

Meeting Summary Report

DEep Submergence Science Committee Woods Hole Oceanographic Institution Carriage House Woods Hole, MA May 17-18, 2004

Executive Summary

The Deep Submergence Science Committee (DESSC) met on May 17-18, 2004 at Woods Hole Oceanographic Institution (WHOI). The meeting included reports from the three agencies that support the National Deep Submergence Facility (NDSF). Representatives of the NDSF provided reports on:

- Vehicle operation summaries
- Support ship improvements and plans
- Status of WHOI archives
- Ship and vehicle upgrade plans.
- Response to community survey on biology system and sensors
- Navigation upgrades and improvements
- Near bottom high resolution sonar systems
- Rock drill
- Deep submergence scheduling in 2005 and beyond

The DESSC discussed their 3-year agenda. Major items include the replacement of ALVIN, bringing new assets into the NDSF, observatory needs, maintaining an inventory of vehicles and tools, shallow submergence science needs, and expeditionary science. The DESSC reviewed future global deep submergence initiatives including RIDGE2000 and Margins.

There was discussion on ocean observatory facility needs. Recent studies indicate that deep submergence assets will play a critical role in the installation, operation, and maintenance of ocean observatories and associated science support operations. Both Human Occupied Vehicles (HOVs) and Autonomous Underwater Vehicles (AUVs) will be able to perform important tasks at observatories, but ROVs are expected to be the “work-horses” of deep-sea observatories due to their extended dive duration, heavy-lift capability, and available power. At least two additional deep-ocean ROV are needed to meet the projected demand from ocean observatories and still satisfy other science needs.

The meeting concluded with status reports on new vehicle design efforts. WHOI submitted a proposal for a replacement deep diving HOV to NSF in March 2004. The HOV proposed build plan would be to start immediately with the hull materials testing program. If all goes on schedule, the vehicle would be ready for service in 2008. There was a report on the Hybrid ROV (HROV) status. The HROV should be ready for service in 2007.

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MEETING SUMMARY REPORT

Day One: Monday, May 17, 2004

Introductory Remarks, Meeting Logistics, Introductions - Patty Fryer, Deep Submergence Science Committee (DESSC) Chair, called the meeting to order at 0830 on Monday, May 17, 2004. The meeting was held at Woods Hole Oceanographic Institution (WHOI), Carriage House. The agenda for the meeting is included as *Appendix I*. The items of the agenda are reported in the order addressed. Meeting participants introduced themselves. The list of attendees is included as *Appendix II*.

A motion was made and approved to accept the minutes of the [January 25, 2004](#) DESSC meeting.

Patty reviewed the current DESSC membership status and the role of DESSC. Terms of four DESSC members, including the Chair, will end this year. A call for nominations was announced to the community earlier in the year. Individuals interested in serving on DESSC have provided statements of interest and CVs. Each DESSC member was provided with a package containing this information and was asked to review the material so that the topic could be revisited later in the meeting.

There was a brief discussion on whether a group of alternate DESSC members should be formed. These alternates could be called upon if a DESSC member was unable to participate in a meeting. This concept was not approved. The DESSC agreed that being on the committee is an important role. If a member does not attend meetings, or is inactive they should be replaced.

In other membership news, Patty reported that Shirley Pomponi has stepped down as Chair of the Shallow Water Submergence Committee (SWSC) and ex-officio member of DESSC. She has recently taken responsibilities the acting Managing Director at Harbor Branch Oceanographic Institution (HBOI). It was suggested that Craig Young could be nominated to DESSC and also be asked to serve as chair of the SWSC. Patty has contacted Craig and he has indicated that he would be willing to serve if appointed.

Agency and UNOLS Reports

National Science Foundation (NSF) – Dolly Dieter provided the NSF report. She reported that NSF expects to be level funded in 2005. Ship operations costs are increasingly going higher and higher. The increasing cost of fuel is a big concern and is impacting operation budgets. Although no major budget cuts are forecasted, there are concerns about increasing costs for operations.

The deep submergence budget levels for next year will likely remain level. NSF has tried to find support for NDSF improvements, such as, lighting for ALVIN.

Mike Reeve briefly discussed this year's NSF budget problem, which resulted in a \$12M shortfall. In anticipation of an NSF budget increase for FY04, an increase in ship time was scheduled for calendar year 2004. When the actual budget was level funded, funds were unavailable to support all of the ship time scheduled. The budget shortfall was split between NSF's science and facilities programs.

Office of Naval Research (ONR) – John Freitag provided the report for ONR. He reported that in recent years the Navy has not made a lot of use of ALVIN. The agency's primary involvement with the NDSF has been with ALVIN's certification.

The Navy's contribution to WHOI's Hybrid ROV (HROV) development effort has been in the area of the micro-fiber tether design. SPAWAR has been sharing their technology development with WHOI in this area.

Lastly, John reported that the Navy's submarine NR-1 has announced availability for science opportunities. In the past these opportunities were not advertised widely. The recent opportunity was announced to the DESSC community. The sub has a depth capability of about 800 meters. The scheduling of NR-1 normally takes place in October. Projects are primarily chosen on the basis of how they fit with the Navy's schedule for use of the vehicle. There have been some reports that the Navy is considering recharging NR-1's reactor.

National Oceanic and Atmospheric Administration (NOAA) – Barbara Moore provided the report for NOAA with information on both the National Undersea Research Program (NURP) and Ocean Exploration. In budget news, the agency isn't optimistic about receiving anything more than a level budget in the next few years. They are committed to the NOAA days they have on the ship schedule. NOAA has been working to make NURP more in line with their missions, and as a result there will likely be less emphasis on the geological research in future.

Major changes are planned for the Ocean Exploration (OE) program. The program will be more "requirements driven," which is not very friendly to research. They will move towards planning many years in advance with a more matrix management approach. The agency is still learning how to do this. It will be a more deliberative and longer planning process. OE and NURP will be working more closely together. They will try to keep NURP more mission driven and OE more exploratory. OE will be using more non-NDSF vehicles (Ballard's Hercules and HBOI's Sea Links). NURP will continue with their commitment of \$500K for NDSF. It is unlikely that this level of funding will increase. More funds are going is going into diving programs and other less expensive (shallower) work.

The \$28M budget for this year is split evenly between NURP and OE. Next year's request (FY05) looks like it will be \$22M.

UNOLS Report – Peter Wiebe, Chair Elect, provided the UNOLS Report. His viewgraphs are included as *Appendix III*. He began by explaining activities that have impacted 2004 fleet operations. The NSF budget shortfalls impacted fleet utilization with a number of ship time deferrals. Problems with acoustic and marine mammal permitting have also resulted in some cruise cancellations or deferrals.

An area of recent concern for UNOLS is with Radio Frequency Spectrum Management. The potential for increased demand on the spectrum frequency could have serious impacts on ship communications. UNOLS is working with NSF and ONR to communicate with the FCC on this issue.

There are two efforts focused on shipboard over-the-side handling. Two of the winch manufacturers, Dynacon and Markey, have been visiting ships and conducting winch inspections. There is also a load handling system symposium underway. The effort is being lead by Matt Hawkins, U. Delaware.

Peter reviewed the Fleet Renewal activities. NSF has stated that they will support the acquisition of the Regional Class vessels. UNOLS will work to prioritize the Regional Class Science Mission Requirements (SMRs). Construction could begin as early as 2006. The Navy is supporting an Ocean Class Phase II study that will compare three hull variants (a monohull, SWATH, and X-Craft) to the UNOLS SMRs. Funds for construction of Ocean Class ships has not been identified, but will be requested again by RADM Cohen.

Ongoing ship design efforts include the ARRV (construction funds are included in NSF Major Research Equipment (MRE) account), an EWING replacement, and the CAPE HENLOPEN Replacement Vessel. The EWING replacement with a modern seismic ship has been moved forward. Plans are underway for LDEO to acquire the WESTERN LEGEND.

The current Fleet includes 27 ships. In 2020 six of the current UNOLS ships will still be in operation. Assuming that the new seismic vessel, ARRV, 3 NSF Regional vessels, and the CHRV are funded, six additional ships will be available for a total of 12 ships. With the addition of Ocean Observatory ship time (installation and O&M), demand is expected to increase approximately 1000 days by 2020. The additional Observatory ship time represents over 40% of the current use of the Global Class. Observatory needs will compete with the major interdisciplinary research programs that rely on the Global Class Vessels. Funds to support the estimated future increase in ship time have not been identified. The ship time projections indicate catastrophic consequences if there are further delays in new vessel design and construction.

Lastly, Peter reported that UNOLS is preparing a response to the Ocean Commission Report. UNOLS strongly supports the recommendation to Congress for modernization of critical infrastructure (Recommendation 27-4) and urges placing Recommendation 27-4 near the top of the prioritization list. Also, UNOLS endorses the recommendation to Congress to double the federal ocean and coastal research budget (Recommendation 25-1) and urges that 25-1 be placed at the top of the prioritization list for action by Congress.

Discussion followed. Dave Mindell asked if there are any indications that demand for the ship time would go down? Peter replied that reports have not indicated this. There will also be a need for an event response capability. Schedule flexibility would help allow ships to be available for event response.

National Facility Operators Report

NDSF Vehicle Operations Summary: Rick Chandler provided an update of ALVIN and ROV operations for the past year. His viewgraphs are included as *Appendix IV.a*. Engineering dives were conducted off San Diego in January. One day was lost this year to mechanical problems. The vehicle has had 250 hours bottom time. In 2004, ALVIN celebrated its 4000th dive and 40th anniversary.

Rick reviewed 2004 ALVIN Dive Statistics. At the time of the meeting, total ALVIN dives are 4,012 with a collective total depth of 8,339,919 meters and a total time submerged of 27,658 hours. The average depth per dive is 2,079 meters and the average time submerged per dive is 6.89 hours. The total persons carried are 12,029. Rick showed the percentage of dives conducted by discipline. Most dives were conducted either for biology or geology/geophysics research.

Next Rick reviewed the 2004 ROV and towed vehicle operations. There has been two science cruises conducted as of May 2004: Rob Pockalny had a cruise on THOMPSON

at Endeavour Deep using Jason2 and DSL-120. Jason2 had nine lowerings with 297 hours of data. They had their longest lowering of Jason2, 72-hours. The other cruise was in support of Martinez on KILO MOANA at the Lau Spreading Center using the DSL-120 sonar. DSL-120 had 7 lowerings for 390 hours of data. Four more Jason2 cruises are scheduled this year.

NDSF Support Ships – Al Suchy reviewed maintenance projects completed on ATLANTIS in 2003-2004 and plans for 2004. His viewgraphs are included as *Appendix IV.b*. Completed improvements include:

- A-frame maintenance.
- Deck renewal in portions of Main Lab & passageway.
- Rebuilt #2 Reefer Compressor.
- Two Top End Overhauls of Engines.
- Lubricated trawl and hydro wires.
- Replaced/overhauled many components of the Galley.
- Replaced hot water heater for upper deckhouse.
- Cleaned generators in place.
- Hydro winch and boom hydraulic maintenance.

Dick Pittenger commented that the problems Al identified should be included in the Lesson's Learned document being compiled by UNOLS. Maintainability demands are a lot higher on ATLANTIS than with KNORR. Measures should be taken to avoid these problems during design and construction efforts in the future.

Maintenance is also scheduled for July 16-27, 2004 in Seattle and Oct 7-30, 2004 in San Diego. The projects to be carried out include:

- Replace Hydro-Mechanical Safety Shutdowns on all 6 CAT engines.
- Overhaul a big and a small diesel engine and clean attached generators.
- Convert AFFF piping from steel to CuNi.
- Conduct NSF sponsored maintenance and training on Markey Hydro &
- Trawl winch in Seattle (home of Markey).
- Make permanent repair to puncture in the hull, starboard side freeboard, where fender failed in Manzanillo, Mexico.
- Renew at least 2 more weather-tight doors.
- Complete hydraulic repairs to hydro-booms to eliminate creep on one while using the other.
- A-Frame maintenance general corrosion protection and hydraulic work.
- Gage & Meter Calibration
- Clean Main Propulsion motors.
- Install vent outlet mods in labs.
- Pursuit of lab drain mods.

Al explained the impacts of new security regulations. These regulations apply to all of the UNOLS large ships. Access to ship will be impacted and everyone must be aware of the new regulations. There will be an increased need for pre-authorized access lists.

Gangway watches may request pictured ID's in MARSEC Condition 1. There will be thorough search of person and belongings on 25% of personnel coming aboard in MARSEC Condition 2. In MARSEC Condition 3 there will be search of 100% of person and belonging coming aboard ship. Implementation of the new regulations will impact manpower demand.

Lastly, AI reported on the impact of rising fuel costs. To date, about \$100k more than what was in the proposal budget has been spent on fuel. These increased costs are having a significant impact. They are struggling with this and looking to see what additional cost cuts might be possible.

Status Report On The Archiving Of All Deep Submergence Data In The WHOI Archives

– Dan Fornari provided a status report on archiving. He reviewed the various archiving activities that have been underway and asked for DESSC input. The archiving activities are detailed in *Appendix IV.c*. He reviewed the efforts involving video data migration, meta-data, and development of a distributed database. These efforts have involved:

- Preservation, migration and better access to the 35mm ALVIN, Jason2 and Argo II still images through digitization and proper cataloging with relevant meta-data,
- Assessing ALVIN data logger data, migrating data on older media no longer in common use, and properly labeling and evaluating vehicle attitude and navigation data,
- Migrating older ALVIN and Jason2 video data, especially data recorded onto Hi-8 tape that is very susceptible to degradation on each replay, to newer digital format media such as DVD,
- Improving the capabilities of the NDSF archives to better serve the increasingly complex needs of the oceanographic community, including researchers involved in focused programs like Ridge2000 and MARGINS, where viable distributed databases in various disciplinary topics will form an important component of the data management structure.

A real challenge has been merging the navigation data with the archives – this was a major goal of the project and they have been successful. The navigation data was post processed. They are trying to use the best data available, not the raw data. The current ALVIN and Jason2 Frame-Grabber & Virtual Van URLs are:

ALVIN <http://www.whoi.edu/marops/vehicles/alvin/alvin_framegrabber.html>, and
Jason2 <http://www.whoi.edu/marops/vehicles/jason/van_cruises.html>

The real-time capability for providing metadata and visual data from ALVIN and Jason2 has been valuable to optimizing scientific productivity on research cruises and satisfying metadata requirements of major science programs.

A prototype system was developed, built, and implemented to address putting the historical ALVIN datasets on-line, and at the same time, transferring the video to DVDs. Dan showed photos of the equipment. As part of the prototype testing historical dives from the East Pacific Rise 1991-1994 and Endeavour 2000 were processed. For each dive, the video imagery was transferred onto DVDs, images frame-grabbed every 15

seconds, and a composite Frame-Grabbed dataset with merged Navigation and Attitude data for each dive is available on-line via a web-browser. <<http://4dgeo.whoi.edu/hist-alvin/>>.

Dan gave examples of duplicated DVD video imagery from various cruises. With the current prototype set-up (2 DVD recorders, 1-axis 4port video server, 1-computer, 2-hi8/vhs video input sources) processing time is ½ real-time, or stated another way, the data can be processed twice as fast as real-time. For data that is newer than 1991, WHOI estimates that a 1/2 FTE can do the complete processing including frame-grabbing, DVD media transfer, and nav/att processing and merging. With more equipment and personnel, they can process the data faster.

Dan explained that for dder data, they don't have experience yet. There may be problems with video quality, and for much older datasets (70's, early 80's). There could be navigation data-format/media issues, which would take longer to sort-out and process. They will need to add several pieces of equipment to the production system including DVCam players, time-code readers/displays, and an audio switcher for dives that contain LTC.

Dan suggested that a message be sent to the community asking for their old data that they would like to contribute to the National deep submergence archive.

They have been striving for consistency with ALVIN and the ROV data. With agency seed money they have been able to work through many of the archiving challenges and establish the mechanics so that they can go to production.

Dan requested input from the agencies and DESSC:

Suggestion – It would be good to include information about the source of the Navigation data.

Question - How does the old and new data get into the archives. Dan - The new data gets archived automatically. However, getting the historical data into the archives has been an issue that they are struggling with.

Question – Is any of the data annotated? It would be a very valuable feature. Dan – No. The effort has been rather daunting, but perhaps it could be something that could be added for new data.

Suggestion – It would be important to get the cruise reports into the archiving.

Dave Mindell commented that there is a Boston firm (EMC?) that was looking for large archiving projects. They did a Spielberg project. This project seems like something that would be of interest to them.

NDSF Chief Scientist – Dan continued with perspectives on the NDSF Chief Scientist position and thoughts for the future. He explained that he is stepping down for a new position to Chair the Deep Ocean Explorations Program at WHOI at the end of June. He has appreciated the time that he has spent in this position. Some important and continuing deep submergence issues include:

- There will continue to be the need to match deep submergence vehicle capabilities to future facility needs.
- Calibration is critical (sub-meter). This will take on a whole new level of importance.
- There continues to be good communication between the Chief Scientist and the operations group. Dan explained that he has learned more about the realities of operations. Hopefully communications will continue to be good and will expand.
- Communications between DESSC and Chief Scientist. This is very important element of the Chief Scientist's position.

Personnel Changes in Marine Operations - Dick thanked Dan for his efforts. His contributions as Chief Scientist were very important. The chief scientist position has been advertised and the application deadline is July 1st. Maurice Tivey has agreed to serve as the Chief Scientist until a new one is aboard. The appointment would be to the tenured scientific staff in any one of the five disciplines. The position receives six months of institution support.

Dick continued with a report on several other personnel changes. Jon Alberts, the marine coordinator has been at WHOI for six years and he has improved the position at WHOI by leaps and bounds. He plans to leave WHOI, but will stay on to set the 2005 schedule. Liz Caporelli has been hired as his replacement. Bob Detrick will replace Dick Pittenger as the WHOI Vice President for Marine Facilities and Operations.

Access to the Sea Task Force – In the fall 2003 Bob Gagosian formed a committee and tasked them to conduct an internal WHOI study to investigate access to the sea including, ships, vehicles and observing systems. Bob Detrick chairs the committee, which includes scientists and engineers. Their first meeting was held in January. They are required to submit their report by July 2004. Two non-WHOI individuals, Debbie Kelley and Margo Edwards, will be involved in the study. A summary of the report can be provided at the fall meeting.

Patty Fryer thanked to Dick for his commitment.

Tim Shank suggested that the Chief Scientist position would benefit with staff assistance. Dan Fornari remarked that he has relied heavily on the deep submergence groups. They have been very good in following through on Dan's ideas. He is very grateful for the support groups.

Mid-morning break

Upgrades to National Deep Submergence Facility

ATLANTIS Improvements status – Al Suchy reported on the status of ATLANTIS improvements. Some of the major items include fire fighting foam, additional buses for voltage regulation, and HVAC improvements. Hydro mechanical safety shutdown is being investigated. The sensory devices are indicating problems when there are no problems. WHOI is investigating ways to reconfigure/split staterooms to get additional single staterooms for crew. The ship scientific support group personnel also spend a great deal of time aboard ship and it would be nice to have single staterooms available for them. WHOI is trying to find 6 additional rooms. The preliminary feedback is not good, but they will continue to explore options.

Annual request for upgrades to science sensors and operational capabilities of NDSF vehicles – Tim Shank reported on the response to his community survey regarding biology system and sensor upgrades. His survey and a summary of responses are included as Appendix IV.d. The survey was posted on March 12, 2004. Over a period of two months, 34 individuals responded (Macro-ecology = 25, Microbiology = 4, Bio-instrumentation/engineers = 2, Geology & Geophysics = 3). Tim presented the results from the biologists. A sampling of the results are provided below:

Vehicles used by survey participants:

- 73% used HOVs in the past 2 years (1% never)
- 63% used ROVs in the past 2 years (7% never)
- 41% used Towed Vehicles in the past 2 years (38% never)
- 24% used AUVs in the past 2 years (67% never)

The survey participants were asked the importance of the vehicles for their future research:

- 83% - HOVs important to very important for research in next 5 years
- 92% - ROVs important to very important for research in next 5 years
- 48% - Towed Vehicles important to very important for research in next 5 years
- 60% - AUVs important to very important for research in next 5 years

Survey participants were asked how important it was to be able to work in various depth ranges:

- 500-1000m - 44% - Very important; 24% Not important
- 1000-2000m - 56% - Very important; 30% important; 0% not important
- 2000-3000m - 68% - Very important; 18% important; 0% not important
- 3000-4000m - 54% - Very important; 23% important; 4% not important
- 4000-5000m - 33% - Very important; 38% important; 17% not important
- 5000-6000m - 21% - Very important; 21% important; 42% not important
- 6000-7000m - 17% - Very important; 17% important; 61% not important

The survey asked the importance for being able to carry out research in waters shallower than 1000m with various vehicles.

- 44% - HOVs very important
- 38% - Towed Vehicles not important

- 42% - AUVs not important
- 45% - ROVs very important; 30% not important

The survey asked the importance for being able to carry out future research deeper than 5000m with various vehicles:

- 35% - HOVs very important; 46% not important
- 29% - Towed Vehicles very important; 50% not important
- 46% - AUVs very important; 38% not important
- 78% - ROVs important/very important; 19% not important

They were asked about their envisioned observatory research:

- 68% - HOVs important/very important; 25% not important
- 36% - Towed Vehicles important/very important; 44% not important
- 50% - AUVs important/very important; 31% not important
- 74% - Vacuum samplers

The survey asked which tools and samplers were used most often:

- 59% - Sediment push cores
- 63% - Manipulator Claw
- 56% - Bioboxes
- 56% - Nets and Scoops
- 40% - Water chem/in situ sensors
- 37% - Quantitative faunal samplers

Tim summarized the comments regarding vacuum samplers, biobox collection boxes, and imaging systems:

Vacuum Samplers:

- 60% of respondents have used one in the past 3 years
- Only 22% satisfied with current samplers available with ALVIN
- Optimal size chamber is 2 liters (37%)
- 8 to as many as possible chambers desired (56%)
- Chambers must be free of contamination, thermally insulated, removable,
- Adjustable for size (50%)

Biobox Collection Boxes

- 63% of respondents have used one in the past 3 years
- 59% are not satisfied with currently available boxes
- Boxes must free of contamination (61%), thermally insulated (58%)
- Compartmentalized (58%)
- Adjustable for size (56%)
- Provided by the NDSF (73%)
- 55% of biologist use boxes not provided by themselves
- Good sealing mechanisms, Clear lids, Easy to drain

Imaging Systems

- Important to current research 85%
- Importance to upgrade 78%
- Satisfied with overall quality 49%
 - Camera configuration 57%
 - Camera resolution 71%
 - Lighting intensity 57%
- Importance to quantify 72%

Suggestions for ALVIN/Jason2 included:

- Increase quantitative usability 75% 84%
- Upgrade suggestions included:
- Jason2:
 - “Computer decoded holography;
 - 3D diffractive elements instead of lenses;
 - High-res digital still on J2,
 - Record the zoom and angle of the cameras,

ALVIN:

- Record all ALVIN channels,
- Access to High Definition,
- Better resolution pan and tilt on ALVIN,
- Move the ALVIN 3-chip off the arm”

Biological Mapping

- Prior use of vehicle to map 56%
- Importance to navigation resolution upgrade 91%
- Importance of image resolution upgrade 95%

Comments regarding mapping included:

“Doppler navigation has been a great help with ALVIN”

“The most important thing for biologists in mapping...is that the images be geo-referenced...funding should be put into continued navigation improvements;

Make high-accuracy navigation standard rather than a costly option;

Improve variable ballast control on Jason2”

The survey included an open forum section. Appendix IV.d. includes selected quotes.

LUNCH

Suction samplers - Dan Fornari provided a general description of oceanographic suction samplers. His slides are included as Appendix IV.e. Oceanographic ‘slurp’ samplers consist of several key components. The primary components are:

1. An electrical or hydraulic pump system that provides suction flow to drive the system,
2. An outlet hose that connects the pump or hydraulic power system to a collection chamber,

3. A collection chamber that contains a mesh filter, the size of which can be changed depending on material to be sampled, mounted at the outlet opening, and
4. A handle-mounted inlet hose that leads from a collection chamber to the material to be collected

Dan described the proposed new multi-chamber suction sampler for ROV Jason2 and ALVIN. The suction sampler proposed will be designed for use on both ALVIN and ROV Jason 2. They are proposing that two systems be built. Each vehicle conducts multidisciplinary science operations throughout the year and often during individual cruises, hence each vehicle requires this capability.

The suction sampler will have five acrylic sample containers in which biological samples can be collected. Each sample container will be individually sealed from ambient contamination before, during and after the dive. The five sample containers will be encased in a polyethylene plastic, insulating cartridge. This insulating cartridge will allow all five-sample containers to be switched out as an assembly and also help maintain the samples at desirable temperatures during vehicle recovery.

Dan opened the floor for discussion.

Anna Louise – There is a need for variable intake size. She would like a smaller, more discreet sample size, sip samples. Dan – The pump will be variable speed, which would likely allow variable in-take sizes. There was concern about how to take a small sample of known volume. This item will need to be addressed further.

Other Upgrades – Discussion followed on other upgrades. Barrie Walden reported that they would like to acquire additional Octans, which are critical to improved navigation. Perhaps rather than put the emphasis on video upgrades at this time (while they continue to evaluate the technology), they would like to put funds into acquiring Octans. One exception is a purchase of a small camera for the ROVs and new small zion lights.

Debbie Kelley suggested that an outboard digital camera should be acquired to replace ALVIN's 35 mm. The "Insight" works fine on ALVIN, but is difficult to use. Also downloading through the hull with an USB has been problematic. They will continue to assess the system and compare with the ROVs.

Tim Shank reported that when moving the pan-n-tilt camera, the image gets fuzzy until focused.

Pat Hickey suggested having the camera hardwired to some degree; it accidentally gets turned off from time to time.

Navigation – Dana Yoerger reported on navigation upgrades and improvements. The Beacon Long Baseline (LBL) Navigation supports multiple vehicles, is backward compatible with existing transponders and receivers, and allows faster surveys. The first tests this summer with ABE

ROV Upgrades and Near Bottom High Resolution Sonar Systems – Andy Bowen summarized tethered vehicle activities in 2004. His viewgraphs are included as Appendix IV.f.

Activities include:

- Replacement of the control vans
- Designing a new shop area (Blake building renovations)
- New MEDEA
- Surface Location Beacon
- SM2000/DSL120a processing integration
- Science Pan-n-tilt (with camera)
- First use of the slack tensioner
- Sony DSC
- Homer Probes
- New Cores
- Fall WHOI Dock trial

Andy provided bathymetry examples from Rob Pockalny's January 2004 cruise. The examples included EM300 data, DSL-120A phase-bathymetry, and SM2000 data.

Cathy Offenger has rejoined DSL and will take on the operations management issues and is taking on the pre-cruise planning.

ROCK Drill – Dan Fornari reported that the rock drill proposal was not funded. It received favorable reviews, but was too expensive. Dolly reported that Marcia McNutt (MBARI) called Dave Epp (NSF) to let them know that MBARI had an opportunity to lease the drill out commercially at a good profit. After this activity, MBARI would be interested in the arrangement of a lease or transfer to WHOI. Dolly indicated that the MBARI drill would fit most needs and is much less expensive than the drill proposal. This will be explored further.

Transitioning ABE into NDSF – Dana Yoerger provided a presentation on ABE. He explained the benefits of adding ABE to the NDSF:

- Increase access to AUV technology
- Reduce costs
- Remove added cost to science proposals.

He showed a listing of ABE cruises completed to date. The vehicle is gaining interest. ABE is fully autonomous. It can be used in night time operations with ALVIN during the day. It can now operate for about 30 hours with no ALVIN in the water. It has operated in high relief terrain. The vehicle uses Long Baseline (LBL) based navigation. Its digital still camera enables species identification. The AUV paradigm is very rich and just beginning to be exploited.

Dana outlined the steps to full operational status

- Stabilize vehicle core systems, hardware and software
- Maximize commonality with other WHOI vehicles
 - o Hardware systems
 - o Real-time software
 - o Mission planning simulation

ABE staffing requirements are for two or three FTEs from the operations group plus one from science. There are also mission programming requirements. The operation group is responsible for data integrity. Dana reviewed the day rate calculation. For 140 operating days annually, the annual cost would be \$800K, which translates to a day rate of \$5.7K per day.

A second AUV vehicle, SENTRY, will go in the water soon. The vehicle has increased speed and faster descent/ascent, is highly maneuverable, and is more easily serviced. They will probably need both vehicles.

The floor was open for discussion:

Question - Would SENTRY be considered for the NDSF? Dana – it should be a natural progression once proven.

Mike Reeve indicated that it is reasonable to consider new facilities. Only the ships and the NDSF are funded outside of the science budget. Three additional items have been requested for support from the Research Facilities section. These include:

- HOVs in general including HBOI vehicles
- Aircraft
- ABE

Dolly suggested that as DESSC tackles this issue, they should consider the bigger issues: the impact on budget and the other facilities that have requested Research Facility funds.

Deep Submergence Scheduling: 2005 and Beyond - Jon Alberts review the straw man ALVIN/ROV schedule for 2005 and beyond (*Appendix IVg*). Annette DeSilva continued with a review of the facility requests and identification of funded programs. The requests were presented geographically (*Appendix V*).

2005 funded programs include work in geographic areas:

- Off Hawaii
- North East Pacific Rise (NEPR)
- Costa Rica, Galapagos
- Jeff, Vanc. Is.
- Cal Coast
- Western Pac
- Western SP- Lau Basin, Fiji
- Eastern S. Pacific - Pito Deep, Easter Is.

There are 69 ALVIN funded days, 182 ROV days and 29 towed vehicle days.

2005 pending programs included requested days in the:

- Canary Is. & Mid Atlantic Ridge (MAR)
- NEPR
- Juan de Fuca
- California Coast
- Western Pac
- Off Hawaii
- Costa Rica, Galapagos
- Western SP- Lau Basin, Fiji
- Gulf of Mexico

Pending totals included 160 ALVIN days, 221 Jason days and 4 DSL-120.

For 2006 and beyond, areas of funded work for ALVIN and ROVs were in the:

- NEPR
- Off Hawaii
- Juan de Fuca
- West SPac - Lau Basin

There are 47 ALVIN days and 4 ROV days.

Long-Range Planning Issues

Status of the NDSF Memorandum of Understanding (MOU) – Mike Reeve reported that the current MOU would be extended.

Shallow Submergence Science Committee – Patty Fryer reported that Shirley Pomponi has stepped down and asked if this effort should be continued? There is the potential to bring on a new member who could also address shallow issues. Bob Detrick pointed out that ORION has an element that includes three areas where shallow vehicles are of interest:

- Coastal observatories
- Shallow seeps
- Mid-water work

It was agreed to try to recruit a new DESSC member to address shallow interests.

DESSC 3-Year Agenda - Patty Fryer presented the issues facing DESSC over the next three years (*Appendix VI*):

- New faces – There will be new members of DESSC and new WHOI personnel.
- Replacement of ALVIN
- Proposal to integrate ABE into the NDSF
- Observatory needs oversight/advocacy
- Inventory of vehicles and tools
- Shallow submergence science needs

- Funding - Advocating for tools and upgrades for the facility across the agencies and international partners.
- Margins
- R2K needs at focus sites
- Expeditionary science
- ROV development to meet future needs (observatories)

Dolly pointed out that ISIS is in service and can possibly support some of our needs.

Future global deep submergence initiatives:

RIDGE2000 – Dan Fornari reported that the real challenges facing RIDGE planning have to do with scheduling of facility assets and access to tools. As an example, getting the slurp for the Lau basin work was a big effort. These sorts of things will continue to come up.

Margins – Patty Fryer indicated that the Margins program is interested in Subduction science. Dan recommended that the Margins be contacted to determine if their science that cannot be done due to the seismic permitting issues, could instead be done with deep submergence facilities.

Observatories – Bob Detrick discussed ocean observatory facility needs. His slides are included as *Appendix VII*. Deep submergence needs for ocean observatories have been addressed in two recent reports:

- 2003 NRC Report “Enabling Ocean Research in the 21st Century - Implementation of a Network of Ocean Observatories” (Detrick et al.)
- 2003 UNOLS Working Group Report: “Ocean Observatories Facilities Needs from UNOLS” (Chave et al.) The UNOLS Working Group Report is available at
<http://www.unols.org/committees/fic/observatory/work_group.html>.

Deep submergence assets will play a critical role in the installation, operation and maintenance of ocean observatories and associated science support operations. Both HOVs and AUVs will be able to perform important tasks at observatories, but ROVs are expected to be the “work-horses” of deep-sea observatories due to their extended dive duration, heavy-lift capability, and available power.

The role of ROVs in ocean observatories include:

- Conduct scientific investigations (mapping, sampling) around proposed observatory sites prior to installation
- Install experiments and sensors in areas of complex topography (e.g. in a hydrothermal vent field)
- Perform servicing of some observatory sensors and instruments after installation or carry out experiments requiring unique capabilities of HOV
- Used for high-resolution mapping for cable-route surveys

- Conduct high-resolution seafloor, geophysical or photographic mapping around an observatory node for scientific studies and to identify changes
- Conduct regular repeat surveys to determine variation in water column properties around a node
- Respond to transient events detected by monitoring observatory sensors
- Specialized ROV for burial and post-lay inspection of cables
- Installation and servicing of seafloor junction boxes, deployment of 'extension cables'
- Connection of moorings to seafloor junction boxes
- Servicing, repair or replacement of network equipment or instruments
- Deployment of long-term science experiments and general science support

The Chave report indicates that the ROV requirements needed for support of ocean observatories include:

- Deep ocean operation (to 6500m and beyond)
- Twin manipulators with at least one being a highly dexterous master/slave design
- Ability to accommodate on-board payloads of no less than 250 lbs water weight
- Adequate dynamic thrust to lift and move objects weighing up to 500 lbs in water
- Ability to lift of up to 2000 lbs to recover junction boxes and other equipment
- Ability to operate to Sea State 5, and preferably higher, for both NEPTUNE and the global buoy observatories
- Ability to carry diagnostic tools to troubleshoot nodes/associated equipment. In-situ
- High precision real-time acoustic navigation
- Flexible power and data telemetry to accommodate a wide variety of sensors
- Ability to use a cable payout reel system for short (up to 10 km) near-bottom lays
- Fiber optic umbilical with dedicated spare fiber.
- Deployable from a variety of support vessels

The current generation of academic ROVs, such as Jason2, are highly compatible with ocean observatory requirements. The estimated operation and maintenance requirements for ROV support is approximately 600 ROV days per year. A single, deep-ocean ROV, Jason2, available through the NDSF is not adequate to meet both observatory and general science requirements. At least two additional deep-ocean ROV are needed by 2010 to meet the projected demand from ocean observatories and still satisfy other science needs.

Bob summarized the issues for DESSC, UNOLS and ORION:

- What is the most cost-effective mix of academic and commercial ROV for ocean observatories O&M?
- What capabilities should be given the highest priority for UNOLS-operated vehicles?
- What role will non-US ROVs play in O&M of ocean observatories (e.g. Canada, others)?
- Should academic-operated ROVs (or AUVs) dedicated to observatory work be managed through NDSF? If so, what are the implications for how the NDSF is structured and operated in the future?
- What design criteria will need to be established for observatory nodes and future vehicles to allow ROV (and HOV) operations around nodes with surface or sub-surface moorings?

End Day one

Day Two: Tuesday, May 18, 2004

Discussion of replacements on the DESSC – The day began with a discussion on DESSC membership replacements (*Appendix VIII*). Four members are rotating off, as well as the Chair. Nominations and statements of interest have been received. DESSC reviewed the material and made recommendations. The nominations process will be continued via email.

NSF raised the issue of “Conflict of Interest” and stated that in the view of their legal counsel it is not appropriate for an advisory group to include membership from someone employed by the facility. This applies to Tim Shank’s position on DESSC. After discussion, it was decided that this is a matter that would need to be addressed by the UNOLS Council.

Vehicle and Equipment Inventory Project – An inventory of vehicles and equipment has been compiled and is posted on the DESSC website <<http://www.unols.org/committees/dessc/inventory/vehicles.html>>. Additional items can be added. We would like to expand the listing.

Replacement HOV update: Proposal and Design Status - Bob Brown reviewed the status of the replacement HOV (*Appendix IX*). He reviewed the vehicle’s performance and science specifications. The basket payload will be 400 lbs. Bob showed the conceptual design layout, which includes the same ALVIN lifting device, 2 manipulators, 4 thrusters, and 5 view ports. He showed the arrangement for the CTFM sonar, pan n tilt, array of lights, and HMI lights. They are still evaluating the viewport configuration options. The mock up facility at WHOI is complete.

Bob reviewed the project status. The SwRI report is complete. WHOI submitted a proposal for a deep diving HOV to NSF on 31 March. The proposal is in the review

process at NSF with an anticipated decision in summer 2004. They continue to develop the material-testing plan with the Navy, SwRI and ABS.

The HOV proposed build plan would be to start immediately with the hull materials testing program. The vehicle design would start in early 2005. The proposal is for a two-phase approach with the ability to stop vehicle design/build based on the results of the hull forging. The personnel hull is to be supplied to the vehicle builder as owner furnished equipment. The sphere will be tested to 1.25 design depth. Bob showed the project timeline. If all goes on schedule, the vehicle would be ready for service in 2008.

Presentation to Dick Pittenger – On behalf of the ALVIN pilots, Pat Hickey recognized Dick Pittenger for his leadership to the facility and operation.

Hybrid ROV (HROV) Status Report - Andy Bowen reviewed the status of the HROV project (*Appendix X*). In 2004, development of syntactic floatation material for the HROV will be conducted with final testing of the material in 2005. They will also complete proof pressure testing and cyclic testing of the 10-inch ceramic housing. Two light fiber approaches are being evaluated:

- Armored micro-cable (FOMC)
- Bare coming fiber (LEAF)

They are concentrating on the bare leaf fiber. It is less expensive, has ~2 lb breaking strength, and has low hydrostatic. Re-use would be required for the armored cable, while it is not required for the bare fiber.

HROV lighting requirements call for a strobe capability for low duty cycle and low power. Available lamp choices include:

- Halogen
- Xenon strobe
- High power LED

A HROV Advisory committee has been formed and includes Melanie Holland, Lawrence Lawver, Chuck Fisher, Deb Kelley, Keir Becker, and one other member from industry.

The HROV should be ready for service in 2007.

Winter DESSC Meeting Strategies – The winter DESSC meetings were discussed. Patty Fryer reported that the special session at the 2003 Fall AGU Meeting was well attended. Approximately 60 people attended the DESSC meeting held at the January 2004 AGU Meeting in Portland. This was the first time the winter meeting was held at a venue other than San Francisco. The January meeting included a NDSF training session. Following the meeting, participants were surveyed on their assessment of the training session. Annette DeSilva reviewed the survey results (*Appendix XI*). In general participants thought the training was useful and there should be additional opportunities in the future.

Bill Ryan commented that one of the best ways for new users to become familiar with the vehicles is with timely scientific publications from. New users need to see how results are turned into paper. A special session at AGU could be devoted to papers. This might be something that DESSC participate in. Bob Embley suggested that we put together a list of deep sub papers that are presented.

Dave Mindell suggested a journal be created highlighting the significant science that has been conducted using deep submersible tools/vehicles. It could be an edited volume with a forward by a scientist.

Debbie Kelley suggested that we use videos for training.

The Fall AGU meeting this year is scheduled for 13-17 Dec 2004 in San Francisco, CA. The DESSC meeting will be held on Sunday, December 12, 2004.

Operational Summary and Collaborations with Other Deep Submergence Activities:

MBARI – Marc Chaffey reviewed facility operations at MBARI in 2004. In 2004 there is 20 days of external funding. An AUV highlight included a 1000 km CTD survey. The MARS observatory is in the permitting process. The project is getting support from NSF and includes commercial involvement. Heavy installation operations are being contracted out.

Patty Fryer showed a series of slides with highlights of other facility operations (*Appendix XII*).

Bob Embley presented a video from his cruise in the Western Pacific. The video was taken during a ROPOS dive. It provided the first ever footage of an underwater eruption.

HURL will take their vehicle, *Pisces*, to the SW Pacific on the way to New Zealand.

Outreach, Education and Archeology

Archeology - David Mindell reviewed ocean archeology programs. URI and Bob Ballard are accepting graduate students for their new archeology program. They plan to visit the *Titanic* this summer. There are plans in the works to look for Shackleton's ship, ENDURANCE in 2006 in the Wendall Sea. There may be the opportunity for operations in the Bransfield Straights to look at a vent site. The ENDURANCE project is receiving National Geographic and NOAA funding. They will use the ISIS ROV and a Russian Icebreaker.

RIDGE Lectureship Program - Dan Fornari reported that there were four very successful lecture programs this year. Lecturers included Maurice Tivey, Cindy Van Dover, Andy Fisher, and Charlie Langmier.

Patty Fryer reported that a Virtual Museum has been developed and is focusing on the Marianas. The Museum includes data plus outreach.

1200 *DESSC meeting adjourned.*