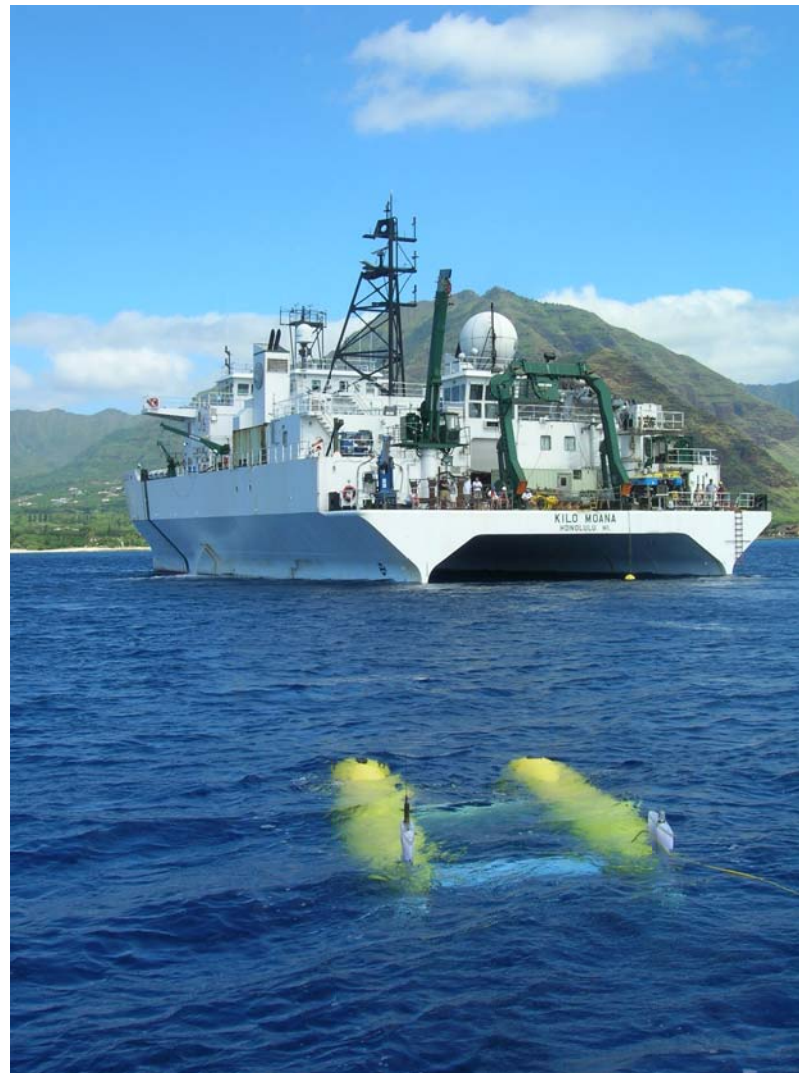


HROV Nereus Nov. 2007 Field Trials

Wai'anae Coast, O'ahu

DESSC
December 2007

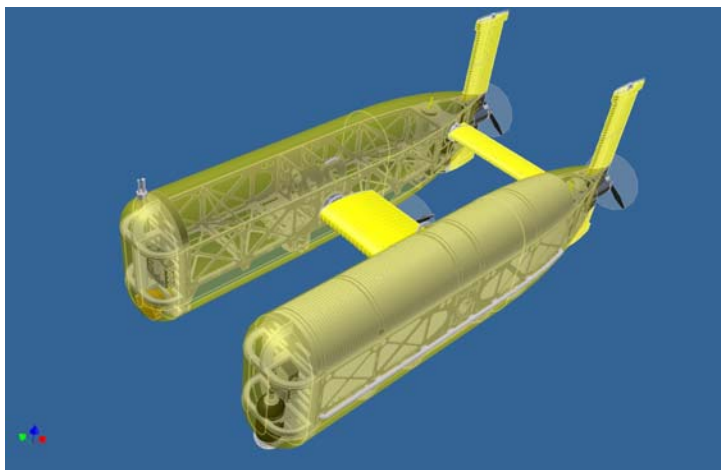


R/V Kilo Moana

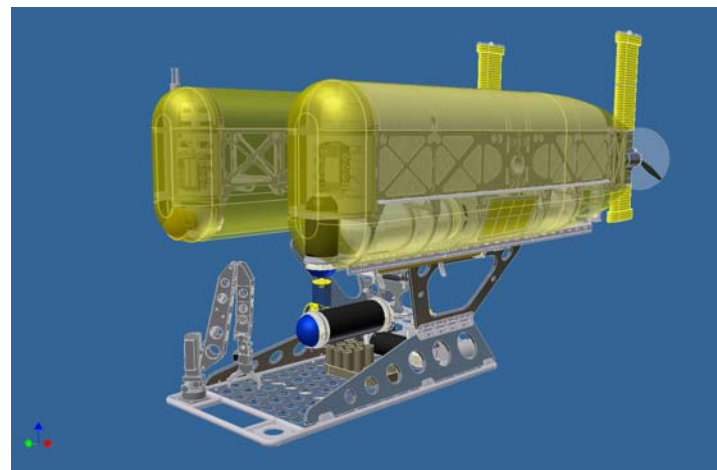


What is the HROV Nereus?

- A Hybrid cross between a AUV and ROV in a single package
 - AUV for mapping
 - ROV for close inspection, sampling and manipulation
- New Class of vehicle intended to offer a cost effective solution for survey/sampling and direct human directed interaction with extreme environments



AUV Mode



ROV Mode

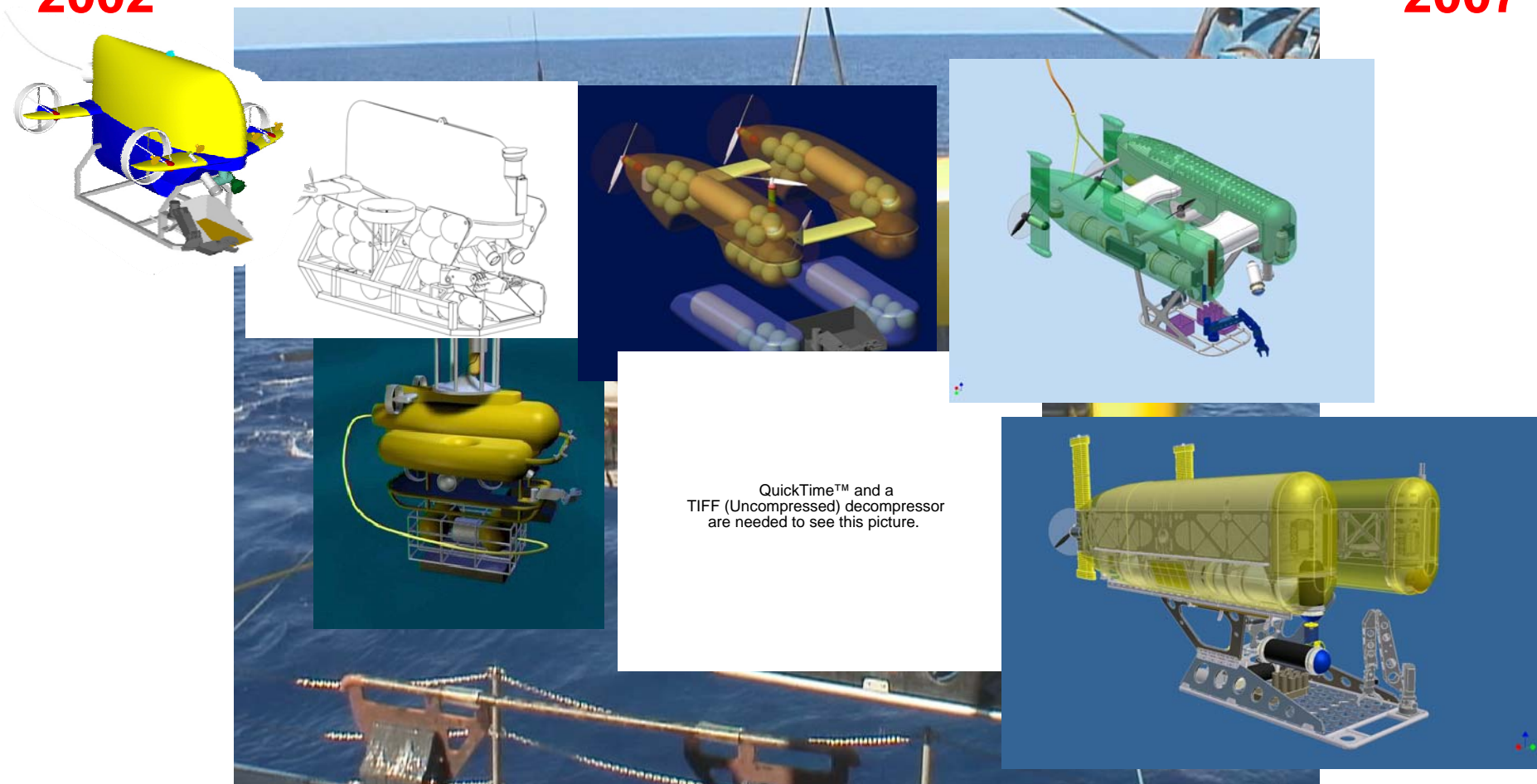


Animation
(2min)

Evolution of HROV

2002

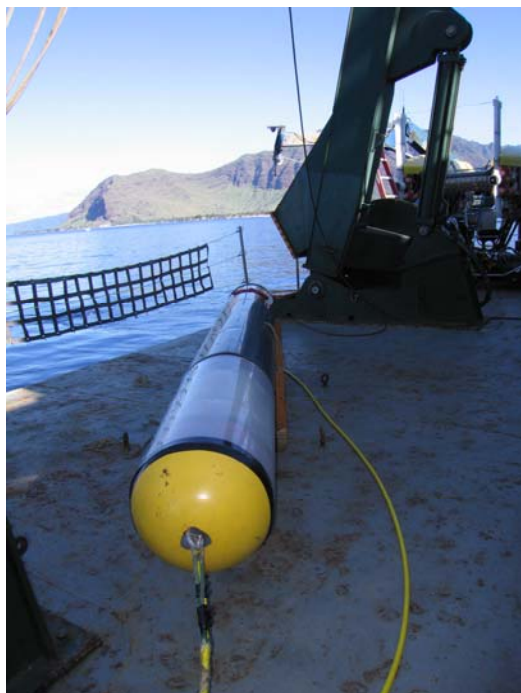
2007



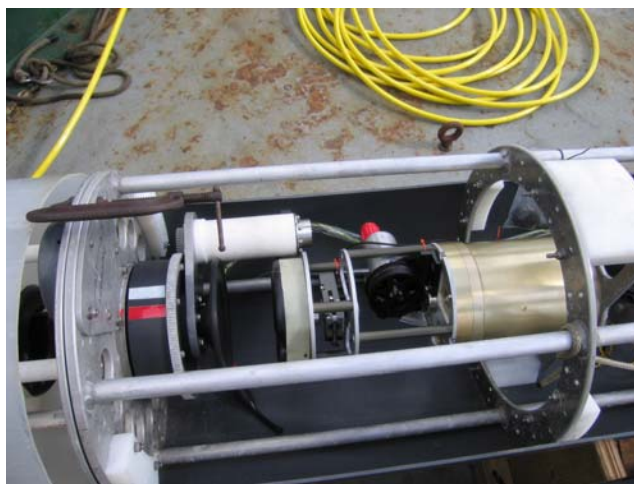
HROV Installation on RV Kilo Moana



Fiber Tether Management



Floatpac/Depressor
assembly

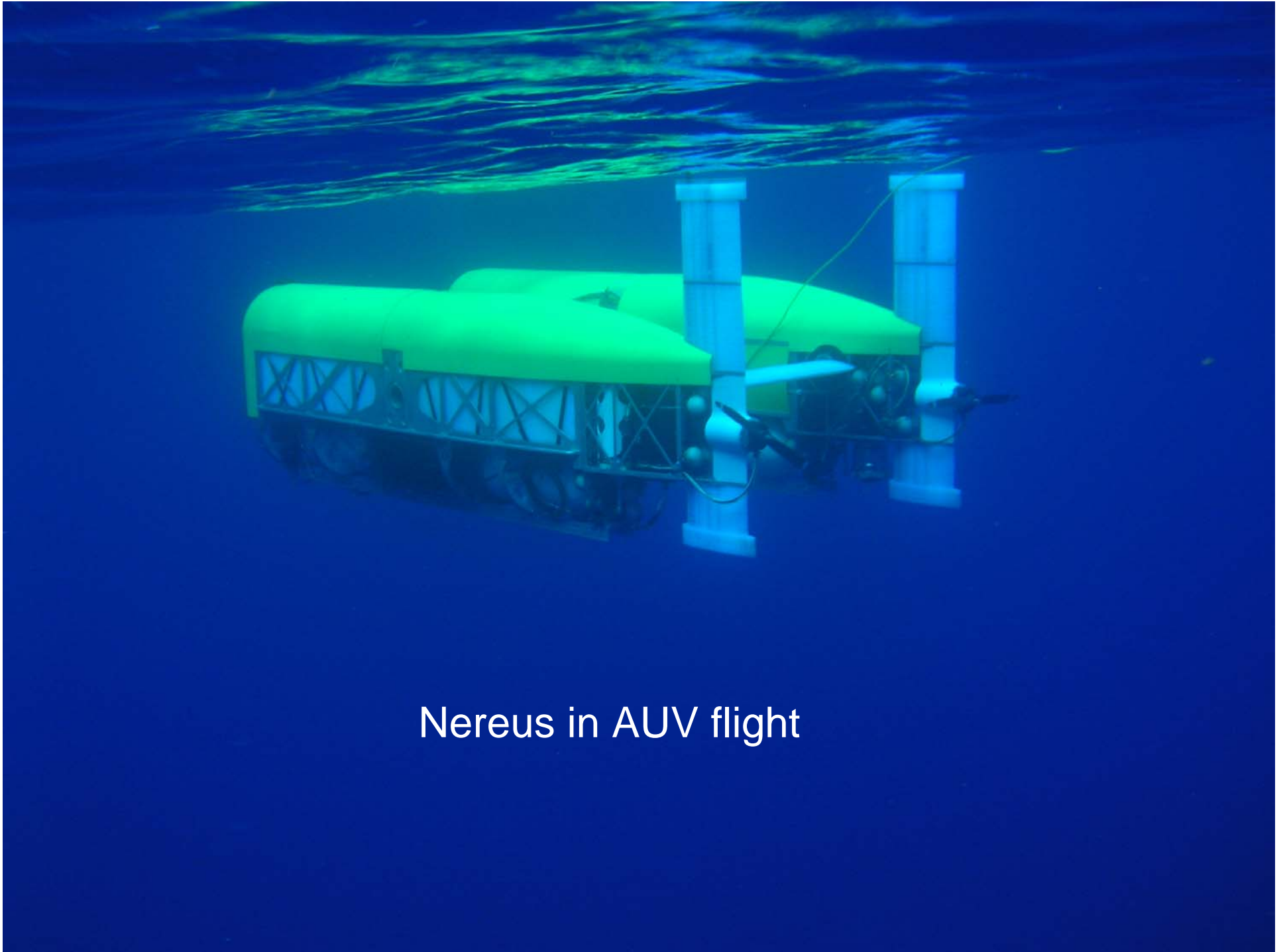


20 KM fiber Canister



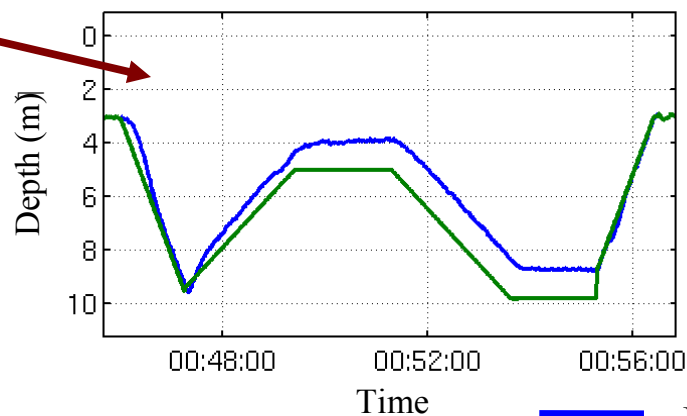
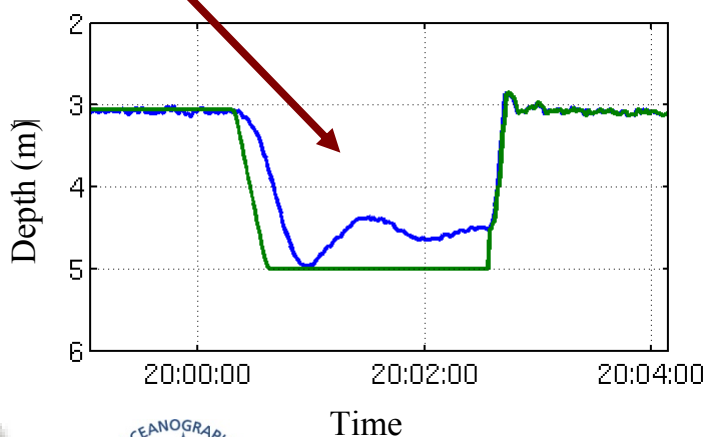
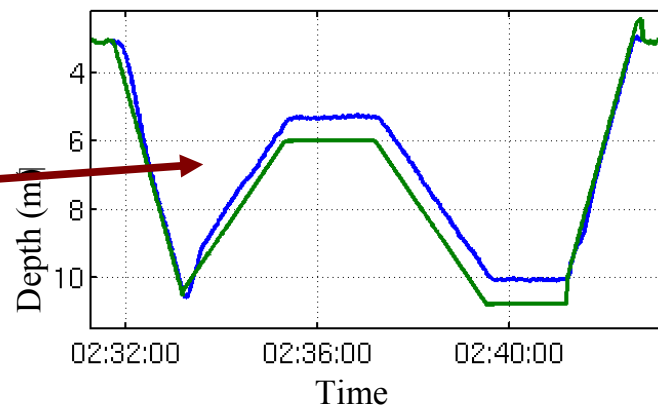
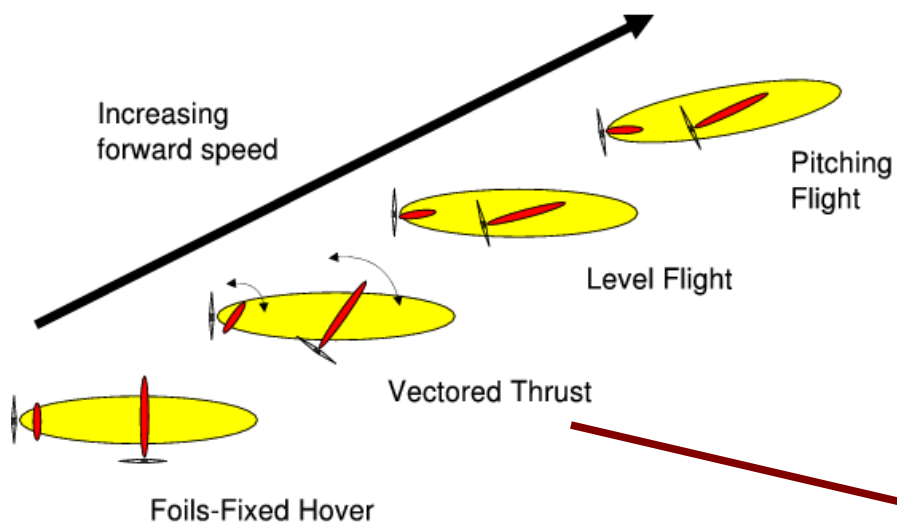
Fiber Tether
Recovery





Nereus in AUV flight

HROV Flight Control

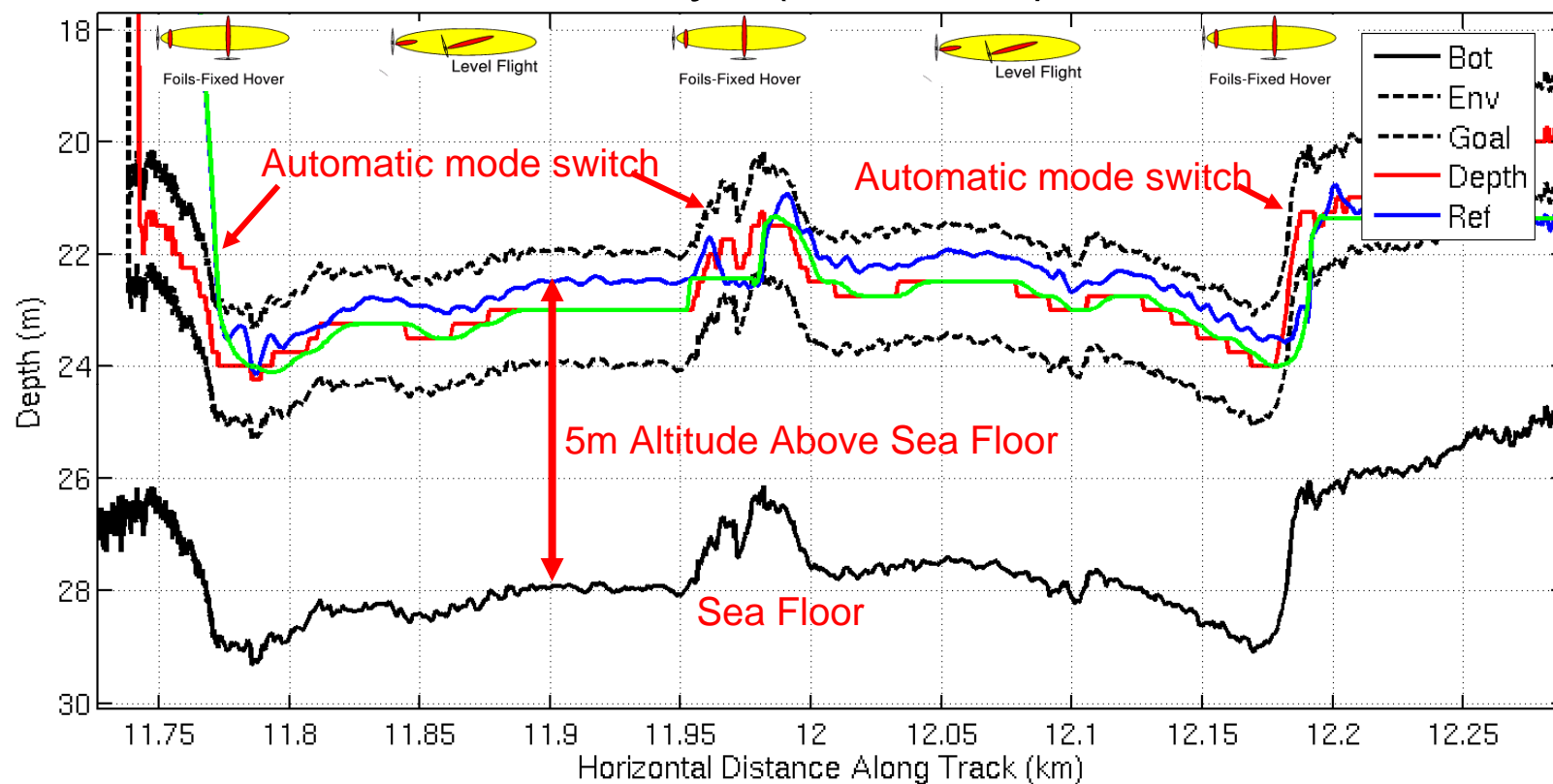


— Depth Reference



HROV Terrain-Following

For optical imaging surveys (~5m) and bathymetric sonar surveys (50-100m)



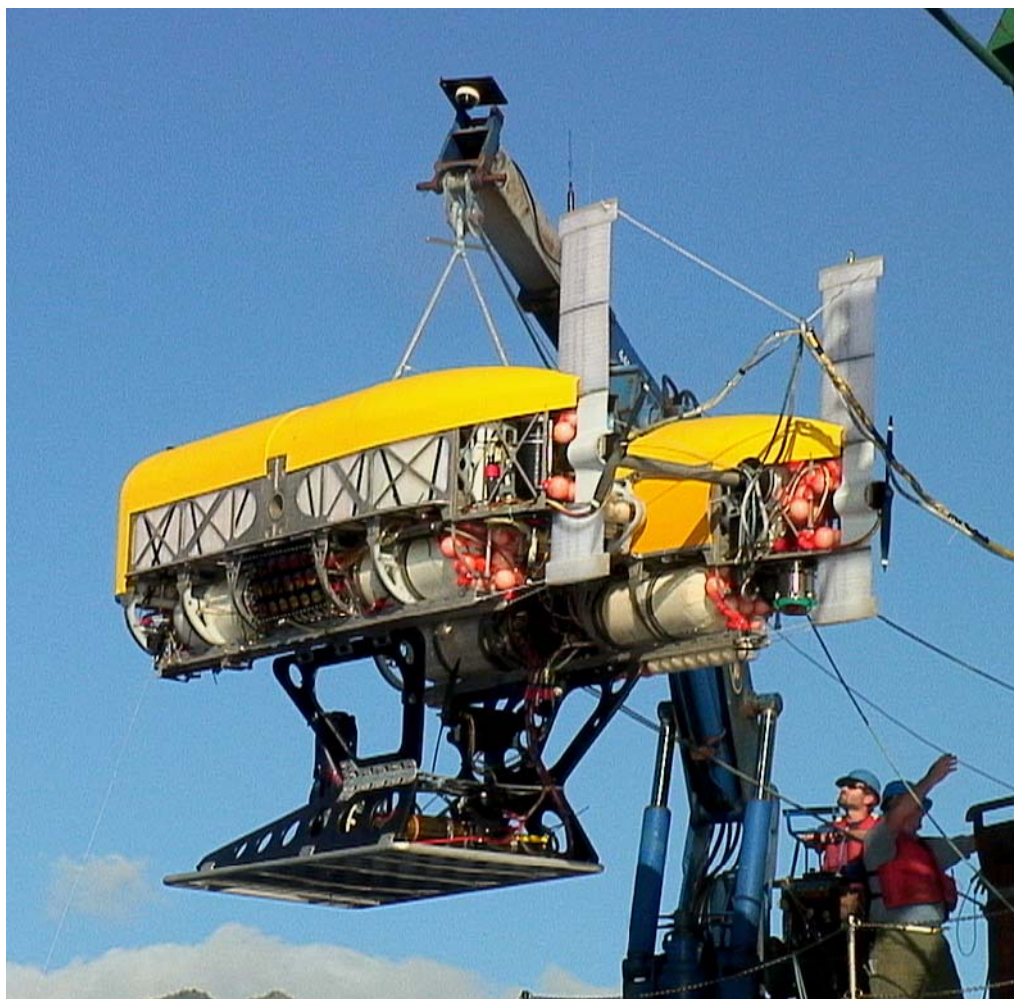
HROV Control and Navigation Highlights

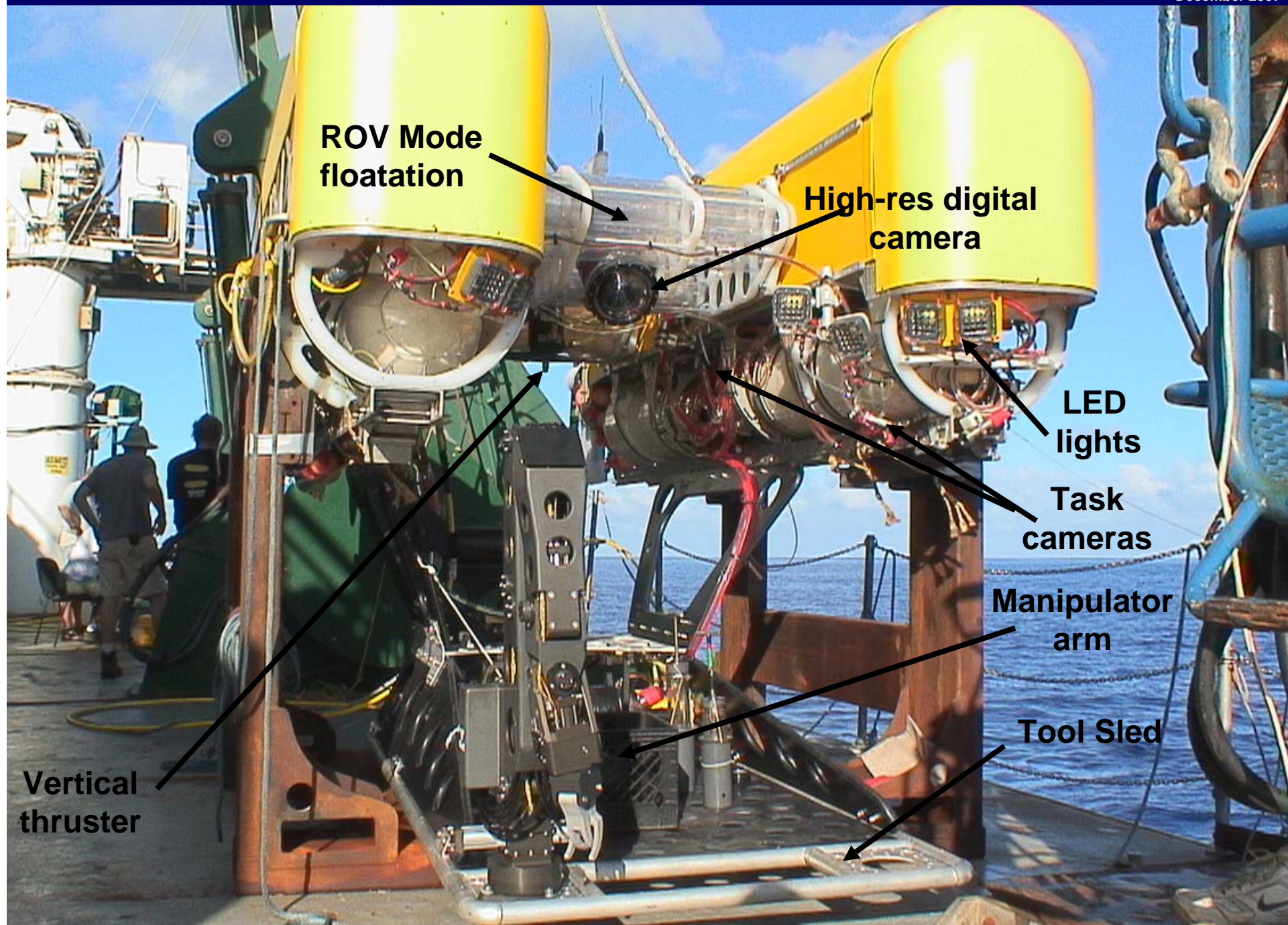
HROV Sea Trials November 2007

- Control:
 - ROV Mode Control: Auto-heading, auto-depth, auto-XY.
 - AUV Mode Flight-Control: Hover, Level Flight, Pitching Flight.
 - Waypoint (leg) navigation for surveys.
 - Terrain following: low altitude (5m +/- 1m) and high altitude (e.g. 50m +/- 5m)
 - Hydrodynamic Performance Characterization of vehicle, control surfaces, and propulsors.
- Navigation: 300 kHz Doppler, Optical gyrocompass, and pressure depth.
 - Autonomous Doppler navigation in AUV-mode.
 - Interactive Doppler navigation in ROV mode.
- Acoustic Communication
 - Real-time uplink of navigation data, vehicle health data, and sensor data.
 - Real-time downlink of commands (e.g. “abort”, start mission X, etc.).
 - Interrogation of standard Benthos LBL transponders for LBL navigation.
- Mission Control
 - Executes pre-programmed high-level missions and responds to sensor input.
 - Launch new missions on command or in response to sensed condition. In ROV-mode monitors fiber tether, executes pre-programmed mission on loss of fiber telemetry.



Vehicle in ROV Mode





**ROV Mode
floatation**

**High-res digital
camera**

**LED
lights**

**Task
cameras**

**Manipulator
arm**

Tool Sled

**Vertical
thruster**

ROV Mode Toolshed

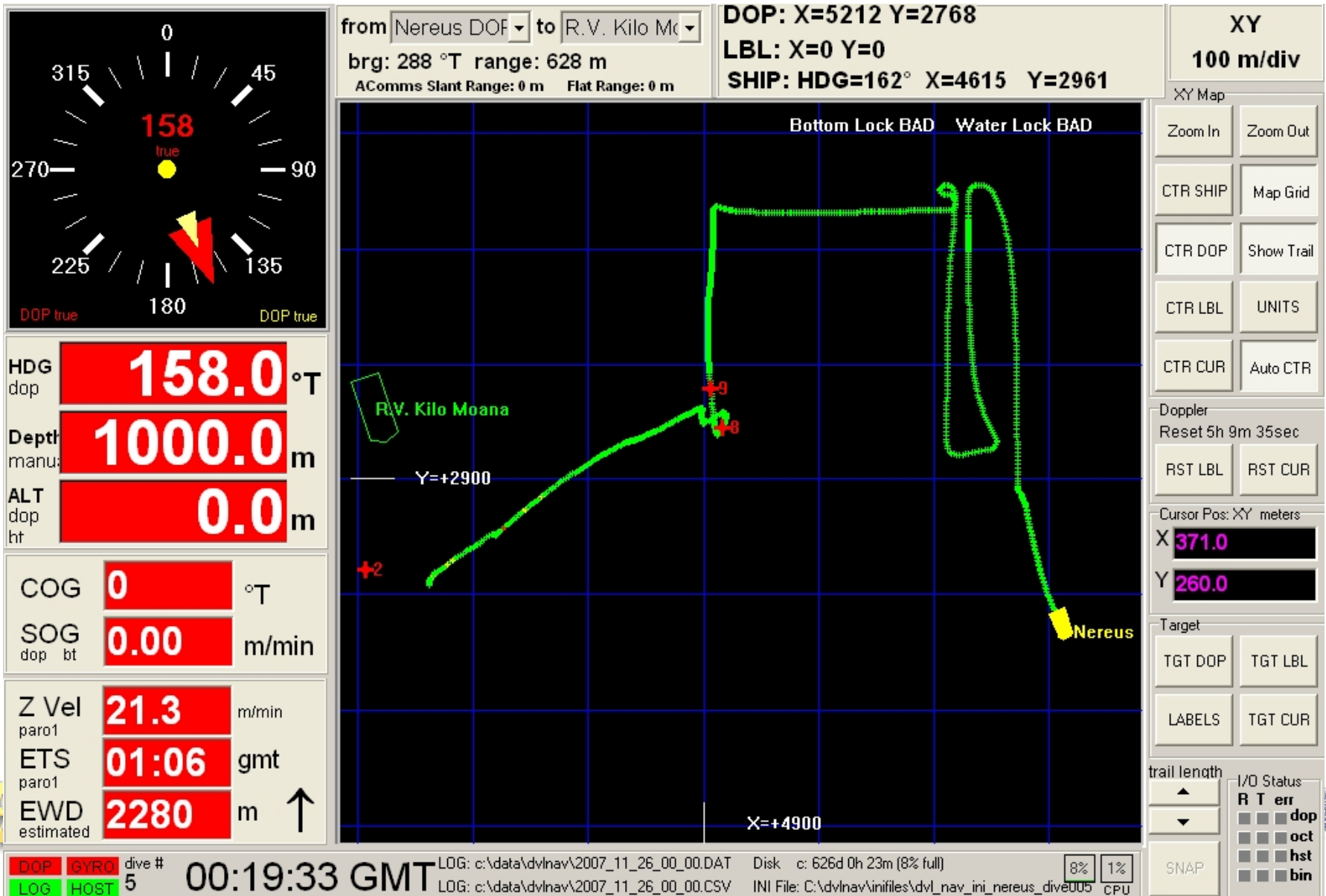


Flyaway Surface Control



Extreme Horizontal Mobility for Sampling and Survey (2.25km covered)

DESSC
December 2007



Nereus Sampling



Movie
(6 min)

Future Science Capabilities?

ROV

- Downlooking imaging capability
- High-resolution (publishable) imagery
- Sample retrieval (elevator) system
- Suction sampling system and biobox
- Temperature probe

AUV

- Color imaging capability
- Sonar imaging capability
- CTD



HROV Demonstrated Capabilities (Nov. 2007 Field Trials)

ROV

- Proven viability of micro-fiber tether
- Sampling (push cores, grabs, and scoops- full manipulator function)
- Near-bottom survey control (transit speed and auto-altitude for surveys)
- LED lighting systems with utility cameras

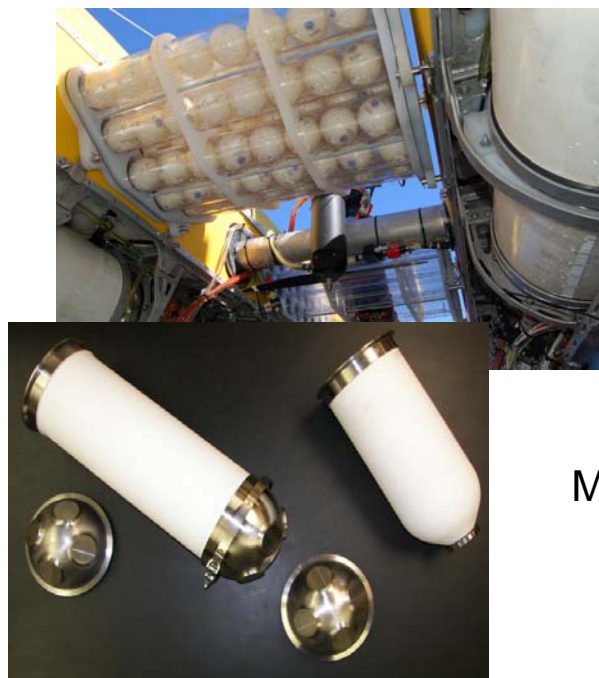
AUV

- Bathymetric mapping capabilities via track-line following
- Bio-Geo mapping via bottom following and survey camera
- AUV user-sensor payload and space (T track and car mounts)
- Data driven response survey capability

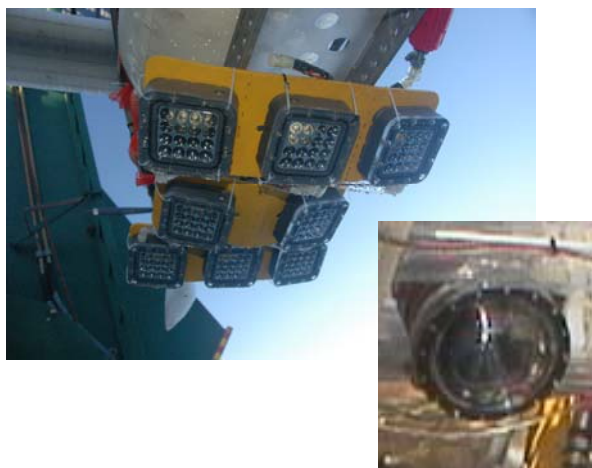


New Technologies Enabling the Nereus System Design

Ceramic Buoyancy
and Pressure Housings



Low Power
High Quality Imaging/Lighting



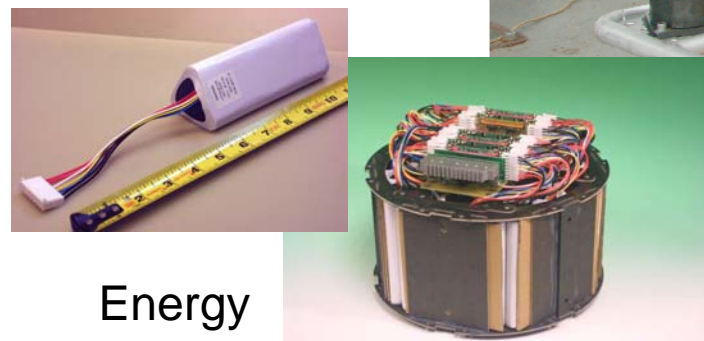
Low Power
Capable Manipulators



Micro-Fiber Tether
System



Energy
Storage



Project Notes

- HROV is an original mapping and sampling vehicle expanding technology and science to 11,000 meters
- HROV- 60% reduction in shipping cost compared to Jason II
- HROV- 40% reduction in estimated day rate compared to Jason II
- HROV technology transfer- Thin Fiber Communication Link, LEDs, batteries, etc. to other submergence systems/applications
- HROV can be effectively operated from non-DP ships (lowering cost)
- Synergistic approaches using two (lightweight/fly away) deep vehicles
- Educational opportunities and broadening experiences for diverse interactions amongst engineers and scientists
- Informal education capability focused on discovery in the most extreme environments on earth



