DEep Submergence Science Committee
Woods Hole Oceanographic Institution
Carriage House
Woods Hole, MA
June 13-14, 2005

Executive Summary:

The Deep Submergence Science Committee (DESSC) met on June 13-14, 2005 at Woods Hole Oceanographic Institution (WHOI). The meeting included agency reports from NSF and NOAA. Representatives of the National Deep Submergence Facility (NDSF) provided reports on:

- Vehicle operation summaries
- Status of WHOI archives
- Ship and vehicle improvement and upgrade plans.
- Navigation improvements
- Slurp Guns
- Rock drill transfer
- Deep submergence scheduling in 2006 and beyond

The meeting included status reports on new vehicle design efforts at WHOI. The replacement deep diving Human Occupied Vehicle (HOV) is moving forward and if all goes on schedule the replacement HOV would be ready for service in 2009. Karen Von Damm provided a report from the Replacement HOV Oversight Committee. The Hybrid ROV project is also progressing and the vehicle should be ready for service in 2007. An update on the status of AUV development efforts at WHOI was provided along with a summary of ABE operations.

A new task item was assigned to DESSC. NSF and NOAA have requested that the DESSC establish safety standards for HOVs. The Navy will not inspect the replacement HOV.

There will be one vacancy on the DESSC in September.

Recommendations:

- **Copyright Issues** – DESSC recommends that WHOI include the credits from source for images/photos that are included in their archive and on their website.

- **Access to Data** – Recommend that WHOI provide clear guidance to incoming cruise participants on how the contents of the ship's computer hard drive will be used post-cruise

- **Shallow Submergence Science Committee** – DESSC recommends that the Shallow Submergence Science Committee is no longer needed. Access to non-NDSF issues is being addressed. Safety concerns regarding use of non-Navy inspected HOVs will be addressed by a soon to be formed subcommittee.

Action Items:

- **Establishing Criteria for bringing New Assets into the NDSF** –DESSC will review and comment on the latest revision of the criteria. Once the draft has been finalized, it will be circulated to the agencies, then the NDSF operator for comment. Pending revision, the draft criteria will be sent to the UNOLS Council for approval.

- **Liaison to RHOC** – Identify a DESSC member who is willing to serve as a liaison to the Replacement HOV Oversight Committee. Provide the recommendation to Dolly Dieter

- **Establishing Safety Standards for the use of Human Occupied Vehicles** - NSF will send a letter to DESSC with a charge to establish safety standards for HOVs. At the summer Council Debbie and Peter will inform the Council about the charge. The safety standards will address certification of the vehicle, certification of the ship, and training (vehicle and ship crew). In response to NSF's charge a subcommittee will be formed. Potential members include RVOC Safety Committee representative, HOV operators from WHOI, HBOI, and HURL, and science users (DESSC). Input from the Navy and legal counsel would likely be required. This effort might span 2 years.

- **Winter Meeting Strategies:** A subcommittee of Craig Young, Jennifer Reynolds, and KT Scott will recommend a strategy (forum(s) and format) for the winter DESSC meeting that will better engage the deep submergence biologists. They will also consider including a training session as part of the meeting.

- **DESSC/NDSF Booth –** DESSC proposes that there be a DESSC booth at the Fall AGU meeting that could highlight the NDSF vehicles. WHOI offered to help provide the graphic displays for the booth. DESSC members could help staff the booth. A proposal requesting agency approval and funds to support the booth is required.

- **DESSC Membership -** Dave Mindell completes his 2nd term in 9/05. Nominations are needed to fill his position. Individuals associated with Margins or Archeology research are desired. Annette will send Deb Kelley the list of past nominees. Hedy Edmonds completes her first term in 9/05 and has expressed a willingness to continue for a second term.

- **Replacement HOV Sensors/equipment** – DESSC will poll the community on scientific equipment requirements for the replacement HOV. Input on new and emerging technologies is needed. This input is needed so that it can be included in WHOI's RFP for the new vehicle. The deadline for sending information is needed from WHOI.

- **Navigation** – DESSC will consider to what level navigation data should be the responsibility of the NDSF Operator.

- **Equipment Proposal** - WHOI will request DESSC endorsement of their 2006 shipboard scientific equipment proposal. The proposal is likely to include a request for a New Kongsberg DP system, a new isotope van, and winch slip rings.

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Meeting Minutes

Day One: Monday, June 13, 2005

Introductory Remarks, Meeting Logistics, Introductions – Deb Kelley, Deep Submergence Science Committee (DESSC) Chair, called the meeting to order at 0830 on Monday, June 13, 2005. 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 December 2004 - DESSC Annual Community Meeting and the May 2004 - DESSC Meeting.

Agency and UNOLS Reports

National Science Foundation (NSF) - Dolly Dieter provided the report for NSF. The NSF budget is grim and will likely be so for the next few years. Additional budget reductions can be expected next year. It is unlikely that NSF will be able to support anything beyond the essentials.

National Oceanic and Atmospheric Administration (NOAA) -Barbara Moore reported that NOAA's 2005 budget is not as bad and in 2005 they will continue to support at past levels. NOAA will have 29 *Alvin* days in 2005 and 46 are planned in 2006. In 2006, the President's budget request for NOAA is less than in 2005. The future will likely be either level or down.

UNOLS Report -Peter Wiebe, UNOLS Chair, provided the UNOLS report. His slides are included as ***Appendix III***. He reviewed the following topics:

- Budget Shortfalls and Impact on 2006 Ship Use
- Fleet Renewal Activities
- Arctic Icebreaker Coordination
- Aircraft for Oceanography

In February 2005, Larry Clark (NSF) sent a letter to UNOLS outlining the funding shortfall in February 2005. A UNOLS ad hoc committee was formed in March 2005 and included Marcia McNutt, MBARI (Chair), Eileen Hofmann, ODU, and Denis Wiesenburg, UAF. They are evaluating the funding levels to define the magnitude of the problem. They plan to have recommendations in time for the scheduling meeting in mid-July. They will work to develop a plan for ship lay-ups that will fit the budget realities and minimize impact on funded scientific programs. They will consider longer term issues such as the impact of retirements versus lay-ups, the various forms of lay-ups, and funding prospects in the out years (Observatories).

Peter continued by reviewing Fleet renewal activities:

Regional Class – UNOLS has provided feedback to NSF regarding IPT representation, operational capabilities and performance requirements. Money is available at NSF to begin the design/build process and an RFP will likely be announced later this year.

Ocean Class – UNOLS provided a recommendation on the Ocean Class hull form in February 2005. The recommended hull is a monohull. The availability of funds and timeline is still unclear, but ONR continues include funds to support ship construction in their budget request.

General Purpose Global Vessel SMR - A Steering Committee was formed to update the Global Vessel General Purpose SMRs. A community on-line survey form regarding science needs is coming soon.

Other Ship News - In other ship news, the *Langseth* should be available for operations in 2006. Gyre will retire this summer, and BBSR plans to acquire *Seward Johnson II* and retire *Weatherbird II*. The *Hugh R. Sharp* will replace *Cape Henlopen* in 2006.

Dolly Dieter added that NSF's Major Research Equipment (MRE) queue has been reordered and the Alaska Region Research Vessel has moved up to the top of the list. It is now planned for 2007. Ocean Observatories is now third in the queue.

UNOLS Fleet Improvement Plan – The Fleet Improvement Committee is updating the 1995 Fleet Improvement Plan. They hope to have a draft in September 2005.

Peter reviewed the Arctic Icebreaker Coordination Committee (AICC) and icebreaker activities.

- *Healy* left on June 3rd for three missions in the Arctic.
- The *Polar Sea* engines were condemned and there was no money to fix them. NSF now has Congressional authorization to charter for a second vessel for McMurdo
- President's budget request for icebreaker operations support was included in the NSF budget for FY2006. Many decisions about future icebreaker funding, operations and major overhaul/replacement will be affected by the final appropriations action on this budget proposal, which is still pending.
- AICC provided comprehensive review and comments on two draft versions of a "Mission Analysis" report, which is the first step in a procurement process that could lead to major overhaul or replacement of the *Polar Star* and *Polar Sea*.

Peter reviewed the Science Committee for Oceanographic Aircraft Research (SCOAR) activities and plans-

- SCOAR is developing procedures and criteria for broader use and accessibility of aircraft
- Interact with NCAR-OFAP and ICCAGRA
- Set up procedures for designating new National Oceanographic Aircraft Facilities
- Define basic instrument suite for UNOLS ocean science aircraft
- Set up web-based CIRPAS request system
- Determine operational guidelines and safety standards for UNOLS NOAF aircraft

National Facility Operators Report

NDSF Vehicle Operations Summary – Rick Chandler summarized vehicle operations and highlights. His slides are included as ***Appendix IVa***. *Alvin* highlights include:

- Engineering dive during Karson cruise in February. The new engineering dive paradigm is to conduct the dive during a science cruise
- There have been four science cruises so far: Karson, Vrijenhoek/Van Dover, Vetriani et al., Shank.
- 48 dives have been completed
- 2 dives lost to weather, 3 for medical emergency
- 240 hours bottom time
- 3 more science cruises scheduled this year
- New pilot: Gavin Eppard
- Overhaul coming up in November

Rick continued with a summary of ROV operations in 2005:

- Three science cruises so far:

- Karson / *Atlantis* – Pito Deep – *Jason* and *DSL-120*
- Meg Tivey / *Melville* – Lau Basin – *Jason*
- Vrijenhoek / *Melville* – Lau Basin – *Jason*

- *Jason*: 36 lowerings, 589 hours of data
- *DSL-120*: 1 lowering, 95 hours of data
- Four more *Jason* cruises and one with *DSL-120* scheduled later this year

Status report on the archiving of all deep submergence data in the WHOI archives - Maurice Tivey reviewed the WHOI archiving activities (***Appendix Vb***). He began with the framegrabber for *Alvin* and *Jason* and showed examples of real-time and archiving basis for digital data collected by the NDSF vehicles. All of the *Jason* cruises are on-line since 2000. The archiving effort extends real-time data collection. The framegrabber website can be viewed at: <http://www.whoi.edu/marops/vehicles/alvin/alvin_framegrabber.html>

Discussion/Questions and Answers:

- Debbie Kelley – How do you bring in updated Navigation into the archives? Maurice – This hasn't been done yet. There should be a warning that this is the real data, it is not the processed navigation.
- Discussion on data – Barrie Walden indicated that after two years a message is sent to the PI letting her/hem know that their data will be made public, unless they get an extension.

Experimental Ship-grabber – Maurice explained that this would provide data from the ships. <http://4dgeo.whoi.edu/shipdata/index.html>.

Maurice provided a Summary of income from NDSF vehicles imagery/data. For the first half of 2005, the income is $23,884.

Lastly, Maurice reviewed the Legacy Data. It contains 736 *Alvin* and *Jason* images. The images are mostly *Alvin* shots from 2002 <http://www.whoi.edu/ims/>. Jeff Karson asked what are the plans to advertise this? It would be good to get the word out to COSEE and other outreach programs.

Catalina Martinez expressed surprised at seeing her photos on the WHOI website with their copyright. Barrie – if the images are on the hard drive on the ship it will be dumped into the photo library on-line. DESSC recommended that WHOI provide the appropriate credits the photos. WHOI will take this recommendation and address it.

Update of NDSF-related WHOI Activities - Bob Detrick provided the status of the internal WHOI Access to the Sea Task Force (as related to NDSF) (***Appendix Vc***). WHOI formed an internal Deep Submergence Advisory Committee (DSAC). Members include Tivey (chair), Forrester, Mullineaux, Owens, Reves-Sohn, Seewald, and Singh. They have regular meetings of the Deep Submergence Operations Group (DSOG) *(Alvin + Jason* groups). The Chief Scientist of the NDSF (Maurice) now regularly contacts PIs following legs using NDSF assets to obtain candid feedback and suggestions on improving operations. They continue to promote cross-vehicle innovations. Maurice and Dan Fornari submitted a proposal and received funding to

transfer the MBARI rock drill to WHOI and operate it as a 3rd party tool for use with NDSF vehicles. They also submitted a proposal and received funding (with SIO) through the NSF Digital Archive program to develop a multi-institution, scalable digital archiving testbed to provide improved on-line access to data from WHOI ships and vehicles (especially photographs, video imagery). WHOI has continued with development of HROV, construction of HOV replacement for *Alvi*n, and dockside testing of *Sentry*. They held a "project management" course for WHOI PIs and engineers WHOI has established an "Access to the Sea" endowment to provide seed money for the development and testing of new tools, vehicles and sensors, or the enhancement of existing systems.

Mid-morning break

Upgrades to National Deep Submergence Facility:

Atlantis Improvements status - Al Suchy discussed *Atlantis* improvements (***Appendix Va***). From Dec 2004 to January 2005 the ship was in San Diego and the following improvements were made:

- Installed High Seas Net
- Completed repairs to # 1 Generator
- Overhauled a big diesel engine
- Moved radar antenna to eliminate blind spot aft of the mast
- Installed components of the *Alvin* Rescue System

WHOI will request DESSC support for their 2006 shipboard scientific support equipment proposal. It is likely to include:

1. New Kongsberg DP system for *Atlantis*
2. New isotope van for *Atlantis*
3. Winch slip ring system for *Atlantis*

There is need for a DP system upgrade. The existing Robertson system, used extensively for *Alvi*n, *Jason* and *DSL-120* operations, is vintage 1980s design and is becoming obsolete and unsupportable. Science demands better station keeping and track follow accuracies in far more challenging sea conditions than what the existing Robertson DP system can deliver. The existing Robertson System has a variety of limitations. WHOI will propose the Robertson unit be replaced with Kongsberg system similar to Knorr/Thompson. The cost is approximately $300K/$250.

A new isotope van is needed because the current van is structurally deteriorating past the point of repair. The van was constructed in the 1980s. Dolly asked if they are taking advantage of the pooled vans. Barrie replied that their cruises are typically too long in duration to consider using the pooled vans.

Al continued by summarizing the issues to be addressed in 2005/2006. These include an effort to overhaul the bow thruster in drydock in 2006. May need DESSC support to ensure *Atlantis* is drydocked in 2006. Additional Plans:

- Modify engine voltage regulator system in Dec 2005

- Replace HMSS systems in Seattle, July 2005
- Clean propulsion motors in Seattle, July 2005
- Continue making incremental HVAC mods
- Continue supporting lab drain modifications

ROV Control Van Upgrades - Andy Bowen reviewed the planned tethered vehicle upgrades (*Appendix Vb*):

- Replacement control vans
- *Medea* upgrades
- Surface location beacon (GPS/Iridium) - Still testing. If lost vehicle can phone home.
- Slurp pump test and evaluation
- 3-chip science video camera – There are space issues on *Jason*. They are trying to find a camera with good resolution that doesn't compromise space.
- Homer probes -- in hand and tested
- 300 kHz Doppler for *DSL120A* and *Jason* (spare to 1200 KHz)
- New bio boxes for use with elevator
- Summer/Fall maintenance periods
- Pixelfly mosaicing camera with strobes
- Continued work on *Jason* to *Medea* navigation
- Improved video annotation
- Insite digital still documentation camera added

Meg Tivey commented that a tilt capability would be useful.

Slurp Gun fabrication update – Andy continued with an update on the slurp gun. He showed a diagram of the new DSG Multi-chamber "slurp" that was funded by NSF (Sandy Shor). It has a carousel arrangement. The suction pump has been designed and installed on *Jason*.

New ROV Control vans were received in fall 2004 and conversion is planned for late 2005. The vans will offer:

- Improved ergonomics for the data station
- Lower maintenance HVAC
- UNOLS/USCG compliant
- Significant upgrade to monitors and displays

Medea Modifications – Andy reviewed the *Medea* mods:

- Pixelfly (color/B&W) and Insite digital still cameras with strobes
- Scanning sonar
- Color video camera
- Thrusters for heading control
- Additional science payload interface
- Stand-alone power and surface control
- Modifications during August maintenance period

Alvin Upgrades, Operational Issues, and Overhaul - Dudley Foster provided the update on *Alvin*'s overhaul plans (Appendix Vc). He began with by reporting on a personnel change. Noel was recalled to active duty in Afghanistan and has retired.

The *Alvin* overhaul will be a "routine" overhaul and is scheduled to begin in November 2005. No major system changes or significant new fabrication requiring engineering design changes are planned. This will not be an "abbreviated" overhaul. The present *Alvin* is expected to be in service for a full service interval (3-5 years) before another overhaul would be due. The new HOV is expected to be placed in service by the next overhaul window (early 2009). If required, *Alvin* could be overhauled in the future and continue with the present capabilities and configuration. Scientific instrumentation upgrades over the next several years are generally not limited by the vehicle infrastructure and could be added as required. New lead-acid batteries were installed Mar/Apr 2005. They expect those to remain in service for another year after the overhaul. Another new set may be required prior to another overhaul window (or new HOV delivery in 2008/9). Sea trials and certification dives for *Alvin* are planned in April 2006

Major changes planned during the overhaul include:

- New motor controller for evaluation (upper aft only)
- Develop inertial navigation system (PHINS DVLNAV enhancement)
- Fiber optic penetrator certification and test
- Build and install new VB seawater valve
- Schilling Titan 4 if suitable and funded (replaces Kraft)
- Evaluate SM2000 installation (may require structural change)
- Being considered: Frangibolt releases, hull window stud repairs, increased hydraulic power

Dudley reviewed the 2005 *Alvin* bottom time and depth (to June). A chart is included with his slides.

Status of Third Party Tools - Rock Drill Proposal to transfer drill from MBARI to 3rd Party Tool - Maurice Tivey reviewed the status of the rock drill transfer (***Appendix Vd***). The drill has been transferred to WHOI from MBARI as a third party tool. The first field program is scheduled for September 2005 during Deb Kelley's cruise. The drill will be sent from MBARI to Seattle to meet *Jason2* for its maintenance period. After Deb's cruise the drill will go to WHOI and the frame will be rebuilt. Maurice reviewed the estimated cost breakdown for drill use on a cruise. The total per cruise estimated cost is $22,400 and covers technician salary and travel, insurance, expendables, and shipping/logistics.

Discussion/Questions followed:

- Question - Can the drill only drill horizontally? Maurice – right now it drills best horizontally. It would take some doing (but is possible) for it to go vertically.
- Marc Chaffey commented that if the frame is going to be heavily modified, serious considerations should be made to configuring it for both vertical and horizontal drilling.
- The weight of the drill is 450 lbs in water.
- It takes about 5 hours to obtain a core.

Navigation Discussion: Deb raised the topic of navigation when using the three different NDSF vehicles. Dana commented that when continuity between cruises is needed, arrangements should be made prior to the cruise. Meg Tivey remarked that transponders installed during previous cruises aren't always in place when the location is revisited. This problem needs to be addressed in areas that are frequently visited. Deb stated that there would be an increasing need for site revisits. Deb suggested that this should perhaps be an area that is addressed by DESSC. They should consider whether or not navigation should be the responsibility of the NDSF.

Lunch Break

Deep Submergence Scheduling and Related Issues: 2006 and Beyond

Straw man schedule for 2006 and beyond - Liz Caporelli reviewed the draft 2006 schedule for *Alvin* and the ROVs and emphasized that they are very draft and everything could change once the funding decisions become firmer. Liz's slides are contained in ***Appendix VI***. Alvin will be in overhaul during the first four months of 2006. Operating areas currently include the Gulf of Mexico, EPR, Juan de Fuca, and Northern California. The ROV schedule has many pending programs.

In summary for 2006:

Alvin - 228 days requested
Alvin or ROVs - 150 days requested
ROVs - 497 days requested
DSL-120 only - 34 days

Review of facility requests and identification of funded programs for 2006 and beyond - Annette DeSilva continued by showing maps of the geographic vehicle request areas. Her slides are contained in ***Appendix VII***.

Replacement HOV Update:

Design Status – Bob Brown reviewed the project status of the replacement HOV. His slides are included as ***Appendix VIII***.

The personnel sphere design and fabrication Request for Proposal (RFP) has been submitted to the Oversight Committee and NSF for review. The personnel sphere RFP has been submitted to Southwest Research Institute (SwRI) and the proposal is currently being completed by SwRI. The contract has been let with Phoenix Int. for a Lithium battery study. Emerson & Cuming developed a 33 lb/cu.ft syntactic foam and development is continuing for a lighter foam. The RFP for vehicle design and fabrication is under development.

The Syntactic foam evaluation is continuing. SwRI is recalculating weight and balance to determine weight margins for different density foams. If a sufficient margin exists for 33 lbs./cu. ft. foam, than they will pursue ABS approval and first article testing. As a first fallback they will determine if a depth limitation based on a 31 lbs./cu. ft. foam would be acceptable. As a second

fallback, they will explore the possibility of conducting the R&D necessary to qualify ceramic sphere/syntactic foam matrix material.

To address areas of higher risk the project has been broken into two phases:

Phase One:

- Feasibility testing for prospective energy system
- Qualification testing for syntactic buoyancy foam
- Preliminary vehicle design for sphere attachments
- Design and forging of personnel sphere

Phase Two

- Completion of personnel sphere
- Complete design and fabrication of remaining vehicle

Bob showed the RHOV construction schedule. If all goes on schedule, science operations can begin in February 2009.

Replacement HOV Oversight Committee (RHOC) Report - Karen Von Damm, Chair of the RHOC, provided a committee report. Her viewgraphs are included as ***Appendix IX***. Karen reviewed the committee membership and their charge. WHOI provides the committee with monthly and quarterly reports. Over the past year they have had a series of meetings.

RHOC Continuing Concerns:

1. Hull
2. Syntactic Buoyancy Foam - will 30 lb/cu. ft. be available
3. Batteries
   - Will Li available in time?
   - If not compromises as to dive duration/depth
   - Available later?
4. Variable ballast
5. Risk assessment and management
6. What will be the required trade-offs?

A project website is maintained on the UNOLS page:
<www.unols.org/committees/dessc/replacement_HOV/replacement_hov.html>.
Dolly encouraged DESSC to look over the website.

Debbie asked that as this process moves forward, should DESSC be reactive or proactive? Karen – They have to wait hear from WHOI to find out the areas where tradeoff decisions may be needed. DESSC would probably be reactive.

Dudley asked that given the extended timeline, would the committee stay through to the end. Dolly explained that the committee was formed with it in mind that initially technical people would be needed. The membership can be adjusted to meet the project needs. Karen added that the private RHOC site has extensive documentation and a tracking spreadsheet. Everything is well documented and tracked.

Deb – in the current timeline, when would the sensors be decided? This is an area when DESSC would like to provide input. Bob replied that fall 2006 would likely be the timing for the sensors. It would be part of the vehicle RFP.

Maurice – How will DESSC fit into the selection of the sensors? Deb – would they like input from the community on the new emerging instruments, size? Bob Detrick – replied that this would be useful. Bob Brown added that it would also be useful to identify which equipment would have to on the vehicle and what equipment could be used with the vehicle, without having to be installed. WHOI will need to let DESSC know when input is needed.

Establishing Safety Standards for the use of Human Occupied Vehicles (HOV) - Dolly Dieter and Barbara Moore lead a discussion on the need for establishing safety standards for the use of HOVs. Dolly indicated that the NSB report indicated that increased access to deep submergence vehicles is needed. Jim Yoder indicated that at some time money would be set aside for this increased access. Although the money isn't available yet, it is time to think about this. NSF has had always indicated that they would only fund work on Navy inspected vehicles. The Navy inspects *Alvin*; bit not other vehicles like HURL and HBOI vehicles. The HURL and HBOI vehicles are ABS inspected. *Alvin*'s inspection is very thorough and includes man rating. Navy has been assisting ABS to become familiar with their inspection criteria. Barbara added that NOAA has safety protocols for vehicles and ships, but they are not the same as the ones that NSF is comfortable with. NSF is asking for something more stringent.

Discussion followed:

- Peter Wiebe reported that earlier in the year a Delta vehicle was delivered to *R/V Cape Hatteras* for a research cruise. The cruise was not carried out because NSF does not support work on non man-rating handling systems.
- Jennifer Reynolds commented that NURP has chartered Delta with the past.
- Craig Young – He has worked on ABS inspected HBOI cruises and other operations and feels that they are very thorough.
- Barbara – there are different levels of the certification, based on the types of vehicles.
- Bob Brown – ABS does not certify the operation, the pilots, etc.

Peter Wiebe stated that UNOLS would need a coherent charge to define the task as a first step. We can establish a subcommittee. We need to define the problem and suggest a course of action to address the problem.

Mid-Afternoon Break

AUV Status - Dana Yoerger provided a status report on ABE and reviewed ABE cruises from June 2004 to March 2005. His slides are included as ***Appendix X***. He showed a map of the world with completed and proposed cruises. Operations have been conducted in the Atlantic and Pacific. They included:

- SeaBreeze Cruise (June-July 2004) R. McDuff, F. Stahr, R. Thompson - Vertical heat flux, bathymetry, magnetics, mapping non-buoyant plume layer

- Lau Basin Cruise (Sept- Oct 2004) C. Langmuir, T. Shank, C. German, D. Fornari - 3-Phase vent localization, bathymetry, magnetics, photomosaics
- Kane Fracture Zone (Nov- Dec 2004) M. Tivey, B. Tucholke, H. Dick - Bathymetry, magnetics, subbottom profiler, *Jason* synergy
- SMAR Cruise (March 2005) C. German, T. Shank, L. Parsons - 3-Phase vent localization, bathymetry, magnetics, photomosaic

On the Kane Fracture Zone cruise they were able to recover ABE, and process multibeam bathymetry before *Jason2* reached the seafloor bottom. Dana showed examples of some of the data collected with ABE. He showed subbottom profiler results, locating and mapping plume sites in 3 phases, and vent site survey using 3-phase approach. During the Southern Ocean operations over a course of a few weeks they went from knowing very little about the area to finding two vents in Phase 2 and animals (shrimp) during Phase 3. The Lau cruise and the Southern Ocean cruise relied on the ABE results for follow-on work.

Dana next discussed the status of AUV *Sentry*. Trials were conducted in March 2005. Control system/dynamic testing is planned for August 2005. The vehicle has four fins and there are thrusters on each fin. Dana showed a movie of *Sentry*.

Peter Wiebe asked if ABE would still be used once *Sentry* comes on-line. Dana - Yes. The vehicles are complementary, but have some differences.

The dive duration for *Sentry* is about 30 hours max. It is 8-feet long and fits in a 20-ft van. It has the same sensory suite as ABE.

Establishing Criteria for bringing New Assets into the NDSF including day rate considerations - Deb Kelley opened the discussion by first saying that we would first start by hearing from the agencies. Dolly Dieter said that this topic first came up at AGU in December when the question was asked if ABE should come into NDSF. If so, how would it be supported? How would other vehicles be brought into the NDSF? Should it be set up as a separate facility?

Discussion followed:
- Craig Young – What is the disadvantage of not putting ABE into the facility? Dana – By not including ABE in the facility, users would need to put ABE in their science proposal and its cost is in the proposal. There is no budget for maintenance. Including ABE in the NDSF streamlines the proposal process and provides continuity.
- Dolly explained the funding scenario. Now all ALVIN, Jason2, DSL-120 costs are added up and then split evenly among the vehicles. The costs aren't as well as known for each individual vehicle with them all being lumped together.
- Dan stated that the synergy between the vehicles is an important issue and it is important scientifically.
- Dolly indicated that the committee should think about if all vehicles should be in the National facility and if they should they all be rolled together with one cost?

The meeting adjourned to a DESSC Executive Session:

There was a brief discussion on images and copyright issues. The DESSC recommend that WHOI provide appropriate credits on photos.

Most of the session addressed the criteria for bringing new assets into the NDSF. They reviewed their draft document. Deb will revise the document to reflect the committee suggestions.

The day rates for NDSF Vehicles were discussed and additional information about the differences in vehicle costs is needed. Depending on the costs, DESSC may recommend that the NDSF assets each have their own separate day rate that reflects the cost of their operation. As an alternative, there can be one day rate for Alvin and Jason2 and separate day rates for the other assets (*DSL-120a, Argo II*)

Adjourn Day 1

Day 2 -Opening Comments - Deb Kelley opened day two of the meeting by reviewing the action items from day 1:

- Establish HOV Safety Standards: DESSC will wait for additional guidance/task statement from NSF and NOAA.
- Revise the draft Criteria for bringing new assets into the NDSF
- RHOC liaison – Provide Dolly with a DESSC liaison to the Replacement HOV Oversight Committee.

Recommendations:

1) Archiving – Photo credit needs to be given to sources. WHOI should provide clear guidance to incoming cruise participants on what is on the hard drive and how it will be used post-cruise

HROV Status Report - Andy Bowen provided the HROV status report. His slides are included as ***Appendix XI***.

Project milestones include:

- 11KM Floatation on order
- Work Space analysis underway
- Manipulator development underway
- Main processor selection/evaluation
- Telemetry specification and selection
- Battery pack prototype in design
- LED elements selected and pressure tolerant forward looking array design underway
- Microfiber tether development:
  - Deployment modeling ongoing
  - Initial field tests (vehicle maneuvering and deep elevator deployment)
- Conceptual vehicle development complete and now being evaluated for stability/control
- Main pressure cases in NDT

The Science Mission Requirement for the HROV are:

- Push coring
- Heat-flow probe (1 to 1.5 M long)
- Hi/Lo temperature probes
- Geotechnical/Geochemical
- Rock sampling/drilling
- Flexible science sensor payload interface
- Biological sampling (grabs/boxes)
- Water Sampling (hot/cold)
- Water column sensing (e.g. methane)
- High resolution bathymetry

Andy showed a graphic of the manipulator and storage baskets.

Workspace summary
- Payload of 75 lb
- Total Sampling System Weight 300 lb
- 1 cubic meter volume for sample storage
- Manipulation Integrated into Workspace

Andy reviewed the scientific sensors and proposed scientific interface. He showed a graphic of the HROV in AUV mode. There are 1500 spheres in the AUV and the vehicle is about 10 ft long. The vehicle configuration (ROV or AUV) would be selected on deck before the vehicle dive. A typical scenario would be to do AUV ops first, then bring the vehicle back. Redock it as the tethered vehicle on board then redeploy as the ROV.

Andy reviewed the video equipment summary. He discussed the ceramic housing manufacture, the utility housings, and the fiber tether design. The candidate tether is inexpensive enough that they don't have to think about reprocessing, just retrieval. Retrieval would be by surface winch. The vehicle would require a special dedicated cable. It might be better to have a dedicated, portable CTD winch that can hold 5 k wire.

The project goals for CY2005 are:
- Complete conceptual development of both vehicle
- Complete manipulator design and have both hardware and software components in test
- Complete fabrication and test of main and auxiliary
- pressure housings
- Make final choices on propulsion and have fabrication underway
- Design and assemble prototype battery subassembly
- Purchase of vendor supplied components
- Further tests of microfiber (deep elevator and shallowAUV maneuvering)

Discussion Followed:
Dolly – when the HROV was proposed it was suggested that the fiber could be tested on *Alvin* so that it could be used as a way to send data up from *Alvin*. When would this happen? Andy said that they are taking the case of least resistance – low risk. They have chosen the least risk path. Dolly indicated that this would be done on the *Alvin*.

Craig Young – How do you keep from running over the cable? Andy – you maintain sufficient tension on the cable. There is a guide tube from the vehicle.

Jeff Karson – Where is the scientific pressure for this? Andy – The most significant aspect of this project is the ability to get to 11,000m for low cost. There is the potential to work under the ice. OPP is supporting this project. The technologies developing under this project will apply to other projects.

Long-Range Planning Issues:

Shallow Submergence Science Committee -Future Plans - Craig Young explained that the issue of shallow submergence science facilities was originally raised during the DESCEND workshop. There were two issues associated with the shallow submergence facilities, safety and access. Both of these issues are now being addressed in other efforts. Craig recommends that a shallow submergence science subcommittee is no longer needed. The DESSC agreed to disband the subcommittee.

DESSC 3-Year Agenda – Deb Kelley reviewed the items that DESSC identified during their Spring 2004 meeting <200405desap06.pdf>. It was noted that the DESSC does not include a rep from the Margins community. As they consider a new member, a Margins should be considered.

Future global deep submergence initiatives:

RIDGE2000 - Deb Kelley reported that interest in Lau Basin continues. NEPTUNE will be in the water by 2008. Vehicles and funding needed to support NEPTUNE.

Margins - Jeff Karson reported that there are four areas of interest for Margins: source sinks, sedimentary, subduction processes, seismic component, and rupture of lithosphere. It is very much focused on active areas. They are not looking at mature systems. There is also interest in pretrology. Specific geographic areas of interest include Costa Rica, Nankai, New Zealand, and the Mariannas.

Ocean Observatories Initiative - Ocean Research Interactive Observatories Network (ORION) - Bob Detrick provided a report on the Ocean Observatories. His slides are included as ***Appendix XII***. The initiative is to provide the infrastructure for making sustained observations and providing real time access to data for research in the oceans. It builds on recommendations from a lot of studies. There are three primary components:

- Global-scale moored buoy observatories
- Regional-scale seafloor fiber optic cabled observatory
- Coastal observatories

The coastal arrays include two types:

- Endurance Arrays – Fixed, permanent observing array arranged as cross-shelf lines and individual moorings
- Pioneer Arrays – Relocatable arrays for process-oriented studies.

The Ocean Observatory Initiative (OOI) is the infrastructure component of ORION. The OOI cost is included in NSF's Major Research Equipment account (MRE). ORION is the science that utilizes the structure. Bob explained what the MRE account is and provided a breakdown of items in the account.

The Alaska Region Research Vessel recently moved ahead of OOI in the MRE. NEON was moved down to pending behind ARRV, but before OOI. They are still trying to determine what all this means. The National Science Board rearranged the items.

Bob reviewed the timetable:

- OOI Science Plan (OSP) - published in May 2005
- OOI Science Advisory Structure - Committees in place by August 2005
- OOI Request for Assistance (RFA)
  - Request for Assistance issued: 1st week of Feb. 2005
  - Letter of Intent due: Mar. 14th, 2005
  - Submission deadline: May 23rd, 2005
  - Panel meeting(s): August, 2005
- OOI Project Execution Plan (PEP)
  - Preliminary PEP due: Nov. 2005
  - Approval of Preliminary PEP: Jan. 2006
  - Refined Preliminary PEP due: July 2006
  - Baseline external review of PEP: Sept. 2006

Rick Janhke and a couple of staff members make up the ORION office.

Close to 50 proposals were submitted in response to the RFA and included 526 unique PIs. Half of the proposals were coastal, 29% were for regional observatories, and 17% were global.

The earliest timeframe for observatory nodes going onto the seafloor is 2008/2009. They want the node locations to be driven by science. The operations and maintenance cost estimate is to cover ship time, deep submergence time, and equipment. The estimates will likely be scaled down from original projections.

Debbie pointed out that Canada is moving forward with their component of NETUNE, they have money. US scientists can apply for the Canada effort.

The question was asked if in terms of support ships, would it be UNOLS or industry ships. Bob indicated that it would depend on the task, but UNOLS vessels could do a lot of the activities. Bob sees an advisory structure like ODP. There would have to be a close link between the observatory operators and UNOLS.

Mid-morning Break

Winter Meeting Strategies – The DESSC members discussed forums for better engaging the non-MG&G community. The Ocean Sciences meeting isn't the best meeting for accomplishing this. Benthic biologists often do not attend the Ocean Sciences meeting. The Benthic Ecology

meeting might be a better meeting. Jeff Karson pointed out that DESSC has to hold a meeting for their business. Maybe we should have posters at other meetings. The DESSC meeting at a Benthic Ecology meeting doesn't have to be patterned after the traditional DESSC meeting. Deb asked the committee biologists to come up with strategies for reaching the non-MG&G. The group of Craig Young, Jennifer Reynolds, and KT Scott were tasked with this.

Fall AGU - 5-9 Dec 2005, San Francisco, CA – The current plan is to not hold the DESSC Meeting at the 2005 Fall AGU. RIDGE2K will hold a special session for NDSF vehicle posters. The suggestion was made to have a UNOLS/NDSF booth. WHOI offered to contribute graphics for a booth. The booth could have flyers with upcoming events. Annette will check with Mike Prince to see if a booth could be supported by the budget. It would also need approval from the agencies.

Outreach, Education and Archeology

Archeology - Dave Mindell reported that there has not been a lot of recent deep ocean archeology activity. There is work planned in Greece and three or four private supporters will support it.

RIDGE Lectureship Program -Deb Kelley reported on the RIDGE Lectureship program. The program provides RIDGE scientist speakers to some of the smaller colleges. Most lecturers visited about five colleges. It is in the second year of the project and it is a great to interact with a lot of students. There is a lot of interest among the students.

NeMO – Bill Chadwick reported on the NeMO project (his slides are in ***Appendix XIII***). NeMO has an interactive dive website, "Dive" <http://www.pmel.noaa.gov/vents/nemo/>. This web site lets you dive with a remotely operated vehicle to the seafloor and back at Axial Seamount. It uses video and computer animation that allows you explore black smoker vents, life forms, and lava flows. The site requires Microsoft Internet Explorer web browser and Macromedia Shockwave or Apple QuickTime. Choose a dive. The dives centered on ROPOS.

Operational Summary and Collaborations with Other Deep Submergence Activities:

ROPOS – A status report on ROPOS was provided and slides are included as ***Appendix XIV***. The first slide shows a ROPOS deployment. The vehicle is contained in a big cage with the winch above it.

ROPOS Upgrade includes:

- A new cage-less system with a self-contained launch & recover system
- Mid-depth system (up to 2500 m)
- Higher horsepower motor (40 hp)
- Medium voltage (3000 VAC)
- Reduced size & weight of tether
- Fiber optic communications
- Caged-system still available (5000m)

Launch and Recovery is via a knuckle boom crane and the umbilical cable feeds through crane. This greatly simplifies launch and recovery. It can operate from more ships, with fewer crew, and with an increased operating weather window. There will be a new telemetry system with more science channels. Navigation improvements are also planned. Sea trials are scheduled for late June 20, 2005.

MBARI - Marc Chaffey provided a report on MBARI vehicle operations. His slides are contained at ***Appendix XV***.

The *Western Flyer / Tiburon* system specifications are:

- 4000 m
- 15 kW
- 1500/450 lb payloads

Planned upgrades for the system include:

- HDTV camera system
- Increase power to 25kW
- 2007 vehicle overhaul or replacement. They are looking at building a vehicle out of kits or off the shelf. They would like to have increased number of ports and plug in capability.

In 2004 *Tiburon* spent 169 days away from homeport and 126 dives were completed. Fourteen days were lost to ship overheating problems. In 2005 the vehicle was away from homeport for 164 days with 136 project days. No days were lost due to ROV problems in either year, to date. NURP supported 20 Tiburon days in 2004 and 21 ROV days in 2005.

The *Pt Lobos/Ventana* system is rated to 1850m. In 2004 the vehicle had 154 at sea days scheduled and completed 134 dives. Three days were lost to ship problems, three to ROV problems, and six days to weather. In 2005 there are 166 ship sea days scheduled/

Marc reviewed the *Zephyr* and AUV operations. *Zephyr* operations included 141 days in 2004 and 135 days in 2005. The AUV CTD operations in 2005 to date include 67 AUV missions, with one day lost. Total kilometers traversed for the AUV is 452 km in 2005 so far.

MBARI's observatory development programs included the MARS program. This is an NSF funded project and participants include U of W, JPL, WHOI, and MBARI. It includes a 62 km sea cable with a single instrument node in approximately 900 meters depth. Subsystem testing is underway. Installation is planned for 2005-2006. The observatory includes a portable mooring system. They are working to improve cable survivability.

China Ocean Minerals and R&D Association (COMRA) - Maurice Tivey reported on the COMRA activities (see ***Appendix XVI***). In March 2006 they expect completion of their 7000-meter submersible. They have bought time on *Alvin* to gain experience. COMRA lost their 3500m

ROV *Sea Dragon* on their 2nd sea trial in the S. China Sea. The tether failed.

COMRA's cruise list in 2005 and 2006 includes work at the Southern EPR, MAR, SW Indian Ridge, and JdF.

Other AUVs at WHOI:

REMUS AUVs - Chris Van Alt reported on the *Remus* AUVs (see ***Appendix XVII***). They are developing a series of vehicles. Systems include a camera/strobe system and a sidescan system. A vehicle was used for aqueduct inspections in New York.

SeaBED AUV - Hanu Singh reported on the SeaBED AUV (see Appendix XVIII). He showed a world map with locations of funded and completed SeaBED cruises. They have been funded by NASA to look under the ice. Work areas have included the deep corals off Puerto Rico, archeology in the Mediterranean, multiple AUVs in the Southern MAR, microbial mats off Chile, and work in the Pacific. The vehicle is small and very portable. FedEx can ship it.

They have been funded from NASA/OPP to use AUVs to look for venting under the ice. U of Maryland has funded to put a manipulator on the vehicle. It has a 5000m capability. The new AUVs are cheaper and easier to build.

HBOI – In 2005 the Johnson SeaLink has approximately 117 operating days planned.

Ocean Exploration - The Ocean Exploration ship has been named and it will be a NOAA ship. The ship was the former Navy USNS *Capable* and is being converted to support exploration. Steve Hammond and John McDonough can replace Craig McLean on the UNOLS lists.

NURP – Barbara reported that a 2300m depth AUV is being purchased. It will be operated out of UNC Wilmington and will be owned by University of Southern Mississippi.

India - India is building a 6000m ROV.

Other business:

DESSC Membership - Dave Mindell completes his 2nd term in 9/05 and Hedy Edmonds completes her first term in 9/05. Hedy is willing to stay on for a second term. A replacement for Dave is needed. Someone with a background in either Margins or archeology is desirable.

Action Items – The meeting action items were reviewed (listed at the beginning of these minutes).

The Meeting Adjourned at 1130 am.

AUV *Sentry* Visit
Following the DESSC meeting, participants were invited to visit WHOI's AUV *Sentry* system.

A DESSC Executive session followed the DESSC Meeting to further discuss the task to establish Safety Standards for HOVs. DESSC will wait for a draft charge from NSF. The subcommittee

doesn’t have to have just DESSC members and it should include a representative from the RVOC Safety Committee. The project can take time and may take a couple years to complete.