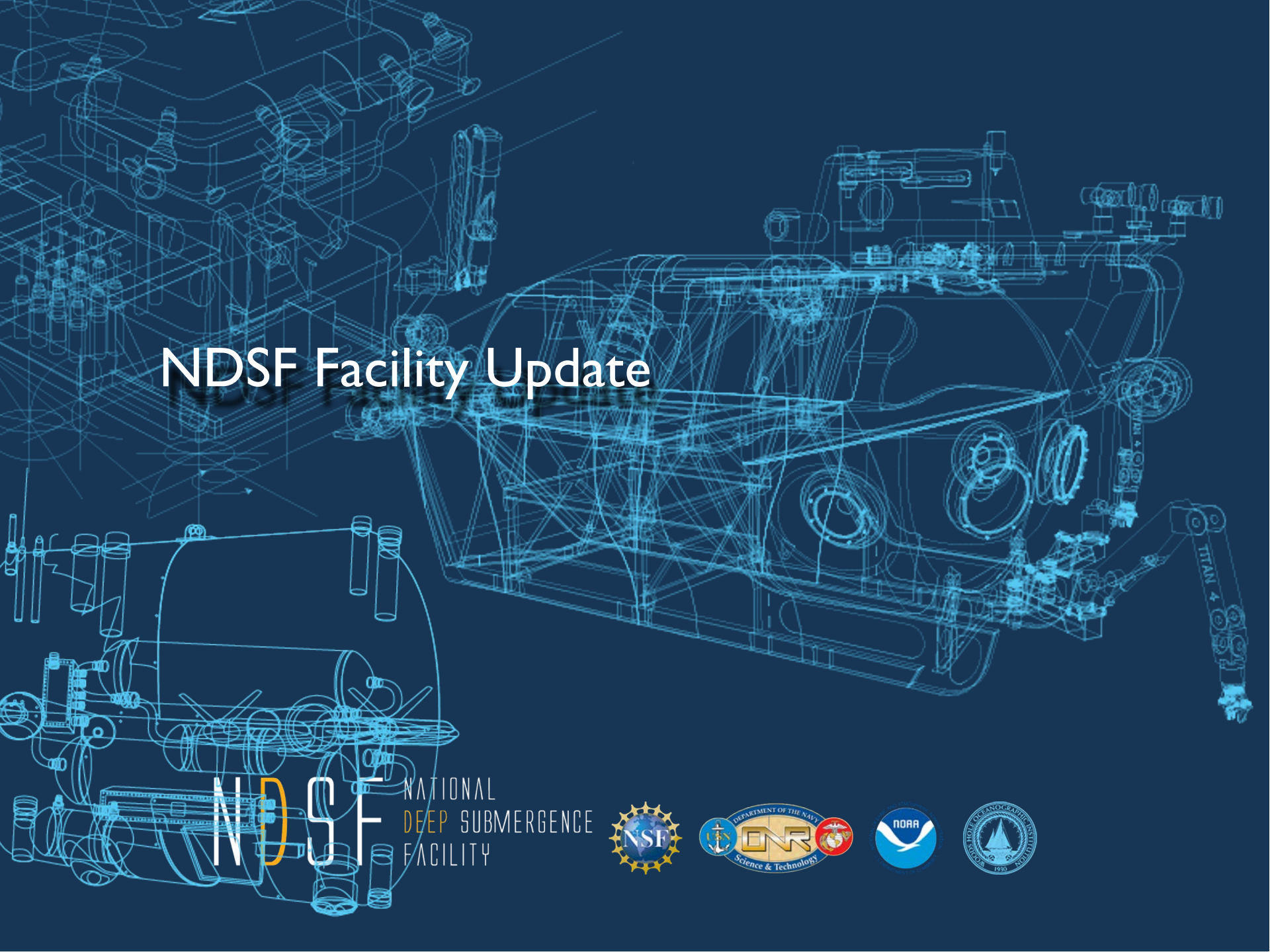

NDSF Facility Update
NDSF
NATIONAL
DEEP SUBMERGENCE
FACILITY
NSF
DEPARTMENT OF THE NAVY
ONR
Science & Technology
NOAA
TITAN 4

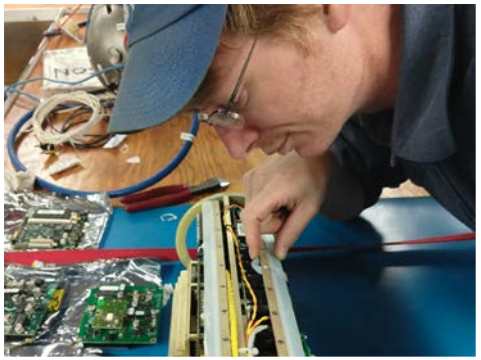
Sentry Staffing Update

Active Team Members

Sean Kelley - program manager
Justin Fujii – Completed first cruise as EL
Zac Berkowitz – At sea electrical support/EL
Stefano Suman – At sea software support
Mike Skowronski – At sea and on shore EE support
Isaac Vandor – continued software support Software engineer
Mike McCarthy – Fill in mechanical help

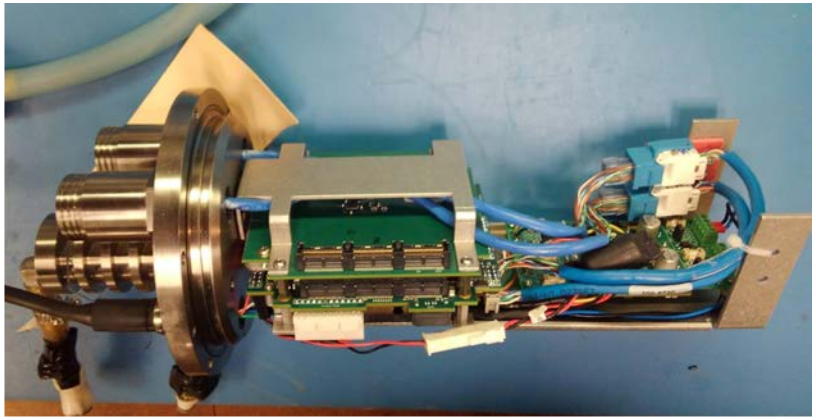
New Hires

Amanda Sutherland – Mechanical engineer
Joseph Garcia – Software engineer

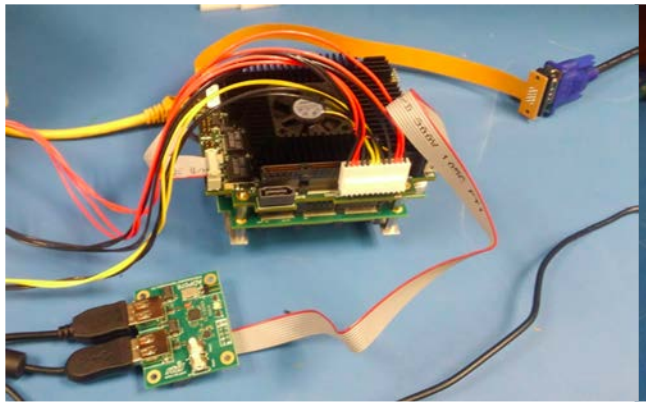


Datapod Upgrade

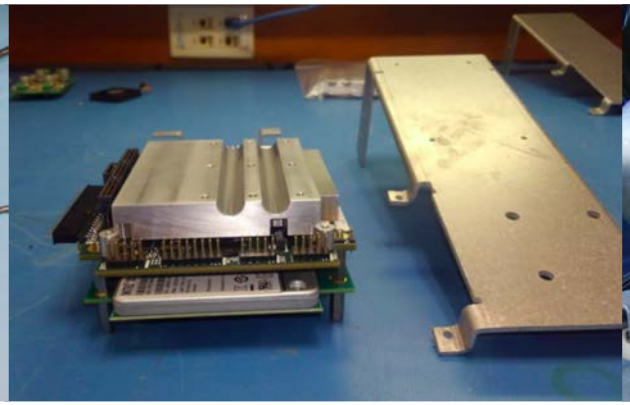
- 10 times CPU performance
- 8 time more RAM
- Easier to spare as it is now identical to main stack
- Replaces 6x 1TB mech. Disks with 1 4 TB
- Free'd up 50% of housing for additional equipment
- Lower power consumption
- Upgraded OS distribution



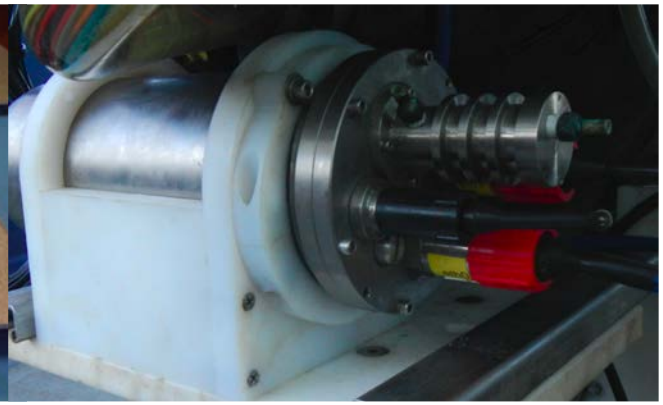
Datapod built summer 2020



OS installation



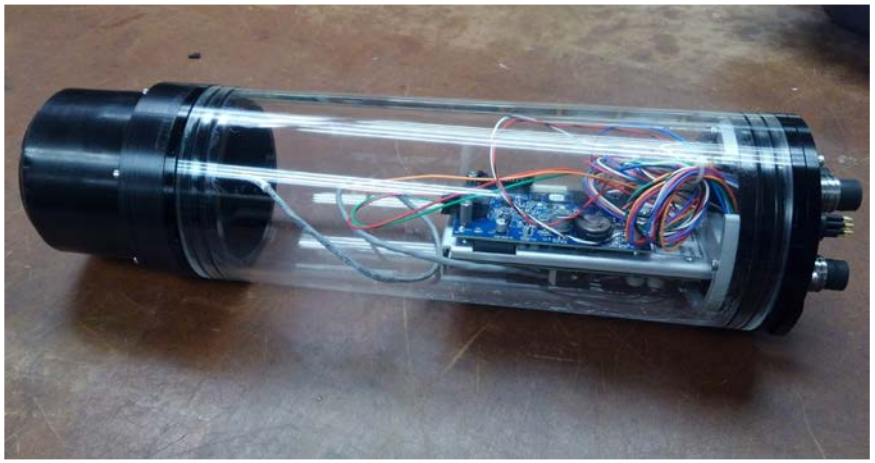
XR Electronics Design Progress



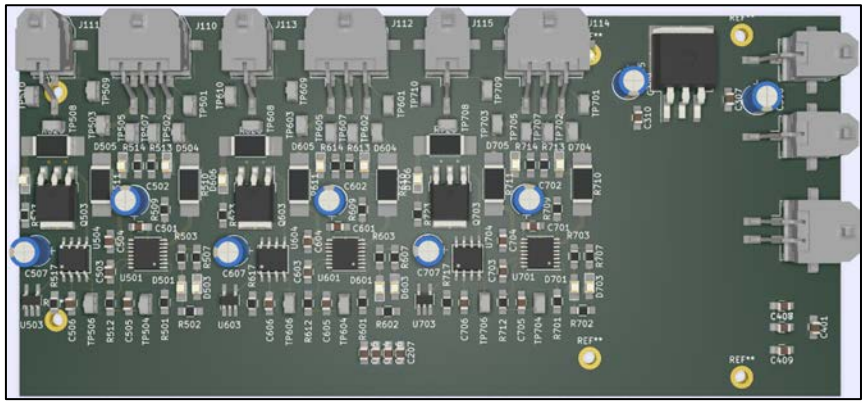
Legacy hardware on the AUV

Sentry XR Upgrade

- **Replacing End of life hardware**
- **Added modem capability's 15kb/s capable modem**
- **Lighter weight**
- **Newer electronics technology**
- **Release weight sensing**



Test housing Design

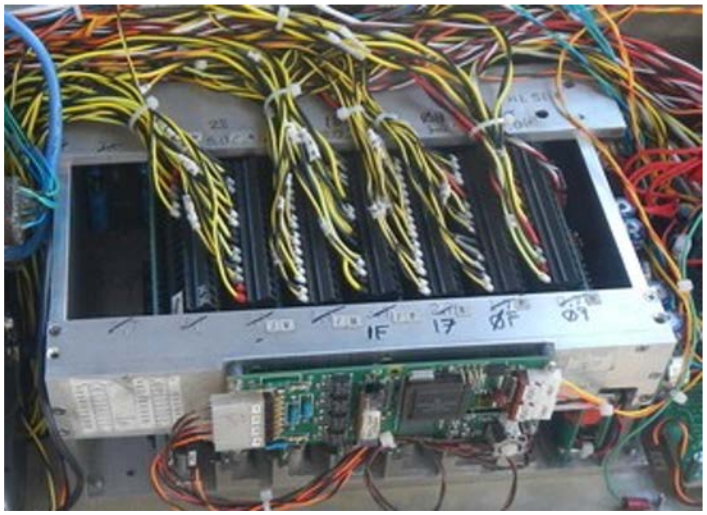


Electronics and PCB Design

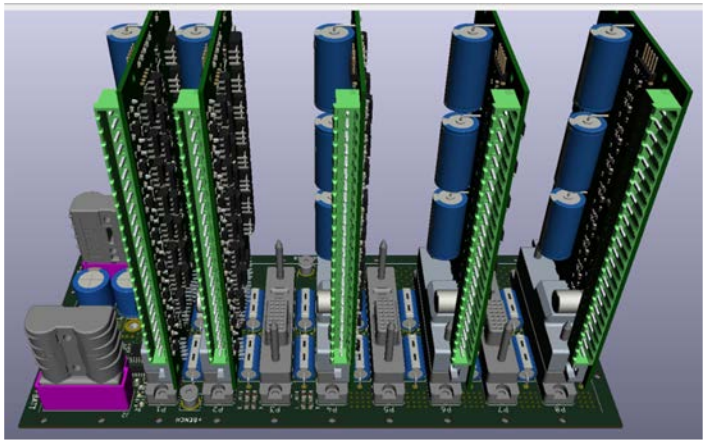
Design leverages COTS modem equipment

Electrical Switches

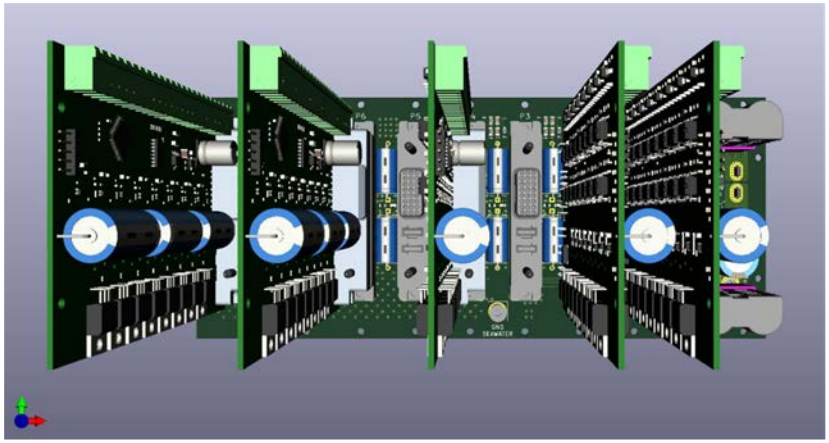
- **Built on existing Switch Design**
- **Replaces end of life hardware**
- **Add current and voltage measurements (critical for AUV operations and remote introspection through acomms)**
- **Increases available power on each channel**
- **Reduces hotel load with increased efficiency in total**



Existing Electrical Switches



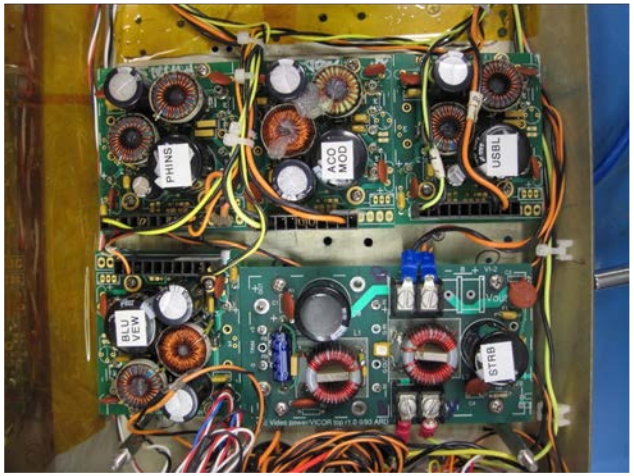
Electrical Switch mechanical model



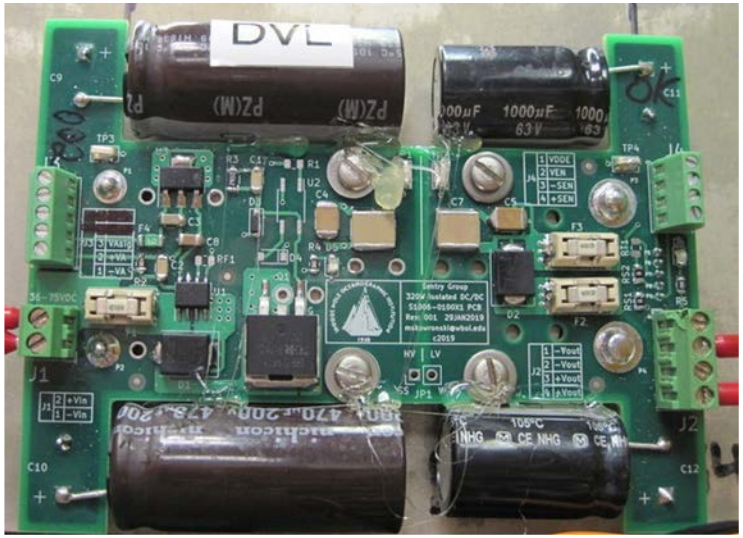
Electrical Switch mechanical design

DC/DC Converters

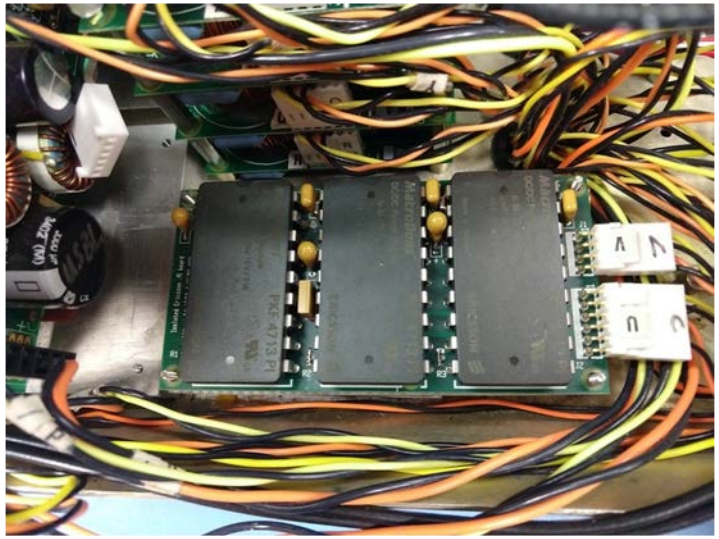
- Replaces DC/DC converters that are >15 years old
- Ties into switches design with added ground detection
- Improved space savings
- Improved efficiency from home made converters still in use in Sentry



Existing DC/DC converters inside the main housing



One of many replacement DC/DC converters

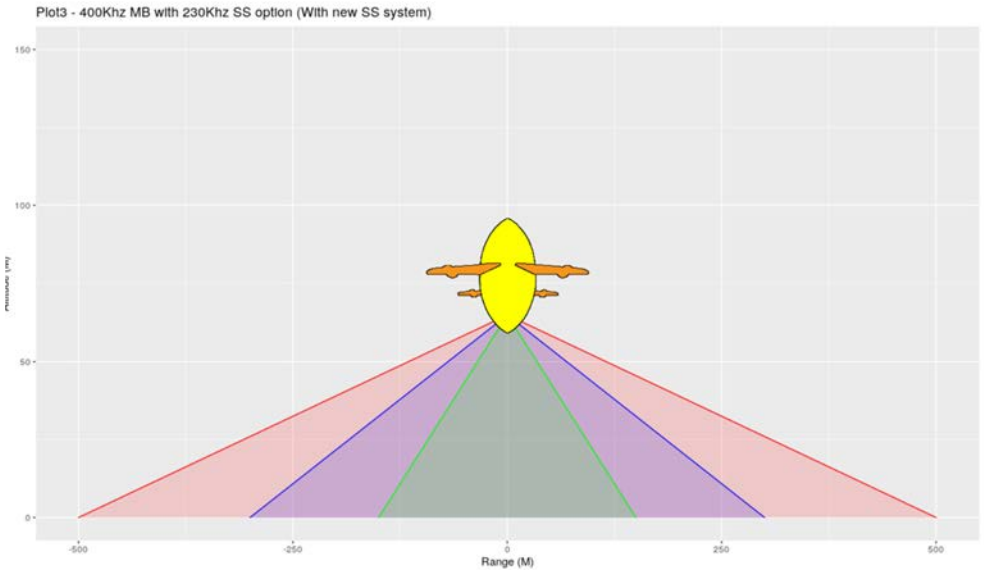


DC/DC to be replaced

Edgetech sidescan Upgrade

- **Replacing 10 year old system with newer components**
- **Tri-Frequency with the highest freq. Channel to be increased to 540Khz (Increasing resolution)**
- **Improved processing and hardware design**
- **No loss in max coverage.**

Edgetech 2205 system

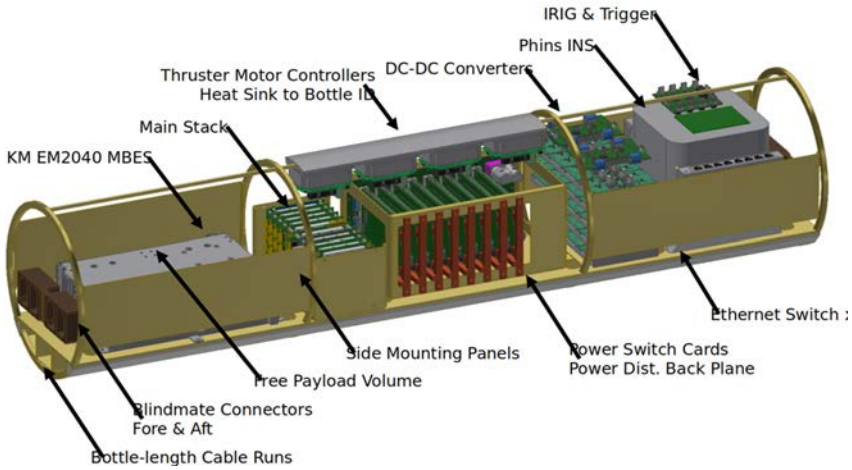


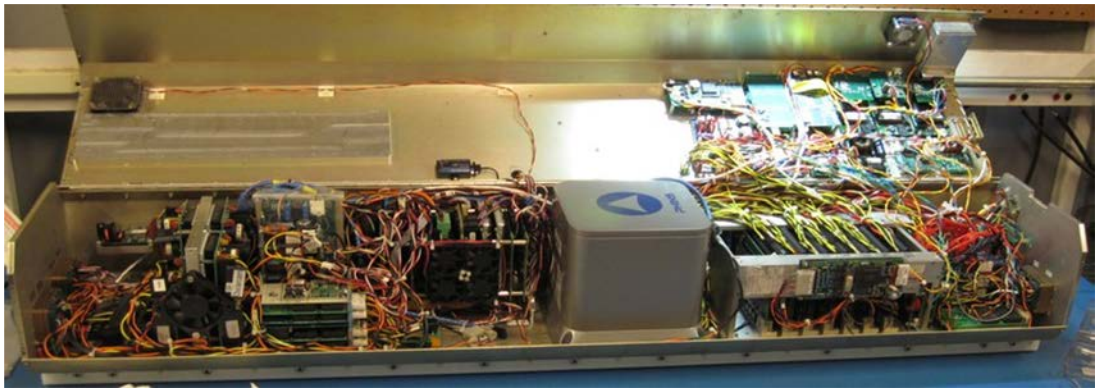
Three channel configurations *(Can run any two at the same time)*

New transducer - Reduced size

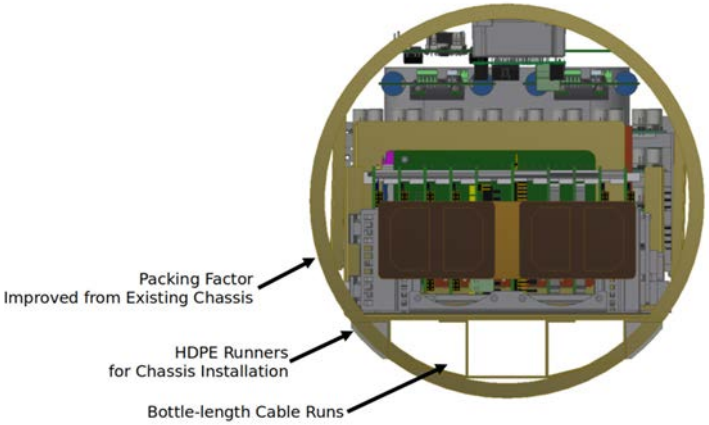
Chassis Upgrade

- **Replacing 10 year design**
- **Improved heat dissipation and thermal properties to reduce on deck 'over heating'**
- **Improved space layout for additional instrumentation**
- **Improved maintenance and overall easier to work on.**



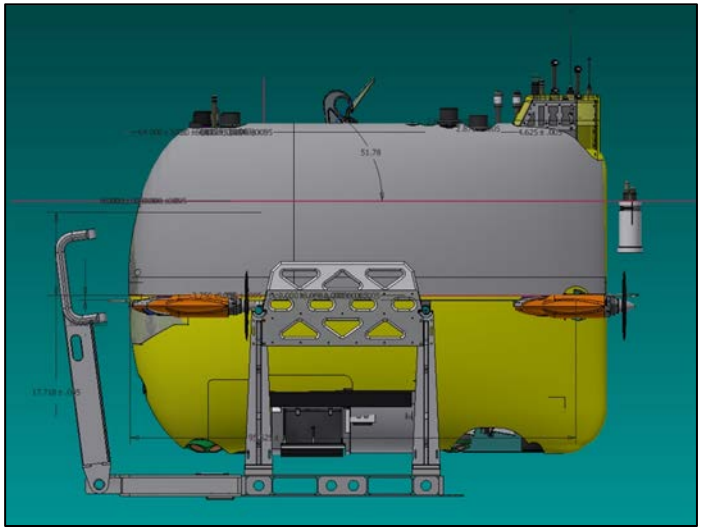


Existing chassis currently used in system

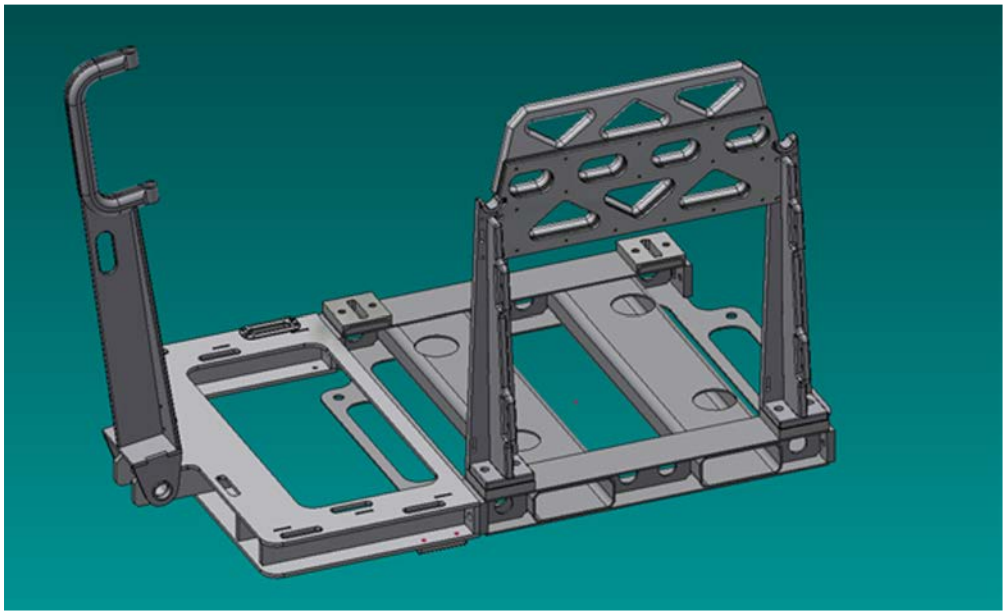


Sentry Cradle Re-design

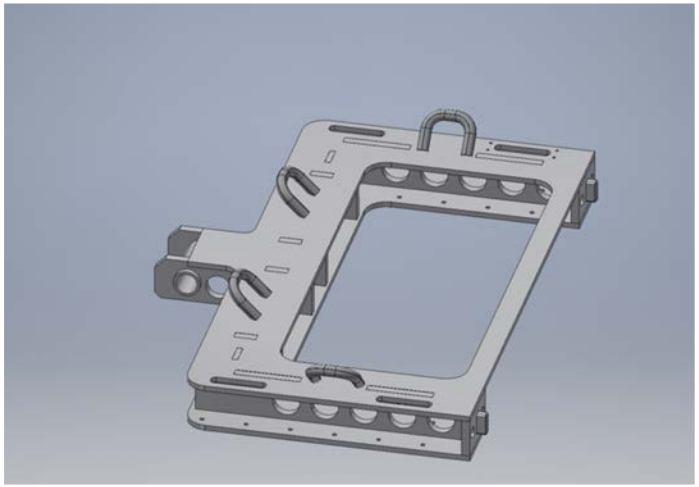
- **Reduced weight for shipping**
- **Improved picking and lifting pockets**
- **Modular design**
- **Improved vehicle access**
- **Reduced ship integration, with additional tie down points**



Chassis Design model

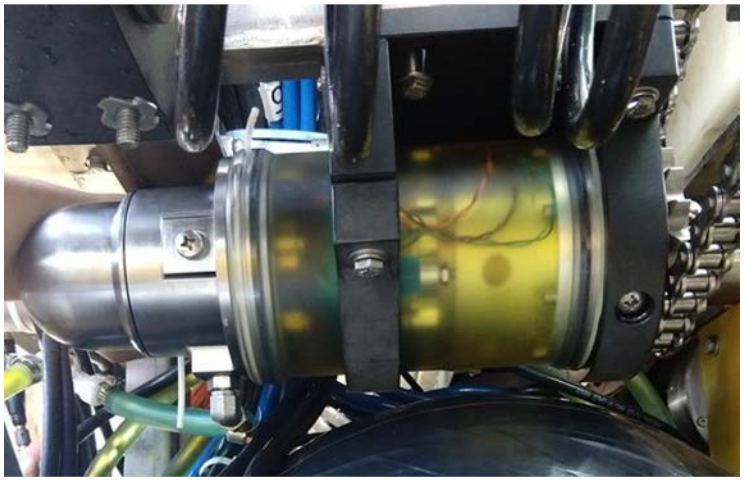


Modular chassis design

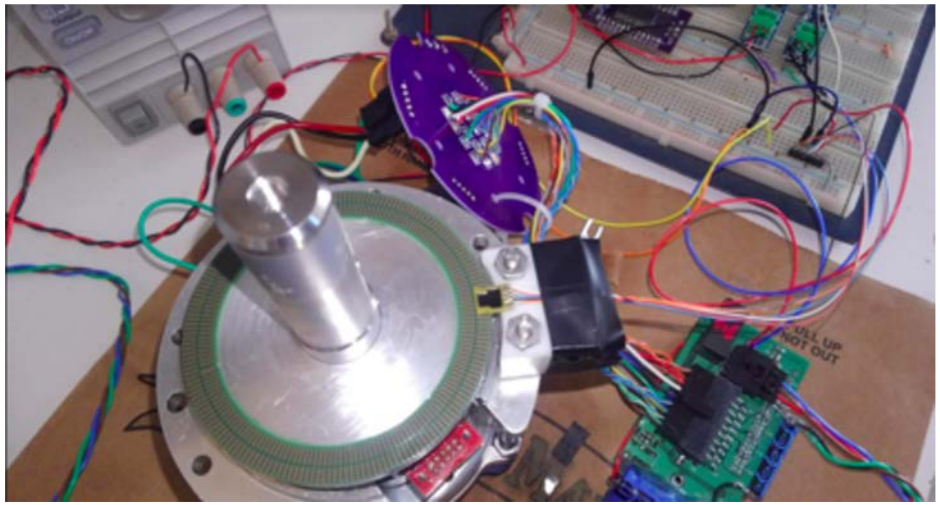


Sentry Servo Development

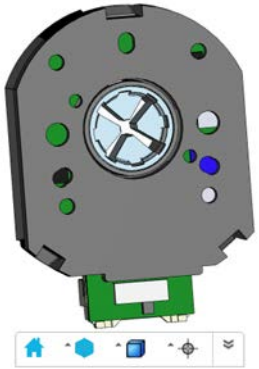
- Existing parts no longer available for legacy hardware
- Improved resolution
- Improved control loops and performance
- Zero backlash gear box
- Working on replacement position sensor for final design



HD Servo installed during 2019 Engineering trials



Incremental encoder testing (At home due to COVID)

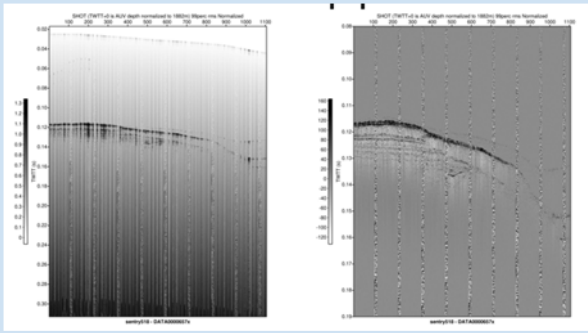


Exploring off the shelf encoder options that can survive the depths required.

General Project updates

Sub - Bottom pipeline: (PCAR-2019)

Software pipeline replacement and improved processing and ingesting and data presentation. Project on hold, will plan to pick back up this fall when staffing can support the effort.



Container Tracking:

Jason & Sentry have purchased container trackers following the Fiji return shipment to allow for improved tracking of the containers worldwide. Already put to use.

DVL upgrade:

Further testing and evaluation along with ROV Jason to determine DVL replacement with the retirement of the workhorse navigator

Jason update: Staffing

- Contractors
  - Lost Summer Ferrel, experienced OET ROV operator, mechanical/Navigation
    - COVID-19 loss of Jason ops, took another position
  - Lost Jim Convery, experienced oil field ROV operator
    - COVID-19 loss of Jason ops, took another position
  - Jim Varnum to retire end of 2020, or early 2021
- Adding 2 new contractors and 2 WHOI (non DSL) participants in 2021
- Alvin participants not available in 2021 (reassembling Alvin)
- Ben Tradd EL and RCA Project Manager
- Tina Haskins Data
  - Joined Jason ops from WHOI
- Andy Billings Mechanical Engineer
  - Moved to Jason from Sentry
- Section leads assigned for each expedition (pcar 2018)

Sulis Stills

Kongsberg EM2040 multi beam (2019 tests Jason)

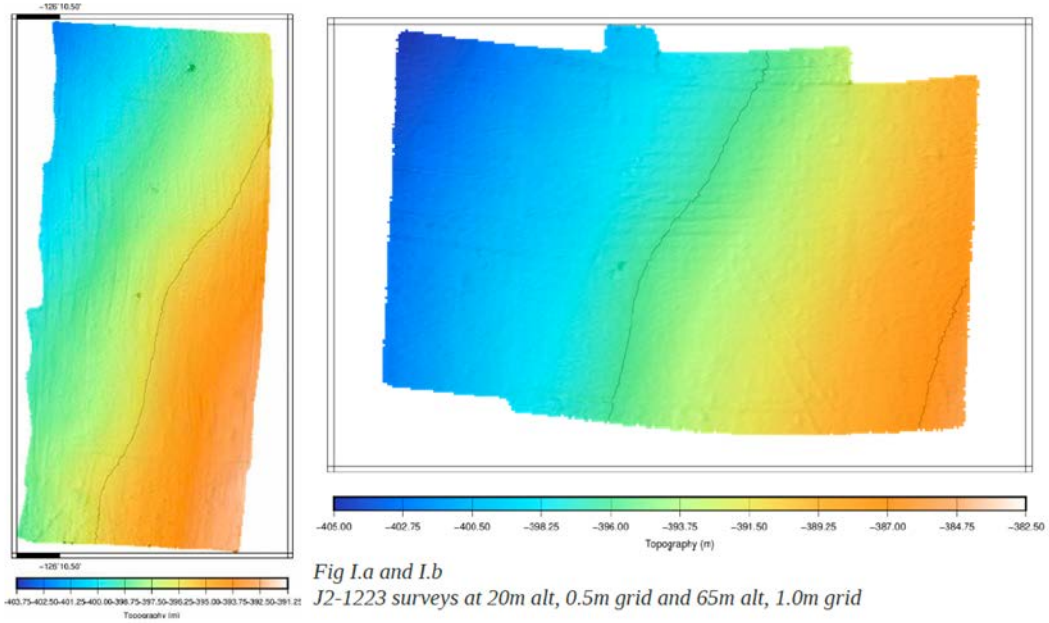
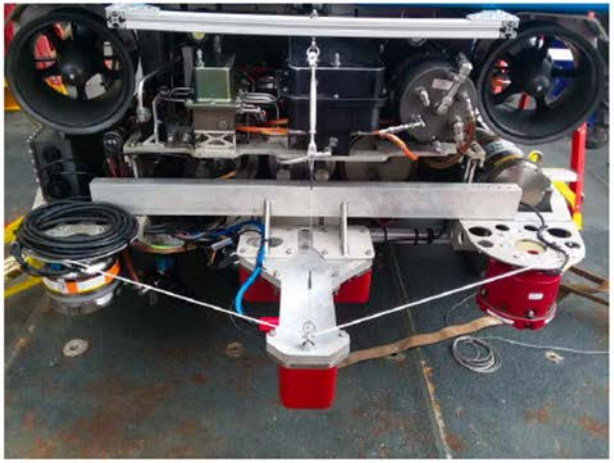
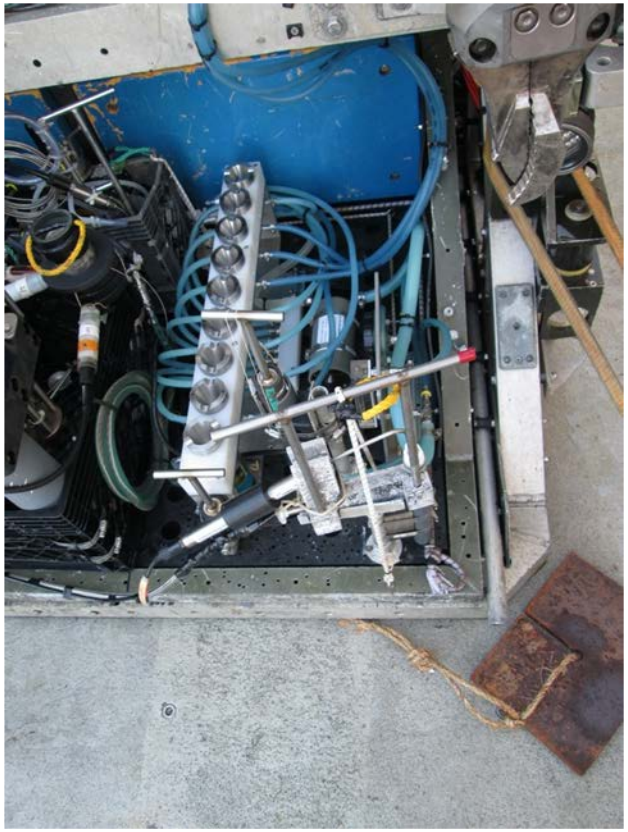


Fig I.a and I.b
J2-1223 surveys at 20m alt, 0.5m grid and 65m alt, 1.0m grid



JASON Highlights NDSF fluid sampler

- NDSF engineers built a fluid sampler in response to community request
- Manipulator operated discrete valves providing range of valving logic
- Mechanical pressure and flow gage
- Polyurethane Polyvinyl alloy tubing 100 C rated, can be replaced as required
- Variable speed/flow controller
- Easily connected to user supplied filters and bags
- Temp measured at inlet using existing temp probe
- Will be tested on upcoming cruise



Jason system upgrades

- New Jason power system (AFX) power outages pcar 2018/19
- New Jetway received 2019
  - Used full time 2020 cruises
- Jetway to be repacked to fit into power compartment in CV A 2021

Jason system upgrades – 4K Camera

- Subsea Sulis Z70 4 k (highest quality subsea cam available at time of purchase) pcar 2019
- Provides both stills and video in one camera (pcar 2018)
  - Faster still storage in still mode
  - Possible to capture stills in video mode with delay
- Full res 4 k recorded in highlights and HD 24/7
- Stills in full res to separate hard drive
- Sulis H264 recorder image color was off in post processing. Adding post dive check performed by science party. Also testing (current cruise) a prototype recorder which would eliminate splitters. pcar 2020

Jason system upgrades

- Providing more manipulator training and practice with ODI connectors to assure ease of connections pcar 2018
  - Purchased topside controller and built HPU for at WHOI manip training pcar 2018
  - ODI connector problems have been identified in other industries
  - Working with RCA personnel to assure implementation of all possible solutions (from industry) to avoid ODI issues
- Rapp winch and NPC crane had annual maintenance to address level wind and general upkeep concerns pcar 2019
- Implemented elevator tracking to prevent loss if weather prevents immediate recovery pcar 2018
- Weather limits have been reviewed with ELs, must consider personnel, equip safety, PIs have strong driver to maximize dive time, ELs are trained to make a safe weather call. These are at odds. Pcar 2019
- MRU data and Commanders weather being used to assist EL in weather call. Pcar 2019
- Used Vessel MRU on one cruise for Active Heave and weather
- Successful 12/12 ops on RCA cruises, pursuing 12/12 on other cruises pcar 2019

Jason short maintenance period June 2020

While Jason was at WHOI

- Test of new Jetway, (main power system for Jason) result of AFX failures
- Test of new UNOLS .681 EO cable via new Jetway and Jason

Assembly and test of prototype thruster motor to replace the units which are original to Jason

Test of new telemetry components for impending telemetry upgrade

NPC crane docking head rebuild and testing

NPC crane testing after maintenance

Rapp winch repairs and testing, including new brake HPU motors, R/R of main drive motor, level wind maintenance, and numerous smaller efforts

Numerous hardware and software upgrades in the Rapp power van

Post shipment repairs in control vans and on Jason

Reorganize system for shift to single body ops from 2-body ops

Repair CV air conditioners

Clean mold that resulted from extended sit in Suva

Jason OHS Maintenance at Otis

- NPC crane docking head rebuild and testing
- NPC crane testing after maintenance
- Rapp winch repairs and testing, including new brake HPU motors,
- R/R of main drive motor,
- level wind maintenance, and numerous smaller efforts
- Numerous hardware and software upgrades in the Rapp power van

Winter 2020/21 Jason maintenance period

Tune ICLs for integrated water sampler concurrent temperature measurment

Repackage Jetway into control van-A power compartment

- Increase reliability

Build new thrusters after testing of prototype

- Old thrusters have reached end of life, become increasingly less reliable and are obsolete

Build new tool van

- End of life due to rust and at sea and shipping wear and tear

Rust maintenance to control vans

- To increase life cycle

Replace control van air conditioning systems

- Current system has very poor reliability and replacement with more suitable for shipboard will increase reliability

Integrate new telemetry system into Jason sub-sea and topside systems

- Current telemetry system is at end of life and no longer supported by the manufacturer

Remove, weigh, and repair flotation block

- Normal maintenance to facilitate frame inspection and repairs, and to increase life cycle of flotation

Reorganize rigging van

- Normal, get rid of obsolete spares

Data entry into Inventory management system

- For better equipment tracking, sparing, failure tracking, to increase reliability

Rapp winch maintenance

- Normal, for reliability

NPC crane maintenance

- Normal, for reliability

Docking head maintenance

- Normal, for reliability

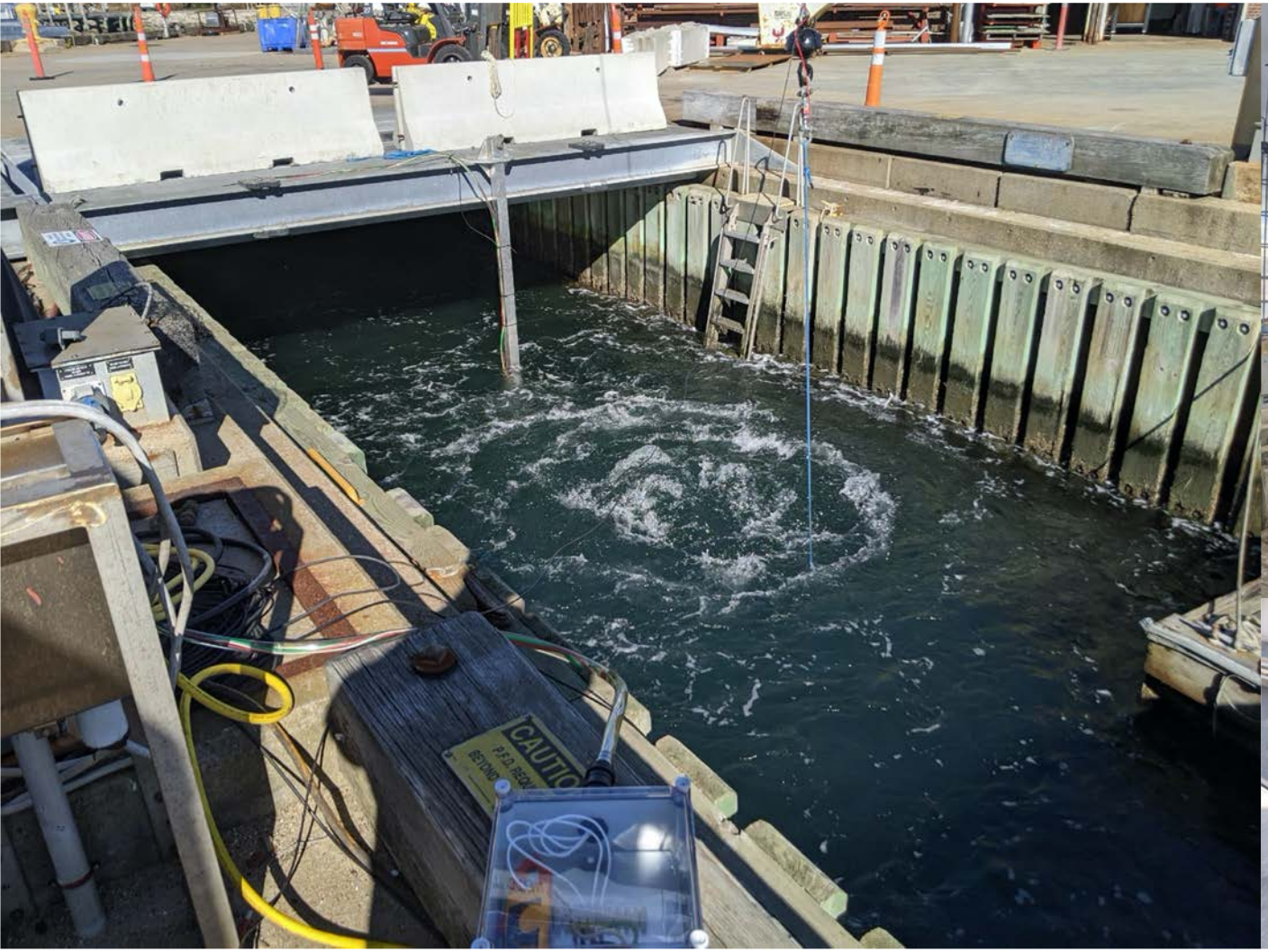
Airline HPU maintenance

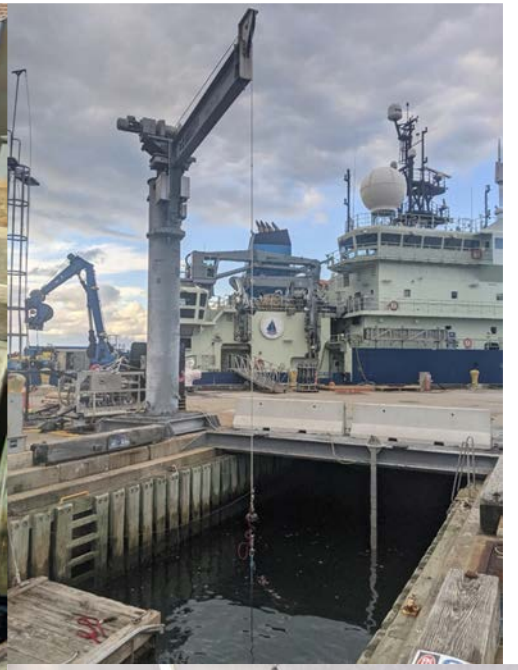
- Normal, for reliability

Sea log system remote operation via tele-presence

- Enable remote button control to offload personnel from the vessel
- Potentially reduce ops team via remote data processing

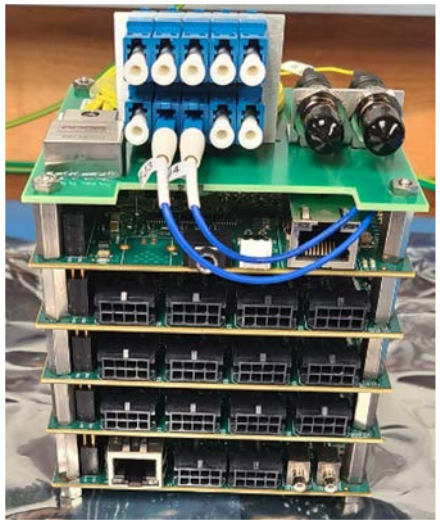
Prototype thruster testing Nov/Dec 2020

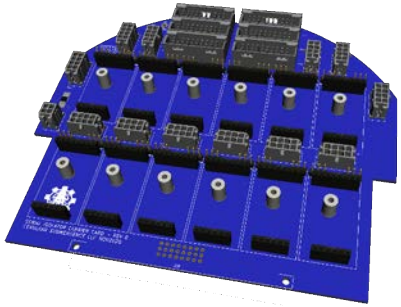




Jason Telemetry Replacement

Status		
Procurement	Complete	All Focal parts in hand.
Bench Testing	Complete	Focal system mock up testing completed.
Topside Rack	40%	Design nearly complete. Some parts on order. Assembly starts in Janauary.
Chassis Refit	40%	Chassis mounting designed, parts in fab this month. Isolation PCB 75% designed. Chassis install starts in January.
Endcap Modification	50%	FEA completed. Modification/pressure test scheduled for early January.
Integration/Test	0%	Integration/test scheduled for February.





Miksis-Olds / Jason engineering cruise objectives

Complete science objectives

- Recover 6 bottom landers, CTD and net tow at each site

Test prototype thruster on Jason

- Thruster used in forward horizontal position utilizing existing controller

Thruster data set

- Collect thruster current vs thrust data for comparison to prototype

Test Phinns IMU

Test new DVLs

- Phinns aligned above DVL's to improve accuracy of DVL NAV

Test AFX

- determine if PP latest change improves the dropout problem

Alvin Staffing Updates

Principal Ops Team
- Danik Forsman – Pilot/Mechanical Section Leader
- Drew Bewley – Pilot/Electrical Section Leader
- Nick Osadcia – PIT/Mechanical Technician
- Rick Sanger – PIT/Electrical Technician
- Rose Wall – Electrical Technician

Additional Ops Support
- Bruce Strickrott – EL/Pilot
- Anthony Tarantino – EL/Pilot
- Mike Skowronski – Pilot
- Phil Forte – Pilot
- Abrams, Elder, Popenoe, Whitman – Tech Support on Cruises

Alvin Internships
- Kaitlyn Beardshear – MATE Intern/EE
- Nick Ellls – Past MATE Intern/ME
- Lucy Norton – 2021/ME

Upcoming Additions
- ME candidates under review
- EL candidate interviews underway

Additional Support Personnel
- Stefano Suman – Data Support
- Thomas Trudell – Tech Support
- Jeff Marlow – Science Support

Alvin Staffing Updates

Major Personnel Milestones

- Danik Forsman - Promoted to Mechanical Section Leader
- Drew Bewley - Completes Pilot Qualifications, Promoted to Electrical Section Leader
- Rose Wall - Joins Operations Team
- Rick Sanger - Nearing Completion of Pilot Qualifications
- Stefano Suman – Assumes lead on Alvin C&C and navigation software taking over for Jon Howland
- Mike Skowronski – Leading project to upgrade Alvin data/imaging system and shipboard archiving, access, and duplication system

Novel Operational Concepts (In Trial)

- Science Liaison – Provides direct support to Sci-Party, Well received on Hansel, Sylvan and Young cruises
- NDSF Data Person - Provides Data expertise, support & QA, regular part of team starting in 2021

Program Goals

- Provide improved support to science party
- Improve diversity within ops and engineering
- Increase appropriate expertise into the Ops Team
- Improve data & sampling product to Science Party
- Merge Engineering and Operations resources
- Enable cruise specific opportunities for novel personnel participation
- Expand cruise participation with only positive impacts on Science Party - use of Alvin bunks

Alvin Data System Upgrades

- **Major Alvin Data System Upgrade**
  (PCAR 2019)

Goal – Improve overall data system capabilities, products and program support:

- **Upgrade data system hardware**
  - Primary submersible systems
  - Shipboard data handling system
- **Define daily data products**
  - Clarify routine products
  - Enable specialty data needs
  - Manage expectations
- **Integrate data expertise into operations**
  - Define position roles and responsibilities
  - Refine resource needs & duties
- **Mirror other NDSF Vehicles' Systems**
  - Incorporate beneficial aspects
  - Align data product deliverables

Alvin Data System Upgrades

Planned Improvements

- **Submersible Imaging System**
  - 6,500 meter capability
  - Integrate 4K video
  - Maintain HD & still image capability
  - Integrate MISO imaging concepts
  - Upgrade camera controls
  - Upgrade video display & recording
  - Reduce observer/pilot task loading to optimize imaging efforts during dives
  - Improve exterior lighting selection, control and separation
  - Improve camera/lighting mounting and positioning versatility
  - Incorporate ability to better adjust lighting/camera position real-time
  - Improve user camera info display
  - Improve overall system 'usability' and ergonomics in-hull

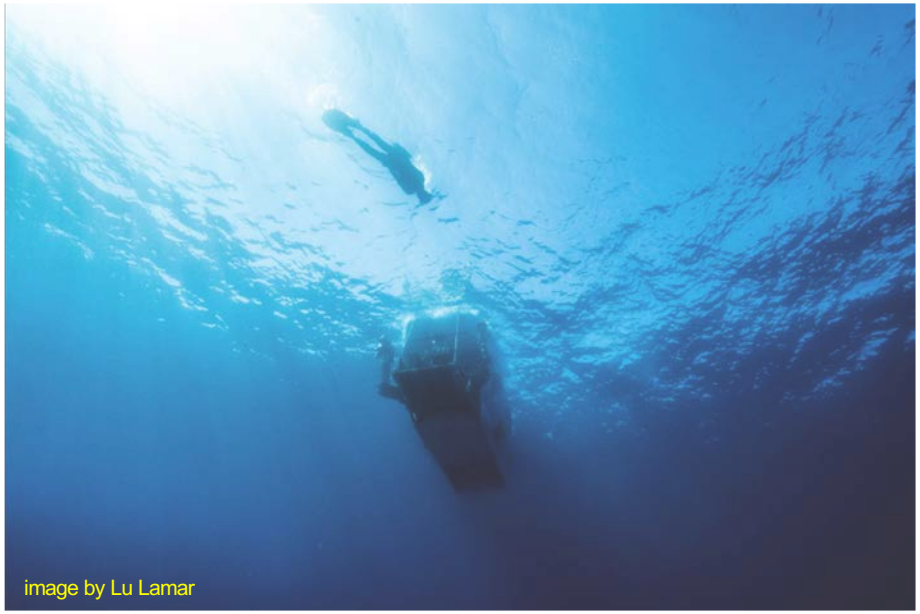


image by Lu Lamar

Alvin Data System Upgrades

Planned Improvements
(PCAR 2019)

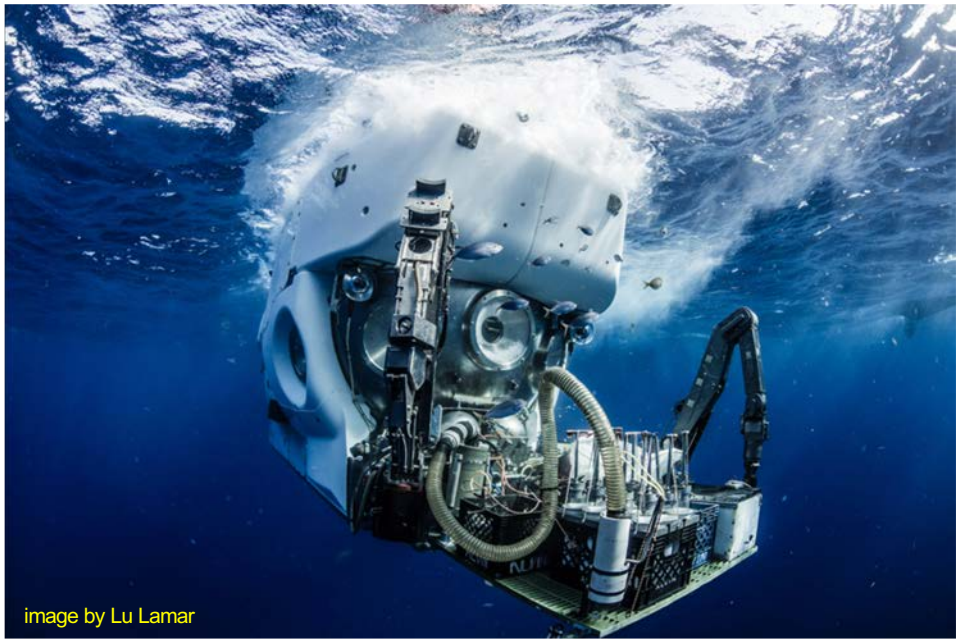
- **Submersible Data System**
  - Finalize new computer installation
  - Upgrade LINUX versions
  - Install F/O network connector to improve post dive data transfer
  - Implement improved observer metadata display
  - Finalize 'Sea-log' integration
  - 'Frame-grabber' officially retired

- **Shipboard Data/Image Handling System**
  - Upgrade network hardware
  - Upgrade duplication hardware
  - Upgrade storage hardware
  - Upgrade access point hardware
  - Improve transfer rates
  - Improve access times
  - Improve ease of access
  - Incorporate routine post-dive data Q/A

- Annual budgeting/expense for progressive component upgrades to stay aligned with advances in technology

Alvin Data System Upgrades

- **Program & Community Considerations**
  - Additional recorder dedicated to full-time front end recording (fixed-focus wide shot
  - 4K (and higher) imaging plan including considering change from Apple Pro-Res to H.264 codec for improved compression and quality
  - Need for separate 'Proxies' if H.264 is implemented
  - Alvin stand-alone shipboard data network, ship's network has access to system but hardware storage and interface components in a new, unique Alvin system (similar to other NDSF vehicles)
  - Creation of post dive data access 'GUI'
  - Roles and expectations of 'Data Person'
  - Review of video access/transfer expectations including training videos to assist observers with evaluating their need for video – goal to reduce portable hard-drive queues and/or desire to copy everything (PCAR 2019)
  -



- Post-procession expectations
- Expectations for data record integration and Q/A of data from unique, science supplied sensors

Alvin Additional Upgrades

Planned Improvements

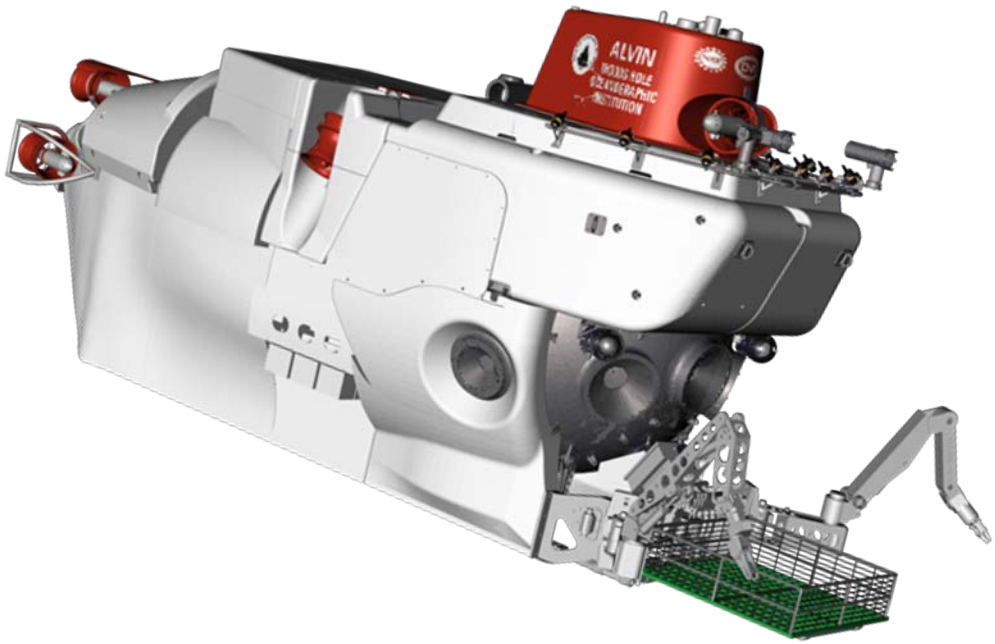
- **New Temperature Instrument Suite**
  - Hi, Low and Heat-flow probe capabilities
  - Better accuracy and range resolution
  - Reduced implodability concerns – pressure tolerant electronics and probes

    (PCAR Sylvan 2019)

- **New wireless optical data transfer system**
  - Under development to replace ICL's

    (PCAR Sylvan 2019)

- **Acoustic data/image transmission**
  - Under development to provide metadata and image transfer capabilities
  - Will complete 'Science Observer Station' in main lab



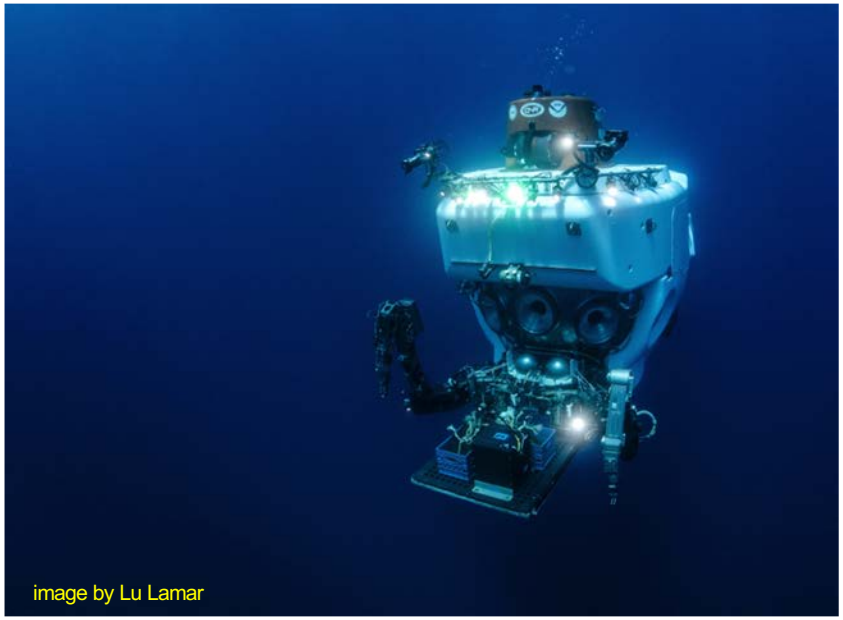
Alvin Current Efforts

Alvin Overhaul Began March 2022

- Off-load and high-bay setup completed by April 6th
- Team stand-down till May 8th
- Systematic disassembly begins
- Disassembly completed June 19th
- Primary maintenance work underway

COVID-19 Consideration

- Arrival, off-load and disassembly in the midst of March – June Covid peak
- Team creates and adopts proactive measures to ensure personnel safety
- Evolving plan working directly with WHOI leadership
- Many team members working remotely
- On-site team complement minimized as much as possible
- Alvin leads working with other groups to incorporate best practices and any 'lessons learned'



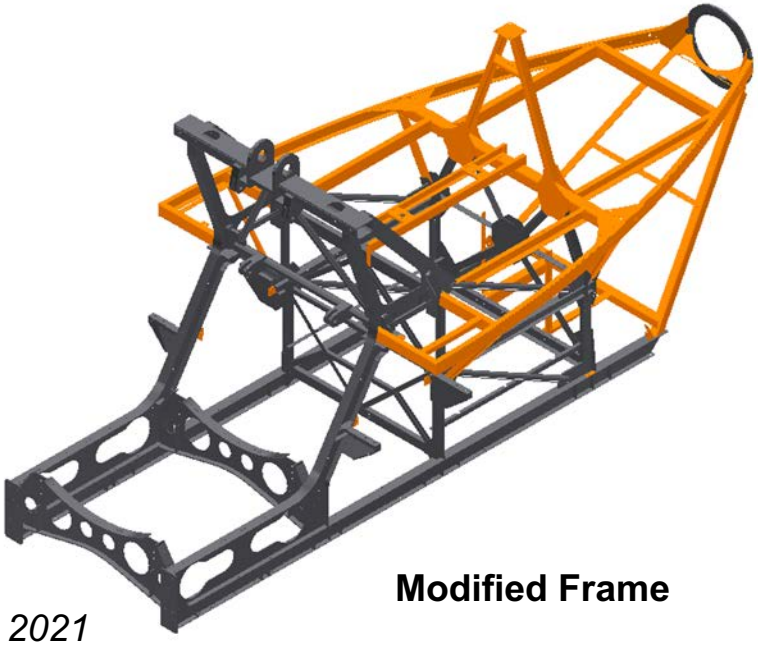
Program Goals

- Ensure team member safety
- Follow US, MA and WHOI guidelines
- Maintain planned overhaul schedule
- Minimize overall impact on overhaul and preparation for 2021 return to operations

Alvin Overhaul

Overhaul Phases

Disassembly	*May 2020 - Jun 2020*
Maintenance& Modifications	*Jun 2020 - Jul 2021*
Reassembly	*Mar 2021 - Jul 2021*
Testing	*Jul 2021 - Aug 2021*



Modified Frame

Overhaul Major Milestones

Atlantis Mid-life Refit	*July 2020 - July 2021*
Atlantis Transit to WHOI	*July 2021 - Aug 2021*
Alvin Post Overhaul System Testing	*July 2021 - Aug 2021*
Alvin On-load	*Aug 2021 - Aug 2021*
Alvin Dockside Testing	*Aug 2021 - Aug 2021*
Sea Trials 1	*Aug 2021 - Sep 2021*

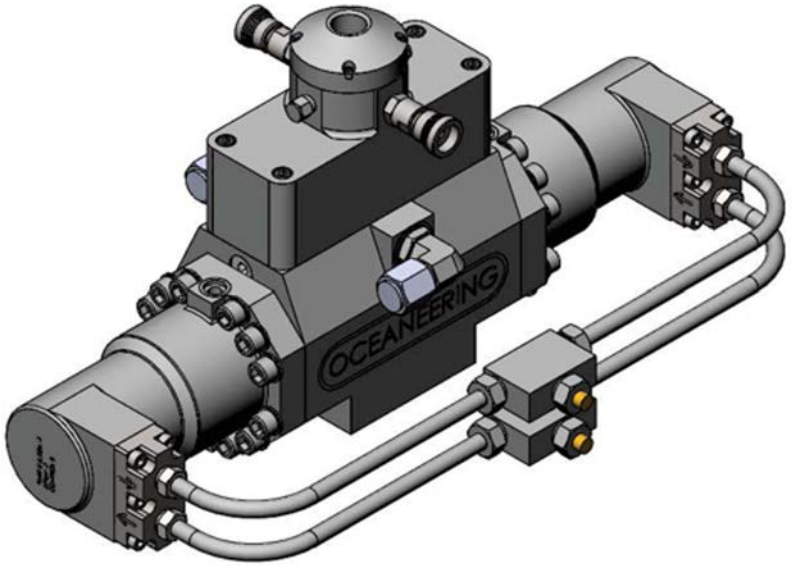
Alvin Overhaul

Ballast Sphere Milestones

✓	*Ballast Sphere Machining/Welding*	*June 2020 Nov 2020*
✓	*Post Weld Heat Treat*	*Nov 2020 - Nov 2020*
•	*Final Machining*	*Nov 2020 - Dec 2020*
•	*Tech Readiness Review*	*Jan 2021 - Jan 2021*
•	*Hydro Test*	*Jan 2021 - Jan 2021*
•	*Post Hydro NDT*	*Jan 2021 - Feb 2021*
•	*Ship Spheres to WHOI*	*Feb 2021 - Feb 2021*

6,500 Meter H.P. Ballast Sphere

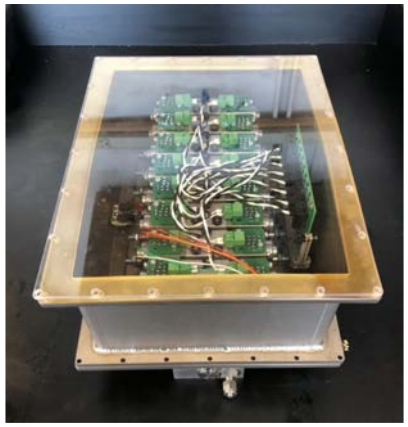
Alvin 6500m Mechanical Systems



New Variable Ballast Seawater Pump
- Hydraulically powered
- 10 lbs per/minute at 6,500 m
- Moderate size
- Easy to maintain
- 2 units completed

Testing Completed November 2020
- Passed 24 hr continuous run test

Alvin 6500m Mechanical Systems



Aux. Hydraulic Manifold

Distribution Hyd. Manifold

Seawater Pump Test Frame

Main Ballast Blow Valve

Variable Ballast Isolation Valve