Greensea IQ
Intelligent Ocean Solutions

WOODS HOLE OCEANOGRAPHIC INSTITUTION

mROV

UNOLS DeSSC

May 20, 2026

Molly Curran, Andy Bowen
Woods Hole Oceanographic Institution

NDSF NATIONAL DEEP SUBMERGENCE FACILITY

Shout out to team, gsiq and sponsors

DeSSC White Paper

Deep Submergence Science Committee (DeSSC) Recommends Acquisition of a Medium-Sized Remotely Operated Vehicle (mROV) to the National Deep Submergence Facility

16Nov 2022
DeSSC

- Increase **accessibility** to deep-sea research
- Provide **redundancy** for the heavily used ROV Jason
- **Design concept:** Similar capability to **ROV Jason**, but usable on **smaller ships** (especially Regional Class Research Vessels, RCRVs).

Funding for two mROV vehicles

The NSF-Funded vehicle will be operated by WHOI and once it is accepted into the NDSF, it will be requestable through MFP.

The NOAA-Funded (MDBC and OE through the OECI) vehicle will be operated by the University of Southern Mississippi. Priority to MDBC activities but available for NOAA and non-NOAA activities.

Key Personnel, Leadership, and Partnerships

WOODS HOLE OCEANOGRAPHIC INSTITUTION

- Andy Bowen, PI and Director of National Deep Submergence Facility (NDSF)
- Molly Curran, co-PI and Lead Engineer
- Anna Michel, Chief Scientist for Deep Submergence
- Lead Design and build mROVs, Operate NSF-funded mROV

THE UNIVERSITY OF SOUTHERN MISSISSIPPI 1910

- Leila Hamdan, Associate Vice-President for Research
- Operate NOAA-funded mROV

Greensea IQ
Intelligent Ocean Solutions

- Regina Yopak
- John Dunn
- Greensea IQ software and user interface, including vehicle electronics

NDSF NATIONAL DEEP SUBMERGENCE FACILITY

Science Advisory Committee

Chair: Anna Michel – Woods Hole Oceanographic Institution
Roxanne Beinart – University of Rhode Island
Jill McDermott – Lehigh University
Jason Sylvan – Texas A&M University
Amanda Demopoulos – USGS
Jeff Beeson – Oregon State University, NOAA PMEL
Geoff Wheat – UAF / MBARI

NDSF NATIONAL DEEP SUBMERGENCE FACILITY

What are the medium-sized ROVs (mROVs)?

Compatibility with US ARF, RCRVs, and NOAA vessels of opportunity

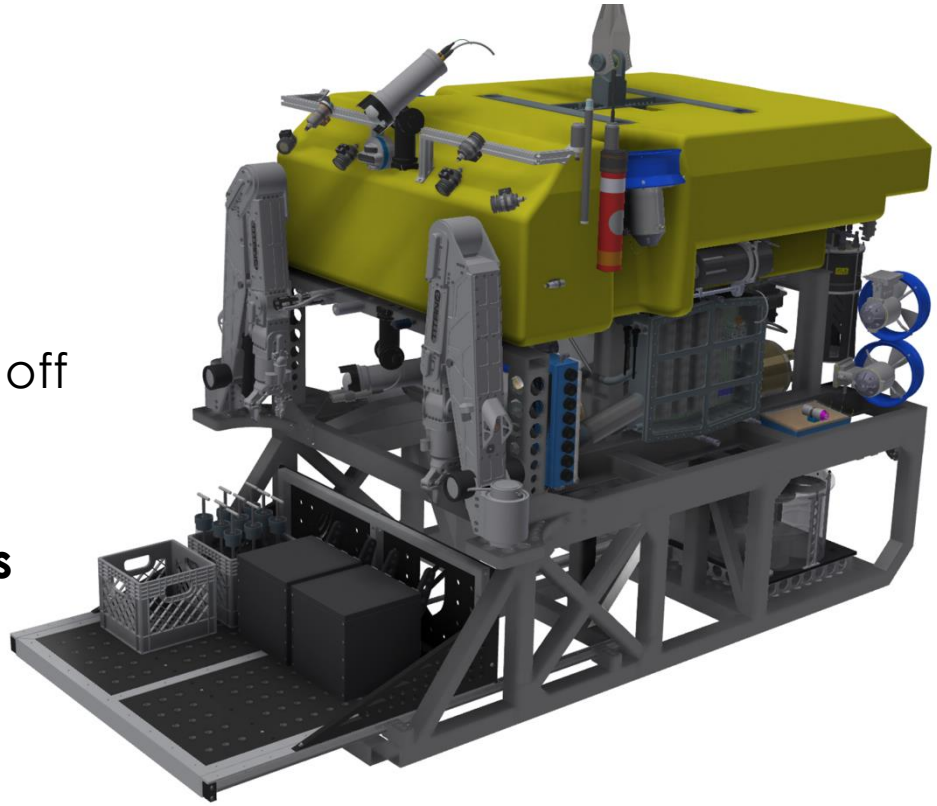
Maximize use of shipboard equipment

Leverage proven designs

- Reusable and modular WHOI/GSIQ supplied components & off the shelf components

Optimized system concept – 30 years of ROV science ops

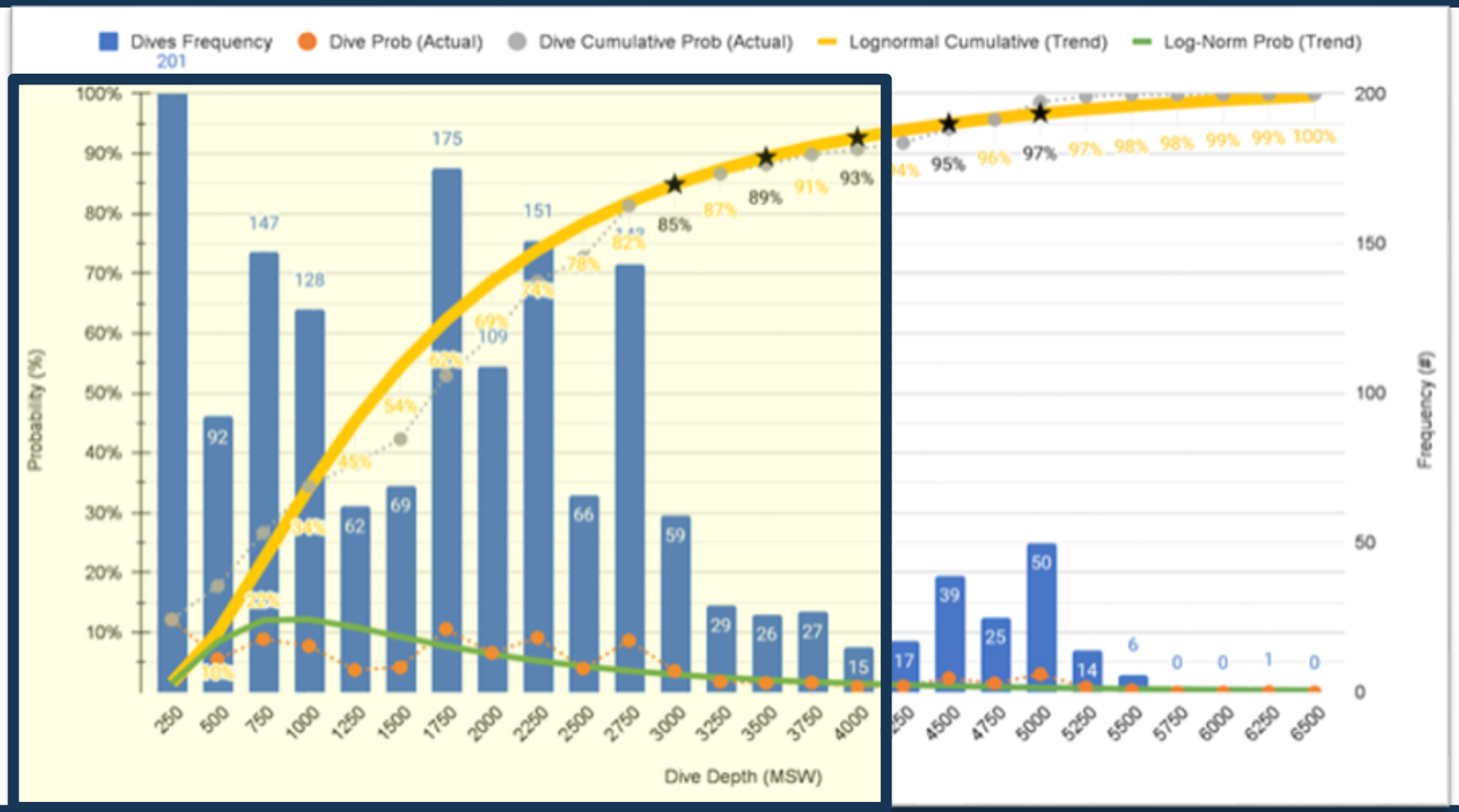
- ~85% Jason capability in reduced footprint
- Reducing operational costs
- Remote operations



Ship Compatibility

- Reduced vehicle size and deck space needs compared to ROV Jason
- Able to operate from small to medium vessels including RCRVs
- Designed for remote operations
- Smaller operations team, data flow to shore, easier access to data, shore-based engineering support

4000m rating can accomplish 93% of ROV Jason work



NDSF NATIONAL DEEP SUBMERGENCE FACILITY

Two Hi-Cube Containers / Vans

Vehicle Shipping Van

- Hi-cube 20’ container for shipping vehicle and docking head
- Can be left on the dock

Tool / Power / Server Rack Van

- Hi-cube 20’ container
- Needs to be on board for ops

Logistics

- 1-2 Trucks (weight will likely drive need for 2 trucks)

Design Overview

Size, weight, and depth

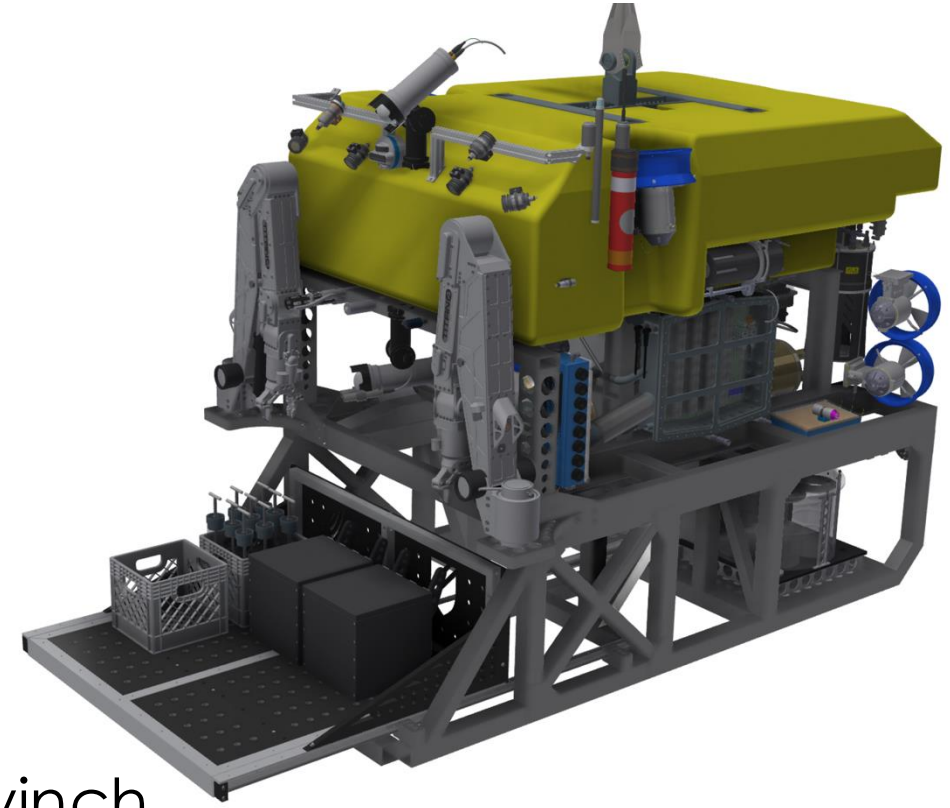
- 4000m rated
- 85% physical size of ROV Jason
- ~7000lbs

Payload

- 300lbs wet, ~900lbs dry

Launch and recovery

- Single body
- A-frame - using ship's 17mm EOM cable and winch
- mROV docking head for safety and ease of operations



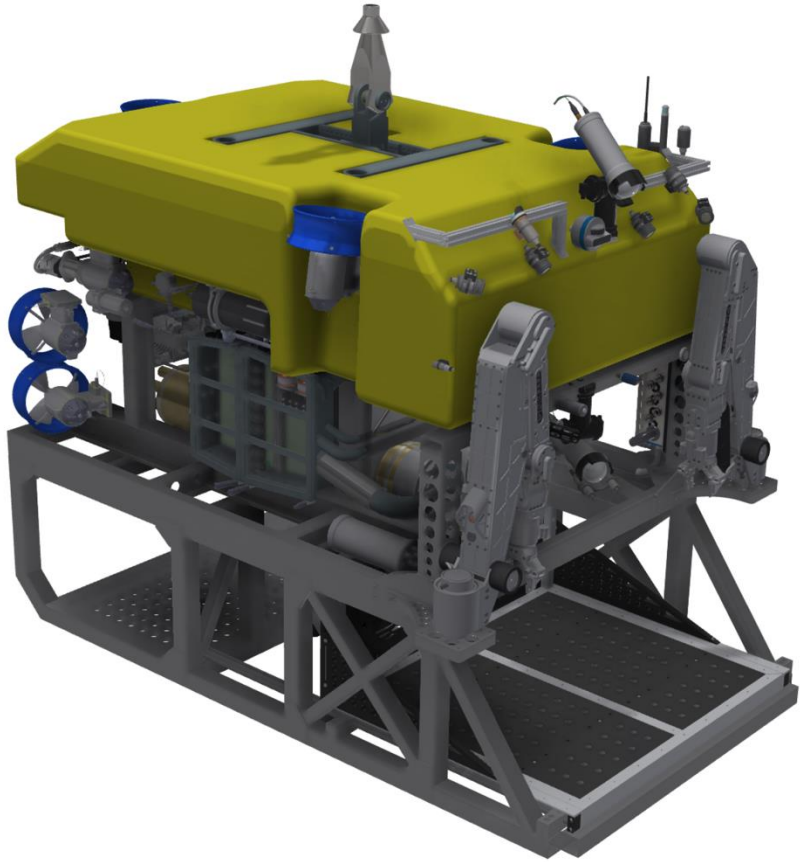
Partnership with GSIQ

- Commercial partnership, readily scaled outward
- Open architecture collaboration (OPENSEA software)
- Systems Engineering expertise
- Customizable ROV electronics, control software, and topside interface solutions
- Turn-key reliability of a commercial solution with the adaptability and configurability of a science-driven research ROV

Greensea IQ

Science sensors and sampling payload

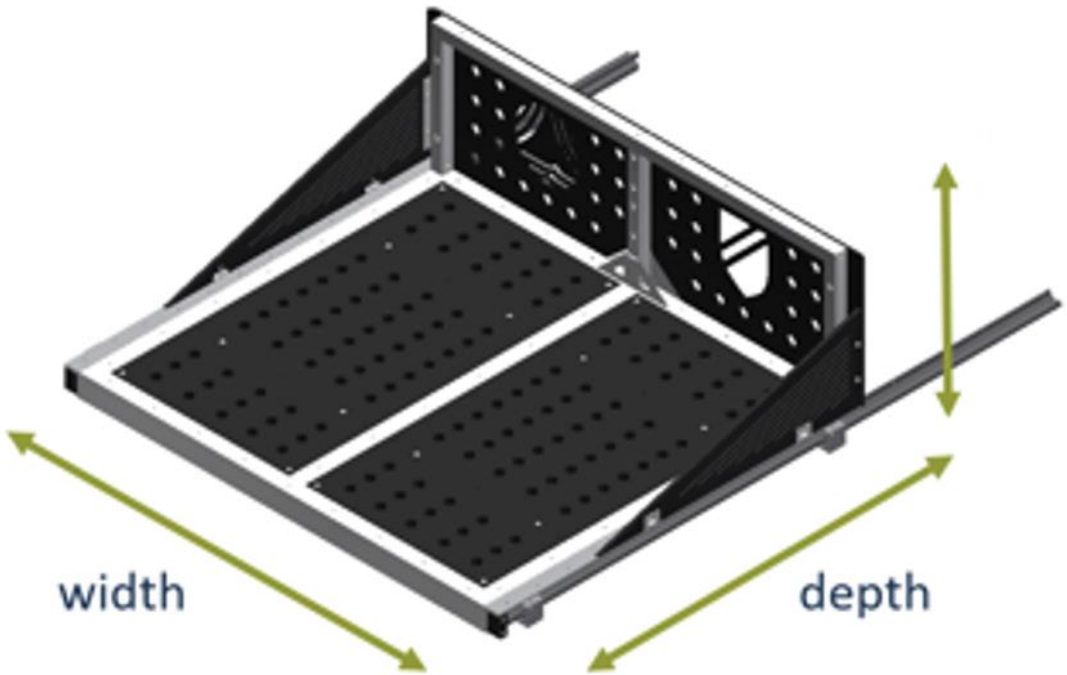
- **CTD** (Seabird SBE 49 FastCAT)
- **Sound Velocity** (Valeport miniSVS)
- **Oxygen Optode** (Aanderaa)
- **Temp Probe** (WHOI-NDSF Design)
- **Magnetometer** (APS 22-bit 3-Axis Fluxgate)
- **Multi-chamber suction sampler**
- **Bio-boxes**
- **Push Cores**
- **Power, communication, and hydraulic ports** for auxiliary sensor and sampling integration



What can science expect?

- Two 7-DOF **manipulators**
- No swing arms
- **Basket**: 56” x 46” x 23”

  ROV Jason basket area: 58” x 37” x 23”



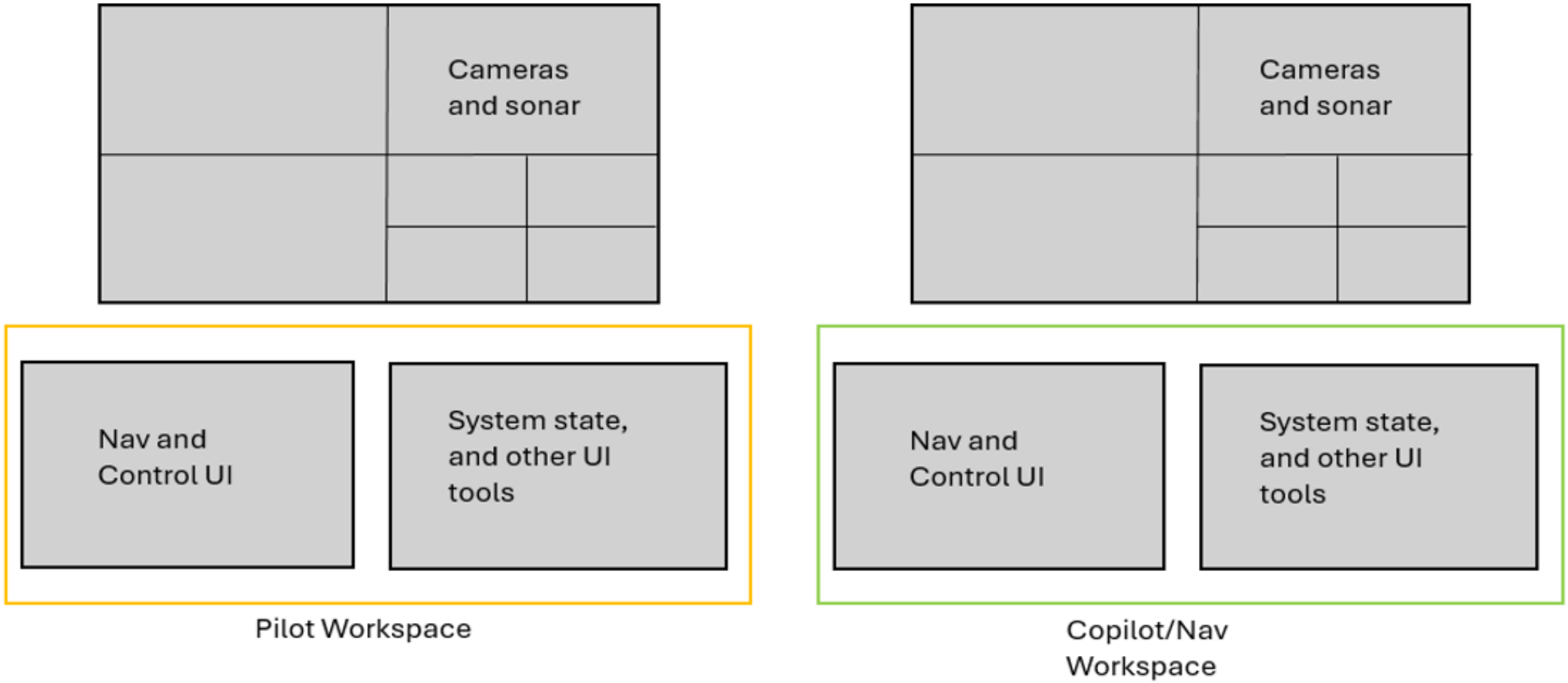
- **Aft Science Bay**: 36” x 24” x 65”

  Fits all aft bay equipment previously installed on ROV Jason

Lighting and Imaging

- **Imaging sonar** (Blueprint Oculus MD750d)
- **4K Camera** (Insite Pacific Mini Zeus 4k)
- **HD/SD Cameras** (DSPL Multi Seacam)
- **Pan and tilts** (ROS Accu-Positioner)
- **Scaling Lasers** (SubC Imaging Mantaray)
- **Lights** (DSPL LSL-2000)

No control van → Operation in the lab



Progress Update

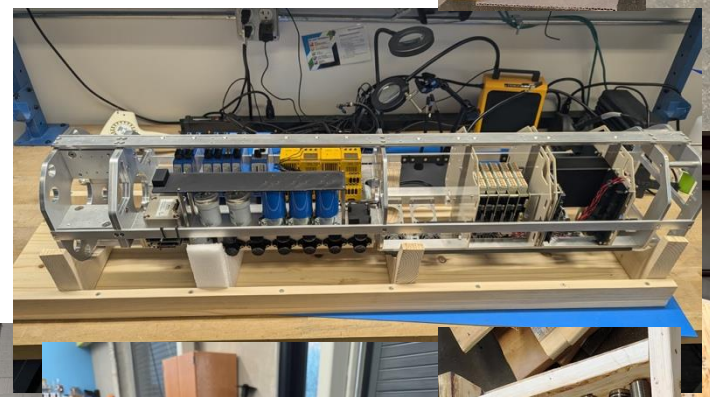
- Critical design reviews complete
- Drawings of major systems out for fabrication
- Most(if not all) major components purchased, many in hand
- Testing components and integrating software as components arrive

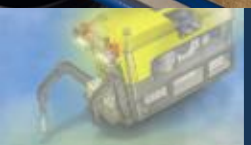
Timeline

- June - July Vehicle Assembly / Testing
- Late July Dock Testing
- August NOAA Sea Trials
- September NSF Sea Trials





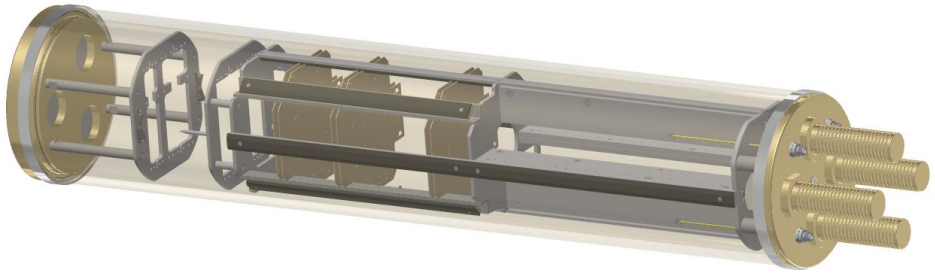



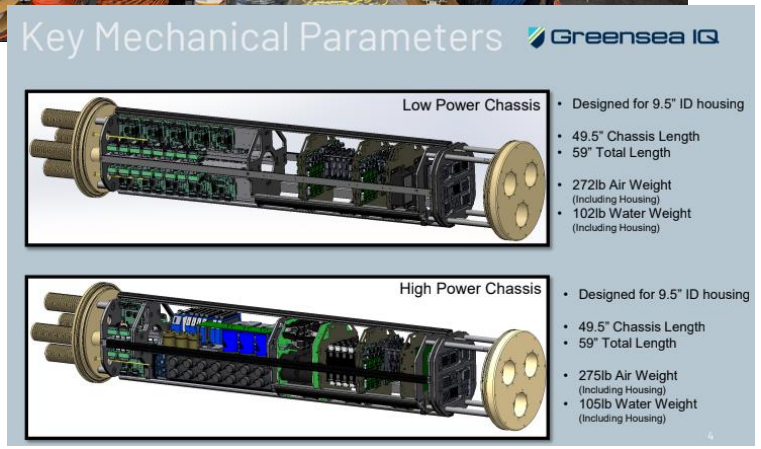



NDSF NATIONAL DEEP SUBMERGENCE FACILITY

Electrical

- Chassis Assembly and QA:
  - Working through wiring redlines
  - V&V for mechanical assembly completed
  - Note: cradles will travel with system
- Pilot console: out for manufacturing
- Weatherboards complete & installed
- All wiring (external to housing) in hand
- Finished ordering jbox parts – most in hand (wagos, terminal blocks, din rails, etc)
  - Will begin mocking those layouts up soon.
- Finalizing documentation for building up wiring harness.
- PDU power up testing complete
- Second Telemetry unit arrived and tested
- Contactor and load resistor testing underway



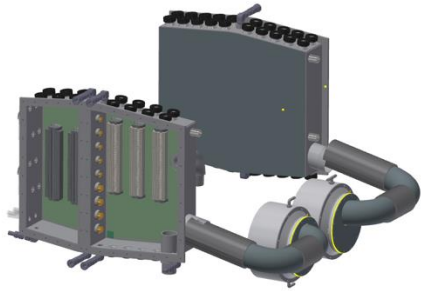


Software/Data/Networking & OTH

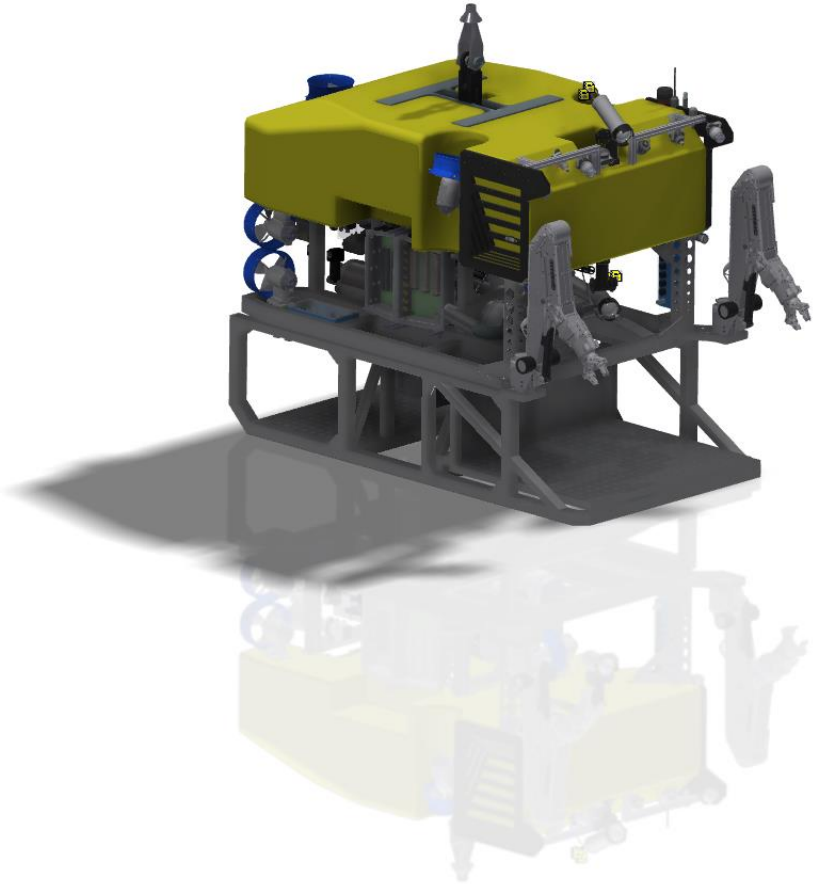
Integration Focus

- Device interfaces: wrapping LCU integration, situation light integration, wrapped telemetry integration until assembly testing
- Power management schemes:
  - Design and implementation complete for hydraulic side until assembly testing
  - Working on design for electrical side
- Data and networking: networking design complete, implementing on hardware (for both shipside and shoreside)
  - Items out for configuration (both wired and wireless)
  - Remote access to them set up for testing
- Telemetry: implementation complete until chassis integrated into vehicle
- OTH: LTA design implementation underway
- Navigation: implementing design that supports multiple nav solutions

Mechanical



- Hydraulic design complete
- Oil compensation complete except for compensators (vendor delay)
- Weight and balance macros and spreadsheet configuration complete.
  - Huge step and critical milestone for overall vehicle design.
- Foam refined based on weight and balance final drawings at the vendor
- Component placement refinement based on weight and balance
- Transformer layout finalized and in fabrication
- Preliminary bullet design complete & presented to CLARS
- Frame nearing completion
- Science basket and lower frame in fabrication
- Hydraulic system control manifold at vendor for machining
- Much more!



Mechanical

Housings

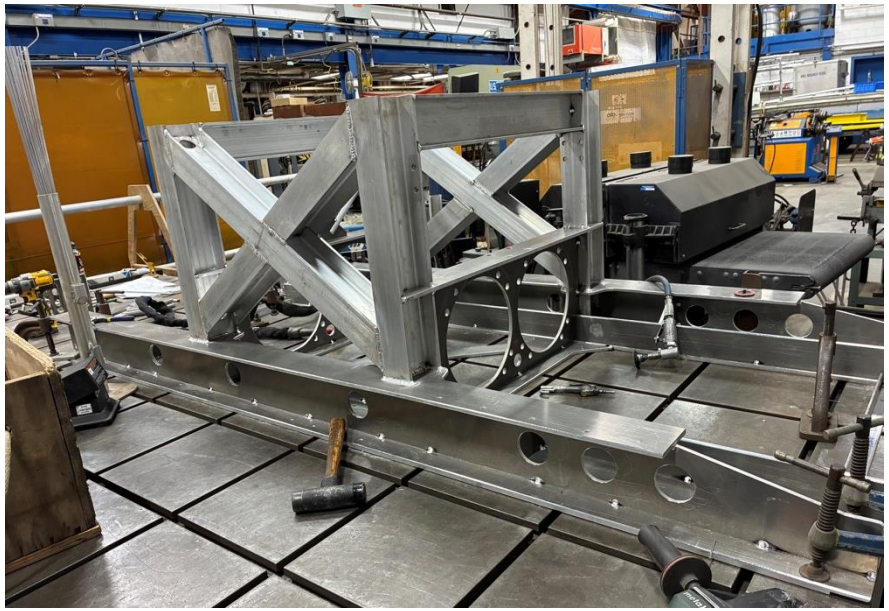
Endcaps

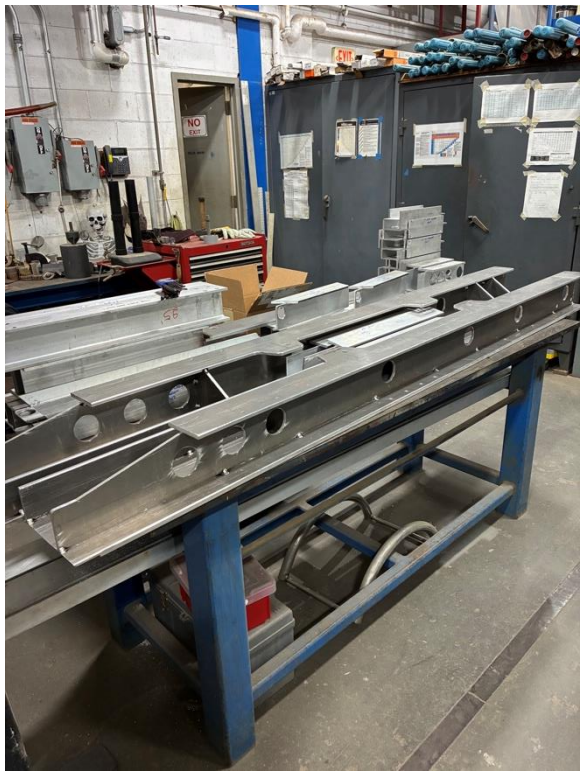
Foam

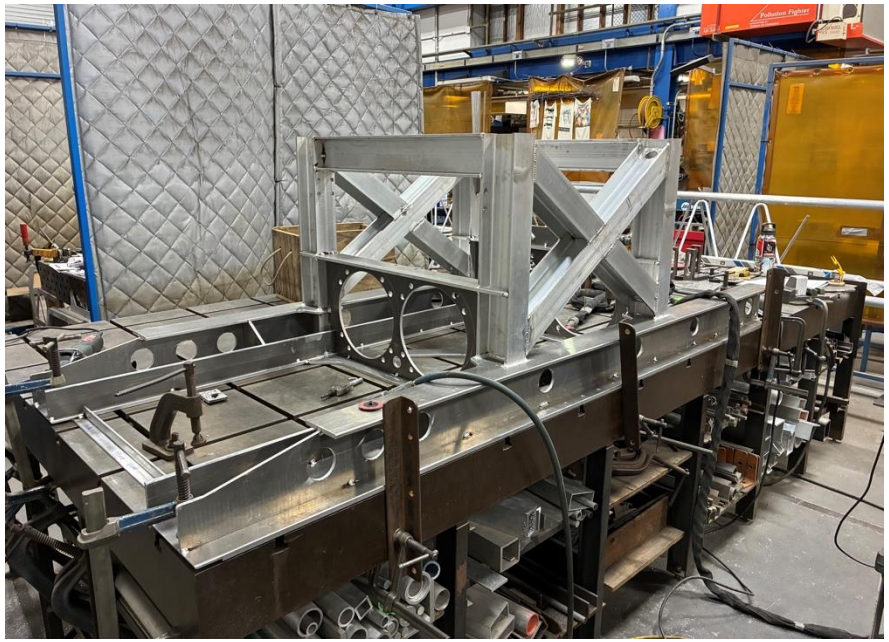
Main Housing penetrators

Mechanical

Main Frame







Basket

Tool Skid

Mechanical

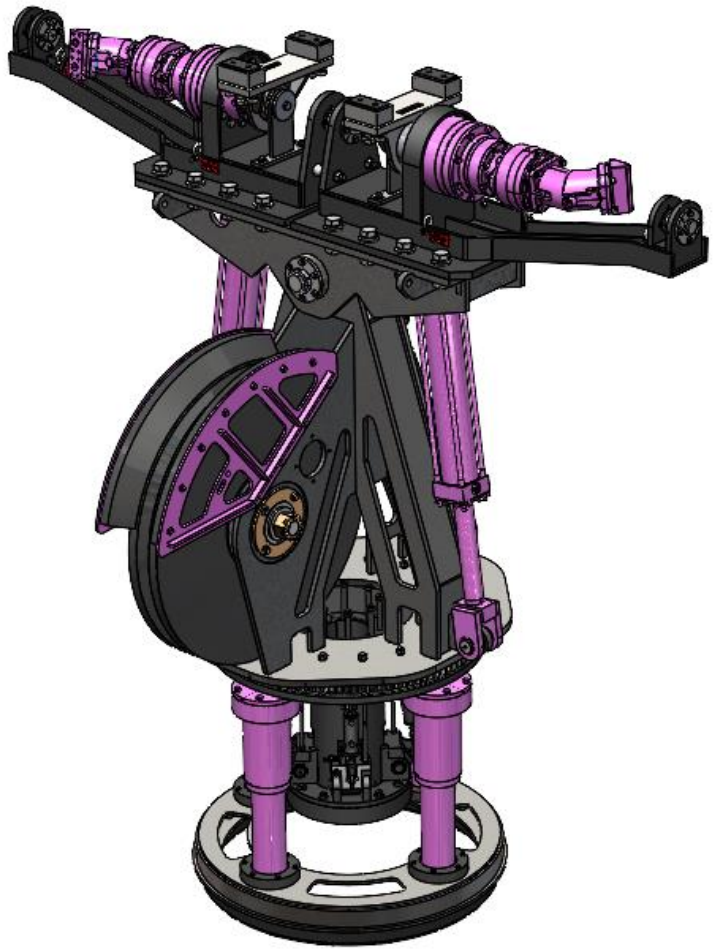
Manipulator Testing

Vans

- *MROV Power/Storage Van is progressing well. PDU and Server Racks will be integrated at WHOI in June.*
- *mROV Vehicle Van is at WHOI's Deep Tech Building. Currently serving as project build storage space*

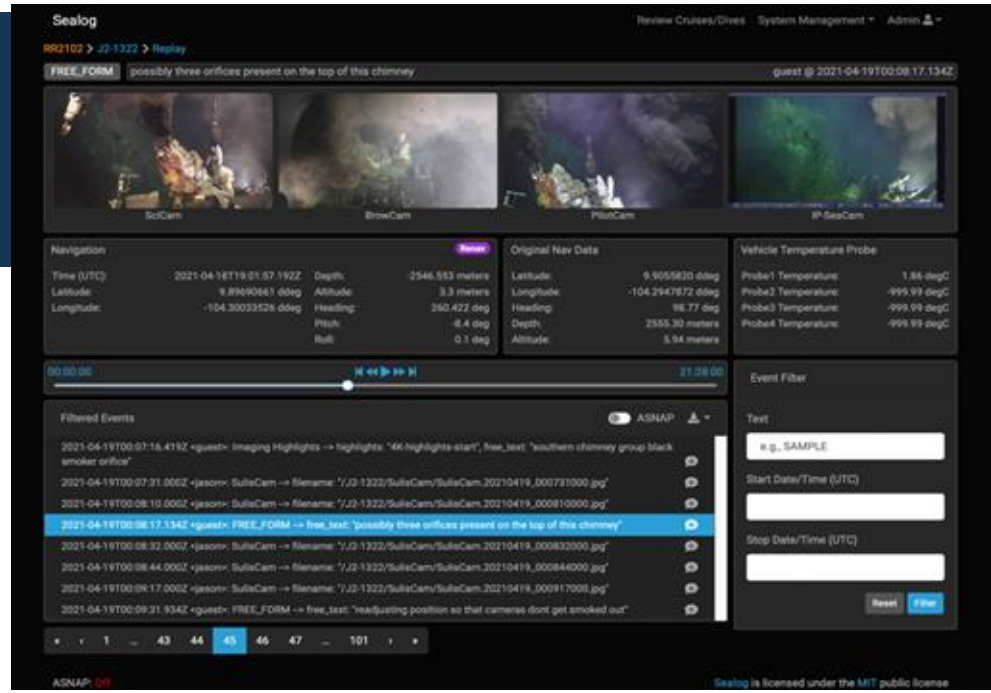
LARS

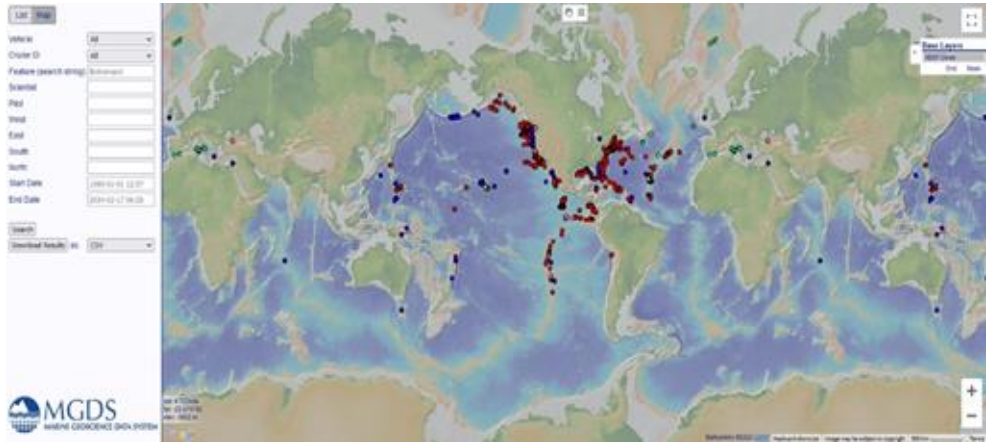
- Design Accepted – have a path fwd for deployment and use on the Foster
  - Mitigates the need for detailed FEA on Foster aframe
  - New design does not apply torque to aframe crossbeam (adjustable).
- Yes, it really is pink.
- Continue working closely with RCRV team, Glosten team (RCRV engineering group), Nancy Foster team, Armstrong team, and C-LARS team.
- Working on Nancy Foster winch solution with USM
- Working with Nancy Foster crew



NDSF Data Package

- Real-time automated vehicle and navigation logs, raw data collections, user events, vehicle video, video stills, and post-processed products
- Built to NDSF data package standards
- Focus on data access to the community
- Standardized content across vehicles





Timeline to operations

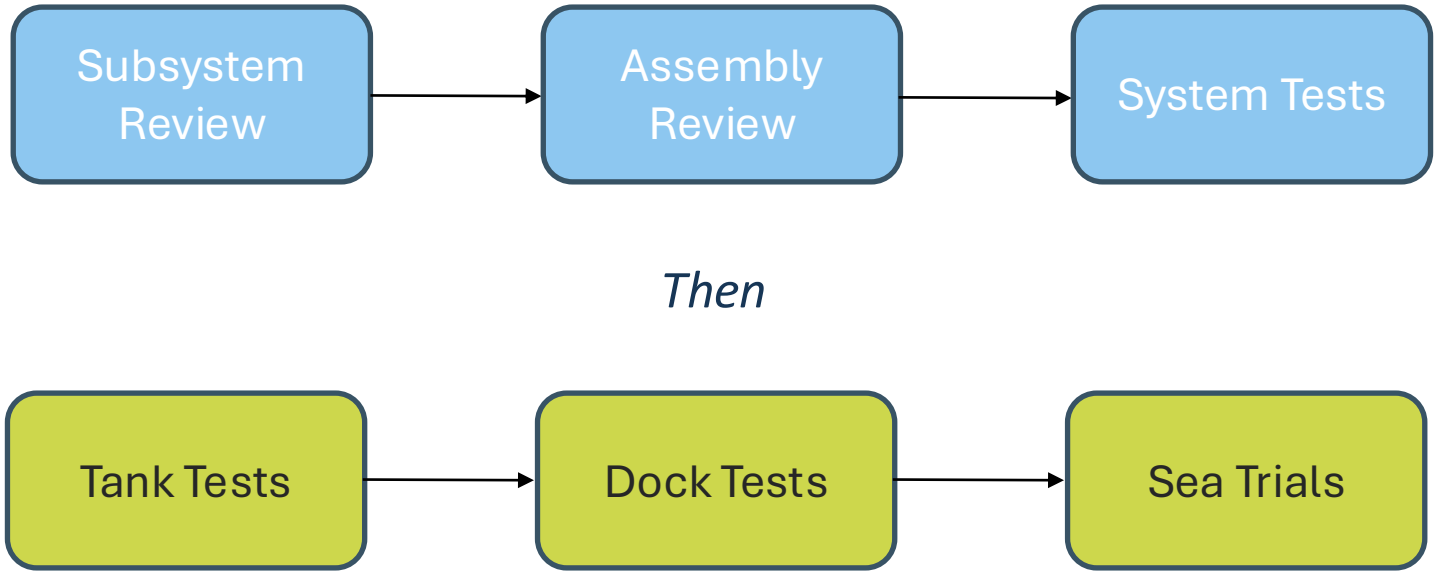
- Build and Assembly On-going
- NOAA Sea Trials and Science Verification Expedition (Aug/Sept) 2026)
- NSF Sea Trials (September 2026)
- NSF Science Verification Expedition (Q1/Q2 2027)
- DeSSC Meeting May 2027
- Available for science (~Q3 2027)

NDSF NATIONAL DEEP SUBMERGENCE FACILITY

Systems Engineering

- Updates

- Assisting in topside rack assembly in DeepTech
- Assisting with chassis redlines and QA
- Implementing and reviewing test states for entire system:



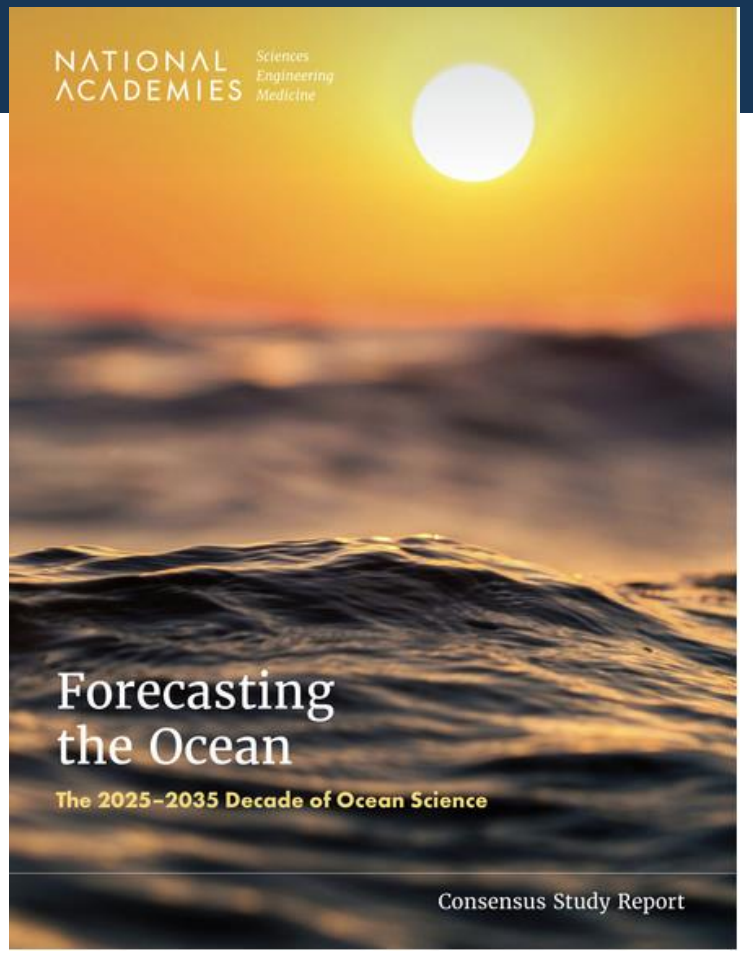
Important Components Purchased (Big Picture)

- Manipulators
- All hydraulic components
- All oil compensation components
- High risk & long lead item chassis components
- Long lead cables and connectors
- All cameras and lights
- All navigational sensors
- All science sensors
- Most remote ops and topside components
- *The telemetry system*
- *The buoyancy pack*
- *The electrical chassis (mechanical bits)*
- *The Launch and Recovery System*
- *The power distribution system*
- *The transformers*
- *Thrusters*

2025 Decadal Survey

"decreased number of vessels in the ARF, along with ***sustained demand for deep-submergence vehicles****, has meant that some scientists wait 4 or more years to see their expedition realized."*

"a persistent and ***growing interest in using ROVs*** *and AUVs* ***in the coastal and nearshore environment****, but NDSF assets are often oversized for use in these locales and on regional vessels"*



2025 Decadal Survey

"NDSF's ongoing efforts to develop the midsize ROV need to be supported"

*"Expand the array of assets available to users, including **lower cost ROVs** and AUVs for **deployments on coastal and regional vessels** (i.e., used in nearshore and coastal regions)."*

*"Expand the scientific footprint of each HOV, ROV, or AUV dive by **enhancing remote science capabilities** and the inclusion of autonomous assets that can work alongside the vehicles and perhaps be deployed simultaneously."*