

NDSF Facility Update

NDSF NATIONAL
DEEP SUBMERGENCE
FACILITY



NDSF DEIJ Update

Micki Barboni & Anna Michel

NDSF NATIONAL
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New Internships for ROV Jason and AUV Sentry: Mate Program

2 Female interns from MATE

Sarah Sergent

Junior at Northwestern Michigan College

Pursuing a BS in Marine Technology

Gartman and Nooner cruises with the Jason team.



Syenna Graham

Senior at Virginia Polytechnic and State University

Pursuing a BS in Ocean Engineering

Nooner cruise with the Sentry team

Spending a few weeks at WHOI after the cruise with Sean Kelley (Sentry lead) as her mentor



OEI Internships

2 Tuskegee University Interns

Fernando Billups

Junior pursuing a BS in Mechanical Engineering

Advised by Dr. Michael Jakuba and working on Nereid under ice (Nui)



Jessica Barrow

Junior pursuing BS in Environmental, Natural Resources, and Plant Science

Advised by Dr. Annette Govindarajan in the Biology Department

Internship will focus on the biodiversity of the ocean's twilight zone and how to apply molecular methods to study that biodiversity



Continued Challenge: Housing

Working with WHOI Sustainability Coordinator and diversity officer on housing

Lack of housing ...

Diversity Training

Andy Bowen, Anna Michel and Micki Barboni participated in a Mentorship discussion with Dr. Marisela Martinez-Cola, the author of "Collectors, Nightlights, and Allies, Oh My! Building Strong Cross-racial Mentoring Relationships"

We are scheduling a future session with Dr. Martinez-Cola and the NDSF teams



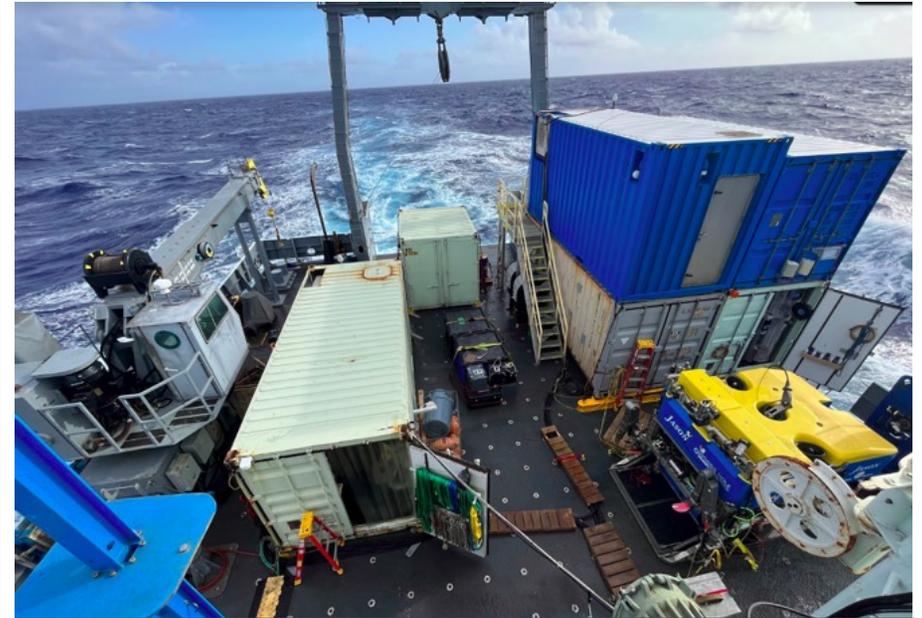
Jason Team



The Amy Gartman cruise out of Newport, OR that starts today has 50% women on the Jason team. This is a first for the Jason ROV!

Sentry Operations Summary 2022

- **104** operating days thus far in 2022
- Cruises Completed
 - **Boettcher – GOFAR**
 - **Beinart – Lau Basin**
- **31** dives
- Total survey time: **448 hrs**
- Total Distance covered: **1079 km**
- Vessels: **R/V Thompson**



AUV Sentry and ROV Jason integration on R/V Thompson

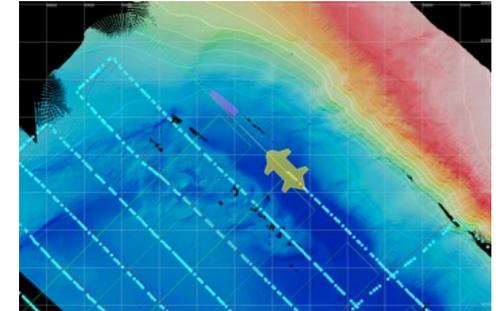


Sentry Operation Highlights

- **Back to back 50 day** cruises on Thompson
- Mapping and sidescan surveys at GOFAR fracture Zone
- **SyPRID** sampling of larve at Lau Basin
- **Real time data** to shore for on shore dive planning and data feed (GOFAR)
- **Operations with ROV Jason** (Lau Basin)
- Continued isolation protocols for both cruises



Sentry onboard for 2022 Beinart cruise with SyPRID



At WHOI real time data Feed during GOFAR



JASON Operations Summary

- One cruise completed in 2022
 - Single body on R/V Thompson
 - Larv-Sym - The impact of symbiont-larval interactions on species distributions across southwestern Pacific hydrothermal vents
 - Ch Sci; Roxanne Beinart (U. Rhode Island), with Shawn Arellano (Western Washington U.), & Craig Young (U. Oregon)
 - 16 dives, 9-1/2 days Jason in water
- Under way this week
 - Single body on R/V Thompson
 - Escanaba Trough - Hydrothermal sulfide system- exploring the seafloor and oceanic footprints
 - Ch Sci: Amy Gartman (United States Geological Survey)

JASON Highlights

- Telemetry replacement complete and fully successful
- Propulsion upgrade proceeding
 - Motor design complete, controller design proceeding
- Hydraulic control upgrade complete
 - New board eliminates pc 104 stack, simplifies control
- PHINs IMU integration underway
 - enables closed loop off bottom
 - Improves Navigation accuracy
- Sulis 4 k camera interface improved **pcar 2019**
- Sentry Kongsberg EM 2040 tested successfully on Jason
- Sea-log being used extensively, mostly positive feedback
 - Recognize concerns and developing transition from VV to Sealog **pcar 2020**
- New North Quissett Storage Facility

Alvin 2022 Team Update

New Alvin Team members 2021/22

- Randy Holt – Expedition Leader
- John Dymek – Mechanical Engineer
- Kaityln Beadshear – Electrical Technician
- Matt Skorina – Electrical Engineer
- Nick Ellis – Mechanical Engineer
- Benen Elshakhs – Mechanical Engineer
- Fred Jackson – Certification Engineer

Personnel Promotions

- Nick Osadcia – Section Lead
- Danik Forsman – Training Coordinator

Pilot Qualifications

- Rick Sanger – September 2022
- Nick Osadcia – End of 2022



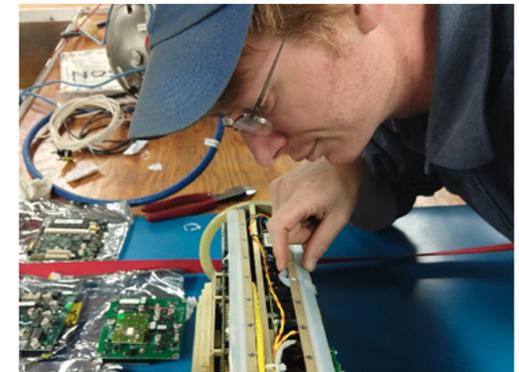
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Sentry Staffing Update



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
- Matt Silvia** - Mechanical Engineer
- Amanda Sutherland** - Mechanical Engineer
- Joe Garcia** - Software Engineer
- Renee Gruner-Mitchell** - Summer 2021 Intern



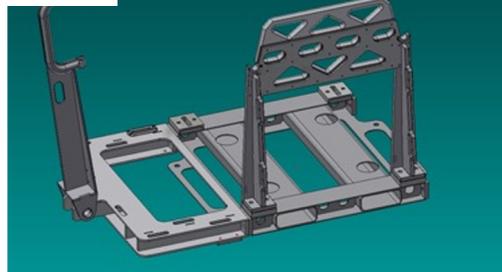
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Hardware Upgrades



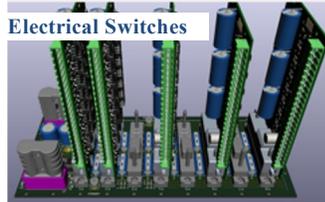
- Cradle replacement
- Sidescan Sonar replaced with Edgetech 2205 system
- Chassis complete redesign
- Datapod Camera hardware upgrade (Done)
- WHOI micromodem upgrade to version 2
- SyPRID Electronics upgrades (Done)
- Battery replacement - including electronics
- DVL integration of Nortek
- XR replacement hardware

Cradle

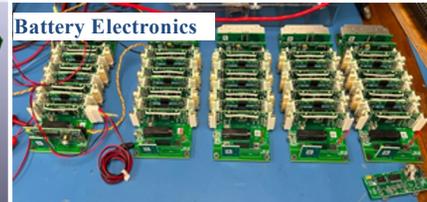


Chassis Replacement

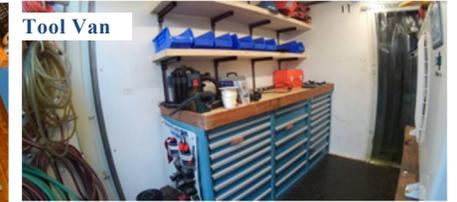
Electrical Switches



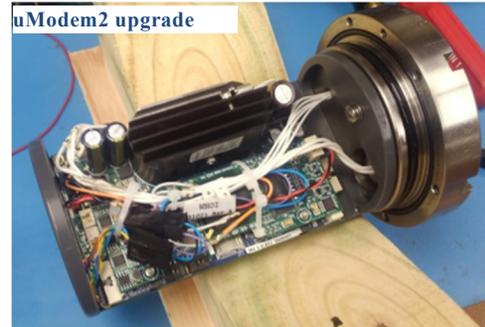
Battery Electronics



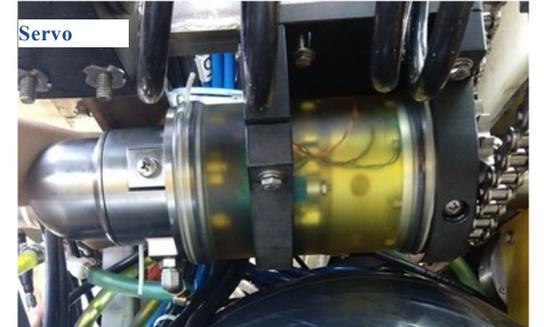
Tool Van



uModem2 upgrade



Servo

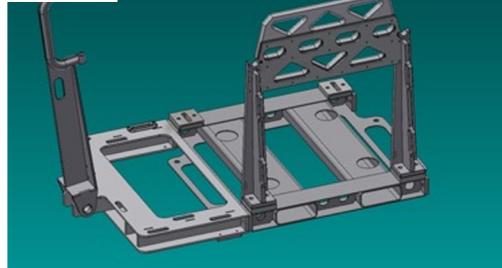


General Upgrades and updates



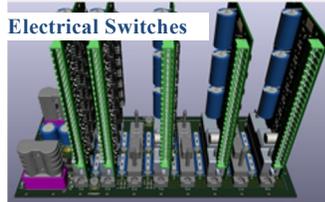
- Mission Controller Development (In Progress)**
- Sidescan Sonar replaced with Edgetech 2205 system
- Chassis complete redesign in process
- Camera upgrade in progress
- WHOI micromodem upgrade to version 2
- SyPRID Electronics upgrades (Done)
- Battery replacement - including electronics**
- DVL integration of Nortek**
- XR replacement hardware
- ROS2 distribution upgrade

Cradle

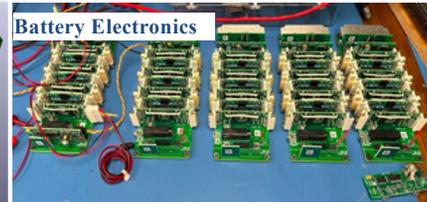


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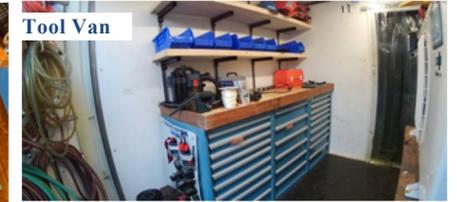
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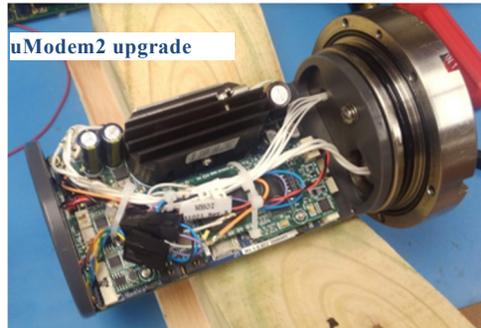
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uModem2 upgrade



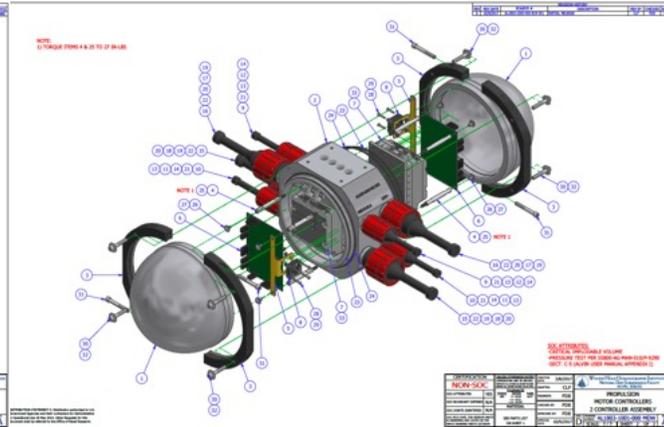
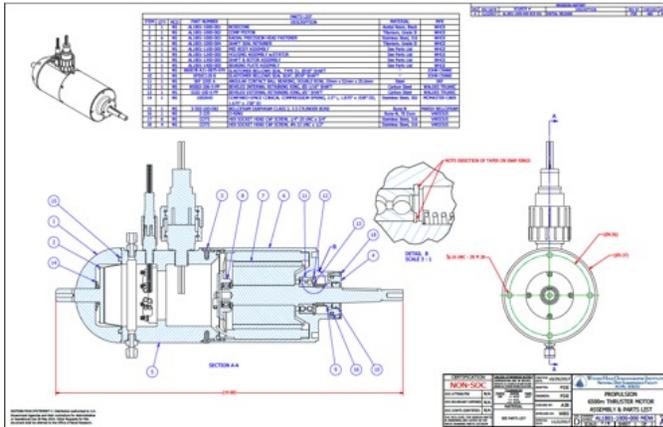
Servo



Jason update: Staffing

- Lost participants to COVID and retirement
- Added 2021
 - Jeremy Paulus, contractor prior WHOI engineer, mechanical
 - Peter Hall, ProteQ contracting firm, mechanical
 - Gabby Inglis, OET, electrical/Nav
 - Tom Lanagan, WHOI engineer, mechanical
 - Ronnie Whims, move from WHOI Marine dept., mechanical
- Several new participants for 2022
 - Megan Bachant, WHOI facilities
 - Stephen Murray, WHOI facilities
 - Jessica McLaughlin, WHOI Jason casual new hire
 - Isaac Vandor, WHOI Sentry
 - Amanda Sutherland, WHOI Sentry
 - Tom Trudel, contractor, mechanical
 - 2x Mate interns
 - UH ROV ops, Blue Eisen & Jeff Koch
 - Gianna Conroy, ProteQ contracting firm, electrical
- Alvin participants not available in 2021/22
- Section leads assigned for each expedition **pcar**

Jason system upgrades: Propulsion



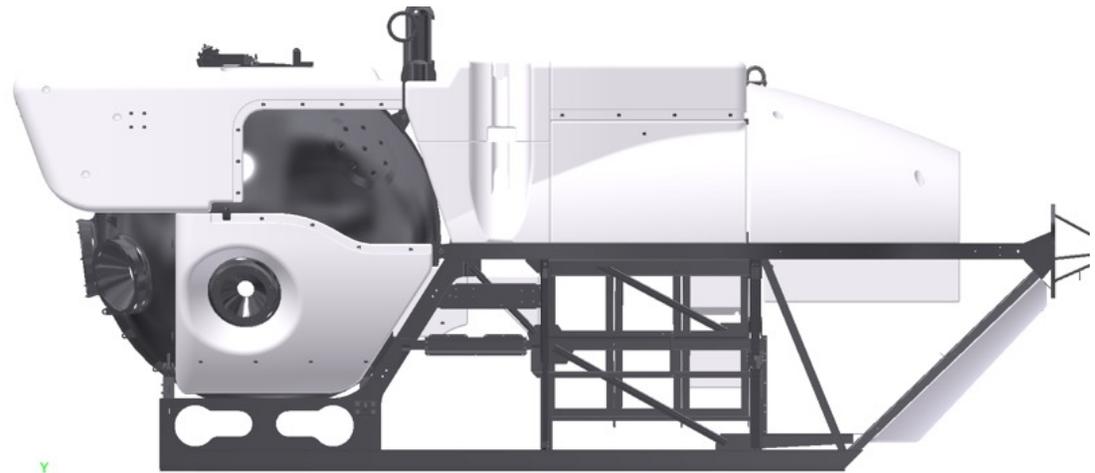
Jason Engineering Activities

- 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](#)
- Addressing ICL and temp probe reliability issues
[pcar 2022](#)

DSV Alvin



- 20 individual pieces
- 10 pieces are either new or modified during most recent overhaul
- 1/3 of the total weight of Alvin is syntactic foam
- 332 cubic feet



Root Cause Evaluation

Non-uniform Loading of Syntactic Foam Material

Multiple fixed mounting points introduces shear stresses
Syntactic foam has limited tolerance for shear stress

Action: New formal requirement to allow foam dimensional change at depth

Corrective Actions

- Choose fixed point for blocks to “shrink” towards and modify all other attachment locations to provide necessary D.O.F
- Similar design concepts used in most locations
 - ✓ Slide bearings
 - ✓ Tie-Rod springs/counterbores
 - ✓ Removing redundant fasteners

Steps Complete

- ✓ Determine Root Cause
- ✓ Develop Concept designs
- ✓ Detailed Designs
- ✓ Perform Attachment Calculations and Revise designs accordingly
- ✓ repair
- ✓ Submit designs for NAVSEA Review
- ✓ Modify/fabricate/order parts
- ✓ Assemble

Return to Service

11/29/21 - 4/1/22	Foam Repair at ESS
2/11/22	Foam Analysis Complete
2/11/22 - 4/15/22	ECAs submitted to NAVSEA
2/14/22 - 5/6/22	ALVIN Reassembly
5/20/22	NAVSEA Survey
6/21/22	Load on RV Atlantis
6/24/22	Authorization for Crewed Testing
7/5/22	Depart for Sea Trials
7/24/22	Science Verification Cruise

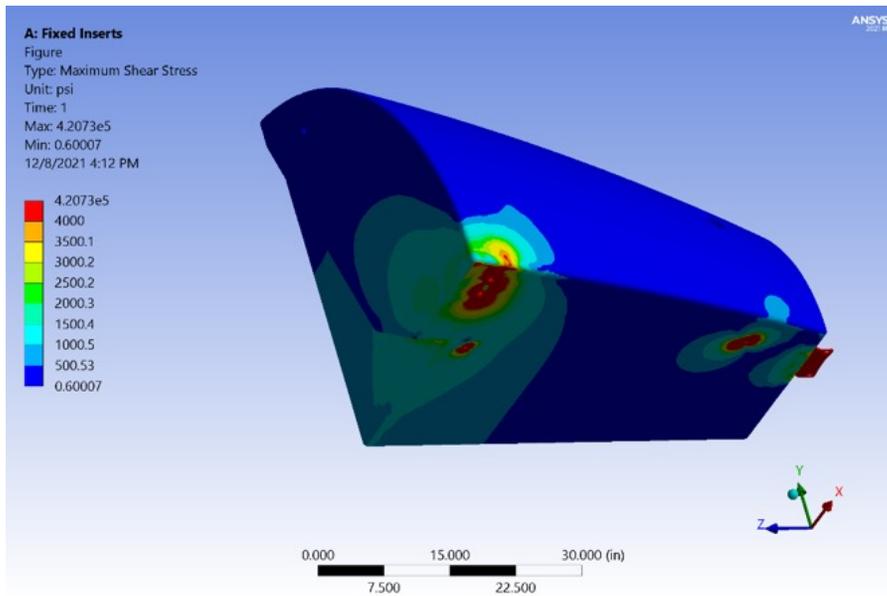
Questions?



Jason system upgrades

- Addressing ICL and temp probe reliability issues [pcar](#)
- Rapp winch and NPC crane had annual maintenance to address level wind and general upkeep concerns [pcar](#)
- 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](#)

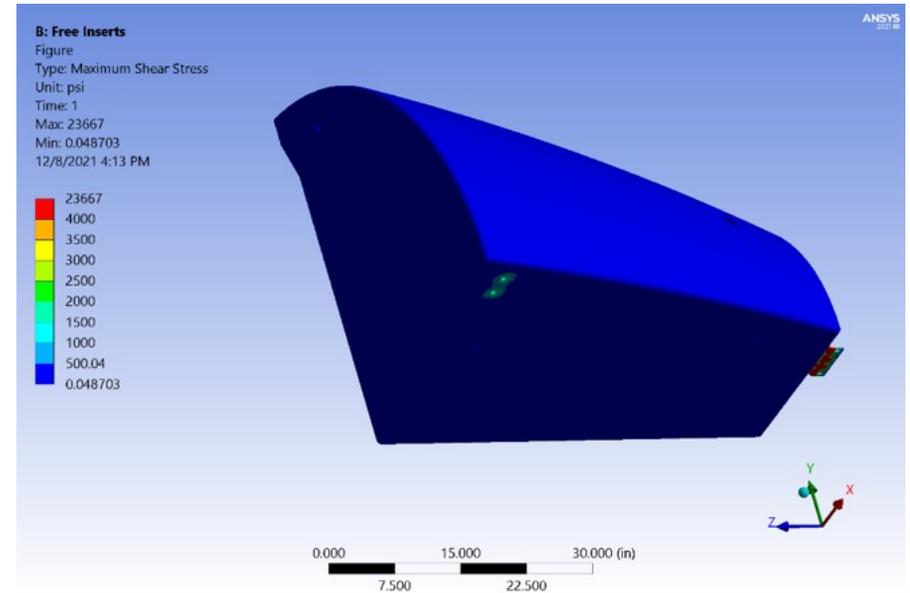
Major Upper Aft FEA Summary Report



Shear Stress, existing

- Shear >4000 psi at forward inserts extends around block corner
- Shear >2000 psi seen in extended area

High stresses are indicated in area where damage has occurred



Shear Stress, modified

- Areas of high shear stress eliminated

2021 Sea Trial Events

- 10/28/21 – 10/31/21** Tethered Trim Dives (Dives 5066-5068)
- 11/1/21** Inclining Experiments (Dive 5069)
- 11/2/21** Harbor Dives (Dive 5070)
- 11/3/21 – 11/13/21** Ocean Trials (Dives 5071-5075)
- 11/11/21** First foam crack identified (Dive 5074)
- 11/12/21** DFS 025-21 Approved resuming manned operations
- 11/13/21** Additional foam cracks identified (Dive 5075)
- 11/14/21** Sea Trials Suspended
- 11/22/21** Incident Report 005-21 provided to NAVSEA
- 11/29/21** DSV ALVIN returns to Woods Hole, MA

Jason LARS Maintenance at NQSF

- WHOI built new maintenance and storage facility for Jason LARS equipment
- Numerous hardware and software upgrades in the Rapp power van



Syntactic Mounting Modifications

Tie Rod w/Spring

- Reduces tie-rod 'slack' and overloading at attachment points
- Transfers buoyancy forces and accelerations to the frame



Shoulder Bolt w/Bearing

- Combines slot and shoulder bolt for 1-2 degree of freedom)
- Reduces stress to acceptable levels

Syntactic Foam



Attachment Calcs.

Requirement for 1g, 1g, 2g loading

Based on Accelerations during emergency conditions rounded to nearest 1g

Tie-rod loads limited by spring force at depth

Every bracket, bolt, and frame connection must be within load limits base on material allowable

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](#)
- Redesigned GUI with P&T control integral [pcar 2018](#)
- Replaced Super Scorpio [pcar 2017](#)
- Connector oil leak on demo unit replaced by Jason connector on final unit [pcar 2018](#)

Jason system upgrades

- Addressing ICL and temp probe reliability issues [pcar feb 2022](#)
- 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](#)
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ALVIN Syntactic Floatation Timeline

- **11/11/21 Dive 5074 (3550m)**

Post-dives revealed cracking on Lower Aft Block

DFS 025-21 approved allowing resumption of dive operations

- **11/13/21 Dive 5075 (5338m)**

Post-dive inspections revealed cracking on 6 of 20 foam blocks

Lower Aft Block

Mid-Ship Mid-Forward Block

Major Aft Block

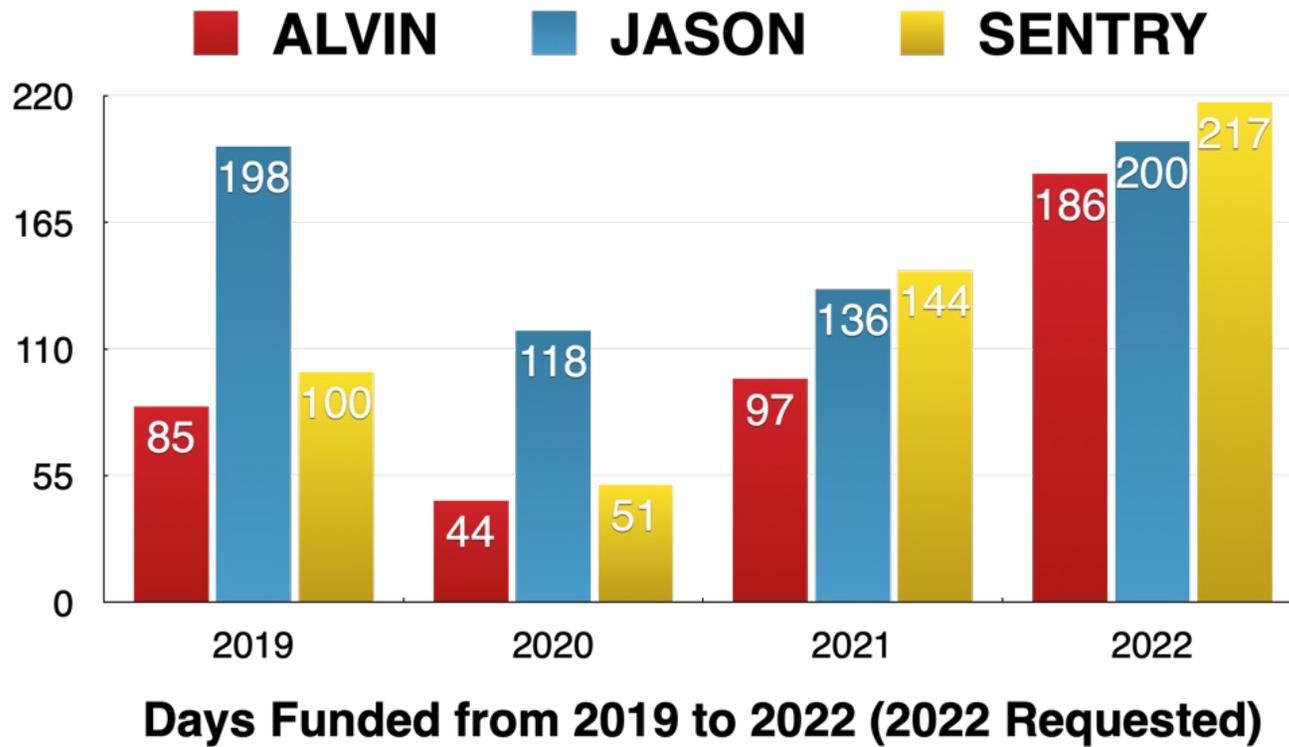
Mid-Aft Block

Tail Block

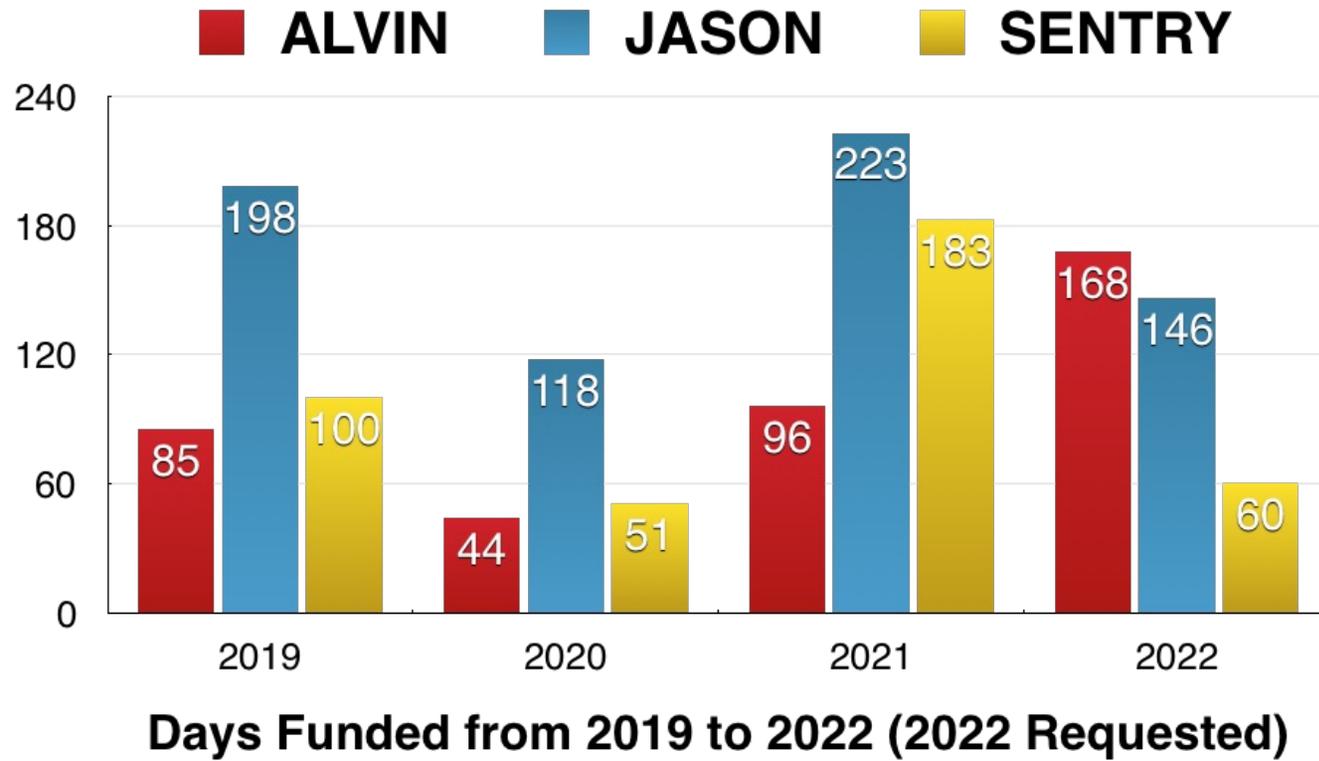
Starboard Major Mid-Ship Block

Following slides can be used as reference if requested

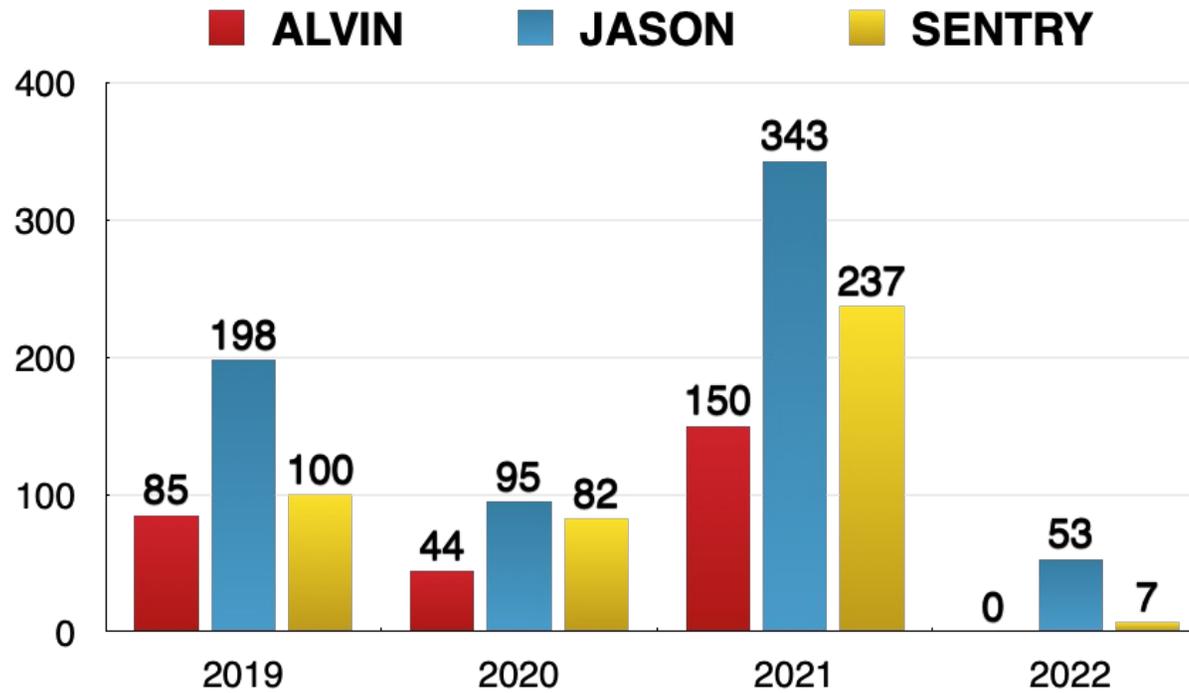
Spring 2021



Fall 2020

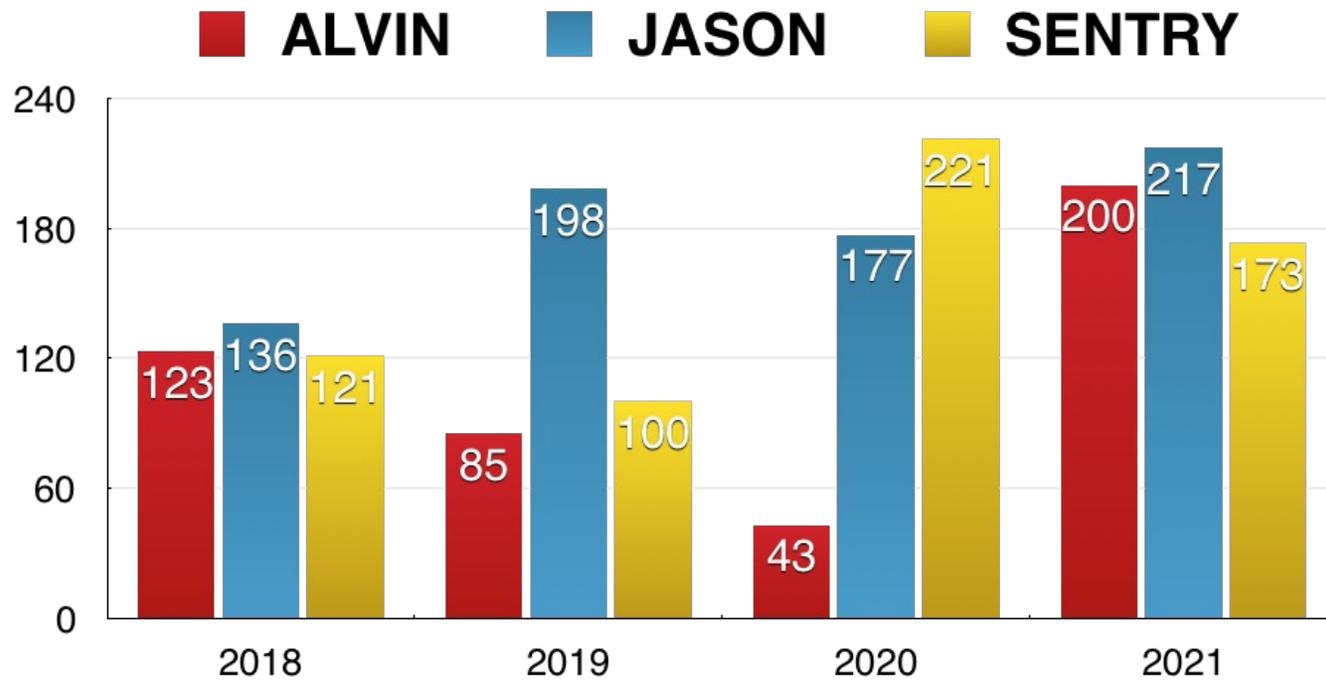


Spring 2020 DeSSC



Days Funded from 2019 to 2022 (2022 Requested)

December 2019 DeSSC



Days Funded from 2018 to 2021 (2021 Requested)

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