Airborne Expendable Ice Buoy (AXIB) for Polar Ice Zone Deployment

“Where it came from and where it’s going”

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The AXIB was developed under a NOAA SBIR Phase I and II, Pablo Clemente ‘Colon’, Program Manager

• Must be robust and the form is designed to move rather than being crushed by the shifting ice without regard for orientation. Regardless of whether it is up side down or right side up.

• The sensor mast and barometer are designed to bend 90 degrees in any direction to avoid fracture.

• Multi-season platform constructed of a high strength isotropic composite hull.

• The hull is primarily designed for water deployment then allowed to freeze in.

• Long life Lithium Thionyl Chloride Battery Packs in the lowest point of the hull and thick foam layer above the batteries insulates them from the extreme temperatures and allows the warmer sea water to protect them.

• The original prototypes, deployed in August and September, 2008 survived and reported data for over 4 years.
AXIBs in production
2008: AXIB Prototype Deployed from the USCG Icebreaker Healey
2008: AXIB Prototype Deployed from the USCG Icebreaker Healey
2008: AXIB Prototype Deployed from the USCG Icebreaker Healey
2008: AXIB Prototype Deployed from the USCG Icebreaker Healey On Multi-year ice
2008: AXIB Prototype Deployed from the USCG Icebreaker Healey
2008: AXIB Prototype Deployed from the USCG Icebreaker Healey In Open Water
Air Deployment Test Video, 130 kts @ 300ft
Air Deployment Cone Release Test
Composite Fabrication Process Utilizing VRIM (Vacuum Resin Infusion Molding)
Thermistor Mast With Flexible Spring Mount
MetOcean ARGOS Telemetry Electronics Packages
MetOcean Iridium electronics packages
Configurable/Adaptable Electronics Package Prototype (Iridium/ARGOS)

- Utilizes widely available components
  Large open-source community
- Optimized For Low Power Operation
- Adaptable to a range of sensors
Ice Mass Balance
Buoy Concept
Self Erecting AXIB Buoy For On Ice Deployment
Self Erecting AXIB Buoy Test
NOTES:

1. WEIGHT: ~88 lbs (~40kgs)
2. MAST CAN BE BENT FOR FITTING INTO DEPLOYMENT TUBE.
3. PARACHUTE CAN BE FITTED TO OUTER RING.
4. SENSOR PACKAGE TO INCLUDE AIR AND SEA WATER/ICE TEMPERATURE THERMISTOR AND BAROMETER.
5. CAN ALSO BE CONFIGURED WITH A THERMISTOR CHAIN.

PRELIMINARY
USNA Ocean Engineering
Capstone Design Project

1/C Phil Reynolds
1/C Molly Solmonson
2/C Sharon Bong
Team Introductions

• 1/C Phil Reynolds
  From Island Heights, NJ
  Service Selection: Submarines
  On Varsity Offshore sailing team

• 1/C Molly Solmonson
  Born and raised in Anchorage, AK
  Service Selection: Surface Warfare

• 2/C Sharon Bong
  From San Diego, CA
  Desired Service Selection: Marine Corps Ground
• Design a ocean engineering system
  – Work closely with team members and faculty
  – Utilize USNA facilities to incorporate engineering design, proposal writing, project management, and cost estimation into final project
  – Final oral presentation of design project takes place on April 24th in front of panel of faculty and engineers
USNA Arctic Buoy

- Future plans: place in wave tank at USNA to test in Arctic Ocean wave climate
USNA Arctic Buoy

- **Design Parameters**
  - Launch types: Air, Surface, Land, **Sub-surface**

- **Submarine Certification**
  - Has to meet SeaNav and SUBFOR Requirements
  - Could take 1-2 years for all certifications
Calculations

- Calculate for each instrument and component of buoy:
  - Center of Buoyancy (COB)
  - Center of Gravity (COG)
  - Metacenter
  - Natural Frequency of Roll/Heave
Questions?