DESSC Spring Meeting, May 15,

# <sup>2024</sup> Summary of 2024 Sentry Debriefs

- Jill McDermott (Lehigh) & Dan Fornari (WHOI) 9N EPR Sentry & Alvin on R/V Atlantis AT50-21
- Mandy Joye (U Georgia) & Karthik Anantharaman (U Wisconsin Madison)– Hydrothermal systems of Pescadero and Guyamas Basins, Gulf of California – Sentry and Alvin on R/V Atlantis (AT50-22)
- Daniela Di Iorio (U Georgia) Bush Hill seep, Gulf of Mexico Sentry and Jason on R/V Revelle (RR2405)
- Bill Chadwick (OSU), Scott Nooner (UNCW), David Caress (MBARI) –Axial Seamount - Sentry and Jason on R/V Atlantis (AT50-26)
- Adam Soule (URI) et al Archeology, volcanology manganese nodules, hydrothermal plume hunting and mapping, vicinity of American Samoa – Sentry on EV Nautilus (NA165)
- Julia Bowles (U Wisconsic Milwaukee), Jeffrey Gee (Scripps), Dorsey Wanless(Boise State U), Janine Andrys (Boise State U) – Southern EPR – Sentry and Alvin on R/V Atlantis (AT50-31)

#### Sentry Debrief Highlights – Modes of Use

- McDermott et al.
  - I-m-scale multibeam mapping
  - Seafloor photography with MISO cameras (5-m altitude)
  - Wave glider enabled one concurrent Alvin & Sentry operation
- Joye et al.
  - I-m-scale multibeam mapping
  - Multibeam water column imaging hydrothermal plumes
- Di lorio et al.
  - I-m scale multibeam mapping
  - Multibeam water column imaging of gas and oil seeps
  - Seafloor photography with Prosilica camera

### Sentry Debrief Highlights – Modes of Use

#### • Chadwick et al.

- I-m-scale multibeam mapping measuring vertical change over repeated long baseline surveys
- Terrain Relative Navigation from MBARI used to closely repeat prior survey tracks
- □ Soule et al.
  - □ I-m-scale mapping
  - Seafloor photography with MISO cameras
  - Water properties including SAGE and MAPR sensors
  - □ Some dives as deep as 5800 m
  - Needed Wave Glider, but unable to fit on EV Nautilus
- Bowles et al.
  - I-m-scale multibeam mapping
  - Total field magnetometer mounted externally



Sentry Debrief Highlights – Modes of Use

- Summary
  - I-m-scale multibeam mapping 6/6
  - Multibeam water column 2/6
  - Seafloor photography 3/6
  - Science party supplied sensors 2/6
  - □ Wave glider 1/6
    - +1/6 desired but not workable on ship

# Sentry Debrief Highlights – Issues of Note 1

#### McDermott

One mission list to multibeam failure

#### Joye

- Problems using multibeam water column data to detect hydrothermal plumes
  - First serious use of EM2040 multibeam water column data
  - Problems logging the multibeam data with water column enabled because of previously unknown limitations in the data logging software
  - Sentry personnel were able to piece the dataset together post-cruise from secondary logs
- One mission lost due to multibeam failure
- Sentry operations terminated due to failure of R/V *Atlantis* starboard crane

#### Di lorio

Unexpected restrictions on Sentry use due to 50-m high moorings deployed during the cruise – if the PI had understood the issue fully she would have changed the order of operations.



#### Sentry Debrief Highlights – Issues of Note 2

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- DVL failure cost one dive failure
- R/V Atlantis stability issues following midlife engine change required placing the Jason winch further inboard than in the past. In turn this left inadequate deck space for Sentry, mooring and CTD operations (fortunately CTD was not necessary, but Sentry deck ops were very tight).

#### Soule

- Multiple failures on deepest dives
  - USBL messaging didn't work deeper than 5000 m
  - Motor housing for port forward thruster flooded
  - No spare thruster so remaining dives used 3 thrusters
  - Drop weights failed repeatedly
- Realtime navigation poor without USBL aiding when doing unattended operations concurrent with ROV dives
  - Likely improved in the future by shift to using Kalman filtered output of new Phins C7 INS



Sentry Debrief Highlights – Sentry Reliability

- The core vehicle was largely reliable, excepting:
  - One thruster and two drop weight failures during >5000 m deep dives
  - Two missions lost to multibeam failures and one to DVL failure



#### Sentry Debrief Highlights – Sentry Team

- The PI's consistently praised the skill, professionalism, hard work, and enthusiasm of the Sentry team members at sea.
- Expedition leaders were Isaac Vandor, Zac
  Berkowitz, Matt Silvia & Sean Kelley, also explicitly mentioned Tim Joyce.



# Summary of 2024 *Alvin* Debriefs

Arellano, Costa Rica Margin (Alvin) Jan 2024 McDermott, East Pacific Rise (Alvin/Sentry) Feb-Mar 2024 Joye, Pescadero Basin (Alvin/Sentry) April 2024 Levin, Aleutian Margin (Alvin) May-June 2024 Bowles, South EPR (Alvin/Sentry) Nov 2024



## **Alvin Debrief Highlights**

- Many members of the science parties were able to dive for the first time
- Two new GoPros were used on Alvin: one mounted on the brow and one on the starboard manipulator arm. The brow camera was widely appreciated for its time-lapse playback, which was especially helpful for post-dive science review.
- There is a high level of confidence in the professionalism of the pilots. PITs were praised across multiple cruises. Mechanical leads were frequently commended for exceptional problem-solving.



#### **Alvin Debrief Highlights**

- iPad-based camera control remains a significant limitation.
  Lockups, delays, and user interface issues were reported by every cruise. Users suggest a return to manual or joystick-based pan/tilt/zoom controls.
- Cruise objectives were often adapted in real time to accommodate discoveries or conditions (e.g., strong currents, map offsets). Flexibility from the Alvin team was essential.



# **Alvin Debrief Highlights**

- The Alvin team generally did well responding to science requests.
  For example:
  - Mechanical lead Nick Osadcia was frequently commended for his exceptional problem-solving and dedication, including rebuilding a manipulator arm mid-cruise.
  - PITs Randy and Kaitlyn (Arellano cruise) and Matt and Benen (Levin cruise) were praised for making users feel safe and supported.
  - Rick was thanked for his proactive approach to power conservation, helping extend bottom time on dives.



#### Pre-cruise and Mobilization

- Most PIs found pre-cruise planning productive but emphasized the need for better continuity when personnel were changed following planning meetings (e.g., EL or tech team swaps).
- It would also be helpful to meet with the pilots sailing, when possible.
- Some PIs noted confusion regarding pressure certifications and camera depth ratings. There is a desire for clear guidance on how to carry out necessary pressure tests and ensure equipment readiness for deep-diving operations.
- The pre-cruise checklist was used by all cruises in 2024, but it could benefit from more tailoring. Experienced Alvin users found it repetitive or lacking in detail. New users appreciated having it.



#### **Operations: Vehicle performance**

- Of the 5 Alvin cruises, only 1 achieved its full dive count; 2 were significantly impacted by weather or mechanical issues (Bowles, Levin).
- Across cruises, Alvin was launched in challenging conditions (complex sea states, sharks)



#### **Operations: Vehicle performance**

- Power management affected dive length on several cruises.
  Bottom time was often shortened due to battery use or conservative recovery timelines. One pilot, Rick, is very proactive about power conservation. Other pilots will likely develop these skills further with additional experience.
- Navigation issues (e.g., beacon failure, position offsets) caused inefficiencies on multiple cruises.



# **Operations: NDSF-provided equipment**

- Camera systems produced good imagery when functional, but are unreliable. On nearly all cruises, observers had to reboot iPads to regain camera control, sometimes multiple times per dive. Port and starboard camera logging in Sealog occasionally mismatched with observer seats, and in one case, a port observer's comments were lost entirely.
- Several cruises noted that camera placement (especially for close-up imagery) remains suboptimal.
- Most users like using the iPads for event logging in Sealog.
  Event logger and dive review were great. Digital log files support post-dive review, dive summaries and efficient generation of cruise reports.

## **Operations: NDSF-provided equipment**

- The Alvin team did a great job preparing users to collect samples using paired majors samplers.
- Slurp samplers were mostly functional, though samples sometimes mixed within canisters. Some PIs requested future design improvements.
- Some sensors (CTD, optodes) and Niskins had failures during deep dives (e.g., non-sealing at 5000m, grounding issues).



# **Operations: NDSF-provided equipment**

 One Schilling manipulator arm flooded during a deep dive on the Levin cruise and had to be rebuilt mid-cruise. Mechanical lead Nick Osadcia completed the repair. Other cruises reported no issues. In particular, the dual Schilling arms used on Bowles' cruise were effective and did not impact battery life.



#### **Operations: User-provided equipment**

- Isobaric gastight fluid samplers were successfully integrated and used to collect high-quality fluid samples.
- New fluid samplers on Joye's cruise yielded excellent results and were operated smoothly, once pilots become familiar with them.
- Temperature loggers were deployed and recovered successfully.
- SAGE CH<sub>4</sub> sensors performed well on both Alvin and Sentry. A few comms dropouts during ascent were noted.



#### **Operations: User-provided equipment**

- Pilots returned science-provided equipment in good condition, helped troubleshoot minor issues, and Rick trained users on how to inspect gear for electrical grounds.
- Movie cameras and educational outreach tools were used by multiple teams.
  - One cruise used a camera from a movie producer inside the sphere, but approval to deploy it was delayed until midway through the cruise.
  - Another cruise hosted a videographer affiliated with a commercial film project; the footage produced was not made accessible to the science team and could not be shared with PIs.
  - These cases highlight limitations related to equipment integration, approval processes, and media content ownership.



#### **General Recommendations**

- Across cruises, PIs recommended building in engineering dives prior to science operations, especially leading up to deep dives, to uncover potential issues before costly delays occur.
- Greater clarity is needed on when PIT dives are required and how aborted or test dives count toward PIT allocations.
- Alvin teams are overstretched at times. Sailing with only 2 pilots was a concern. Limited availability of experienced Alvin team members, including the presence of several new trainees, slowed basket reconfigurations and late-night integrations in some cases.
- The data team received high praise on all cruises. Joe Garcia and Larry George were described as exceptionally helpful and proactive.



#### General Recommendations (cont.)

- High-quality internet access was transformative. Multiple teams reported much stronger ability to conduct real-time collaborations, teaching, and outreach from sea.
- Several PIs requested greater support and retention incentives for Alvin team members; e.g., enhancements to living and social spaces on Atlantis to improve quality of life during cruises.



# Summary of 2024 Jason Debriefs

Chadwick, Axial Vent (Jason/Sentry) 2024 Kelley, Mexico (Jason) 2024 Barry/Lloyd, Mariana Backarc (Jason) 2024 Stern/Pujana, Challenger Deep (Jason) 2024 Wheat, Juan de Fuca (Jason) 2024 Schmidt, Axial (Jason) 2024



#### Jason Debrief - Overview

- Overall, Jason and the Jason Team supported a diversity of projects across many regions and vessels
- A diversity of user supplied and NDSF supplied assets were successfully used
- The JASON team continues to be highly praised including particular people stepping up into needed roles and helping graduate students at sea.



#### Jason Debrief – Operational Issues

Overall:

- Winch/Crane issues resulted in 4.5 days lost ship time across 2 cruises.
- Overhauled Atlantis requires specific deck layout resulting in cramped operations (no CTD possible) – communicated via PCAR.
- Minor issues (blown hoses and challenging navigation due to ship USBL issue) but Jason team overcame.
- Jason Pelagic pump issues on one cruise
- Reduced weather window due to 2 body setup
- Bad weather led to significant days lost across numerous cruises

#### Jason – Team

- A few new Jason users went to WHOI for planning meeting, was important.
- Jason team was also welcoming at sea.
- Overall, Strong praise for the team.



# Jason – Recommendations from users

- Telestrator or similar capability (allows drawing on screen)
- Provide part numbers for items to interface with JASON equipment (UFO tubing for example).
- Identify EL during pre-cruise planning
- Spares for pelagic pumps or variable speed pumps for Jason
- Clear expectations during the planning process for approximate weather windows
- Option for Online Video hosting for cruises that would like it.



Jason – Recommendations from users

- Including in checklist if outreach/cruise needs requires quick access to data/video (although PIs were often not aware of the checklist).
- Have the ability to overlay whole dive track.
- For remote participation, need for louder speakers.

Main Point of Discussion: Discussing pro's and con's of 2 body system during pre-cruise and in particular impact on weather window and capabilities.

