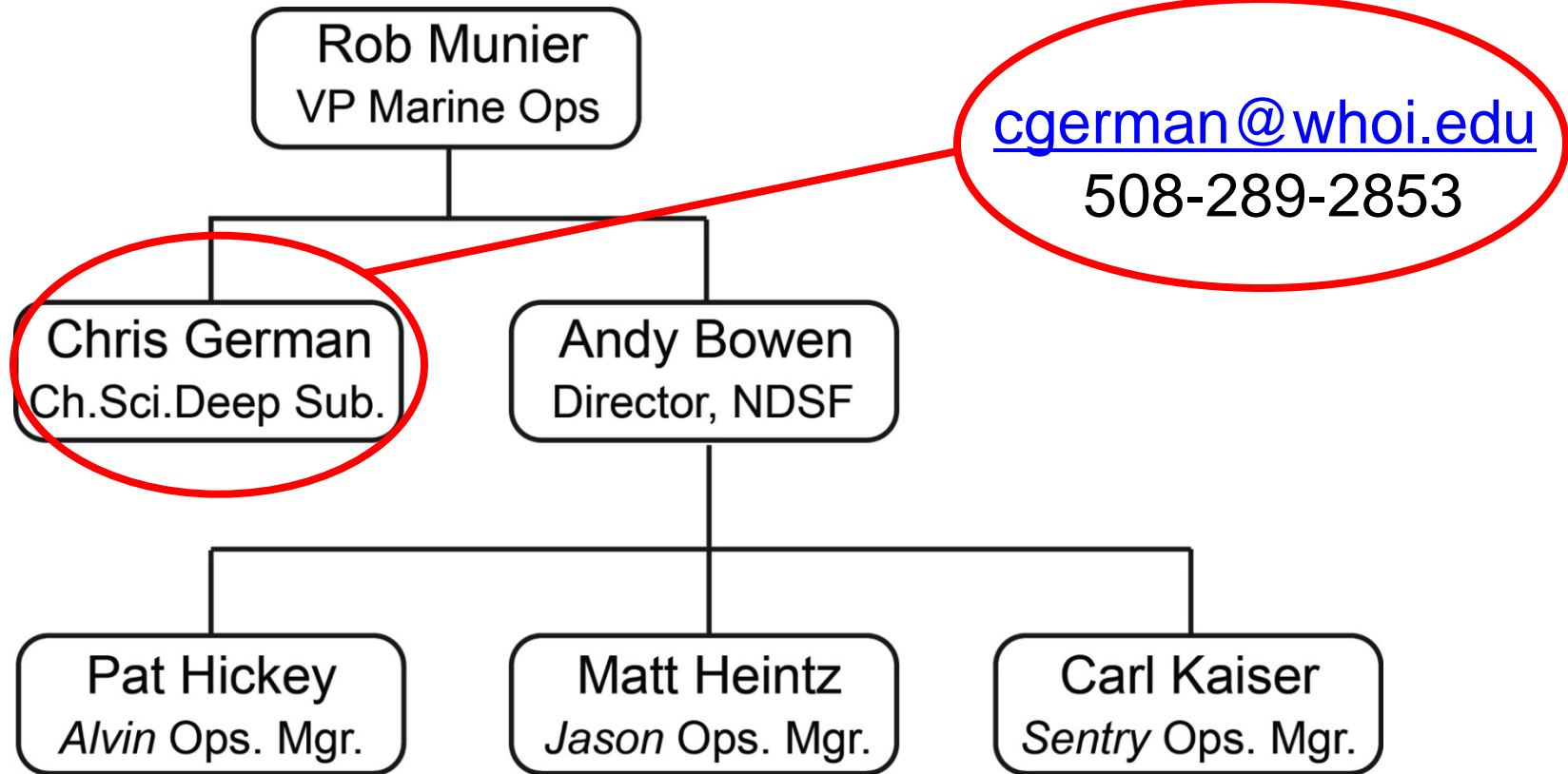
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Early Career Science Program

A: Structure of the NDSF



www.whoi.edu/ndsf



Early Career Science Program B: Meet The Vehicles



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Early Career Science Program B: Meet The Vehicles



HOV Alvin – Science Mission Requirements

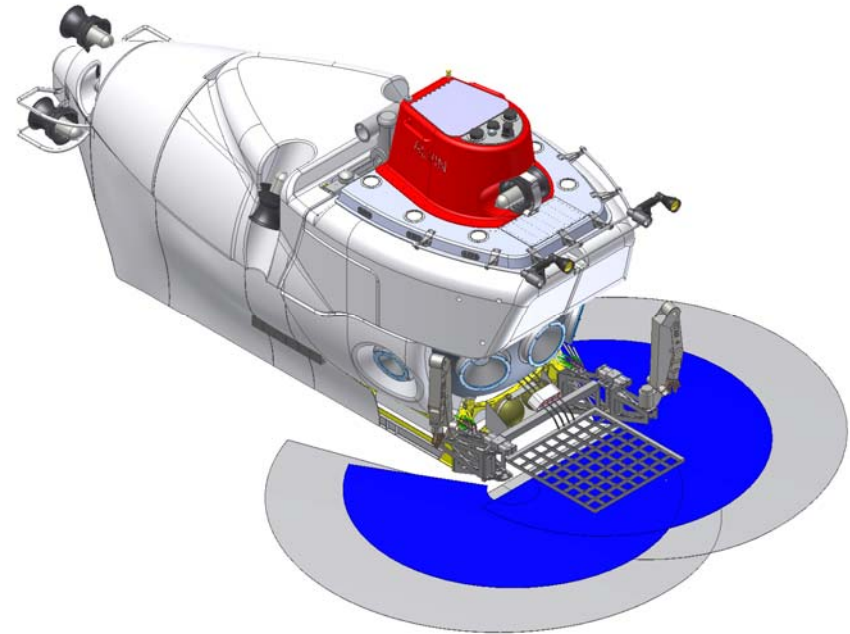
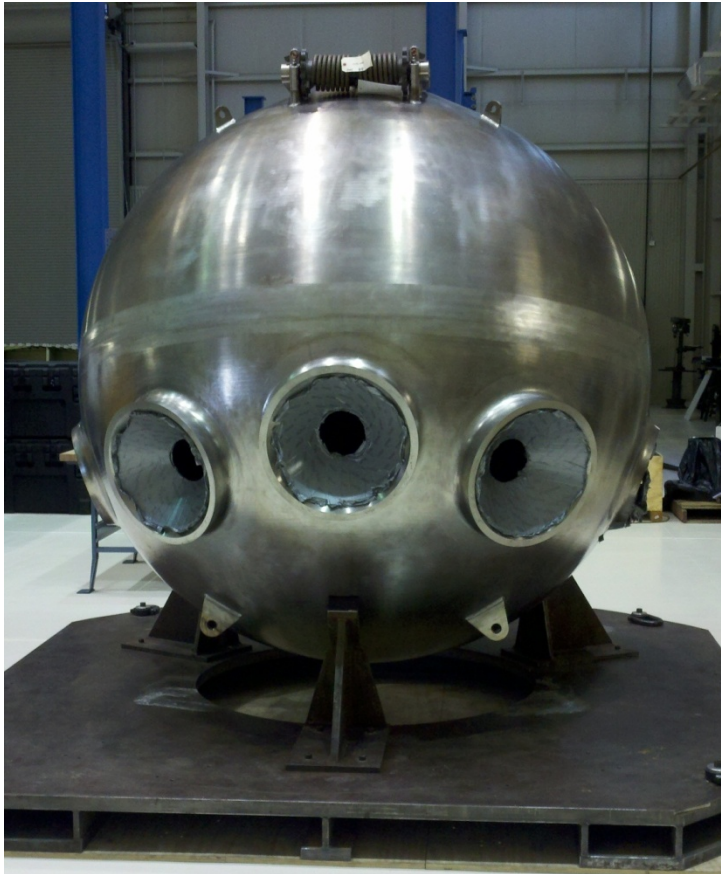
- *In situ* direct **observations** of the deep ocean and seafloor
- High-resolution **imaging** and recording/documentation of observations
- Systematic **exploration** of previously uninvestigated regions
- Systematic **surveys** of the seabed and the overlying water column
- **Sampling** (geological, geochemical, biological/microbiological) at the seafloor and in the overlying water column
- **Interaction with instrumentation** at the seafloor
- **Descent** to the seabed, **transit** between sites, **ascent** back to surface



Early Career Science Program B: Meet The Vehicles



HOV Alvin – Unique Capabilities

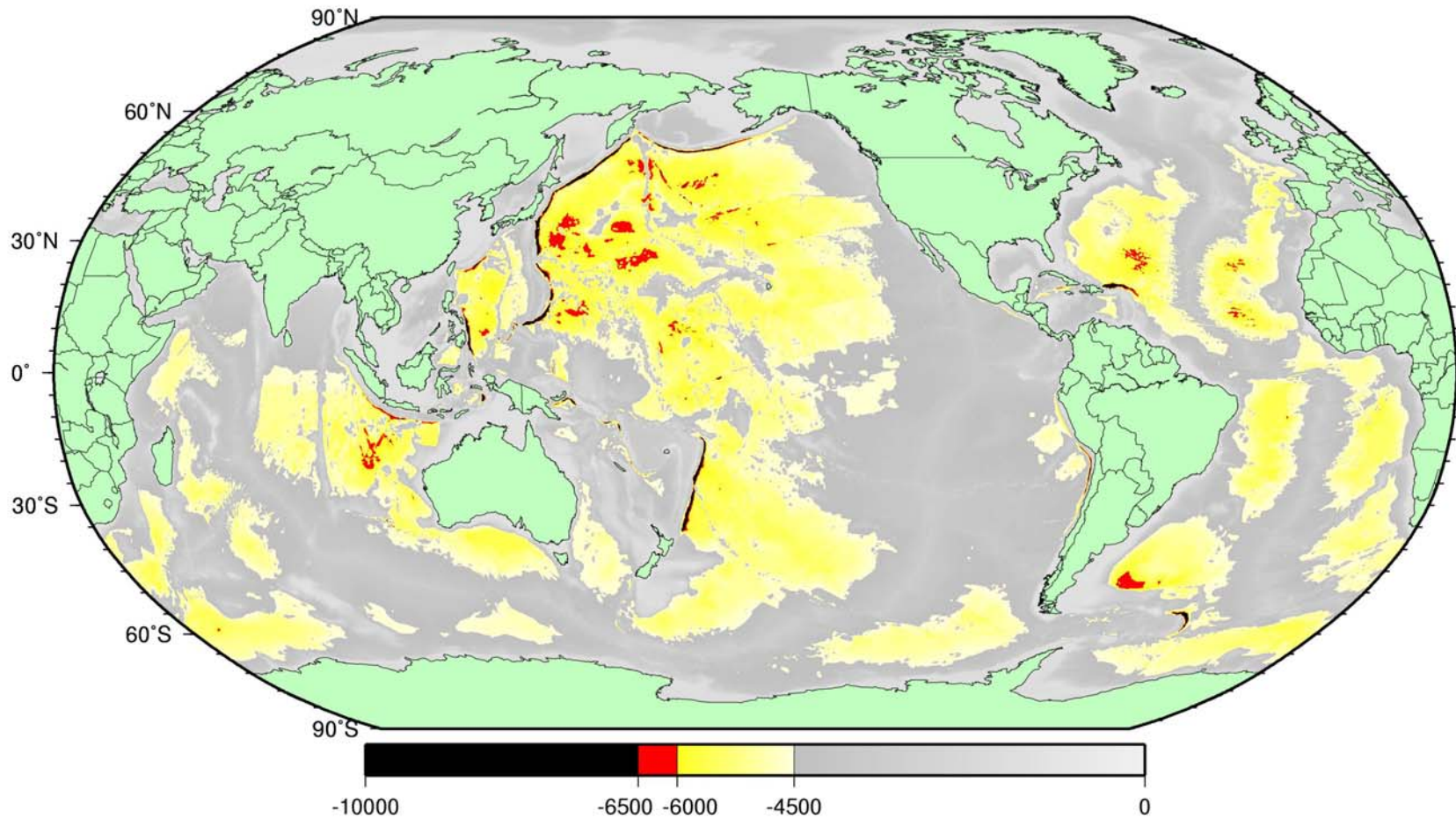




Early Career Science Program B: Meet The Vehicles



65% of Seafloor <4500m, 98% of Seafloor <6500m



50% of Earth > 3000m



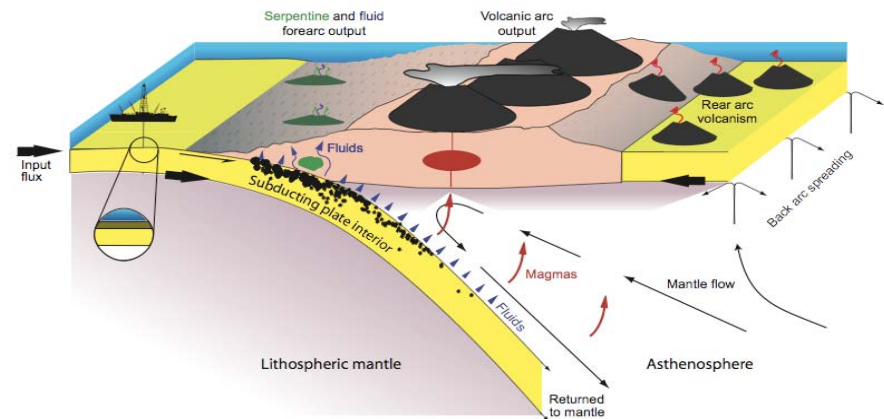
Early Career Science Program B: Meet The Vehicles



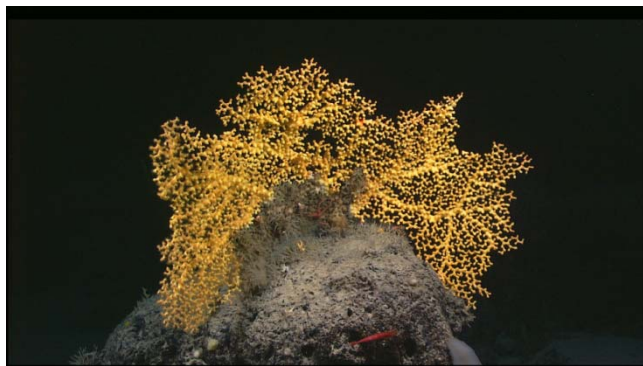
Mission Types (1 of 2)



Mid Ocean Ridges & Flanks



Active Ocean Margins



Deep Sea Corals



Gas Hydrates & Continental Shelves



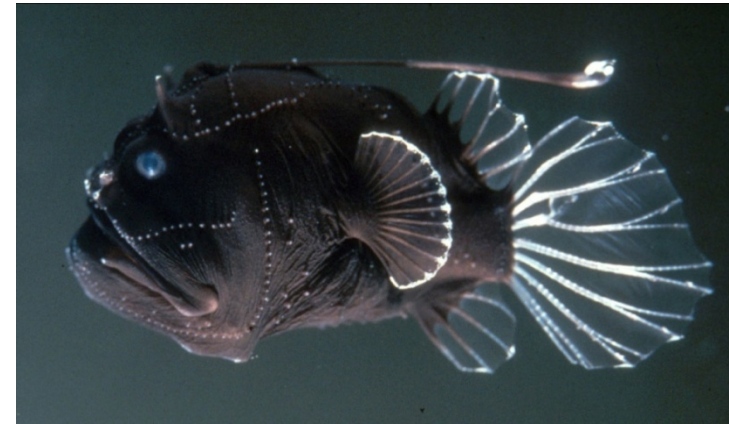
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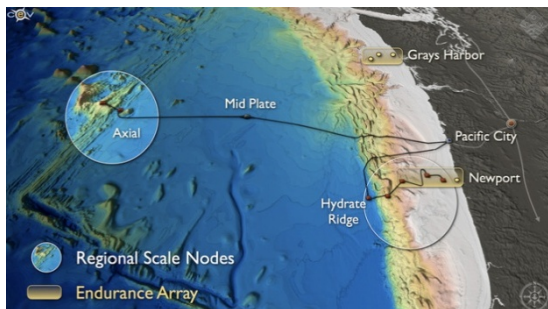
Mission Types (2 of 2)



Abyssal Plain Ecosystems



Mid-Water Ecosystems



Other Science Initiatives – ODP & OOI



Education & Outreach



Early Career Science Program B: Meet The Vehicles



Standard Science Tools (Alvin & Jason)

Profiling Sonars

Reson Multibeam Sonar
Imagenex Profiling Sonar
CTFM Scanning Sonar
Tritech Dual Frequency Scanning Sonar

Temperature Devices

High and Low Temperature Probes
ICL Temperature Probe
Heat Flow Probes

Sample Storage Equipment

Biological Sample Boxes (various sizes)
Custom Science Baskets

Sampling and Data Collection

Magnetometer
Major Titanium Water Samplers
Niskin Bottles
Portable CTD
Push Cores
Scoop Nets
Small Capacity Slurp Samplers
Large Capacity Slurp Samplers
Hydraulically-Driven Slurp

Navigation

Long-baseline, Doppler,
USBL



Early Career Science Program B: Meet The Vehicles



Scientist-Provided Tools (Alvin & Jason)

- Gas-tight Fluid Samplers
- McLane Remote Access Sampler Moorings
- McLane Sediment Trap Moorings
- Rock Scoop Sampler
- Stand-alone Acoustic Monitoring Moorings
- Bushmaster Samplers
- HDTV Offload Prototype Camera
- Temperature Sensor Array
- SIPPER Micro Water Sampler
- ARTY -- RNA Preservation Biosampler
- Deep Ocean Mass Spectrometer
- Deep Ocean Gas Chromatograph
- Insulated Bio Boxes
- Colonization Trays
- Ekman Style Box Corers
- IMAX 80mm Camera



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Early Career Science Program B: Meet The Vehicles



Imaging Sonar

Mini Zeus
On P&T

Kraft Manip

Pilots
Mini Zeus
On P&T

Nav Sonar

LED lighting arrays

NDSF HD camera
On Science
operated P&T

Schilling Manip

Push Core array
Transferable to elevator

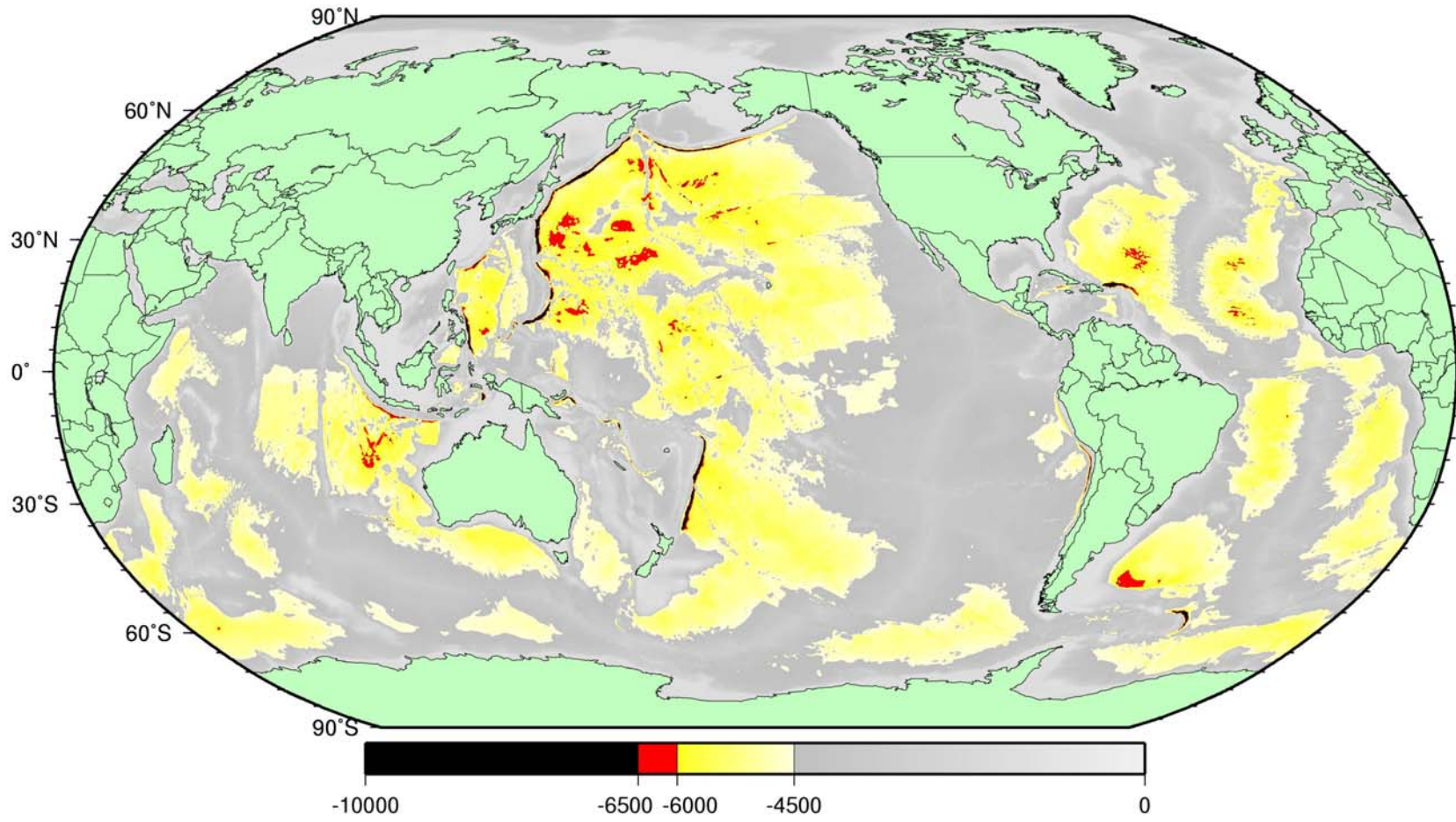




Early Career Science Program B: Meet The Vehicles



98% of Seafloor <6500m

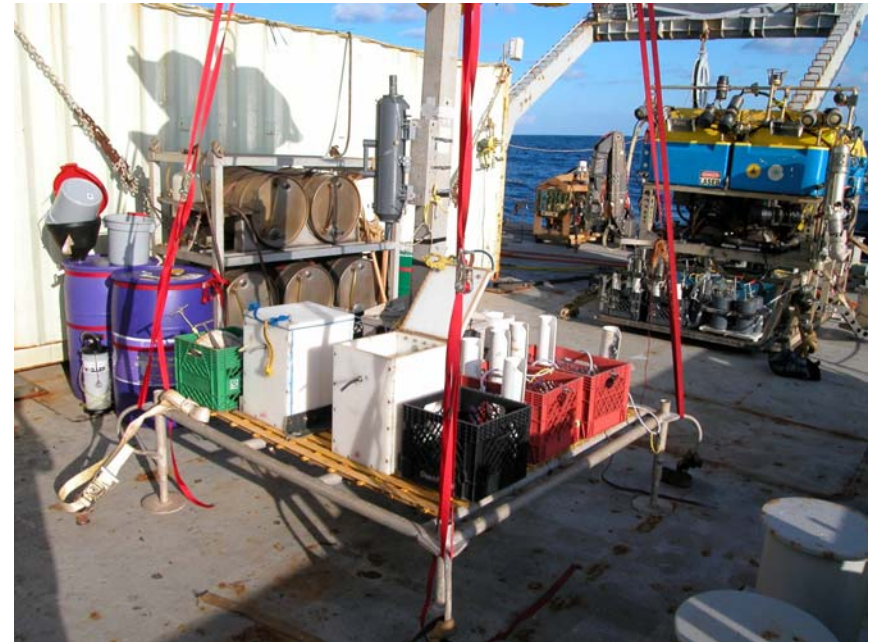
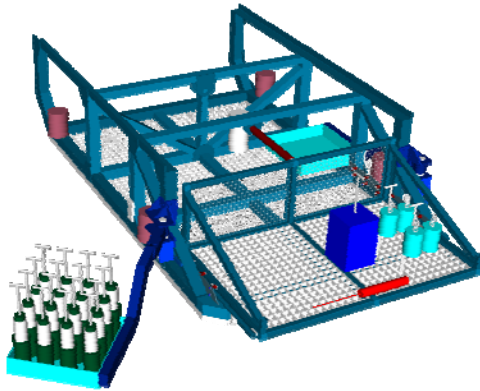




Early Career Science Program B: Meet The Vehicles



Baskets & Elevators





Early Career Science Program B: Meet The Vehicles



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Woods Hole Oceanographic Institution
1930

University-National Oceanographic Laboratory System

NSF

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

DEPARTMENT OF THE NAVY
ONR
Science & Technology

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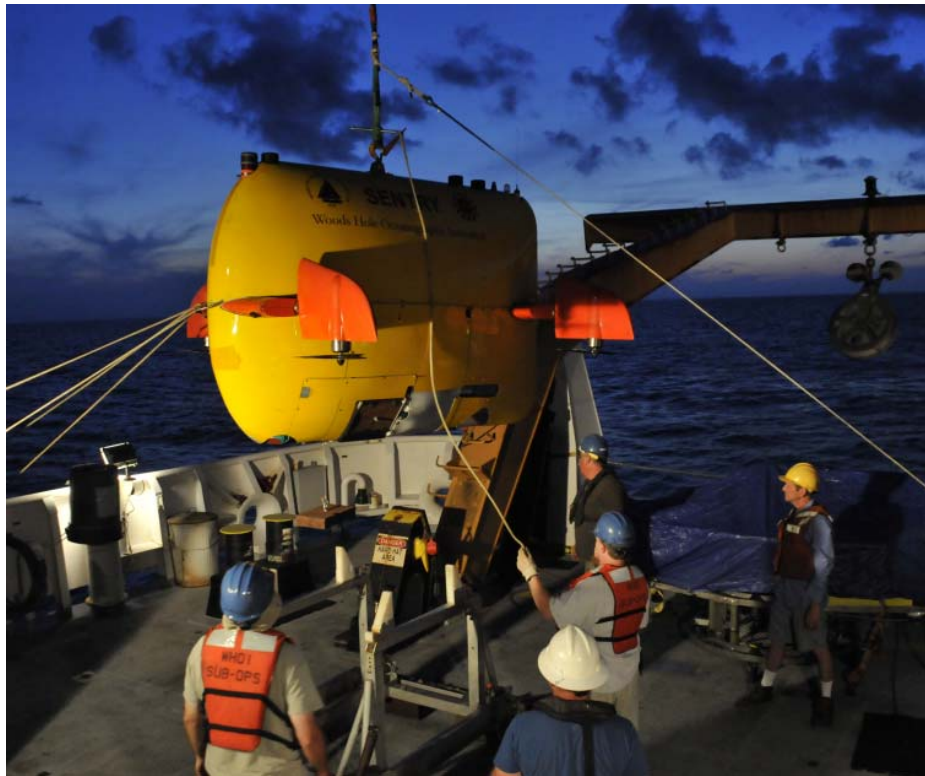
Medea



Early Career Science Program B: Meet The Vehicles



AUV Sentry



- Untethered & Autonomous
- Primarily preprogrammed
- Precisely navigated (USBL or LBL)
- Water Column & Seafloor Ops
- Low bandwidth acoustic comms
 - Vehicle status
 - Snippets of science data
 - Mission reprogramming



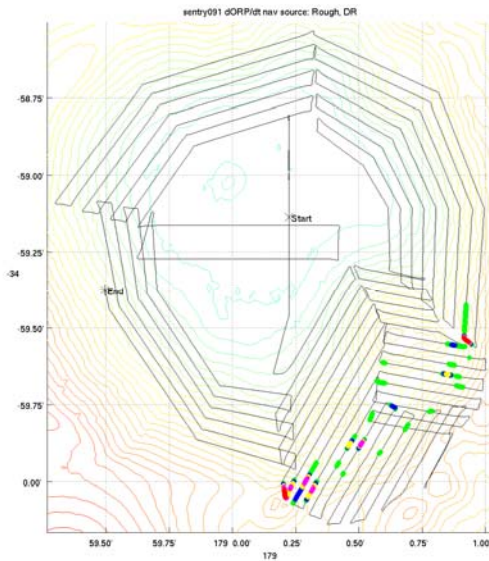
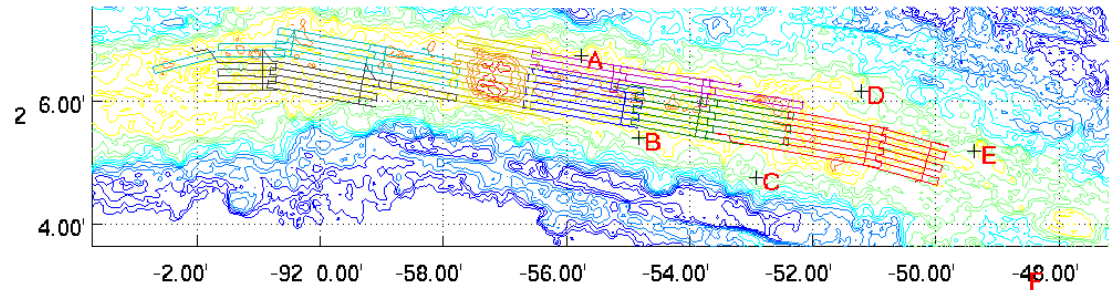
Early Career Science Program

B: Meet The Vehicles

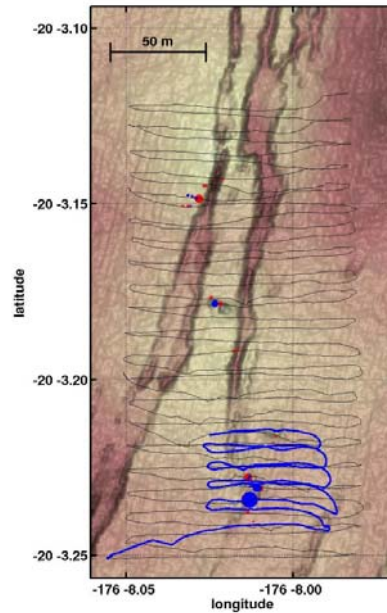


Mission Types

Grids
(Geophys)



Contour Following



Adaptive (Exploration)

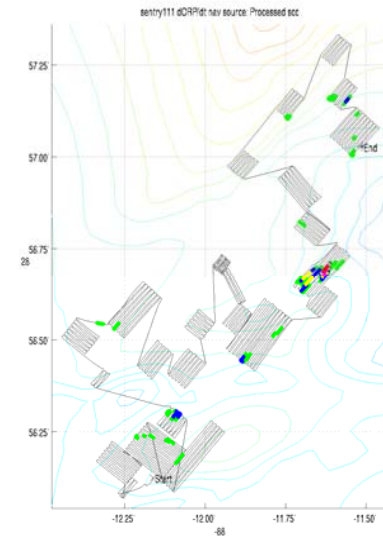


Photo Surveys



Early Career Science Program B: Meet The Vehicles



Standard Tools

Geophysics

Reson Multibeam Sonar
Edgetech Sidescan Sonar
CHIRP Sub-Bottom Profiler
3 x 3-component Magnetometer

Oceanography

SeaBird CTD
Optical back-scatter
Dissolved Oxygen Sensor
ADCP Capability

Seafloor Imaging

1 MPix DSC (upgrade in 2013)
Strobe Lamp

User-Provided Upgrades

Oceanography

In Situ Eh/RedOx Probes
Fluorometer (Organic Carbon)
In Situ Mass Spectrometer
In Situ SUPR Sampler (2013)

Seafloor Imaging

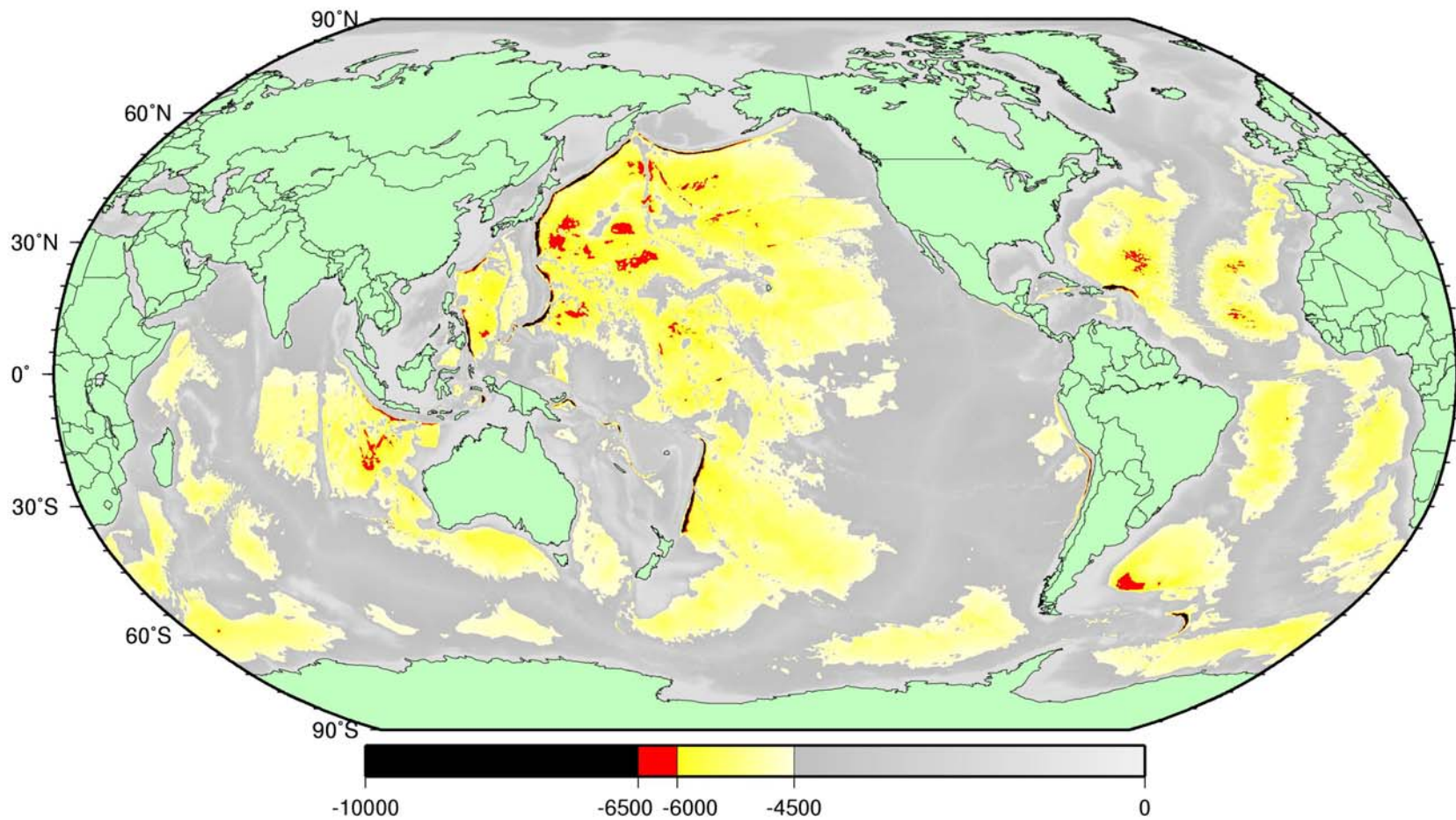
3D Imaging



Early Career Science Program B: Meet The Vehicles



Sentry – Upgraded from 4500m to 6000m in 2011

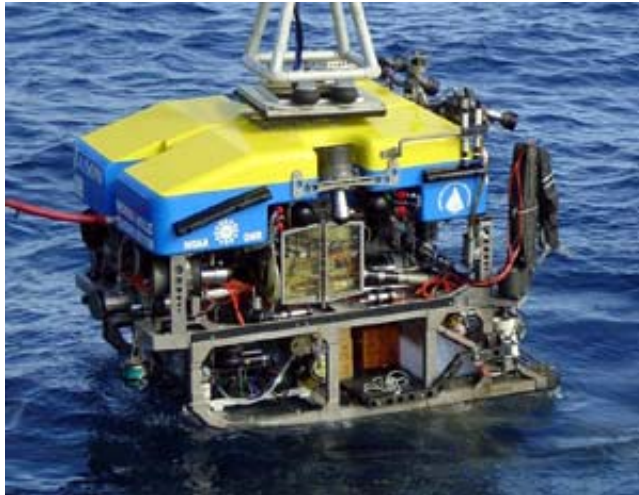




Early Career Science Program B: Meet The Vehicles



Multiple Vehicle Operations





Early Career Science Program **C: Interacting with the NDSF**



Planning Your Cruise

- Pre-submission discussions
(choice of vehicle; technical feasibility; cruise duration)
 - Grant submission
(UNOLS shiptime request)
 - Once you are funded
(Pre-cruise planning; ~6 mths lead; Expedition Leader)
 - Once you are at sea
(Dive planning; responding to “events”)



Accessing Data Post-Cruise

- Complete data sets are provided to lead PI at cruise end (data is proprietary for 2 years, then must be banked/shared).
 - MGDS is the core data repository (<http://www.ideo.columbia.edu/research/topics/mgds>)
 - Archive of all video data is stored *off-line** at WHOI
- Quick-look versions of Alvin and Jason data available via:
 - Frame Grabber: <http://4dgeo.whoi.edu/alvin>
 - Virtual Van: <http://4dgeo.whoi.edu/jason/>