

MEETING MINUTES

The UNOLS DEep Submergence Science Committee Meeting June 10-11, 2008

Woods Hole Oceanographic Institution Woods Hole, MA

A copy of these minutes can be downloaded as a pdf <[200806desmi.pdf](#)>

Executive Summary:

The Deep Submergence Science Committee (DESSC) met on June 10-11, 2008 at Woods Hole Oceanographic Institution (WHOI). The meeting began with a joint session of the DESSC and the Replacement Human Occupied Vehicle Committee (RHOC) to discuss and formulate a recommendation regarding the future direction of the Replacement Human Occupied Vehicle (RHOV) project. WHOI representatives provided a status report on the RHOV design effort, budget summaries, and options for moving forward. The regular DESSC meeting followed the joint session and included agency reports from the National Science Foundation (NSF), Navy, and National Oceanic and Atmospheric Administration (NOAA). Representatives of the National Deep Submergence Facility (NDSF) provided reports on:

- Vehicle operation summaries
- NDSF data management and archives
- Ship maintenance updates and vehicle improvements
- Navigation and imaging upgrades
- Deep submergence scheduling in 2009 and beyond

Summaries of the NDSF user debrief interviews were reported. WHOI provided a summary of proposed corrective actions to the issues raised by the users.

The DESSC discussed strategic planning for the future and agency representatives commented on funding projections and initiatives within their respective agencies. New science directions that could potentially utilize deep submergence vehicles in Polar research were discussed.

Recommendations:

- DESSC recommends to NSF that WHOI pursue the 6500m RHOV acquisition option. The DESSC recommendation for a 6500m, environmentally friendly HOV reaffirms DESSC and RHOC's early recommendations.
- DESSC recommends that NSF adopt a uniform policy for requesting and funding the use of the National Deep Submergence Facility assets within their agency.

Action Items:

DESSC Action Items from their June 2008 Meeting:

1) RHOV Letter – Deb Kelley and Cindy Van Dover will prepare a joint DESSC/RHOC letter to NSF recommending that WHOI pursue the 6500m RHOV acquisition option. The DESSC recommendation for a 6500m, environmentally friendly sub reaffirms DESSC and RHOC's early recommendations. [Note – after the meeting it was decided that RHOC and DESSC should each send a letter to NSF.]

2) 2008 fall/winter DESSC Meeting Agendas and Forums –The 2008 winter meeting will be held at AGU.

- Finalize the draft DESSC agenda that was presented during the meeting. Select a topic for the afternoon session. Emphasis should be on engaging students and new users.
- Send the agenda to agency representatives for comment.
- Develop guidelines for PI Reports. Reports can include show-n-tells and short (1-minute) videos.
- Look into the cost and feasibility of having a mixer at a future meeting.
- Explore potential options/venues for a traveling “NDSF road show” that would attract students.
- The DESSC community meeting will alternate between AGU and The Ocean Sciences Meeting.

3) DESSC Letter to NSF Regarding Uniform Funding – Deb will draft a letter to NSF requesting that they adopt a uniform policy for requesting and funding the use of the National Deep Submergence Facility assets within their agency.

4) *Sentry* Transition into the NDSF – At the May 2006 DESSC meeting, DESSC endorsed WHOI’s proposal for incorporation of ABE into the NDSF and the replacement of *ABE* with *Sentry* when *Sentry* becomes fully operational. The criteria for Incorporating new Assets into the National Deep Submergence Facility <http://www.unols.org/committees/dessc/CRITERIADOCUMENT_062206.PDF>, states that the operator should be prepared to provide DESSC with information on: “Is the asset proven to be robust and beyond a developmental stage? Documentation of successful missions/ deployments should be included with records of reliability, durations of deployments, and life expectancy.” Upon receipt of this information from WHOI, DESSC can consider the replacement of *ABE* with *Sentry*.

5) DESSC Membership and Nominations: Hedy Edmond’s second term will end in September 2008. A call for nominations will be announced seeking candidates with a background in chemical oceanography and experience with use of deep submergence vehicles. The deadline for nominations will be September 15th.

6) NDSF Vehicle Debrief Interviews – Appoint a DESSC member to replace Hedy as the debrief leader for *ABE/Sentry*.

Continuing Action Items:

7) Pilot Retention and Career Advancement –DESSC recommends that WHOI prepare a document that articulates the institution’s strategies for pilot retention as well as procedures for implementing exit interviews for those pilots who resign. DESSC recommends that WHOI management promote learning opportunities and career advancement opportunities for pilots.

8) Mode of Operation for *Jason* Watches – DESSC recommends that WHOI explore options for staggering the start and end times for *Jason* watches with the goal of achieving better continuity through a dive cycle.

9). Science Outfitting Survey for the Replacement HOV – At the appropriate time, develop a community on-line survey and circulate it to the community.

10. Science Training Opportunities for Pilots - DESSC will formulate suggestions on workshop/training science sessions for pilots. The session(s) should demonstrate how the data from the vehicles are used for different research disciplines. We will make an outline for different disciplines (e.g. geology, biology, chemistry) on what elements of these programs would be beneficial to the pilots and work towards putting these documents together.

11. R2K Lectureship program – DESSC recommends that the R2K Lectureship program include an *Alvin* or ROV pilot as a distinguished lecturer. (Kelley)

Appendices:

I	Agenda (html)
II	Attendance Sheet
III	Replacement Human Occupied Vehicle Project Update (2.1 MB)
IV	Replacement HOV Oversight Committee Recommendations
V	UNOLS Report
VI	NDSF Operations Summary
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VIII	Pilot Status and Personnel
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XIV	NDSF Scheduling: 2009 and Beyond
XV	Alvin Upgrades
XVI	Jason Upgrades and Control Vans
XVII	Sentry Sea trials
XVIII	HD Upgrade Project
XIX	Navigations Upgrades
XX	NDSF User Profile
XXI	Technology Advancement Workshop summary (3.6 MB)

Meeting Summary Report:**Day One: Tuesday, June 10, 2008 - Carriage House****DESSC Joint Session with the Replacement Human Occupied Vehicle Committee**

Introductory Remarks, Meeting Logistics, and Introductions - Deb Kelley and Cindy Van Dover opened the joint meeting of the Deep Submergence Science Committee (DESSC) and the Replacement Human Occupied Vehicle Oversight Committee (RHOC). Participant introduced themselves. The

meeting agenda and participant list are included as *Appendix I* and *Appendix II*.

Deb Kelley said that she wants the DESSC to have the opportunity to hear all details of the RHOV project and discuss as needed. Cindy said that she would like to have a joint recommendation from RHOC and DESSC at the outcome of this meeting.

Anthony Tarantino presented the RHOV project status. His slides are included as *Appendix III*. Anthony reviewed the status of the sphere and highlights from the forging process. Ladish successfully formed both hemisphere disks. Stadco is preparing to build welding/machining fixture. The sphere completion is scheduled for mid-July 2010. The first two risks with the sphere (130" disk forming and hemisphere forming) have been retired. Two risks remain; electron beam welding and post weld stress relief. A video of sphere forging process was presented.

Anthony reported that the RHOV design scope was scaled back to include only systems that overlapped with the *Alvin* upgrade concept development. WHOI has visited key vendors for penetrators, foam, and batteries. All of the vendors are local to Woods Hole. Risk assessments on these components have begun.

Teledyne D.G. O'Brien is a penetrator vendor. The RHOV double bulkhead penetrator design is similar to *Alvin*. The fiber and copper penetrator development is considered low risk. Teledyne has no ABS experience but has several MIL-STD-24217 compliant designs.

WHOI visited Trelleborg Emerson and Cummings, Inc., a foam vendor located in Mansfield, MA. An 18 month lead time is needed for the foam fabrication.

WHOI visited Lithion Inc. (Yardney Technical Products Inc.) in Pawcatuck, CT. Yardney believes they can meet the Pressure Balanced Oil Filled (PBOF) battery specification based on their past experience which includes providing the batteries for the Mars Lander. They developed the *Sea Cliff* Silver Zinc PBOF battery. They haven't built a lithium battery and they don't have experience with ABS. They are working to get experience with them.

WHOI is recommending that testing and qualification procedure development begin immediately to reduce risk. All three of the vendors agree that this should begin immediately.

Anthony provided additional information on battery technology. John Inman, NSWC Subject Matter Expert (SME), believes that a safe Pressure Balanced Oil Filled Lithium chemistry battery can and will be developed using current technology. Inman is considered an expert on lithium batteries and is willing to work with WHOI. NSWC is willing to collaborate with WHOI and the cell manufacturer in the development of purchase and test specifications.

NSWC has solicited a quotation for design feasibility and prototype demonstration of PBOF Li cells. The quotation covers:

- Cell Gassing Volumetric Analysis
- Compensation Method development
- Five prototype cells for testing
- Test Plan development
- WHOI assisted cell testing

The estimate for the NSWC study is ~\$300K. Bob Detrick submitted a proposal to fund this study to Bob Houtman (ONR) the first week of June 2008. Applications of the study extend beyond HOVs. WHOI will assist in this effort.

WHOI evaluated the Shinkai battery for use in the RHOV. JAMSTEC switched the *Shinkai 6500* battery from Silver Zinc (AgZn) to a GS Yuasa-developed Lithium Cobalt Oxide (LiCoO₂) battery in 2004 because of performance, cost, and maintenance issues. The *Shinkai 6500* battery does not meet RHOV requirements for voltage, charge/discharge cycles, and energy. Yuasa was solicited for the RHOV battery quote, but their quote was the highest. Lessons learned on the design and implementation for the *Shinkai 6500* can be used to improve performance on the RHOV.

A study was conducted on the 1 atmosphere battery housings and it concluded that the option is viable for a 4500 meter vehicle, but may present weight problems if designed for the 6500 meter depth.

The critical system designs that are applicable to both the RHOV and upgraded *Alvin* vehicle were reviewed. These included the telemetry system, power switching, computer architecture, video system, and high voltage selection. Focus is on safety, reliability and maintainability.

A hydrodynamic analysis of the RHOV is required to determine buoyancy, thrust and horsepower requirements. LM completed work on a High Fidelity RHOV model and determined the static drag coefficients for 3 axes. The results are included on Appendix III, slide 20.

WHOI and LM were asked to develop a concept for an *Alvin* Upgrade that would use the titanium personnel sphere now in production. The goals were to:

- Satisfy as many target RHOV design goals as possible
- Keep RHOV improvements
- Leverage RHOV design efforts

- Reduce project costs
- Allow for a phased upgrade to the full 6500m vehicle over time

The RHOV Project Design Goals from the National Research Council (NRC) were for a vehicle that could offer:

- Increased bottom time
- Increased battery capacity
- Improved fields of view
- Improved interior ergonomics
- Improved interior electronics
- Automatic position keeping
- Reduced seabed disturbance
- Increased science payload
- Increased operating depth

The RHOV goals that could be accomplished with an *Alvin* Upgrade include:

- Increased on-bottom time
- Increased battery capacity
- Larger personnel sphere; more interior space and improved ergonomics
- Improved field of view for pilots and observers
- Improved interior electronics
- Automated position keeping
- Sampling basket load limits significantly increased

- Improved lighting and video systems
- Increased hydraulic plant capacity (improved manipulator performance)
- Increased thruster horsepower (better maneuverability)
- Improved mid-water research capability

The RHOV goals that would not be accomplished and an *Alvin* Upgrade are:

- Increased operating depth to 6500m
- Reduced seabed disturbance (will continue to rely on drop weights for ascent/descent)
- Multi-purpose, large capacity seawater ballast system (for trim, variable ballast, ascent/descent)
- Elimination of mercury trim system

Some enhancements that are not feasible with an upgraded 4500m *Alvin* and could be implemented later when funds are available. This includes upgrading to an operating depth rating of 6500m, enhancements with a 3-D HiDef imaging system, and microfiber cabling for high bandwidth and two-way communications to the surface.

Anthony reviewed the project evolution steps for the upgraded *Alvin*. The steps include concept development, general arrangement, weight and trim analysis, hydrodynamic analysis, and structural analysis. The slides include sketches of an upgraded *Alvin* with the new titanium sphere installed. The sketches are color coded; where the green is the RHOV components, yellow represents new components, and the existing *Alvin* parts are shown in gray.

A new lift point was needed and is on the sphere. Various lift points are being evaluated and a fatigue analysis is being performed. On the starboard side there is a new variable ballast (VB) sphere. The foam will have to be relocated forward to offset the new sphere weight.

The *Alvin* recyclables that could be used on the upgraded *Alvin* include the following:

- Frame (Partial)
- Foam (50%)
- Thrusters

- VB pump, valves, and hydraulics
- High Pressure Air system
- Hydraulic Power Unit
- Motor Controller Cans (2)
- Aft Skins
- Aft Main Ballast Tank

The overall size of the upgraded *Alvin* vehicle is very close to the existing *Alvin* and it will still fit in R/V *Atlantis*' hanger.

There will be some new risks associated with the ungraded *Alvin* project. These include:

- Obtaining NSF Approval to re-scope the project (from RHOV to Upgrade *Alvin*)
- ABS Certification Issues (transitioning *Alvin*'s certification from NAVSEA to ABS) for the frame and pressure vessels.
- Schedule Delays – Delays could ultimately impact *Alvin*'s overhaul requirements/schedule
- Management/Engineering Resources – this would apply if WHOI is made the prime for the Upgraded *Alvin* project.

By transitioning to an Upgraded *Alvin*, some risks would be avoided. These include the risks associated with using higher density foam, the variable ballast system, and the *Atlantis* A-Frame capacity issues.

Discussion followed:

- Barrie Walden remarked that optimally, new components for the upgraded *Alvin* would be rated for 6500m.
- Hedy Edmond asked if it would be difficult to incrementally upgrade *Alvin* to 6500m. Barrie replied that it would be non-trivial. Some of the *Alvin* 4500 components that would have to be replaced include the foam, high pressure Air, and motor controllers. The components and systems that wouldn't change are the VB, mercury trim, hydraulics, thrusters, and frame.

Bob Detrick reviewed the financial status for the RHOV Project. The recent RHOV cost estimate from LM was high. The estimated cost of the RHOV exceeds the available budget by about \$27M. The shortfall includes WHOI's pledged contribution and RHOC's recommended contingency funds. Cost increases have been due to a number of factors. The largest increase is due to the LM fixed fee estimate. There have been cost increases to the SwRI contract as a result of delays and increased WHOI oversight that resulted in more meetings.

The project schedule has slipped by about eight months. The sphere delivery is expected in mid 2010 instead of 2009. The slip is due to Ladish's cautious approach. However, as the timeline stretches, the cost goes up.

As a result of the high cost estimate for the RHOV, WHOI was asked evaluate the costs for upgrading Alvin. A Rough Order of Magnitude (ROM) cost estimate was developed for the *Alvin* upgrade project. The ROM estimate assumes that the current contract with LM would be terminated. A commercial entity would provide engineering, construction, integration and testing, and project management to the *Alvin* upgrade. The WHOI effort will remain consistent with their effort in the RHOV project.

The assumptions made in developing the ROM include that the material costs will remain fixed, the sphere will be available on the current schedule, and pressure compensated Lithium batteries with 240 volt electrical system will be used. It is assumed that ABS will accept a large percentage of the current *Alvin* frame and equipment with little additional engineering and testing. A detailed budget estimate with concept design will be required at a later date if the decision is made to upgrade *Alvin*.

Bill Chadwick asked if the Li batteries would be rated for the 6500m depth. Anthony Tarantino – Unless there is a glitch, the batteries would be rated for 6500m. If there are problems, the plan would be to use a 4500m depth rating.

The Upgraded *Alvin* ROM estimated project costs are \$15M to \$20M less than RHOV project cost, but the ROM cost still exceeds the current project budget. If the *Alvin* upgrade option is pursued, WHOI would be the prime contractor. The ROM estimate is based on an external prime. The cost of upgrading *Alvin* to 6500m at a later date has not been estimated.

WHOI has spent or committed \$15M to date on the RHOV project. Available funds are not sufficient to complete the project. Susan Avery has expressed her strong support for the project. The WHOI Trustees met a few weeks ago and also expressed their support.

Bob Detrick was asked what could be done with the remaining project funds. Bob replied that funds could be used to complete the RHOV detail design. However, the Navy may not want to certify *Alvin* beyond 2010 and we would have a design that is unaffordable.

Dolly expressed concern that the *Alvin* upgrade option is enough of a change from the original RHOV proposal that the option would have to be approved by NSF before proceeding. This could be a lengthy

process.

Wrap-up of the Joint DESSC/RHOC Session – Cindy Van Dover summarize recommendations from the RHOC regarding the material that was presented by WHOI. Cindy’s slides are included as *Appendix IV*.

RHOC is recommending the following path forward:

1. Discuss WHOI options with DESSC
2. Draft a joint RHOC and DESSC recommendation
3. Approve and submit the draft RHOC/UNOLS recommendation to NSF before 23 June (before the WHOI Director meets with NSF leadership)

Cindy provided a brief recap of developments since February 2008. The Upgraded *Alvin* can be viewed as intermediate phase toward 6500m capability (but at greater cost than if we were to go forward with 6500m now). The Upgraded *Alvin* includes most of the exciting engineering aspects of the 6500 RHOV (except depth). However, it assumes many of the risks of the 6500 RHOV (batteries, sphere, and foam). There is a possibility of additional unknown risks associated with ABS certification. The 4500 RHOV is not as environmentally friendly (mercury trim and drop weights) as originally proposed. It is not an existing NSF project; and will need an external review. There are uncertain costs associated with re-scoping and re-proposing the 4500 RHOV. There is an uncertain cost of delay in terms of human resources and loss of expertise. The interest of LM in the project will likely decrease, as well as potentially that of the WHOI Director and Trustees.

Dolly reemphasized that the Upgraded *Alvin* presents a major change in the RHOV project scope that could result in a significant delay. Bob Detrick added that it would require a new budget and proposal. WHOI would be the prime contractor and they would have to award subcontracts. He estimates at least a year delay.

The 6500 RHOV cost model has been modified (cost plus and fixed price), leading to higher cost, and lower financial risk, but no change in scope.

The WHOI Director and Trustees are in favor of retaining a HOV capability. They have expressed interest in raising and/or loaning funds to cover the budget shortfall, provided NSF contributes additional funds and WHOI receives something in return. There is a potential for a very public fund-raising campaign. There is a perception that the “RHOV” would be more attractive and easier to promote in fundraising efforts; hence, the ‘4500-m RHOV’ label. WHOI has arranged appointments to discuss project strategy with the NSF leadership. Ownership of the vehicle should stay with NSF.

Cindy introduced some questions for RHOC and DESSC to consider, given the already substantial investment in the RHOV:

- Should the United States retain an HOV capability? NRC report says YES; if now NO, what has changed?
- What other considerations besides science are important to consider in making a recommendation to NSF about support for an RHOV?
- How important are depth and environmental considerations for a RHOV?
- Can a 4500m RHOV be proposed and approved in a reasonable amount of time? How rapidly does the cost differential diminish between 6500m RHOV “now”, 4500m RHOV “as soon as possible”?

Cindy reviewed the four options that are before DESSC and the RHOC for consideration. The options include:

1. 6500 meter RHOV
2. 4500 meter RHOV
3. Retain Alvin
4. Eliminate the HOV capability.

The pros and cons of each of these options are summarized in slide 6 of *Appendix IV*.

DESSC Discussion:

- Marsh Youngbluth – He promotes the state-of-the-art option. We are planning for a facility that will be available for another 20 plus years. This is our chance to maintain a US capability. The 4500m doesn't meet all of the project goals. He asked if there are any risks associated with the *Atlantis* handling system.
- Anthony Tarantino – There are few concerns associated with the handling system, but they think they will be manageable. The frame was designed for SEA CLIFF.
- Hedy Edmonds – Promotes the 6500m RHOV.
- Jeff Karson – Agrees that the 6500m RHOV should be pursued. Over the lifetime of the vehicle, the extra funds required to complete the project seems worthwhile. Jeff is impressed with how much work has gone into the RHOV. In his view the engineering of the RHOV excited him more than the added depth rating.

- Craig Young – Options 3 and 4 should not be considered. We should identify the new science that could be done with the 4500 RHOV. Chris German replied – New Li batteries will allow enhanced mid-water science and improved maneuverability.
- Jennifer Reynolds – She is favoring the 4500 RHOV. She is not focusing on the 6500m as the key aspect of the vehicle. The cost of adding that capability might not be worthwhile.
- Hedy Edmonds – She expressed concern about the cost differential between the 4500 RHOV and the 6500 RHOV. Time delays associated with gaining approval for the 4500 RHOV means higher costs; which would reduce the differential between the 4500 and 6500 RHOV.
- Hedy Edmonds – The long term benefits that could be provided by the 6500 RHOV should be considered. Some benefits are intangibles; such as, excitement and National capabilities.
- Barrie Walden – The 4500 RHOV ROM cost estimate would go down if WHOI takes over as the prime.
- Jeff Karson – Will WHOI be able to find additional funds to support the 4500 RHOV option? Bob Detrick – Susan Avery has indicated that it would be difficult to raise the funds.
- Bill Chadwick – What is NSF's interest in supporting this project? Cindy – This is unexplored at NSF's highest levels. If the project budget becomes too high, the RHOV project will reach the cost of a MREFC project.
- Cindy – The February RHOC recommendation to NSF stated a continued need for an HOV capability. Dr. Avery has requested that the DESSC/RHOC recommendation include science justified.

DESSC/RHOC Executive Session – Following the executive session, the joint meeting of DESSC and RHOC ended. The regular DESSC meeting began after the lunch break.

Lunch Break

DESSC Meeting

Introductory Remarks, Meeting Logistics, and Introductions - Deb Kelley opened the DESSC meeting. She reviewed the status of DESSC action items and recommendations from previous meetings:

- DVDs for *Jason* - DESSC agreed with the recommendation that the science party be required to provide personnel to run *Jason* DVD decks for archive video. WHOI NDSF will inform *Jason* users of the policy during pre-cruise planning meetings.

- Magnetometer on *Jason* - DESSC position: Scientists, who wish to use the magnetometer with *Jason* to collect magnetometer data, will be required to carry out a calibration turn during each dive/lowering. WHOI will revise the NDSF website to inform users of this requirement.
- HD cameras on *Jason* and *Alvin* - DESSC endorsed the HDTV upgrade planned for *Alvin* and *Jason*. The upgrade includes acquisition of two HDTV cameras (one for *Jason* and one for *Alvin*) with zoom optics; interface and control electronics. The cameras would be operated as standard equipment with zero cost impact on vehicle day rate. High quality still imagery would be possible with the HDTV cameras. DESSC recommends that adequate training for pilots in the use of the new HDTV cameras is essential.
- 2008 DESSC Meeting Plans and agendas/format: - A draft agenda for the winter meeting was distributed.
- *Alvin* & *Jason* debriefs: - ongoing. Bill Chadwick asked for feedback from DESSC on the user debriefs reports. All agreed that the reports and process are very useful and provide a good format to speak to the operators. They also like them because they provide DESSC with a focus on how to assist NDSF.

Agency and UNOLS Reports

NSF Report – Brian Midson provided the report. Brian worked at NSF for the past seven years. Dolly Dieter has retired and her work has been divided up amongst the program managers in the Integrative Programs Section (IPS). Brian has been assigned to the NDSF program.

Deb Kelley asked if there has been a decline in proposal pressure at NSF. Brian – Proposal pressure was down for MG&G, but it was not for lack of interest. RIDGE and MARGINS are entering the synthesis phase. He encouraged the science community to keep proposal pressure high.

NOAA Report – Karen Kohanowich provided the report for NOAA. Barbara Moore has taken a detail at the Department of State. The NOAA National Underwater Research Program (NURP) and Ocean Exploration (OE) programs are merging into the Office of Ocean Exploration and Research (OER). Of the six NURP centers (4 in the East and 2 in the West), Congress only funded the two west coast centers. OE and NURP personnel will be merged under the new OER organization. Steve Hammond has been named the acting director and they expect to name a permanent director soon. The emphasis for OER will be on technology development for exploration. Support for NDSF will decrease.

NOAA will send out a Request for Proposals (RFP) for a Cooperative Institute (CI) in mid-June 2008. The Institute will be funded by FY09 funds. Once the CI is established, the plan would be to close the centers. The NOAA owned facilities (*Pisces* and *Aquarius*) will still be funded. The start up money for the CI is \$2M. The RFP for the CI will be for 5 years and will be recompeted every 3 or 5 years. The CIs compete on themes. The themes will be announced in the RFP.

The NURP budget for FY08 was \$10M and the OE budget was \$19M. The OE budget included costs associated with the vessel *Okeanos Explorer*. Commissioning of the vessel is planned for August 13, 2008. Field trials are scheduled for September to November 2008. A full season of operations is planned in 2009.

ONR Report – Bob Houtman reported for ONR. There are no significant changes to the 2009 Research Facilities budget compared to 2008. The base budget is \$10M with a few million additional dollars from other Navy sources. In 2008 \$2M was added to the budget to support marine mammal research. The Navy is moving forward with plans to build two new Navy ships. Three Navy organizations are involved with the ship acquisition effort; NAVSEA/PEOShips will manage the contract, ONR is the mission sponsor, and the Oceanographer of the Navy is the owner. PEOShips is conducting a notional ship design. The notional design will estimate whether the community's threshold values for the Ocean Class Science Mission Requirements can be met within the budget constraint of \$92M. The two ships are scheduled to begin service in FY2014 and will replace the *Knorr* and *Melville*. Operation of the ships will be competed. The Navy expects to have an RFP for design/construction in the fall.

Bob reported that he has been hired as the new NSF IPS section head. ONR has announced the position opening for Bob's ONR position.

Brian Midson asked about the future of the long coring capability when *Knorr* goes out of service. Dolly replied that based on demand, they will look at a *Revelle* as a platform for the coring system.

UNOLS Report – Vernon Asper, UNOLS Chair-Elect, provided the report for UNOLS. His slides are included as *Appendix V*. Vernon reviewed the UNOLS projects that are currently underway which include plans for a wire workshop, adding functions to the UNOLS Ship Time Request and Scheduling system, revising all SMR documents, finalizing the Fleet Improvement Plan, drafting a new UNOLS brochure, and establishing data management best practices. Details are included in his slides.

UNOLS has provided guidance to the scientific community regarding the Transportation Worker Identification Credential (TWIC). Information is available at <http://www.unols.org/info/UNOLS_TWIC_INFO_051408.pdf>. TWIC cards are required for unescorted access to secure vessels and facilities. UNOLS recommends that scientists who use secure vessels/facilities obtain TWIC cards

Vernon reviewed UNOLS Fleet renewal activities. NSF has suspended Phase II of the Regional Class acquisition effort (detailed design and construction phase) until funding is available (FY 2010 or later). NSF remains committed to the RCRV, but will likely be forced to build fewer ships. The R/V *Marcus Langseth* began science operations in 2008. Dolly added that there were a lot of hurdles bringing *Langseth* on-line, but they are getting great data.

Fleet operations face challenges. Ship day rates are climbing faster than the government budgets that fund them. The 2009 schedules are light, there are not enough ship operations funds, and the outlook for

improvement is dim considering the federal budgets. Ship scheduling efforts for 2009 continue.

National Facility Operators Report:

NDSF Vehicle Operations Summary - Rick Chandler provided a summary of the 2008 NDSF operations. His report is included in *Appendix VI*. There were two *Alvin* science cruises since the December DESSC meeting with a total of 25 dives. The average dive duration was eight hours.

There has been one *Jason* cruise for Peter Lonsdale in the Gulf of California. There were 26 lowerings and *Jason* was in the water for 387 hours. 8,871 lbs of rocks collected.

There was an *ABE* cruise to the Tasmanian Seamounts in January 2008. Only six dives could be conducted instead of the anticipated 12-15 dives due to weather. There were about 37,000 photos taken over 50 hours and about 15 hours of multibeam data were collected. There were some vehicle problems. Two dives were shortened due to broken thruster shear pins. Bottom-following was more difficult than *ABE* had previously experienced.

NDSF Data Management Report – Scott McCue’s slides are included as *Appendix VII*. He reviewed the NDSF data management five areas of responsibilities which include:

- video and imaging systems
- real-time data logging and display
- pre-cruise and post cruise coordination
- at-sea processing pipeline and QC
- Processing tools.

Scott reviewed the web page improvements for pre-cruise planning. Snapshots of the web pages are included in the slides. There is a listing of standard data products for pre-cruise planning. There is also a page for frequently asked questions for pre-cruise planning.

Data management activities were discussed. “Management of Data” includes management of cruise data *plus* management of corporate knowledge. Data from the spring 2008 dives onward will be staged online.

At-sea processing and data logging current activities are detailed in the slides.

The video capability within the new *Jason* control vans has been improved. The high definition upgrade

for *Jason* progresses.

Vicki Ferrini reviewed the data management responsibility on “Data accessibility and interoperability.” Part of the role is to facilitate the data interface to other users. They would like to create a relational database.

Pilot Status and Personnel - Pat Hickey reviewed personnel and pilot status. His slides are included as **Appendix VIII**. Pat was promoted to the SE&OG Manager and Bruce Strickrott was promoted to Alvin Expedition Leader. Pat’s slides detail the personnel changes. There are six qualified pilots and four pilots in training. To increase retention, WHOI is considering revisions to their shore leave policy. They are also trying to find ways to shorten the training period for becoming a pilot.

Deb Kelley pointed out that *Alvin*’s schedule has been light the last couple of years. She asked if during the down times are there training opportunities for pilots. Pat – If it is possible to place an *Alvin* pilot on an ROV cruise, they will attempt to do it. But it isn’t always easy. They do try to carry out training during down time for STCW and other regulatory requirements. But this can cut into shore leave. They try to have camera training on the ship.

Break

NDSF Vehicle Debrief Interviews:

Feedback from recent *Alvin* cruises - Mike Tryon summarized the *Alvin* debrief interviews. His slides are included as **Appendix IX**. There were three cruises for 32 dives at the East Pacific Rise (EPR).

Pre-cruise planning went very smoothly and most users were very experienced. One complaint was that not all of the information for interfacing user-provided sensors with *Alvin* systems arrived at the ship. The reports were mixed on local agent service. The agent costs were sometimes inflated over the original agreed-upon price. There were no failings that impacted science. The port manipulator failed once but all dive objectives were achieved and the arm was repaired by the next day. Batteries performed excellent and the science parties enjoyed long bottom times. The DVL sometimes lost bottom lock. There are still some problems with the science party bringing the wrong type of DVDs to the ship. There was a problem with the *Alvin* duping station on one cruise

Response from Pat Hickey - Pat Hickey commented on information not getting to the ship. Bruce Strickrott is now participating in the pre-cruise planning. Sometimes science user supplied equipment is not ready until shortly before the cruise.

Feedback from recent *Jason* cruises - Bill Chadwick summarized the *Jason* debrief interviews. His slides are included as **Appendix X**. Some of the issues identified included:

- PI felt pressured to use *Alvin* instead of *Jason*
- Not clear to PI that digital bathy was wanted (expected paper maps)
- Only loss of dive time (~8hr) was due to a manipulator arm leak on last dive.
- LBL navigation not used, Doppler performed poorly on steep slopes
- First use of new control vans - seemed to work well, although screen layout changed from watch to watch. Could it be standardized?
- PI felt strongly that US deep submergence community has not been best served by pooling of resources into a single-entity NDSF
- PI felt the deep submergence community would be better served by multiple ROVs vs. HOVs
- PI was disappointed by the lack of support for multibeam ops on *Atlantis* (system obsolete and techs untrained to make maps in support of dives). Matt Heinz commented that the SSG tech was new.

There were many complements and high praise for the vehicle and *Jason* operation.

Bill also provided an HDTV update from the August 2007 *Jason* cruise. One-hour HDCAM highlight tapes were made, but were expensive. The tapes cost \$65 and decks cost \$20-50K. A solution is to go with HDV, which is an HD format on mini-DV tape. Tapes cost \$5 and decks cost \$1K-2K. The video looks good, but not for frame grabs.

Response from Matt Heinz – Matt’s slides are included as *Appendix XI*. His responses are provided below:

It was not clear to the PI that supplying digital bathy was preferred. - Matt: The multibeam data is important for DVL overlays.

Doppler performed poorly on steep slopes. – Matt: The 300 kHz Doppler still does not work properly on steep terrain. They are hoping to come up with a solution by the summer.

First use of new control vans – They seemed to work well, although screen layout changed from watch to watch. Could it be standardized? - Matt explained that this was the first cruise. They will rethink letting the Pilots have their own screen design and consider coming up with a more standard format.

Dive durations were “over-zealously inflexible”- Matt explained that a steady cycle is needed for the ops team. It was the first time they tried the 8-hour turnaround time. Chris German asked if the quicker

turnaround times would work on other ships. Matt – The only thing that allowed the quick turnarounds was the help of the ship’s crew. One way to do this on other ships is to get help from their ship’s crew. Jennifer asked if this is something that can be arranged on other ships. Matt replied that *Thompson* and WHOI crews will offer help. If he is able to get the other UNOLS ships to work this way it would be possible.

Feedback from recent ABE cruise - Hedy Edmonds’ slides are included as *Appendix XII*. The *ABE* team deserves high praise. The shear pins on the *ABE* thrusters appear to provide only a failure mode rather than a protection function. The *ABE* team should procure a better radio direction finder for recoveries.

Pre-cruise planning - On the science side, science needs to either provide good bathy to AUV group ahead of time for dive planning or allow for collection of multibeam data as part of cruise plan. A more formal pre-cruise planning process is recommended.

Platforms - AUVs are even more portable than *Jason* and will encounter more issues with ship handling systems, crew experience, etc. Perhaps there should be a means by which platforms can be vetted.

Response from Rod Catanach – Slides are included as *Appendix XIII*. Areas that were identified that need attention include pre-cruise planning, mobilization, and pre-cruise preparation for working on an unfamiliar ship.

Pre-Cruise Planning – WHOI will work to organize pre-cruise meetings using a format similar to *Jason* and *Alvin*. Web-based resources will be updated with a pre-cruise planning questionnaire designed more specifically for AUV operations.

Typically 2 days are planned for mobilization onto a ship. This proved insufficient for the Adkins cruise for several reasons. WHOI realizes that one of their group should have arrived a day or two earlier to make sure all was ready. By arriving early, the state of readiness of the ship and equipment could have been assessed and needs negotiated face to face.

The informal process of vetting the ship’s capabilities for AUV operations relied on published specifications and communication with the operator. Pictures of the ship are great, but are short on detail. WHOI only visited a ship once to resolve operational issues in the past, but it was very effective. Perhaps this should be done for any “new to us” vessel.

Thruster failure - On the Adkins cruise there was trouble with thrusters breaking the shear pins. As a solution, the pins will be replaced with solid titanium pins.

Radio direction finder inadequate - WHOI will try to procure a better system in next year’s budget, but will borrow or enhance their current system if possible for the upcoming 2008 cruises.

Annette asked how many people would be required to support *Sentry* at sea. Rod replied about the same as Jason. Dana added that on cruises where *ABE* is being used with *Jason*, then they can share personnel and perhaps go down to 2.5 people.

Vernon asked about the *ABE* day rate? Rod replied that it is \$11,396 and includes personnel, shipping, and data.

Debrief Process – The DESSC discussed the merits of the debrief process and any issues that have arisen. Mike Tryon reported that there is an issue with having just one debrief report. The summary report loses its anonymity. Hedy commented that the AICC debriefs include everyone; the Coast Guard, NSF, AICC, and users. There are about ten people on the interviews. All agreed that the debriefs are effective and should continue.

Deep Submergence Scheduling: 2009 and Beyond - Liz Caporelli reported on NDSF vehicle scheduling. Her slides are included as *Appendix XIV*. In 2009 there are 61 funded *Alvin* dives for 8 programs. There are 60 funded *Jason* days for five programs. There are 80 *Alvin* pending days and 251 *Jason* pending days. Liz displayed a map of the work areas for the funded and pending vehicle requests.

The general DESSC Meeting adjourned for the day.

DESSC Executive Session – DESSC met immediately after the DESSC meeting for an executive session.

The Executive Session adjourned at 1730.

Day Two: Wednesday, June 11, 2008 - Carriage House

Introduction - Deb opened Day 2 of the meeting at 8:30 am. Cindy Van Dover provided a summary of the RHOC/DESSC recommendation. Cindy reported that the two committees stand firm on their recommendation for a 6500m, environmentally friendly HOV. A recommendation will be forthcoming in a couple weeks.

Upgrades to National Deep Submergence Facility:

***Alvin* Upgrades (incl Reson)** – Pat Hickey reported on the *Alvin* port period and upgrades implemented from January to June 2008. His slides are included as *Appendix XV*. The submersible was offloaded at Scripps MARFAC in mid-January. The mandatory NAVSEA biennial hull inspection was conducted. There was a NAVSEA sustaining certification survey. New Frangibolt releases were added to the batteries and manipulators, replacing expired explosive devices. They added new LED lighting and rear-

facing camera and lighting. A new Schilling T4 manipulator was purchased as a spare. They also purchased Reson SeaBat profiling multibeam sonar (same as *Sentry* unit).

Pat reported that the SIO pier is in terrible shape. – They will not load out the sub there any more.

Deb Kelley asked how the explosive bolts are set off when there is no power. Pat – There is emergency power.

Marsh asked if the cracks in *Alvin*'s sphere were fixed. Pat – In 2005, the inspectors discovered a crack. The crack location was dug out then the area patched with welds. The original *Alvin* welder was brought in and he still had the welding wire in his garage. The crack was at the window inset. It couldn't be seen with the eye, but it was found with dye. They are not sure how long it was there.

Tim asked about the rear camera. Pat explained that it is not a science quality camera; it is really for backing up and obstruction avoidance.

Pat Hickey - The *Alvin* group is rewriting the users manual to include much more detail on science equipment available for *Alvin*. They are hoping to give users enough information so that users make informed choices about what equipment they actually need. *Alvin* group is also adding software on the web site for PIs to work with the basket layout. Brian Midson recommended making the *Alvin* equipment web page and the users manual easier to find.

Jason Upgrades and new Vans - Matt Heinz reported. Images of the new control vans are shown in **Appendix XVI**. Everyone is closer to the action. The watch leader now has miniscreens with what is being recorded. There are ten monitors on the front wall. The back wall has a fold-down chart table.

Deb remarked that it looks like your back is to the monitors if you are mapping in real time. Matt – There are a lot of monitors in the van (42). Before doing any additional random changes, WHOI will wait until a few cruises are complete and ask for feedback. There is some money left over for improvements.

Bill Chadwick asked if the van is any less noisy. Matt - It is a bit quieter due to noise dampeners. There are no racks above which caused separation between the group; everyone is closer.

Marsh – Are the chairs stable? Matt – Yes.

Marsh – What about overlays. Matt – The science party can choose the desired overlay, as well as if they would like it to get it burned to the data. There are a lot of options.

Matt continued his report with other *Jason* upgrades:

- The Kraft manipulator was upgraded. The Kraft manipulator's jaw strength has been increased to 600 lbs, making it much better for rock sampling. However, this is still not as strong as the Schilling arm. The Schilling is still needed for heavy duty work. For the long term, Matt is thinking about a T4 arm and a Kraft arm.
- *Jason* weight was reduced during the upgrade process. Over the years *Jason*'s weight increased. WHOI removed 100 lbs of sulfur and a stainless bottle (40 lbs). The weight reduction allowed a big payload increase. *Jason* payload is now 360 lb water weight. *Jason* is still working with 60-65 lb Pb weight. Despite this, Lonsdale sampled approximately 400 lb of rock per dive.
- The Sharps upgrade is a work in progress.
- The SM2K will be used for *Alvin* and *Jason*. It has been repaired.
- 300 kHz Doppler – It works well in flat terrain, but in scarps it doesn't work. There are a number of failure modes. WHOI is working on a fix, but they don't have an answer. The system is needed for ops later this year.

Sentry Trials - Dana Yoerger reported on the *Sentry* sea trials. His slides are included as *Appendix XVII*. The trials took place on 18-23 April off of R/V *Oceanus*. The objectives were to:

1. Test basic deep-water functionality
2. Make bathymetric map in deep water
3. Test science sensor suite (CT, magnetometer, optical backscatter, Eh)
4. Demonstrate deep LBL system and DVL/INS
5. Demonstrate bottom-following and track-following
6. Gain experience with launch/recovery

They found that the Reson sonar was unreliable. Its function was lost repeatedly over the cruise and no successful deep mapping trials conducted. The sonar was sent back to Reson for main CPU replacement/upgrade. An additional trial will be required before *Sentry*'s July cruise.

Sentry will be able to use the LBL for initialization and spot checks (unlike *ABE*). DVL is now good to 10m in 2km, and they expect this to improve. *Sentry* will be less dependent on LBL than *ABE* is; they expect to just check the position occasionally with LBL, but normally run on DVL.

The personnel goal for *Sentry* is to operate with 2 people for each job. Hard to get them trained up, but they're trying to do it. Chris German stated that NDSF will come back to DESSC with a request for a "training berth" on some AUV cruises.

During the sea trial they compared the GCTD on *Sentry* with *Oceanus*' Seabird. There was good

agreement on temperature, but a calibration issue on C.

Dana reported on the capabilities that were demonstrated during the trial (see slides). There are items that will need to be addressed before the July cruise. These are listed in Dana's slides.

The Chief Scientist for the *Sentry* July 2008 cruise aboard R/V *Thompson* is John Delaney. The objectives are for observatory node site mapping.

Andy Bowen added that *Sentry* is moving from development to operational. They will need a robust set of spares and the ability to repair at sea. As they move forward this is an area that they will look serious at.

Annette asked when the system would be considered mature enough to *ABE*. Dana – They plan to use *Sentry* as the preferred vehicle. The reason that *ABE* was still in use was because of a scheduling conflict. *Sentry* could not have been able to be used with COMRA because of INS issues. *ABE* would only be used to resolve scheduling conflicts.

HD Upgrade Project –Bill Lang reported. His slides are included as *Appendix XVIII*. The design goals for the HDTV upgrade were to develop an imaging system upgrade that improves the overall quality of motion and still-based imagery on *Jason* and *Alvin* without impacting the day rate. The upgrade was approved for funding by NSF in the spring 2008. The implementation is phased. In 2008 fabrication of two HDTV cameras with zoom optics, including interface and control electronics is planned. In 2009, integration and testing of the HDTV cameras on *Alvin* and *Jason* would take place. The schedule of activities is included in Bill's slides.

Bill described the hybrid HDTV camera head (details are in his slides). The still frame acquisition, interval mode, and science on-demand mode features were described. No strobe is required.

The Motion Imagery Acquisition has a flexible system design. Its interface is compatible with many COTS recording systems. The Advanced Imaging and Visualization lab will provide motion recorders on a request for services basis. The technology is still developing. HD recorders will be available for cruises as needed. They don't have a day rate established yet. Commercially, the HD recorders are available for \$500 to \$1000 a day.

Deb cautioned that there are issues associated with play back. Decks can be very expensive (R2K is ~ \$50k) and are unavailable. ROPOS has decided to record to hard drive. Bill - we don't want to develop our own recording system. He recommended that we wait a year to see what recorders become available commercially.

Navigation (Acquisition of two new USBL) – Jon Howland reported. His slides are included as *Appendix XVII*. The Benthos 455 Replacement for the ROV system has operated for more than a year with the first prototype system (n456). The limitations are:

- Only 8 input channels
- No release commands
- Required new boards for each new ship transducer
- Didn't support *Alvin* operation

Spring 2008 tests on *Atlantis/Alvin* revealed a few problems. There was a power mismatch in the n456/UQC. This problem has been corrected. There were also firmware issues in the DSP board and these are under investigation.

Future plans include additional testing of the systems on *Jason* and *Alvin*.

A USBL DURIP/ONR Proposal was written in 2007 and funded this year. Two systems were acquired. There has been a permanent installation on *Atlantis*. There will be a portable system for ROV/AUV/ other uses. The USBL saves ship time with no transponder deployment, survey, or recovery. It enables a rapid response. The range of the USBL is 4,000m and accuracy is 0.2% of range.

The USBL is intended to augment, not replace the LBL. 84% of *Jason* lowerings and 95% of *Alvin* dives in recent years were to depths of less than 4,000m.

Detailed evaluation/comparison/design of the USBL will be complete by end of summer 2008 and procurement is planned in the fall 2008. Development/installation is planned in 2009.

Mid-Morning Break

Reports and Discussions on DESSC related activities and Issues:

Establishing Safety Standards for the use of Human Occupied Vehicles - Craig Young reported that the draft document was sent to NOAA and NSF for agency review in late December 2007. NSF Legal Counsel had no comments. NOAA reviewers had many comments that they compiled into a matrix. NOAA comments were discussed in a committee phone meeting. The NOAA's concern is that they would like to continue their use of the Delta Submersibles, but the Delta's currently do not meet the HOV Safety Standard guidelines. The main issue is the specification for a human rated handling system. The HOV Safety committee stands by their position requiring human rated handling systems. Karen Kohanowich will discuss this issue and situation with the Delta representatives. These guidelines will apply to vehicles operated by UNOLS members and vessels.

Winter Meeting Strategies – Agenda and forums – Deb said that we would like to entice new users

and students to DESSC. A streamline agenda for the winter meeting has been drafted that condenses the reports into a morning session. Annette presented the draft agenda. Many of the oral presentations from previous meetings would be provided in written form and posted on the website. NDSF PI reports are still included on the agenda. We will develop guidelines for the PI Reports so that they can include show-n-tells and short (1-minute) videos.

The afternoon would be open for a special session. There should be an emphasis on engaging students and new users. Suggestions for an afternoon session include:

- Tutorial for potential and new NDSF Users
- Deep Submergence Science Strategic Planning for the Future
- Deep submergence science directions and facility needs in the Arctic

DESSC would like to look into the cost and feasibility of having a mixer at a future meeting. They would also like to explore potential options/venues for a traveling “NDSF road show” that would attract students.

Deb said that the draft agenda will be circulated to DESSC and the agency reps and ideas are welcome. This year the winter meeting will be in conjunction with AGU in San Francisco. The winter meeting will alternate between AGU and Ocean Sciences.

Session - Strategic Planning for the Future – Deb Kelley introduced the session and said that some of the topics for discussion include:

- What are the Federal funding projections for support of deep submergence science?
- What are the new directions in Science that are emerging?
- How are we going to schedule the vehicles
- What are the additional technologies we are going to need?
- Where are the new users going to be coming from? Who are the next generation of Science Users (Chris German)
 - Profiles of current usage
 - Examples of recent “new users”

NDSF Users – Chris German provided a summary on the NDSF statistics and users from 2003-2007. His slides are included as *Appendix XX*.

Jason operations are approaching 50% of the total NDSF use with 150 to 200 operational days per year. There were 88 *Alvin* and *Jason* project PIs during 2005, 2006, 2007, and 2008. Statistics of the research programs by research area and by discipline are included in the slides. Forty projects (45% of all funded proposals) were from “new” PIs. Of 26 PIs new to NDSF in 2005-2008, ten are already repeat users. Chris provided examples of the new users.

Discussion followed:

- Tim Shank – some of the new users have been in labs that used NDSF.
- Deb – depending on the advisors, she finds that a lot of the new users are totally green when it comes to being a chief scientist. Deb has considered preparing a tutorial white paper.
- Bill Chadwick – in the pre-cruise planning process, the operator should be aware that they are new users.
- Chris suggested that the afternoon session at the DESSC AGU be a crash course for new NDSF users.
- Liz Caporelli – New users are contacted frequently by WHOI. If scheduling allows, WHOI tries to pair them with experienced users.
- Matt Heinz – A DESSC training session was held at the Portland meeting. There was a lot of improvements to the NDSF vehicles since the Portland DESSC meeting. Perhaps it is time for another training session.
- Deb – There are some new PIs who don't get proper mentoring.
- Henry Dick – He had a post-doc who had never been given an opportunity to run a rock dredge. NSF should require that PIs provide mentoring.

Federal Funding: Projections and future initiatives:

NSF Ocean Sciences – Brian Midson said that science community should be aware that funding opportunities are available outside of the traditional core programs. NSF is still going to fund programs outside of RIDGE and Margins, it may be more challenging but it can be done.

Discussion:

- Deb commented that the RIDGE program has had remarkable successes. Why would projects like these be difficult to get funded in the future? Brian – Proposal success rates for core programs at NSF is down to 20%, yet for RIDGE the success rate is 30%. It is hard to sell large programs during times of flat budgets.
- Bill Chadwick – If R2K goes away, would more money go to core? Brian – In reality, all of the funds are from the core budget. If new programs are added, the core budget probably wouldn't increase.
- Dan Fornari – There has been some really terrific science and good ideas that came out of the RIDGE program.
- Deb – An intangible benefit that was enabled by RIDGE was that the community was able to get together and collaborate.
- Henry Dick – His perspective is very different. There are huge new opportunities in RIDGE research. A broader approach to RIDGE science is needed than what is currently covered by RIDGE. He feels that the new discoveries in the Arctic change how we should approach new science.
- Brian – There is a program called DISCO that provides a venue for recent PhDs to share ideas in a non-NSF environment. It provides mentorships and advisors. The first DISCO opportunity for MG&G will be held in March. Participants would be within two years of their dissertation. An announcement will come out very soon.
- Comment – Many of the important, fundamental discoveries were supported by core programs. Also, international scientists have been making great discoveries. We have to take into consideration opportunities of working with other countries.

NOAA OER –Karen Kohanowich reported that OER is still developing. The program will focus more on exploration.

ONR - Bob Houtman said that ONR hasn't funded much deep submergence science in recent years. They have been and will continue to be more focused on technology development (like DURIP).

Karen Kohanowich – The Interagency Working Group on Facilities has been tasked with creating an inventory of non-ship facilities. This is to be tied to the ORPP. The inventory will provide a tapestry of shared assets. It will provide an opportunity for the agencies to work better together.

Lunch Break (The DESSC held an executive session during the break)

New Science Directions:

Polar Research – Hedy Edmonds serves on the UNOLS Arctic Icebreaker Coordinating Committee. She reported that when the NDSF just consisted of an HOV and ROV, there was no chance for use of the assets in the Arctic. Now that the AUV is available, we need to consider how it can be used in the Arctic. Recently, polar research scientists learned in a very hard way that NDSF costs had to be included in the science proposal budgets that are submitted to Office of Polar Programs (OPP). The NSF Division of Ocean Sciences supports facilities from its facilities budget. The costs for use of UNOLS vessels and the NDSF vehicles are not included in science proposals. However, this is just the opposite for NSF's OPP proposals.

Discussion:

- Bob Froth – NSF should have a consistent policy within their agency. It doesn't seem right that a science user needs to know the different policies within the same agency.
- Alex – the OPP budget is very small and proposals with NDSF costs are much higher than those proposals without vehicle support.
- Deb suggested that there be a larger community discussion on this topic.
- Comment - A letter from DESSC to NSF recommending a consistent policy for all requests with NSF for proposals requesting support for NDSF assets would be helpful. It would allow OPP scientists better access to the assets. On the short term, it is difficult to prove the assets worth without increased use.
- Brian added that a National asset should be funded in a uniform way. There are emerging sciences and the current system is prohibitive to providing access. The process is detrimental to getting the best science accomplished.
- Deb – The way forward is for DESSC to send a letter to NSF requesting a consistent funding policy for NDSF assets.
- Hedy – At AICC there was a discussion and they agreed that they would like to use the AUVs, but they are too expensive.
- Craig Young questioned whether this recommendation should come from the Arctic community.
Alex – The request should come from a focused user group.
- Deb – Perhaps there should be a workshop that brings together Arctic and deep submergence scientists.
- Karen K added that she is chair of the NOAA AUV committee and this is an area that she is looking at.

A recap of Science Drivers discussed in the Technical Advancement of Remotely Operated Vehicles & Submersibles Workshop - Deb Kelley said that there was need for a workshop that would bring together deep submergence scientists and engineers. Her slides are included as *Appendix XXI*. The workshop was held on January 23-24, 2008. The goal was to outline capabilities that will be needed to support deep submergence research in all areas of the deep ocean and for support of ocean observatory initiatives. There were about 30 participants: representing biology, MG&G, chemistry, observatories, moorings, vehicle operators, and engineers. Presentation on the details of the facility and capability requirements for research initiatives/programs were provided. The research programs and initiatives covered included:

- Seafloor Integrated Study Sites - Exploration Science and Operational Needs – Dan Fornari
- Moorings - ROV Requirements - Bruce Howe
- CORKS/IODP - Keir Becker
- Cabled Observatory Needs - Mike Kelly
- Biology Needs and Wishes - Craig Young

The details of these presentations are included in Deb's slides. The presentations lead to a long discussion. There are a vast array of needs and wishes that cross numerous disciplines. There are not enough people, time, or funds to do all we need at any one facility. There is a need to try to achieve some commonality in vehicles. A concept of pooled equipment, some specialized and some not, should be considered. There is also a need for a different management/funding/scheduling structure for national and international assets. Protocols that ensure cost effective use of the spectrum of assets available should be developed.

It was clear that the workshop was useful.

Discussion:

- Marsh – he reemphasized that some of the international community has developed solutions for some of the areas that we might be interested in. These should be explored.
- Karen K suggested that we contact MTS. They have committees focused on ROVs and AUVs. They are developing web pages on assets.
- Chris – re-emphasized the need for pooled equipment. Institutions could propose to build tools as shared use.

Ultra-Slow Ridges - Henry Dick reported on the challenges of working in the Southern Ocean. There are high sea states and there is a need to cover large areas for mapping. The regions are remote and there is a need for transportable systems. He has tried to put together a proposal for use of *Sentry*. The operating depth is 5000 m.

Strategies are needed for working in high relief areas. These are totally different ridge system. No one has ever mapped these areas and there is potential for brand new discoveries and a lot of compelling science. There is no hydrothermal activity.

Chris German anticipates science pressure for Reson 7125 on *Jason*, sidescan on the AUV (ported from DSL-120?), and possibly CHIRP capability. These would be new vehicle capabilities and would improve application of NDSF vehicles to margins and sedimented environments. NDSF has been taking very good care of ridge science, but should broaden this to other types of areas.

Other Reports - Operational Summary and Collaborations with Other Deep Submergence Activities - Karen Kohanowich reported that the KOK, support ship for HURL's Pisces vehicles, has experienced some hull issues. While the ship gets repaired, Terry Kerby will use the LRT system for launch and recovery of the submersible.

Other business - DESSC Membership – There will be a call for nominations to fill Hedy's term that is ending.

The meeting adjourned.