

Alvin de-brief summaries - 2009

Five cruises for 59 dives

Southern California borderlands
Juan de Fuca
Costa Rica

Alvin de-brief summaries - 2009

Overview:

All the PIs were very satisfied with their Alvin experience and felt that their scientific goals were all met or exceeded. These were repeat users of the facility and many noted significant improvements from previous years.

All personnel from Captain to deck crew, Expedition Leader, pilots, and engineers were at various times singled out for praise. The Alvin team was universally praised for its professionalism.

The following is an overview of some of the issues that came up during the cruises. Some of these are problems that have or will require some sort of corrective action while others are issues beyond the NDSF's control but presented here for their educational value to future users.

Alvin de-brief summaries - 2009

Overview (continued):

The main point of these interviews is to track recurrent issues and make sure there is followup and ultimately that there are no recurrent issues. We are finding that we are achieving that goal. Problems are being dealt with in a timely manner and equipment is being repaired/ replaced/ updated as fast as is practical or budgets allow. The only truly long-term recurrent issues seem to deal with navigation (which has been steadily improving), mobilization/demobilization/agent issues, and, of course, dives lost to weather.

Alvin de-brief summaries - 2009

Pre-Cruise Planning:

All PIs satisfied with planning in general with only a few issues. These were experienced PIs who put a lot of effort into planning.

Despite the advance planning, operating in and out of Costa Rica (Puntarenas) proved difficult due to customs issues and anchorage vs. docking

Juan de Fuca work required complex planning due to multiple programs occurring in the area such as Neptune-Canada. Most was anticipated but the arrival of MBARI's vessel and ROV was not. Neither UNOLS nor MBARI had identified adequately in advance that this conflict was going to occur – something that needs improvement in the scheduling process in future

Alvin de-brief summaries - 2009

Mobilization/Demobilization:

Most gear was transferred at US ports making this easy.

It was new for these PIs to be able to get on-board ship 2 days in advance of the cruise and much appreciated. Not only did this allow the science party to prepare thoroughly but it also allowed the Alvin group to process all the scientists through their pre-dive briefings before leaving port – a distinct advantage when the first dive site was only a few hours away for some of these projects. This was a huge advantage over previous operations and a significant change for the better.

Alvin de-brief summaries - 2009

Operations - Vehicle:

Overall, the PIs thought Alvin was operating close to its very best and that Alvin and Ship operations were very well integrated.

The batteries on the sub worked well throughout all but one of the programs but a 6 week layup before that one resulted in the sub's batteries being in poor condition and consistently underperforming throughout the cruise. This resulted in 0.5-1 hour reduced bottom times and needs paying attention to if Alvin is going to be "laid up" at sea again in future.

There were no other significant issues with the vehicle and all lost time was due to situations outside NDSF's control such as weather, a mechanical failure on the ship, and interference with other vehicle operations in the Juan de Fuca area.

Alvin de-brief summaries - 2009

Operations - NDSF Equipment:

LBL transponder navigation was used for much of this work and generally worked very well. The new USBL system was also used and found to be very effective.

In the early dive series, navigation was hindered by the loss of the forward-looking sonar which failed early on and remained inoperative throughout the remainder of the dive-series and the following cruise. This proved a big setback because this sonar is relied on heavily for target location. NDSF is looking into purchasing a spare.

There was a problem with generating usable data from the CTD on-board Alvin that required more than just the standard SeaBird software. The Alvin team was able to resolve this on board and the unit was ultimately sent to SeaBird for refurb.

Alvin de-brief summaries - 2009

Operations - NDSF Equipment (continued):

There were a few camera issues during the early dive series but all were ultimately rectified and the later dive series reported no camera problems. The still camera was replaced. For high-resolution documentation of some of the manipulations, one PI noted that one cannot always film what is going on from the manipulator arm camera when that is the arm that is being used to conduct the key manipulations! If payload etc were no object, adding a scientist-driven camera on a pan-and-tilt to the brow of Alvin (and the new RHOV) would be an asset.

A PI recommended adding an oxygen sensor to Alvin with the same dynamic range as used on a CTD (0.04 to 2 mL/L) and this is planned for the next overhaul.

Alvin de-brief summaries - 2009

Data hand-over:

This is always put off until the end of the cruise and became a problem when there were only a few hours between the last dive and disembarkation. Often there is a significant amount of data copying required after handoff but before disembarkation. On one cruise the DVD copier became unreliable. Can we come up with a better system, possibly copying all data to PI-provided external hard-drive(s) which allow data transfers at much higher rates?

Alvin de-brief summaries - 2009

User Recommendations:

There should be a planned back-up for the Sonar on Alvin. It is too important of a tool to have to cope without it.

The ship should also maintain the 2 days prior to departure for set-up and ALVIN-related meetings (e.g., briefing, exterior, in-hull) because that greatly enhances the ability to make full use of precious science time on-station once the ship sails.

Effort should be made to improve communications between the SSSGs and the Alvin Group with regard to data transfer.

More attention should be paid to the still cameras on Alvin. This is where the best publication output from having an HOV comes from yet one PI noted that it never seems to be operating at an optimal level.

One PI noted that the ship's IT system was showing its age – more notably than on his previous cruise 12 months earlier.

Alvin de-brief summaries - 2009

User Recommendations (continued):

One PI praised the merits of using Alvin and Sentry together. During this cruise Sentry found new, important and significant sites that could otherwise have continued to remain overlooked, which Alvin was then able to dive on.

Jason debrief summaries - 2009

PI	Date	Ship	Area
Atkins	Dec 2008- Jan 2009	Thompson	Southern ocean
Chadwick	Apr 2009	Thompson	Mariana arc
Resing	May 2009	Thompson	N Lau Basin
Fisher / Podowski	May-June 2009	Thompson	Lau Basin
Reysenbach / Tivey	Jul-Aug 2009	Thompson	Lau Basin
Fisher / Cordes	Aug-Sep 2009	Ron Brown	Gulf of Mexico
Staudigel	Oct 2009	Kilo Moana	Loihi

Jason debrief summaries - 2009

1) Appreciated improvements:

- New control vans & increased vehicle payload
- Two Kraft arms & excellent vehicle reliability
- Prototype HD video camera & frame-grabber
- Virtual Van now available as stand-alone DVD
- More flexibility with dive schedules & turn-around times
- Better communication & cooperation

2) Software issues:

- Better training for renav & mosaicing software?
- Multibeam sonar processed by mbsystem?

Jason debrief summaries - 2009

3) Is it possible to expand the weather window for launch & recovery?

- Weather limitations exclude half of the ocean at least half of the time & operations in marginal conditions are less safe

4) HD Video

- Improved control system & pan-and-tilt for HD video camera (known issue being addressed)
- What is the best HD format(s) that balance high quality with accessibility for science?
- Maybe best to have option of multiple formats, including compressed recording to hard disk

Jason debrief summaries - 2009

5) Navigation

- USBL tested but some problems with drift & positions dependent on ship's heading
- Future need: processing of non-LBL navigation

6) Issues for community feedback

- Do we still need a digital still camera (DSC) with HD camera frame grabs?
- Would it be better to have a DSC mounted in the basket for close-up imagery?
- Do we really need 3 cameras recorded to DVD?
- Is there a preferred HD video format 4 science?

Jason Debrief

1) Appreciated improvements:

- New control vans & increased vehicle payload
- Two Kraft arms & excellent vehicle reliability
- Prototype HD video camera & frame-grabber
- Virtual Van now available as stand-alone DVD
- More flexibility with dive schedules & turn-around times
- Better communication & cooperation



Jason Debrief

2) Software issues:

- Better training for renav & mosaicing software?
 - Improvements underway, e.g. training for all data processors
 - Better tools in development (ongoing)

- Multibeam sonar processed by mbsystem?
 - Yes!
 - New Reson MB sonar for 2010
 - NSF funded NDSF-wide software system improvements for processing MB sonar data
 - SM2K will be phased out



Jason Debrief

3) Is it possible to expand the weather window for launch & recovery?

- NSF funding to develop a new LARS system
- Important implications wrt shipping, deck loading, and fitting on the future Ocean class vessels
- Expect to report to DESSC at Spring meeting on preferred direction



Jason Debrief

4) HD Video

- Improved control system & pan-and-tilt for HD video camera (known issue being addressed)
 - Integration Phase Funded Sept 2009 expect completion 2nd qtr '10
- What is the best HD format(s) that balance high quality with accessibility for science?
- Maybe best to have option of multiple formats, including compressed recording to hard disk
 - WHOI's AIVL: determining best HD motion recording methods for Alvin and Jason



Jason Debrief

- **5) Navigation**
 - USBL tested but some problems with drift & positions dependent on ship's heading
 - Potential causes identified to be evaluated on 2010 engineering dives – still learning
 - Future need: processing of non-LBL navigation
 - Integration of USBL data into DVLNAV underway in '10



Jason Debrief

6) Issues for community feedback

- Do we still need a digital still camera (DSC) with HD camera frame grabs?
 - High quality DSC provides better still image than the HD
 - DSC requires strobe illumination
 - HD stills require post processing
- Would it be better to have a DSC mounted in the basket for close-up imagery?
 - Would improve image
 - Would use up basket space
- Do we really need 3 cameras recorded to DVD?
 - Some science parties want to record >3!
- Is there a preferred HD video format 4 science?
 - Study underway to determine best format(s)



SENTRY Debrief

Sentry not really ready

- System interface programming was more extensive than expected and was not completed during pre-cruise testing.
- Lost ½ day of mobilization due to fuel leak and thus worked into the early morning to do dunk test while dock side.

Testing at sea with damage/repairs

- We deployed Sentry in ~ 80 meters water depth with an umbilical connected in an effort to get better settings for the Reson Multibeam sonar. Sentry was damaged by impact to the hull requiring a wing to be repaired, a new cable run and all to be tested. We managed this with in 24 hours.



SENTRY Debrief

Dive weight release problems

- Investigation back at WHOI with more than 48 hours continuous time in the test well found no problems. After several days of testing under cold conditions an un-commanded release was witnessed. An IC was found to function out of spec when certain timing conditions were met and it sent a very brief power surge to the release motor.

Camera Problems: unexpected shut-off, focus, strobe synchronization and inadequate lighting system?

- Lack of appropriate test and integration time prior to deployment resulting in lost data
 - Strobe sync improperly implemented
 - Data logging bug
 - Improper test specification and procedures at the camera vendor
 - New strobe system being designed and fabricated



SENTRY Debrief

Failure of the Phins INS

- Major component not spared (\$100k+)
- Significant improvisation at sea required to overcome this failure
 - All NDSF assets either need full spares or well tested techniques and procedures for how to overcome failure and continue operating

Camera Problems: unexpected shut-off, focus, strobe synchronization and inadequate lighting system?

- Lack of appropriate test and integration time prior to deployment resulting in lost data
 - Strobe sync improperly implemented
 - Data logging bug
 - Improper test specification and procedures at the camera vendor
 - New strobe system being designed and fabricated



SENTRY Debrief

Camera Problems: unexpected shut-off, focus, strobe synchronization and inadequate lighting system?

- We anticipated that the Sentry camera would be a backup to the MacDonald Drift Camera, but unfortunately the winch on the Brook McCall failed and the Drift Camera could not be used.
- The new camera was received shortly before shipping Sentry and although tested for function, it was indeed not fully integrated and tested in field operations. We tested it in the well and ran the system overnight in the shop.
- We lost data early in the cruise due to a stobe sync problem, which we found and fixed. We also had a system software bug that resulted in the image acquisition program being terminated by the operating system a few hours after the topside network was disconnected. This was found and fixed.
- The camera was aligned, focused and tested at the vendor's facility but during field operations it was found that the images were soft on the edges. A new lens installed after the cruise solved the problem.
- Inadequate lighting is being addressed by a new LED strobe system in fabrication.



SENTRY Debrief

MRU system down on one cruise

- The Phins, Inertial Navigation System, failed early in the Fisher cruise leaving us without an accurate attitude measurement unit. Using data from the past several dives while the Phins functioned, deviation corrections to the flux-gate compass were determined and applied to the navigation controls. This worked adequately.
- To correct for the inaccuracies of using the compass a method was then developed to send an acoustic command to “jog” the track lines back over the study site. Thus Sentry’s track was moved N, S, E or W by 10 or 50 meters at a time to correct for the compass drift. This worked well and has been incorporated into our working capabilities.
- Other than the time lost to engineer the fix, this problem resulted only in a moderate reduction of data quality.



SENTRY Debrief

Summary: The SENTRY system was sent to sea before it was fully ready.

- We acknowledge this, although the weight droppers and INS, which caused the bulk of our problems, had been run on 16 previous science dives. We underestimated the time and effort required to integrate the command and control system with our system control and suite of new instruments, which resulted in some loss of time.
- Our experience gained developing ABE and transitioning it from a prototype to a reliable vehicle occurred over many cruises and dives in many different conditions. Sentry is also a complex vehicle that did not have the luxury of being corrected in real time by human interaction and thus must “learn” to handle new conditions.
- Sentry has matured quite rapidly since the cruise in the Gulf (See results from our Valentine cruise). It is a vehicle with much greater capabilities but more importantly it has room to grow.



ALVIN Debrief

In response to post cruise de-briefings

- 1 Spare 600 Khz ADCP to improve mapping capabilities through higher bottom lock altitudes above bottom.
- 1 Spare plug and play external digital still camera and end cap (no pressure housing).
- 2 Spare forward looking SeaKing Tritech Sonar
- 2 Spare Sonardyne Deep Homer Probes for full *ALVIN* depth capabilities.
- 2 New internal digital HD hand held video cameras c/w ship board duplication decks.
- 2 Spare DSP&L Multi SeaCams (pencil cams).
- 4 Spare DSP&L LED lights.
- 6 McLane 4 ball float sets for elevator work.



ALVIN Debrief

In addition to the equipment listed above, the following general improvements have been made

- Digital still camera have been installed on it's own pan and tilt
- All transponders have now been fitted with vacuum ports to increase sealing reliability.
- The Sonardyne USBL can now transmit data back and forth between the support ship and sub via acoustic modem.

