Opening Comments





R/V Atlantis Mid-Life

- Mid-life is at a critical juncture with current bidders conference in Newport, OR (8 bids expected).
- Alvin overhaul/upgrade completion will be timed with mid-life.

RCRV Resolution

- Keel-laying ceremony for the Resolution held May 9.
- Vessel will be operated by East Coast Oceanographic Consortium (ECOC) led by URI and co-founding members WHOI and UNH along with 12 Associate Members.
- Operational in 2023.

NOAA Ocean Exploration Cooperative Institute

- Led by URI and including WHOI, UNH, and USM.
- Aimed at enhancing ability to explore the seabed, mid-water, and sea-surface of US territorial waters through lighter/smaller ROV and AUV technologies.

WHOI Initiatives

- Ocean Twilight Zone, Ocean Worlds, HADEX
- Development of vehicles (ROVs, Landers, AUVs) to explore ocean frontier regions

NDSF Image Income 2018

• \$1,140.00



NDSF Operator's Report

NDSF Vehicle Operations Summary



Alvin Operations Summary

December 2018 – June 2019



3 cruises

Mid-Pacific Rise (Dec 2018) Davidson Seamount & 9N Bio-transect California Abyssal Plain

28 total dives

8 Gregg (2500 m – 2900 m) 3 Engineering (1500 m – 3300 m) 13 Sylvan (2500 m) 4 Drazen (4100 m)

Dive Times

234 hours submerged159 hours on bottomAvg Bottom time 5.64 hours





Alvin Highlights



- Dive 5000, December 2018
- Live broadcasts during Alvin operations for BBC Blue Planet Live
- Characterization of Davidson Seamount 'Octopus Garden' site
- 2 new Chief Scientists (Sylvan and Drazen) complete excellent dive series
- Anthony Tarantino sails as EL on Sylvan
- Danik and Drew promoted to Mechanical and Electrical Section Leaders
- Kylie Pasternak MATE Intern on Sylvan and Drazen
- Drew Bewley completes Pilot quals in 2019
- New Alvin Mechanical Engineering position open and actively seeking diverse candidates





JASON Operations Summary

70 operating days

3 cruises

Saffronz: Solomon 15 dives (J2-1113 – 1127) 148 hours 10 min SAB Deepwater: Cordez/Demopoulos (J2-1128-1138) 150 hours 27 min Slow Life: Orcutt (J2-1140 – 1143) 100 hours 38 min

- 400 hours total bottom time
- Longest: 35 hrs
- Average: 14 hrs
- Vessels used: Revelle, Brown, Atlantis





Photos by Erik Olsen



JASON Highlights

- New Control Vans received great feedback
- Zero cable torque problems since "Science ROV Cable Torque Workshop and Engineering Cruise established single-body operation procedure

New 4 k camera interface improved





Photo by Erik Olsen



Sentry Operations Summary

- 35 operating days
- 1 Cruise

Marion Rise

- 5 dives
- Total survey time: 95 hrs
- Average dive time: 22 hr
- 270 km of survey

NDSE NATIONAL DEEP SUBMERGENCE

• Vessels used: R/V Thompson



Photo by Lu Lamar

Sentry Highlights

- 1. Operations on the Marion Rise
- 2. Simultaneous operations with dredging program
- 3. Wave Glider Operations without the need for extra bunk
- 4. Zero failures during Marion Rise cruise





DEEP SUBMERGENCE SCHEDULING: 2020-2021 ALVIN / JASON / SENTRY

- State Dept. Notes
- Vehicle Reports
- Observations

NDGF NATIONAL DEEP SUBMERGENCE

• On the Horizon

Exclusive Economic Zones & Boarders



https://www.state.gov/e/oes/ocns/opa/rvc/country/index.htm



New Canadian Protected Area

Location

West of Vancouver Island, British Columbia; DRahom Pacific Bioregist: (CPR).

Approximate Size (km²)

106,700 km²

Approximate % of Canada's ocean levitory

2.42%

Data User/Iffed

May 34, 2017

Interim Conservation Dijactive

Contribute to the protection and conservation of the unique seafloor features (i.e., seamounts and hydrothermal vents) and the ecosystems they suggost in Canada's Official Pacific Bioregos.

Environmental Context

In 2014, Ecologically and Biologically Significant Reeal (EBEA4), including assemburits and hydrothermal veritil, were identified in the Offshore Pacific Bioregion by Fatheries and Oceans Canada (DFO) Science in accordance with a contemation of national (DFO) and international (e.g., United Nations Convertion on Biological Diversity) oriteria for identifying EBEAs.





May Stats 2019	
Alvin 2020	
Funded	50
Pending	55
TBS	38
Total Days	143
Cruises	10
(4 Alvin or Jase	on)

Alvin 2021	
Funded	0
Pending	88
TBS	32
Total Days	120
Cruises	6
(4 Alvin or Ja:	son)

Dec Stats 2018	
Alvin 2020	
Funded	10
Pending	44
TBS	0
Total Days	54
Cruises	5

AIVIII 2021
Funded 0
Pending 34
TBS 14
Total Days 48
Cruises 3





May Stats 2019.		
Jason 2020		
Funded	263	
Pending	266	
TBS	32	
Total Days	561	
Cruises	25	
(4 Alvin or Jason)		

Jason 2021		
Funded	85	
Pending	118	
TBS	73	
Total Days	276	
Cruises	17	
(4 Alvin or Jason)		

Dec Stats 2018.	
Jason 2020	
Funded	49
Pending	83
TBS	13
Total Days	147
Cruises	17

Jason 2021	
Funded	12
Pending	37
TBS	34
Total Days	83
Cruises	10





May Stats 2019.		
Sentry 2020		Sentry 2021
Funded	184	Funded
Pending	65	Pending
TBS	39	TBS
Total Days	288	Total Days
Cruises	10	Cruises

Sentry 2020 Funded 81 Pending 18
Funded 81 Pending 18
Pending 18
rending to
TBS 14
Total Days 113
Cruises 8

Sentry 2021	
Funded	11
Pending	14
TBS	26
Total Days	51
Cruises	4



2019 Alvin, Jason & Sentry Operation Areas



\bigstar	83	Sentry days	4 Cruises
\bigstar	222	Jason days	9 Cruises
\bigstar	67	Alvin days	3 Cruises







Observations

Global Vessel Availability:

- > 2016-2020 Global, Mid-Life Dry Dockings w/ Thompson & Revelle have put a lot of pressure on Atlantis & Sikuliaq to pick up Jason/ Sentry ops in the US
- > 2018-2020+ Thompson operating in Oceania, Atlantic and West Pacific
- > Pressure on vehicle transport logistics and staff

Vehicles:

- > ~Quarter of Jason requests are for Jason or Alvin (Two years in a row)
- > Final schedules end up being half of what was initially requested
- Outreach cruises yield more vehicle requests





On the Horizon

➢ Good mix of funding sources: NSF, ONR, NOAA, NOPP

> Utilization rates are consistent, on upward trajectory

Engineering dives continue to be valuable to the facility & users success

➤ AGOR 23 Class Mid-life Refit:

- Revelle ETC June 2020
- Atlantis ETA June 2020, coordinate w/ Alvin overhaul
- Mid 2021 all vessels back in operation







I'm here to help

Kerry Strom Marine Operations Coordinator

> 508-289-3938 kstrom@whoi.edu



Summary of Debriefs

Alvin, Jason, Sentry



Summary of 2018-19 Alvin Debriefs

Cordes, Costa Rica Seeps (Alvin/Sentry) Teske, Guaymas Basin (Alvin/Sentry) Fornari/Gregg/Perfit, EPR (Alvin/Sentry) [ECS] Sylvan, EPR (Alvin) Drazen, SoCal (Alvin) [debrief not completed]



Alvin Debrief Highlights

- Alvin's 5000th dive was fantastic- "most impressive hydrothermal mound in all Guaymas Basin"
- Overall, PIs were pleased with the performance and capabilities of the Alvin, including at least one new user as Chief Sci, with most of the objectives accomplished.
- Extensive use of elevators with Alvin enabled full biogeochemical characterization of the targeted seeps
- Communication went well between the expedition leads and the scientists
- Impressed with the Alvin group overall, their professionalism, enthusiasm, attention to detail, and superb pilots
 - During Danik Forsman's first expedition as a full Alvin pilot, he preformed exceptionally well and is a great addition to the group. Great job communicating with observers, providing suggestions to enable efficient operations to help achieve science objectives.
 - Alvin PIT Drew Bewley has advanced significantly in his confidence and skill. He was actively engaged with the science party and had a leadership role on Alvin EE questions.
 - Pilot Jefferson Grau did a great job training the scientists during short mobe and transit



Pre-cruise and Mobilization

- Pre-cruise planning was generally complete and very well done
- Planning included discussions of extensive push coring and Alvin group ensured there were sufficient core assemblies for the mission
- New user remarked that the Alvin group provided important guidance on efficient operations
- Discussed required training of scientists in the use of major samplers, but the training did not get completed.



Operations –vehicle performance

- Vehicle performed very well, dived at every opportunity Bottom times were great, very efficient operations
- 2 dives were shortened due to repair required for Navy qualification
- One dive aborted due to failure variable ballast system, which was resolved during a short surface interval.
- One cruise had an extra dive (12 planned, 13 executed), with a nighttime recovery which may provide good practice for future longer dives with the 6500m vehicle sub.
- Issues with manipulators on a few dives impacted completion of mission objectives



Operations- NDSF-provided equipment

4K camera on the sub produced great imagery.

- The HD camera controls can behave erratically occasionally, but overall worked fine.
- Go Pros worked well overall and provided important perspective (wider view) of entire dive.
- Other controllers (e.g., video game controllers) should be investigated and/or users may require more practice prior to diving
- Major samplers and ICL comms were not consistent. ICL did not record temperature in the Alvin data stream.
- Heat-flow probe experienced a fault and had to be secured. On one dive, the temperature probe was used instead of aborting the dive. Overall, the heat-flow probe operated without problems on 8 of the 10 dives.
- Bioboxes need repair and maintenance (only 3 of 5 were usable)
- Event logger (seaLog) and dive review (SeaPlay) were used successfully. Scientists commented that the digital log helped post dive review and preparation of dive reports.
- While elevators worked well for one dive series, another cruise had issues because the elevators lacked an acoustic release and EL was hesitant to use them because of time required to locate them on the seafloor. They were not used, limiting planned sampling collections



Operations- User-provided equipment

Temperature lancers (UNC provided) worked

In situ microprofiler lacked pressure certifications and was not used

O2 probe also lacked appropriate pressure certifications for the target depths, which could be resolved by better precruise communication on tests/planned depths in the future.

Exposure chambers deployed without issue



General Recommendations

Room for improvement in clarifying the chain of command for decision making, particularly for last-minute decisions. There were examples of the EL making judgement calls at the last minute that changed what had been discussed the prior day or overruled instructions given by others (e.g., the launch coordinator). While this generally didn't impact science, it introduced uncertainty into how and when decisions were being made.

At sea, EL focused on safety considerations, including potential issues with a microprofiler with housings that lacked pressure certifications. A focus on – and follow up – on pressure certs during pre-cruise would be helpful.

Improved communication regarding use of sampling gear throughout the planning process (e.g., majors) and follow through to ensure training occurs



General Recommendations (cont.)

- Short port stop for one expedition created a challenge for ensuring all pre-dive training could be accomplished. Suggestion was made to factor in port stop and transit duration to enable training required.
- Event loggers used well by one PI. Broader use by future Pis could be facilitated by pre-cruise training/discussion during cruise planning. Also, one user suggested incorporating voice recording into SeaLog.
- Cameras should not allow digital zoom because this results in poor image quality
- Improved network pipeline to the main lab for Alvin data access
- Alvin bio boxes need to be ready prior to sailing
- Navy approval should have been completed during port stop prior to departure to avoid lost dive time



Summary of 2019 Jason Debriefs

Tivey, Juan de Fuca Sulfides (Jason) [debrief not completed] Solomon, Hikurangi (Jason)



Jason Debrief – Operational Issues

- AFX power supply to thrusters had multiple failures, lead to curtailing of some dive plans.
- Weather calls made on the basis of unreliable forecasts, rather than at-sea conditions led to lost days.
- One cruise w/o debrief only reported everything with Jason was 'fantastic'.

Jason Debrief – Vehicle equipment

- There are some questions around values coming from NDSF supplied heat-flow probe; unclear whether this is a probe issue, or due to seafloor conditions for this particular area.
- The 4K camera was terrific and improved user interface appreciated.
- The new Sealog system was praised for ease of use and capability; the only issue was it was difficult to delineate between science instruments in the .csv file.

Jason – Team Operations.

Launch/recovery only on shift changes led to lost time; consider switching to 12on/12off for dives with short dive schedules.

One expedition was substantially impacted by shipping delay in getting winch and other components required for Jason ops to New Zealand, however, these were largely beyond NDSF control.

Data handling flexibility and delivery during cruise and hand-off a end of cruise was very good.

Summary of 2018-19 AUV Sentry Debriefs

Cordes, Costa Rica Seeps (Alvin/Sentry) Teske, Guaymas Basin (Alvin/Sentry) Fornari/Gregg/Perfit, EPR (Alvin/Sentry) [ECS] Dick, Marion Rise



Sentry Debrief Highlights

P.I.s had good reviews of Sentry's performance and ability to meet their science goals.

Strictly praise for the ability and conduct of the Sentry team during the cruises.

Zac Berkowitz "has ability to read scientists minds", in a good way & Justin Fujii stepping up as mission planner

Water-column surveys were conducted over seep sites via the science-provided wire-flyer and AUV Sentry.

No time lost and >100% of cruise objectives were met due to additional exploration of nearby seamounts

Sentry used for targeted multibeam mapping of dredge targets

"Sentry enabled the scientists to see the seafloor in a new way, which was spectacular. Mapping was a huge success."

4 dives at 9 50'N EPR seafloor mapping for evidence of an eruption and heat flow survey

All of the Sentry objectives were achieved and few technical issues, extra dive

ADCP and additional science-provided temperature sensors were installed

Methane sensor integrated with Sentry. The Sentry team did the integration and the science party was happy with the resulting data



Sentry Pre-cruise Recommendations

Mobilization was smooth

- Pre-loaded several cruises in PR
- Loading in Puerto Rico has benefits associated with U.S. ports
- Experienced science team clearly helps smooth the mobe process
- Port time in Manzanillo went well and on-station earlier than expected allowed an extra Sentry dive.



Sentry Ops Recommendations

- Sentry operations were conducted every other night to accommodate wire-flyer and the limited personnel (4 rather than 5 operators).
- The first Sentry dive ended up as a combined engineering-science dive, because engineering time had been lost due to schedule changes.
- Wave glider allowed dredging ops during Sentry dives and allowed Sentry team to catch a DR error during a dive even though the ship was out of acoustic comm range with the vehicle.
- Minor Reson problems (drop-outs) during one dive; next dive able to fill those gaps.
- Issues with concurrent deployment of the CTD during Sentry operations based on differences in safety of ops between team, crew, and science.

Sentry Data Recommendations

Simplified readme for the Sentry data structures would be helpful to scientists unfamiliar with the deliverables.

Cordes science party wrote "read-me" of data types and their locations and provided this to the EL. This type of document would be an excellent addition to the deliverables and the online documentation.

Add directory on the local (ship's) server that would contain data products that the Chief Sci would refer to frequently during the cruise.

"Side-scan processing has come a long way"

Zac improved the data documentation and it made it easier for Science to locate what they needed. He included detailed descriptions of what is there, how to find it, and what software to use to look at it.

NDSF Facility Update Facility Update





Alvin updates: Staffing



- Anthony Tarantino sails as EL on Sylvan
- Danik and Drew promoted to Mechanical and Electrical Section Leaders
- Kylie Pasternak MATE Intern on Sylvan and Drazen
- Drew Bewley completes Pilot quals in 2019
- New Alvin Mechanical Engineering position open and actively seeking diverse candidates



Alvin updates: Program Improvements

- Camera controller issues resolved
 - (PCAR comments)
- Both Schilling manipulators serviced
 - (PCAR comment)
- Replacement to outdated ICL data link underway
 - (PCAR Comment)
- 4 new sealing bio-boxes delivered
 - (PCAR comment)
- Acoustic releases for elevators are available but do not work easily on the non-standard elevator. Modifications are planned in 2020 no current elevator use planned for 2019
 - (PCAR comment)
- O2 sensor rating (3000 m) was user defined by (G. Wheat) pre-cruise. Dives to the Octopus Garden (3250 meters) exceeded this rating. Housing certification/testing is a significant part of pre-cruise planning but will be amended as needed to improve user understanding.
 - (PCAR comments)







- Group training continues, to avoid future mis-communications or misunderstandings between science party and group leads.
 - (PCAR comment)
- Short in-port periods with short transit times to station can cause training time stressors. Enabling pre-cruise training for users is planned for 2020 and beyond.
 - (PCAR comment)
- "Sealog" event-logger replacement of Frame-grabber underway including implementation of recommended improvements for users and pilots.
 - (PCAR comment)







Alvin updates: Program Improvements



- NAVSEA approval request of noted repair was submitted prior to the cruise but delayed due to availability of NAVSEA oversight personnel. These issues are non-routine and rarely if ever impact dive time (in this case reduction in total dive time on two dives by approx. I hour). Group training on how to avoid these situations was completed.
 - (PCAR comment)





Alvin updates: Program Improvements

- 4K Cameras
- 6,500 meter depth rating
 - Sulis Z70 4k UHD
 - Sub-C 4k camera
 - Testing in October





SULIS Z7O AK ULTRA HIGH DEFINITION DEEPSEA CAMERA DEPTH-RATED TO 6KM AND 11KM

- HD Cameras
- 6,500m depth rating
 - DSPL Vertex HD
 - Testing in October

Vertex SeaCam





Alvin updates: 6500 meter VB system updates





New Variable Ballast system design in final review



Alvin updates: 6500 meter VB system updates

- VB-HP Air Spheres
 - New 6500m ballast spheres
 - Manufacturing underway
 - NAVSEA approved design
 - Expected delivery Summer 2020





New duplex seawater pump

- hydraulically powered seawater pump – joint WHOI/Oceaneering design
- New pump arrives this week for testing



Alvin updates: 6500 meter design progress

- New syntactic foam shaping underway
- New primary hydraulic system design in final review
- Revisions to frame design nearing completion
- Remaining new thruster and motor controller component/housing assembly underway
- 6500 meter component procurement underway
 - CTD DVL
 - Scanning Sonar Cameras
 - Avtrak USBL Beacon Sensors
- Component arrangement in final review







Jason update: Staffing



- New contractors
 - Summer Ferrel, experienced OET ROV operator, mechanical/Navigation
 - Jim Convery, experienced oil field ROV operator, mechanical
- Ben Tradd EL and RCA Project Manger
- Andy Billings Mechanical Engineer
 - Moved to Jason from Sentry
- Section leads assigned for each expedition (pcar 2018)

- We're providing more manipulator training and practice with ODI connectors to assure ease of connections 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
- Implemented elevator tracking to prevent loss if weather prevents immediate recovery pcar 2018
- Weather limits have been reviewed with Els, Pls 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





- Numerous issues contrived to cause late arrival of LARS and miscellaneous equipment to New Zealand
 - Heavy equipment must be trans-loaded from trucks to flat racks to go on shipping vessel
 - New Zealand fumigation requirement
 - Holliday limited heavy gear movement
 - Changes to shipping company schedules
 - Backlog of shipments due to earlier government shutdown and holiday
- NDSF and WHOI shipping office are addressing single source freight forwarder pcar 2019
- NDSF personnel will receive additional training in International shipping procedures pcar 2019
- NDSF and Vehicle schedulers will continue to work closely to assure contingency in the schedule





- NDSF is Testing multi-beam replacement on Jason in 2019
 pcar 2018
- NDSF is developing new heat flow probes due to increased demand, will address data quality pcar 2018
- Development of new thruster motor and controller underway
 - Will seek funds in 2019 to complete
- Tool van approaching end of life
 - Will seek funds in 2019 budget to build replacement
- SeaLog system replacing VirtualVan getting mostly praised pcar 2019
- Working to address concerns with delineation between instruments in csv pcar 2019





 New Jason power system (AFX) continued to plague with power outages pcar 2018/19



- Manufacturer identified issue and we replaced all AFX units in 2019 with newer version
- One failure free cruise followed by one failure on the next cruise (Orcutt 2019)
- Limited impact to science due to ready spares being installed
- Reviewing AFX design and considering return to Jetway
- Jetway won't fit into CV, thus would be installed in AC'd space in vessel during MOB

Jason system upgrades – 4K Camera



- Subsea Sulis Z70 4 k
- 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 resolution 4 k recorded in highlights and HD 24/7
- Stills in full resolution to separate hard drive
- Redesigned GUI with P&T control integral (pcar 2018)
- Replaces Super Scorpio (pcars 2017)
- Connector oil leak on demo unit replaced by Jason connector on final unit (pcar 2018)



ROV Jason - Sulis Stills Image Example





Sentry Update: Staffing



- Sean Kelley fully assuming role as program manager
- Justin Fujii Continued support as primary mechanical engineer, training as EL with solo cruise fall 2019
- Zac Berkowitz continues to provide electrical support and running cruises as expedition leader.
- Stefano Suman continued support as at sea software engineer
- Manyu Belani trained as at sea mechanical lead
- Ian Vaughn continued at sea software support
- Jennifer Vaccaro at sea software support
- Laura Lindzay at sea software support
- Mike Skowronski at sea EL/EE support

Sentry Update: XR replacement



- Engineering and Development to replace existing XR's which provide an acoustic link between Sentry and vessel, as well as control weight dropper systems. XR hardware is at end of life and requires update to electronics and pressure vessel.
- Smaller Foootprint, lighter weight in water leading to additional payload for Sentry

Existing XR

Hardware

- Will leverage Benthos complete solution with topside hardware
- Modem capabilities up to 15kb/s between Sentry and Support Vessel.
- COTS hardware
- Leverages existing robust LBL ping/signals



Ι

NDSE NATIONAL Deep submergence

Benthos Hardware





Sentry Update: EM2040 Integration

- Full integration of the Kongsberg EM2040 Multibeam system, replacing the Reson Seabat.
- Integration is in development ~%30 complete.
- Computer/PU to be installed into Sentry main housing, freeing up space on Sentry's starboard side
- One unit received, happy with delivery times and interactions with Kongsberg.
- Kongsberg providing Linux version of multibeam controller for Sentry.
- Qualification and testing to be completed fall 2019.







Kongsberg Rx Transducer.

Kongsberg PU Computer

> NDSF NATIONAL DEEP SUBMERGENCE

Sentry Update: Pioneer DVL integration

- Full integration of the Teledyne Pioneer DVL. Design and manufacturing of adapter bracket for both Pioneer a Workhorse DVL. Protective skeg design in development with Teledyne for DVL protection when impacting the seafloor.
- Improved Bottom following (Up to 400m Altitude, currently limited to 150m altitude)
- Workhorse DVL to be at end of life No new purchase, Teledyne will continue to service workhorse.
- Same operating frequency as workhorse DVL 300KHz
- Improved bottom following on slopes, often an issue with the workhorse DVL.
- Validation and Qualification to be completed this fall during the Sentry Engineering Cruise.
- Lower Idle Power

Pioneer DVL



Pioneer DVL guard Design







NDSF NATIONAL DEEP SUBMERGENCE

Sentry Operational Improvements



NavG

- Primary navigation program used by NDSF assets
- NavG3.0 primarily used for navigation during 2019 Marion Rise cruise with little to few issues.

Waveglider Operations

- Waveglider used during Henry Dick cruise for the second cruise with Sentry.
- Waveglider operated efficiently without any issues noted.
- Allowed for Science to dredge during Sentry dives
- Provided constant communications with Sentry, capturing fault during dive.

Andreaa Optode Calibration

- Optode to be calibrated to Higher resolution summer 2019
- Multipoint calibration improving resolution from 8.0 umol to 2.0 umol
- Improved oxygen concentration measurements









Sentry update: Data/Software



- Data structure document added to all data drives at end of cruise to improve data access (PCAR multiple)
- Improved written guidelines in development for simultaneous operations (PCAR 2018/multiple)
- Sidescan processing software (sonarwiz) updated to newest revision, utilized/implimented on Henry Dick cruise. (PCAR 2017).
- Calibration documentation included in end of cruise data hard drive.
- Multibeam investigation into processing tools for Kongsberg EM2040.

NDSF Facility Update NDSF 2019 and onward



NDSF Technology Update: New Goals

- Increase the capability, efficiency, and cross training of NDSF by:
 - More aggressively pulling technology from R&D projects
 - Ensuring that designs are as modular and re-useable as possible and that significant effort is put into common hardware and software on all vehicles
 - Moving all vehicles to a single software platform that is also run on R&D vehicles to improve code re-use streamline maintenance and enable technology pull

NDSF Technology Update: Multibeam Project

- Purchased two Kongsberg EM2040 Sonars Reliable and cost effective of available options
 - Building a Sentry install and supporting "Fly-Away"
 - Goal is Jason August 2019, Sentry -September 2019
 - "Fly-Away" is initially just different mounting, but is being designed to integrate easily onto any large vehicle with a basket with only a few connections
- Re-evaluating data post-processing pipeline to deal with a less organized MB-System world
 - Current pipeline relies on code that has declining support
 - Adapt current pipeline by August, 2019
 - Plan for new pipeline by winter, 2019





NDSF Technology Update: ROS/MX Upgrade

- ROS now running on Sentry 60+ dives highly reliable
- Rolling out mission executive for advanced monitoring and autonomy
 - Gives ability to rapidly develop new autonomy modules in a relatively low risk way
 - Gives a high end monitoring and cueing system as well as configuration control that will be highly useful even on human-in/on-the-loop systems
- Started planning work for moving Alvin/Jason to ROS
 - Maintainable, common code base
 - Interchangeable personnel
 - New capabilities for both



NDSF Technology Update: NavG 3

- New vehicle user interface
 - Looks similar, but different from the ground up
 - GIS based co-locate your data, planning, and monitoring
 - Plug in based with savable configurations
- Used on Sentry ops, mainstream on Sentry this fall
- Adaptation begins for Jason this winter.





NDSF Technology Update: Post Processing/Reporting

- Move all three vehicles to a common post processing pipeline
 - Close, but have all diverged
 - Significant work done on Jason and Alvin is still the same c. 2016, but needs some additional features
- Adopt Sentry cruise report format
 - Requires a web front end and a database back end to make accessible to all users
 - Summer student this summer to explore, engineers to finish spring 2020





NDSF Technology Update: Future Road Map

- DS_ROS
 - Rapidly expanding to more vehicles, NDSF, NSF general, ONR, ARPA-E, OTZ, NUWC Keyport, ???
 - Two way street NDSF contributes and receives modules
 - Must solve the divergence and maintenance problem
- Centralize and then interconnect domain knowledge
 - Nav hardware, post processing, imaging?, sonar, etc
- Software and Data
 - Common Code, Workflows, Hardware, and People
- Auto QA/QC/Configuration Management
 - Reduce errors, catch errors earlier, reduce training
 - Better Error tracking, reporting, and analysis
- Common Technology Make using common tech the default not the goal
 - Power supplies, hotel hardware, imaging, topside support, etc
- Simulation and training more of a far field initiative but potentially highly valuable