

**UNOLS**  
**DEep Submergence Science Committee**  
**Planning Meeting**

**Meeting Summary Report**



**Sunday, December 9, 2001**

**Marriott Conference Room, Golden Gate A-1**  
**55 Fourth Street**  
**San Francisco, CA**

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**Introduction** - Patty Fryer, DEep Submergence Science Committee (DESSC) Chair, opened the meeting at 8:30 am and welcomed the meeting participants. She reviewed the day's agenda. The agenda for the meeting is included as [Appendix I](#). These minutes reflect the order in which material was presented. The participant list is contained in [Appendix II](#).

**Approval of Minutes of May 2001 DESSC meeting** – Approval of the [May 2001 DESSC meeting minutes](#) will be deferred to the next DESSC meeting.

**2001 Science Reports** - Principal Investigators who used ALVIN, ROVs, AUVs and other submergence facilities were invited to present brief summaries of the operations.

**Peter Rona** provided a report on NOAA's Deep East 2001: "Voyage of Discovery to Deep Sea Frontiers off the East Coast." This was a five dive ALVIN cruise to the Hudson Canyon in mid September 2001. Many cruise modifications were made to adjust to the events of September 11th. Fred Grassle was the PI and Peter was co-PI.

The program was to study deep-sea processes and resources in the Hudson Submarine Canyon. Information about their program as well as daily logs are contained on the website <http://oceanexplorer.noaa.gov/explorations/deepeast01/deepeast01.html>.

Biodiversity features and pollution were studied. They looked at the axis of the canyon to determine how the pollution was dispersed. They visited deep-water dumpsite, DWD-106. Methane hydrates were examined and it was found that there is active venting of methane at several sites. A map showing the study area is included in [Appendix IIIa](#).

Peter thanked WHOI for their efforts in carrying out this cruise program.

**Deborah Kelley** provided a report on her ATLANTIS cruise with Donna Blackman and Jeff Karson on 11 November to 16 December 2000. The cruise was to the Mid Atlantic Ridge (MAR) 30N 42W for geologic mapping and sampling of the hypothesized oceanic core complex. ALVIN, Argo II and DSL-120 were used during the program. Unexpectedly, they came upon the “Lost City” vent field. They observed very steep, bare rock slopes with undulating shear zones. At the upper portion of this area, broken rocks were observed, resembling beach-like deposits. They think that at one time, this area was above sea level, before sinking and developing vents. Some chimneys at the site reach heights of 60m. Lost City vents were very different in appearance than those found at other hydrothermal vent areas. Temperatures are low, 40-75°C. Lost City fluids are unique with high pH levels and low silica. They collected samples from both active and extinct vents. Additional information about this cruise as well as a dive log can be found at: <http://earthguide.ucsd.edu/mar/intro.html#anchor3>.

**Maurice Tivey** reported on his recent ATLANTIS cruise on 5 November to 3 December 2001. Hans Schouten was the Chief Scientist. The cruise was to the Central Axial Magnetic High on the East Pacific Rise (EPR) axis at 9° 25'-55'N for near-bottom mapping using ABE, ALVIN and DSL-120A. Alvin could not be deployed during the cruise because of viewport failure during testing (see **Operator's Report** below). DSL-120A and ABE were used. Maurice showed an example of the sidescan sonar data and ABE coverage obtained. He provided a micro-bathymetry map of the EPR axis. An interesting feature observed was a flat area described as a “cement pool.” ABE was equipped with a magnetometer and was able to observe magnetic anomalies. The last part of the cruise was for sampling lava flows using ALVIN. Since ALVIN was out of service this could not be achieved. Maurice closed by saying that they were fortunate to have ABE and DSL on ATLANTIS or the cruise would have been a total loss. He thanked the shore support for all their efforts to repair ALVIN during the cruise.

**Dana Yoerger** continued with a report on the ABE operations that were carried out during the November cruise with Hans Schouten. The original plan was for ABE to work in conjunction with DSL-120A and ALVIN. In addition to the science component of the cruise, they also wanted to demonstrate that ABE is able to work along-side the other vehicles.

Dana showed the tracklines of three ABE dives. They averaged about 23 hours on the bottom for each dive. There are a few holes in the data that they are working to correct. They did a tour of the borehole dive site in advance. Dana showed an example of the bathymetry obtained for 9 deg 29' North along with a map of the site relief.

Dana commented that ABE was spending most of its time in the water. A dive cycle would typically spend 24 hours on bottom, 6 hours total ascent/descent time, and 13 hours on deck. They are mostly constrained by the time required for planning. The science party needs time to figure out what happened in the last dive before starting the next. During the cruise, ABE was once deployed and left for 15 hours in the water while the ship did other operations. Dana commented that they have been funded to examine ways to operate two vehicles in the transponder net simultaneously.

**Bob Vrijenhoek** reported on his two cruises that took place in 2001. He was unable to actually go on either of these cruises. The first cruise took place on 26 June to 29 July 2001 on ATLANTIS. Other PIs on the cruise included Cindy Van Dover (15 dives) and Keir Becker (1 dive). Bob's program had two dives and the objective was to return to the Broken Spur site on the Mid Atlantic Ridge to study gene flow and species diversity in deep-sea hydrothermal vent communities. They were able to find 38 hybrid mussels. Bob had high praise for ALVIN's pilot for finding the mussels. The work indicated that the MAR is not conducive to mussel survival, but the reason is still unknown. Bob continued with a report on his Jason and DSL-120 operations on the Central Indian Ridge in April 2001. This was also a study of gene flow and species diversity in deep-sea hydrothermal vent communities. There were many similarities in the shrimp found on the Indian Ridge with those found on the MAR. The vehicles worked well for their work.

Bob had a few operational recommendations and comments. During the ATLANTIS/ALVIN MAR cruise in July 2001, ALVIN worked well for collection of mussels at Broken Spur. The ALVIN pilots (with special thanks to R. Williams) should be commended for their efforts. The ship needs a permanent, high quality, dissecting microscope with digital output in the science lab. During the KNORR/Jason Indian Ocean cruise in April 2001 the vehicles were excellent for searching and documenting a new vent field. The current Jason vehicle, however, has limited abilities to collect organisms. The elevator worked well.

**Stephen Low**, of the Stephen Low Company, gave an update on the IMAX production, *Voyage into the Abyss Project*, and encouraged everyone to attend the showing Monday morning (12/10/01) at the Sony IMAX theater at Metreon. The production is a 20-minute selection of some of the first extensively illuminated super-high fidelity footage of the deep ocean. The selection is raw footage filmed from ALVIN in the IMAX format. It includes shots from hydrothermal vent sites in the Atlantic and Pacific (600m to 4000m). Footage from Richard Lutz's August 2001 ALVIN cruise to the Mid Atlantic Ridge is included. "Voyage into the Abyss" is the working title for the film now in production and scheduled for release September 2002.

This film concept was conceived about ten years ago when preparing for the Titanic film. After many years of fundraising, they are currently working to complete the film the film. *Voyage into the Abyss* is a collaborative science education outreach effort produced by Volcanic Ocean Films Inc., an affiliate of The Stephen Low Company, together with Rutgers University. Major financial support for the project comes from the National Science Foundation. Project contributors include: the New England Aquarium (Boston),

the Museum of Science and Technology (Syracuse) and the University of South Florida. Filming for the project has been completed principally with submersible ALVIN and the deep submergence resources of Woods Hole Oceanographic Institution.

The final film will be the culmination of over six years of development. Approximately 70 million feet of film was shot during the production. Steve had high praise for the WHOI ALVIN operations. The ALVIN pilots were very supportive and knew the dive areas well.

The IMAX camera is 50 times more powerful than the regular ALVIN cameras. The IMAX cameras installed on ALVIN offer much greater visual clarity than can be observed with the ROVs. Their goal is to make people aware of the deep sea, its geological features as well as its biology. The film can be used as a tool for giving the public and the funders of science and the facilities a greater appreciation of the research that has been done. The cost for shooting this film is approximately \$7 million.

The question was asked, "What can the community do to help?" In reply, Steve explained that they need help advertising. They don't have a lot of money for advertising, so any advertising from the community would be beneficial.

A science committee was involved with the films production. IMAX movies are normally 40 minutes or less, so any text in the movie will take away time for the visuals. However, some graphics like those used by Debbie Kelley in her report on the Lost City are useful for providing technical explanations. Steve closed by saying that there is a steep road ahead to get this sort of production accepted by the general public.

**Joris Gieskes** provided the report for **Lisa Levin** on their program titled, "Interdisciplinary studies of the Eel River methane seeps." Lisa was the chief scientist for the program. In October 2000 Jason was used from THOMPSON. In April 2001 Ocean Explorer was used and later MBARI's ROV Ventana was used. Viewgraphs showing the participants, vehicles and equipment used, photos, charts and findings are included in [Appendix IIIb](#). Studies included porewater geochemistry, Benthic biology, foraminiferal ecology, biochemistry, hydrogeology, and stable isotope analysis. The program was supported by the NOAA West Coast and Polar NURP Center. A map of the research area is included in the appendix. They examined non-seep areas, a clam bed, a microbial mat, and carbonates.

Key findings of the Eel River Methane Seep studies included:

- Patchy distribution of seep microhabitats
- Extreme microhabitat variability in porewater geochemistry, animal assemblage composition and distribution
- Variable nutritional sources for macrofauna; limited contribution of methane-derived C relative to other sites
- High sulfide tolerance and possible habitat partitioning among a complex of dorvilleid polychaete species.

**Paul Johnson** reported on his THOMPSON/Jason cruise in June 2001. The title of the project was, "Direct and Indirect Measurements of the Thermal Budget of Two Large Hydrothermal Systems on the Juan de Fuca Ridge." He thanked the ROV Jason team and THOMPSON operations. Paul showed maps of the study area at the Main Endeavor Field (MEF). A byproduct of the study was the bathymetry map of the Endeavor Axial Valley produced from the ROV-mounted SM2000 scanning sonar system. Paul described it "like turning on the lights on the bottom of the seafloor."

The goal of the program was to study the thermal flux areas. If you know where the areas of high heatflow are, you can measure the vertical flux. Jason was used to deploy thermistors. The data collected helps to (a) determine vertical thermal flux through the seafloor in vent areas, (b) discover a large number of circular magnetization lows across the valley floor, which overlie active or extinct hydrothermal vent fields, (c) collect temperature and ADCP data to measure seawater entrainment around a high temperature vent, (d) define regions of diffuse fluid vents with the AST method, (e) make long-term measurements of fluid flow variability due to crustal and tidal processes, and (f) use CTD and near-bottom magnetometer data in the discovery of several new and extinct hydrothermal fields on west axial valley wall, providing new constraints regarding crustal fluid circulation.

Some of the results/findings included:

- In a 500 m by 1000 m box in the MEF, about 600 megawatts were observed in the plume, mostly from high temperature vents.
- Near-bottom magnetic anomalies define zones of crustal accretion.
- Conductive heat flow measurements indicate that the seafloor around MEF is quite cold, except right in the vent field – indicating that flow at the high temperature vents is forcing near-field fluid circulation of cold seawater.

**Eli Silver** reported on his Jason/DSL-120 study in the Huon Gulf aboard MELVILLE in August/September 2001. The project was to study the tectonics and sea level history from submerged coral platforms in the Huon Gulf, Papua New Guinea. The first three days of the cruise were used to construct a SeaBeam map of the submarine bathymetry in the Huon Gulf, including drowned coral platforms. There was an abundance of drowned pinnacle reefs. They could see the reef fronts very well on the images and therefore knew where to dive with Jason. Eli commented that it is good that an upgraded vehicle will soon replace Jason. Jason's arm was incapable of picking up large heavy objects. Fortunately, the Jason pilots were able to make things work and in the end they were successful at imaging the reefs and sampling the carbonates.

Highlights of the cruise included:

- High quality SeaBeam images
- Seven days of DSL-120 side scan imaging
- 18 Jason dive days (further dives limited by elevator and transponder weight)
- 17 elevator loads
- 2,700 pounds of carbonate material was recovered
- Nine depth levels were sampled.

Eli commented that this was a tremendously successful cruise.

**Bob Embley** reported on the shallow water ROPOS cruise operations that were conducted as part of NOAA's Ocean Exploration (OE) program. This was a two-part cruise.

The first cruise was to the Astoria Canyon on June 26 – July 3, 2001. This area is approximately 10 miles offshore from the mouth of the Columbia River, the most westward reach of the Lewis and Clark expedition. Little is known about the abyssal portion of Astoria Canyon. **Waldo Wakefield** and Bob Embley were the co-chief scientists of the expedition. The program was an interdisciplinary scientific study of the geology and ecological relationships of this area. Seven ROPOS dives were made to explore both water column and seafloor features. Video cameras and sampling instruments were also used. They also conducted bio-acoustic sampling, mid-water trawls, and CTD casts. Bob showed a schematic of 3-D topography facing west looking down Astoria Canyon and showed maps of the research sites.

The second cruise was for observations at Heceta Bank off the coasts of Oregon and Washington on July 4 – July 13, 2001. ROPOS operations were from NOAA's R/V RONALD H. BROWN to explore the geology and habitats of invertebrates and commercially important fishes. They hoped to assess the decline in West Coast rockfish stocks and study reasons for its decline. They studied the correlation of fish and the habitat. There was some concern among the fisheries people, that species would not be able to be identified using video from the ROV. The cruise demonstrated that this is feasible. New seeps were discovered in the area. An interesting discovery was a possible ancient shoreline where shells deposits were found. This will become an important archeological site in the future.

Additional information about the NOAA OE project is included on the website, [http://oceanexplorer.noaa.gov/explorations/lewis\\_clark01/lewis\\_clark01.html](http://oceanexplorer.noaa.gov/explorations/lewis_clark01/lewis_clark01.html). Daily dive log observations are contained on the website.

## **Morning Break**

**National Deep Submergence Facility (NDSF) Operator's Report (WHOI)** - Dick Pittenger provided an introduction to the report. He commented on the September pirate attack on the EWING. WHOI plans to install satellite dishes on their ships for improved communications. Dick responded to some of the comments made during the science reports. The ALVIN dives lost during the Schouten cruise were a result of the very high failure rate of ALVIN's viewports. Five out of six of the viewports failed during testing. WHOI has several on order.

Dick reported that ALVIN Pilot, Blee Williams may be leaving the group. He has been a highly dedicated pilot and would be greatly missed.

Viewgraphs for WHOI's reports are included as [Appendix IV](#). Dick showed the WHOI Marine Operations organization chart. They plan to hire someone to assist Jon Alberts as marine operations coordinator. Additionally there will be someone hired to assist Barrie Walden in the Shipboard Science Support Group. Dan Fornari plans to step down as NDSF Chief Scientist later this year.

In 2001, capabilities on ATLANTIS, ALVIN and the ROVs have been or currently are being upgraded. There will be a formal process for community feedback later in the year.

**Operations Summary** - Rick Chandler provided a summary of the 2001 ALVIN operations. There were 169 operating days, 71 dives completed and 16 lost dives (4 weather, 12 mechanical), this is more than they would like to see. The average dive duration was 7.7 hours with an average bottom time of 4.5 hours. The ROVs have had operations spanning the globe. They have been very busy with 29 Jason lowerings (731 hours bottom time) and 21 DSL-120A lowerings (361 hours bottom time). The upgraded DSL-120A was used successfully on two cruises. The 2001 operating costs for the NDSF is \$4,172,649. This was in support of nine ALVIN/ROV science voyages, four vehicles, 16 operations personnel, and 14 engineers/management personnel.

A new modernized WHOI Marine Operations and NDSF web site will be released soon. [Note: It is now on-line at < <http://www.who.edu/home/>>].

**ATLANTIS** - In February 2001 various improvements were made to ATLANTIS. They painted the entire keel to the bulwark, and the entire deckhouse. They inspected the ballast tanks, stern thrusters, and fuel tanks. The Starboard thruster lower unit was replaced. Modifications included:

- Bow thruster sound deadening
- Watertight doors
- Provide overflow for fuel day tanks
- Added new Varo search light
- Modified 01 level HVAC to Mess Deck
- Replaced four weather doors
- Installed new dryer ventilation
- Removed seismic air compressors
- Replaced sewage pumps
- Provided access to 01 Deck Aft
- Modified Drain lines
- Chemical storage van

In February 2002 additional inspections, maintenance, and modifications are planned. The modifications include:

- Install vibration isolation table
- Replace Starboard ALVIN hangar door
- Modify transducer void piping
- Extend fire alarms to Wx Decks



There was some discussion on the ship's drains and possible corrections. There was also discussion on the need for a microscope and the best location for it. The darkroom has been recommended as a good space for microscope work. This will be discussed further at the spring DESSC meeting. (Note: the microscope-stabilized table was installed in March 2002 in the darkroom)

**ALVIN Overhaul (2001) report** - Barrie Walden reported on the ALVIN overhaul and commented that these are always a learning process. They used a lot of outside help for the overhaul work. The ALVIN personnel were needed to train the outside help. An ALVIN overhaul takes a full six months to complete. New, innovation-type projects require additional time to incorporate. The best solution is to accomplish the new projects (if feasible) in advance of the overhaul. The problem with this, however, is that the ALVIN support people are needed for design of these new projects and at the same time they are needed for on-going sub operations. This year, WHOI began the overhaul with a long list of items that could not possibly be accomplished. Additionally, many of the items required that they be done in series as opposed to simultaneously (this takes more time). They were able to accomplish a tremendous amount of overhaul work items.

Completed improvements include:

- Gyro replacement (OCTANS ring laser gyro)
- Doppler navigation system
- Color LCD touch screen computer monitors (flat screen)
- Digital video recording
- Video camera upgrades
- CTFM sonar replacement
- Acoustic modem installation –This can provide a little more flexibility in navigating options; however, it is loud, and as a result they are not using it yet.
- Improved observer ergonomics (legroom, lighting, video controls) – they modified the way some of the instruments are mounted.

Barrie showed a schematic of the ALVIN data collection and distribution system. There are separate computers for the profiling sonar, CTFM sonar, science computer, WINFROG, and DVL navigation. The Athena computer is the main data logger. All of these computers are connected via the Ethernet. When the sub is onboard, it is linked to the ship's system and the time is synced with the ship's timeservers. All of the computers can talk to each other. It has a lot of flexibility.

Barrie showed the schematic for video selection for monitoring and recording. He also showed the videotape cloning/copying and distribution schematic. Eventually WHOI would like to be able to overlay anything desired by the scientist onto the data. Barrie showed a variety of ALVIN upgrade photos. These included the Doppler velocity log, acoustic modem installation, video camera upgrades, digital VCRs with small monitors, science equipment rack modifications, pilot's monitor, new smaller CTFM sonar, DVL Nav, LCD computer monitors, and flat screen observer monitors.

ALVIN overhaul improvements in progress include:

- Data logging and display software
- Video overlay process for dupe stations
- Imagenex profiler integration
- Hard mount pan and tilt controls
- Acoustic modem integration
- Force-feedback manipulator
- Exterior still camera digital replacement

Barrie commented on the ALVIN viewport failures. They have changed vendors for the viewports. They bought these viewports from a company in the UK. Very few subs use conical viewports and go as deep as ALVIN. The viewports are crazing (not actually cracking yet) and WHOI's specifications indicate that crazing is not allowed. They investigated to see if there was something unique about these windows. A crazed viewport was found on the ship and there were no spares. During the Schouten et al. cruise, WHOI airdropped a viewport and unfortunately it was chipped in the process. The new viewports did not arrive in time for use during this cruise. A new batch of viewports was delivered to WHOI but these did not pass WHOI's inspection. One possible cause may be the varnish on the viewport boxes. It is conceivable that the uncured varnish from the boxes is causing the problem. They will do some experiments on the varnish.

**ROV Operations and Upgrades** - Andy Bowen provided an overview of the 2001 ROV logistical requirements. His viewgraphs are included as Appendix V. There were nine major shipments of the ROV systems in 2001, including two by air. This required the tracking of over 500 items per mobilization with a typical combined weight of 68 tons. 43,500 miles were covered with shipments in and out of 15 ports on ten different ships. There were some logistic problems (one shipment was lost), but only one day was lost. Costs included \$100K for sea shipments, \$40K for trucking and \$50K for airfreight. \$107K was spent on travel support for 26 people traveling on 27 legs. Andy showed a map of all the ROV operations, which spanned the globe.

In addition to the 2001 operations, Andy's group has been working on various ROV vehicle upgrades. The primary purpose of the DSL-120 upgrade was for compatibility with the other ROV vehicles. They have also used the DSL-120A to test many of the systems planned for upgrade on the other vehicles. WHOI has been collaborating with HMRG on cruise sonar products. Margo Edwards (U. Hawaii) has been very helpful.

Andy provided a DSL 120A update:

- There was excellent backscatter imagery on the Silver and Schouten cruises
- Bathymetry – there is good data out to 600 m swath. Andy showed a sample of the bathymetry data collected using DSL-120A.
- They still need reduction of system noise relating to WHOI power supplies.
- Refinement of WHOI/HMRG roles and responsibilities
- Integration of DVL to improve navigation
- Addition of Simrad SM2000 multibeam

Andy showed graphics of the Jason II system and a model of one of the many pressure housings. The hardware is starting to be assembled. Testing of Jason II is planned in late May 2002 at David Taylor. The vehicle will then return to WHOI for additional testing. Sea trials are planned on ATLANTIS in July off Astoria. The first science operations are planned for September with Paul Johnson.

### **Break for Lunch**

**ALVIN & ROV Scheduling and Requests: 2001, 2002 and 2003** - John Alberts reviewed the 2001 ALVIN and ROV schedule. His viewgraphs are contained in [Appendix VI](#). Following ALVIN's overhaul and certification process, operations began in the Atlantic in June. ATLANTIS carried out two non-ALVIN cruises during ALVIN's overhaul period. ALVIN ended the year with operations on the East Pacific Rise (EPR). ROV operations began in March and ran into December. Research areas included the Indian Ocean, off California, Juan de Fuca, Huon Gulf, and EPR.

Jon reviewed the 2002 ALVIN and ROV schedule. Karen Von Damm has the first ALVIN program of the year with work on the EPR. After A-Frame certification and the ATLANTIS 5-day INSURV (Navy inspection), operations are planned for Keir Becker, Craig Cary, Janet Voight, NOAA, Miriam Kastner, Bartlett, Jim Cowen, Childress, and Fisher. All operations are in the Pacific. There is some uncertainty in next year's schedule due to late NURP funding decisions. Two Jason II programs are planned for next year, as well as one DSL-120A program in the Western Pacific.

Annette DeSilva reported on changes to the UNOLS ship time request form. This form can now be used as a Long-range planning document, replacing WHOI's "Letter of Intent" form. There is a new check box on the form to indicate that it is a planning document. If at some point the PI would like to change the planning document to an actual request, this can be easily done by just editing the form. The ship time request forms are all entered into a searchable database. This database can be accessed at the following address <<http://www.gso.uri.edu/unols/ship/listmenu.html>>. There is also a feature that allows the selected database entries to be plotted on a world map.

Ray Highsmith reported that the 30 days of NOAA time on ATLANTIS' 2002 schedule are in support of the Ocean Exploration project in the Gulf of Alaska. The funding decisions won't be known until spring, 2002. This makes pre-cruise planning very difficult.

Dana Yoerger commented that anyone with a 2003 or 2004 cruise that would like to use ABE should contact him or Barrie.

**NDSF Archive Status** - Dan Fornari reported on the status of the archives. His viewgraphs are included as [Appendix VII](#). The archives content which include various ALVIN moving images, ALVIN still images, ROV Jason and Argo II moving images, and ROV Jason and Argo II still images. There are 32 CDs of digitized 35 mm ALVIN still images up to Dive #2000 (late '80s). WHOI is seeking funds to complete this effort

and make the images available for science and outreach. Some of these images are available at: <http://www.marine.who.edu/alphotos.nsf?OpenDatabase>.

Material added to the NDSF Archives in CY 2000 included:

ROV Jason, Argo II, DSL-120 sonar from 10 expeditions:

- 1527 video and data tapes
- 105 CDs
- 20 other media
- 8 floppies
- 14 reels 35 mm film
- 17 notebooks or logs

ALVIN – 12 dive programs:

- 745 video tapes
- 24 CDs
- 28 floppies
- 34 reels 35 mm film

Dan provided examples of online catalog records for ROV material in Machine Readable Cataloging (MARC) and a record format for ALVIN material.

Ongoing work to improve the NDSF archives include:

- Improving the visibility of NDSF archives.
- Complete scanning of 35mm ALVIN images to CY1999 data, and make available as CD sets and online with Meta-data tags.
- Ensure proper documentation of various data formats with NDSF data, especially navigation, time, etc.

ALVIN time is now recorded as GMT in order to be consistent with standard oceanographic log-keeping and consistent with ROV/tethered vehicle operations.

### **Other Facility Operator Reports**

**Harbor Branch Oceanographic Institution (HBOI)** – Shirley Pomponi provided the HBOI operations report. HBOI submersibles include Johnson-Sea-Links I & II and Clelia. Shirley provided a description of the vehicles and the HBOI support ships. Information about the facilities is contained on HBOI's website, [http://www.hboi.edu/marineops/marineops\\_home.html](http://www.hboi.edu/marineops/marineops_home.html). There are a variety of tools available for work with the subs. These tools include a multi-function manipulator, tools for collection of mid-water organism, the bushmaster (a collection tool for seep worm communities) and cores and drills. Development of new tools for specific problems for growth measurements and methane ice communities are underway. The vehicles have self-rescue capabilities.

Shirley reviewed the 2001 sub operations. There were a combined total of 135 dive days for JSL-I and Clelia, corresponding to 181 ship days. Operating areas included the South Atlantic Bight, Gulf of Mexico, Gulf of Maine, and Bahamas. Johnson-Sea-Link II did

not operate in 2001 but will return to service in 2002. A breakdown of the 2001 sub days by funding source was provided as well as the entity the funding benefited. In 2001 NSF supported all of their HBOI ship time costs, but none of their sub costs. HBOI supported 61 days, NOAA supported 24 days, and “other” supported 15 days of the 2001 NSF sub time. Shirley provided a ten-year summary of funding trends for the sub operations. In the early 1990’s, NOAA was a large supporter of sub time. This has dramatically been reduced over recent years. Over the last three years, HBOI has been the largest supporter of sub time.

Shirley’s viewgraphs are included in [Appendix VIII](#).

**Monterey Bay Aquarium Research Institute (MBARI)** – Mark Chaffey provided a report on MBARI’s ROV operations in 2001 and future plans. His viewgraphs are included in [Appendix IX](#). MBARI operates two ROVs, Tiburon and Ventana. The Tiburon system has a 4000-meter depth capability and operates from WESTERN FLYER. Total dives to date are 389 with 2816 dive hours. In 2001 Tiburon had 169 sea days. Highlights of 2001 operations included an expedition to Hawaii. During transit, midwater biology dives were conducted. Over 1000 rock and sediment samples were collected over 44 dive days. A total of 66 dives were made during this program. They averaged 10.33 dive hours per day.

In 2002 there are 153 days of WESTERN FLYER/Tiburon days scheduled. Of these, 11 are NURP funded. One major 2002 expedition is planned to the Mendicino Escarpment and Gorda Ridge with Zierenberg, Clague, and Stakes. A Delaney program is planned for the Endeavour area. In early 2003 operations are planned in the Sea of Cortez.

Mark provided a Tiburon sampling update. The toolsled system complement includes midwater tools, benthic biology/geology tools, an NMR probe and Laser Raman spectrometer, and the core-drilling sled. A digital still camera has been installed. A power boost to 20kW is underdevelopment. The HDTV camera is deferred for one year. Mark showed a picture of the HDTV camera on Ventana.

ROV Ventana has a depth capability of 1850 meters and is supported by R/V PT. LOBOS. Total dives to date are 2114 with 9359 dive hours. In 2001 Ventana had 179 sea days with 14 of these funded by NOAA/NURP. They lost three days to weather and one to ROV mechanical problems. In 2002, 174 days are scheduled for operations in Monterey Bay and adjacent waters.

Lastly, MBARI’s new boat, ZEPHER, is very active supporting buoy maintenance and AUV operations.

**SIO Marine Physical Lab (MPL)** – Fred Spiess provided the report on MPL vehicles and operations. The vehicles include Deep Tow and the Control Vehicle. His viewgraphs are included as [Appendix X](#). Fred’s report follows (the full report and figures is contained in the appendix).

**The MPL Deep Tow system** is a multi-sensor, transponder navigated seafloor survey vehicle. It includes a 23 kHz echo sounder, 4 kHz sub bottom sounder, 110 kHz side-looking sonar, multiple proton magnetometers, video and still cameras with strobe and continuous lighting, CTD, Paroscientific pressure gauge, etc.

Operations in the past year included a survey of the seaward portions of the Hilina slump area on the southeast flank of Kilauea, Hawaii, and site surveys for USN ranges. The Hawaii survey was made as a prelude to installation of a precision transponder GPS/Acoustic geodetic net (Poster by Phillips, et al, this meeting). John Hildebrand was the chief scientist. Chris de Moustier was chief scientist for the Navy surveys.

**The Control Vehicle (CV)** is a heavy lift ROV with vertical positioning controlled by wire out and horizontal position adjusted using hydraulically driven thrusters. The vehicle was built under contract with JOI, with guidance from USSAC, and was upgraded in 2000 with NSF funds to take advantage of 0.68 FO wire.

The vehicle was used in three operations in 2001. Two of these were in support of the MPL seafloor geodesy program – John Hildebrand was PI for the Hawaii installation and David Chadwell was PI for a Peru/Chile Trench installation. In the geodetic operations the CV was used for two kinds of tasks. First was in recovery of transponders that were not operating properly. It was also used in precise determination of the depths of the transponders after they had been placed on the seafloor. A package was built that could be placed on the bottom a few meters from any given transponder, remaining connected by a soft tether to the CV. The package included a set of Paroscientific pressure gauges, a transponder interrogation transducer, and a video survey telescope to measure the vertical angle of view of a reference point on the transponder as seen from the package. In spite of the considerable sediment cloud raised by the landing of the vehicle on the seafloor, the fact that the illumination was from above made viewing of the transponder from the package acceptable within a minute or so of landing.

The third CV operation was a wireline installation of CORKS in DSDP/ODP holes 504B and 896A, Keir Becker was PI with Earl Davis, Fred Spiess and Christian de Moustier as co-PI's.

**ATV** - Last year the Navy transferred its ATV, a 6 km depth capable ROV to SIO and SOEST on a five year, renewable loan. This vehicle includes two manipulators, multiple video cameras and other sensors. SIO is working on vehicle preparation, with a plan for a trial operation in the fall of 2002 using either R/V REVELLE or R/V NEW HORIZON. Anyone wanting to use the vehicle or learn about its capabilities should contact [fspiess@ucsd.edu](mailto:fspiess@ucsd.edu) or [jhildebrand@ucsd.edu](mailto:jhildebrand@ucsd.edu)

**Hawaii Undersea Research Laboratory (HURL)** – Patty provided a report on HURL operations and plans. HURL's facilities include the deep-diving (2000 m) submersible Pisces V, a remotely operated vehicle RCV-150, and the support ship R/V KA'IMIKAI-O-KANALOA.

Information about HURL's 2002 plans are contained on their website <http://www.soest.hawaii.edu/HURL/>. HURL has 17 Panel-approved Pisces dives and numerous ROV dives planned for 2002. The Pisces dives are in support of three projects, 6 dives for Smith, 2 dives for Young, and 9 dives for Staudigel. 30 ROV dives are planned as well as an additional two engineering service dives for monitoring the Loihi submarine volcano. Other NURP dive commitments are anticipated.

In addition to NURP dives, HURL has been contracted by NOS and NMFS to conduct dives in the NW Hawaiian Islands as part of the Coral Reef Initiative. Six of these were completed in 2001 and 6 more are scheduled for 2002. HURL has also submitted a proposal to the Ocean Exploration Program for work in the NW Hawaiian Islands.

**ROPOS** – A handout on ROPOS was available at the meeting. Information about the vehicle and operation plans are contained on their website at: <http://www.ropos.com/>. Four programs are planned during July and August of 2002. Operating Areas will include Axial Seamount, Explorer Ridge, Vancouver Island Margin and Endeavor Ridge.

**JAMSTEC** – JAMSTEC is in the process of reviewing the JFY2002 proposals and the schedules of their deep submergence facilities. The next Japanese fiscal year is from April 2002 to March 2003. In April 2001, JAMSTEC opened an office in Seattle, WA. Mr. Kyohiko Mitsuzawa is Director of the Seattle Office and was in attendance at this meeting.

**6500m Sub and New ALVIN Design Advisory Committee (NADAC)** - Patty Fryer reported that WHOI has been funded for conceptual design for an ALVIN replacement sub. The proposed work to be included under this phase of the project includes:

- Determine certifying agency and construction rules
- Select maximum operating depth
- Develop submersible system specifications
- Update cost estimate
- Request for Proposal (RFP) package for detailed design and construction

Vehicle and system level specifications will be developed with input from the science community. This phase of the project is scheduled to be completed by March 2003. NSF has provided \$345K in funding. WHOI is requesting an additional \$230K. After completion of this phase, the next phase will be for detailed design and construction. The cost estimate for a new deeper diving submersible is \$16M. WHOI will form a Design Advisory Committee to provide input to the conceptual design process. The committee will be represented by DESSC members as well as other ALVIN users.

**WHOI/NDSF Chief Scientist** – Patty reported that Dan Fornari plans to step down from his position as WHOI/NDSF Chief Scientist. The community needs to think about this position and how it should evolve. Dan reported that he has written to the WHOI Directorate about the types of things that he does in this position. He noted that the success of the operations is in large part due to the efforts of Barrie, Andy, Dudley and the others in the Operations Group. The key issue that Dan stressed is that there needs to



be continued community input to the NDSF. There will be a transition period when Dan's replacement takes over as Chief Scientist.

On behalf of the community, Patty extended appreciation for the dedication and efforts Dan has made to the NDSF. John Delaney presented Dan with a vintage bottle of champagne as the meeting participants joined in a standing ovation. John also took the opportunity to honor Dolly Dieter for her many hours of dedicated service to deep submergence research and facilities.

Dick closed by saying that WHOI is committed to having a Chief Scientist position. Internally, WHOI will review the position.

### **Agency and UNOLS Reports:**

**National Science Foundation (NSF)** – Mike Reeve took the opportunity to introduce the many NSF representatives attending the meeting: Rodey Batiza, Dolly Dieter, Alexandra Isern, Brian Midson, Lisa Rom, and Sandy Shor. Alex Isern replaces Larry Clark as the Director of the Oceanographic Technology and Interdisciplinary Coordination Program. Larry Clark became the Ocean Sciences Section Head.

**Office of Naval Research (ONR)** – Tim Pfeiffer provided an e-mail update prior to the meeting. In the past month, Sujata Millick left ONR for a position with the Department of Commerce. Tim will be taking over Sujata's responsibilities including deep submergence. With the recent changes in responsibilities, Tim was unable to make arrangements to attend this meeting. He extends his regrets to DESSC.

**National Undersea Research Program (NURP) and NOAA's Ocean Exploration Initiative** – NURP representatives at the DESSC meeting included Ray Highsmith, Jennifer Reynolds, and Geoffrey Wheat. Barbara Moore could not attend, but sent a written report regarding the Ocean Exploration Initiative:

The OE budget for FY 2002 is \$14 M. A broad area announcement was published in the Federal Register in anticipation of that funding level, and as a result 160 proposals were received in the Office of OE. These are in the review process. One of the 2002 projects will be a Gulf of Alaska ALVIN cruise, which is now scheduled for July. Others will be decided by late February, early March.

Waldo Wakefield continued the NOAA report with an overview of the OE program. The viewgraphs are included as [Appendix XI](#). The program was an outcome of the Presidential panel on Ocean Exploration. The panel key science recommendations included:

- Characterize vast array of biology, physical and chemical aspects, including new ecosystems
- Acoustic research
- Biotechnology and mineral resources
- Technology development.



Recommended exploration research priority sites include the:

- Arctic
- Antarctic
- Inland seas.

The panel report recommends support of \$75 million/year for ten years. They recommended single agency leadership, with multi-agency participation. Existing interagency mechanisms should be utilized. The stakeholders (private sector, educators, government, and academia) should be involved in the planning and through all stages. The exploration program should include a major education and outreach component. Including archaeological aspects was also important.

NOAA's Ocean Exploration Initiative goal is to explore unknown ocean realms based on solid science programs and share the information gained with educators and the public so it is available for the future.

NOAA themes include:

- Exploring Frontier Areas
- Exploring the ocean's resources, living and non-living
- Exploring Maritime Heritage
- Exploring natural sounds in the oceans
- Developing new sensors and systems for exploration.

The program began in 2001. Expeditions have included:

- Preserving the USS Monitor
- Islands in the Stream - Gulf of Mexico.
- Continuing the Lewis and Clark Legacy - Astoria Canyon
- Next Generation Tools: Multibeam Side-Scan Sonar – Alaska
- Thunder Bay ECHO: Acoustic Surveying of Shipwreck Alley
- Sound in the Sea: Acoustic Monitoring at Pioneer Seamount -coast of central California.
- Deep East: Deep Sea Resources off the U.S. Eastern Seaboard
- Davidson Seamount: Biological Characterization – California

Information about the Ocean Exploration Program can be found on the web at: <http://oceanexplorer.noaa.gov/explorations/explorations.html>.

The issue was raised that the late funding decisions from the Ocean Exploration make it difficult to schedule the facilities needed.

## **Break**

**Shallow Submergence Science Committee**– The DESSC met during the lunch break to discuss shallow submergence issues and the need for a Shallow Submergence Science Committee (SSSC). Shirley Pomponi provided a report on this meeting. Her viewgraphs

are included as [Appendix XII](#). Facility access for the shallow water submergence community has been an on-going issue. There are concerns and questions that need to be addressed.

At the lunchtime meeting the DESSC discussed the following items:

- Committee membership
- Identification of critical issues.
- Identification of mechanisms to address critical issues.

It was suggested that the Shallow Submergence Science Committee be made up of three members of DESSC, Shirley Pomponi, Mark Chaffey, and Bob Embley. Shirley has agreed to serve as Chair. Three or four additional scientists from the shallow submergence science community would be asked to serve on the committee. Suggestions were made and these individuals will be contacted. Input from operators and agency representatives will be invited.

The SSSC will need to identify and address the critical issues facing their community.

- Identify the key scientific themes for shallow submergence research. What are the scientific questions? There is a need for integrated approaches (shallow water (SW) & deep water (DW); different disciplines).
- Consider mechanisms for the expansion of funding to increase the funding base for submergence science.
- Identify critical facilities/technology needs.
- Identify the assets that are currently available to the community.
- Review the process for access/funding of shallow submergence facilities and identify shortcomings with the process.
- Coordination of agencies in terms of submergence science support.
- What disciplines exist that bridge the “gap” between SW and DW?

The ad hoc SSSC will need to consider mechanisms by which their concerns can be addressed. They will need to consider:

- Is there justification for a national facility type funding mechanism for shallow water submergence science?
- Should a UNOLS fleet model be adopted for coordination of shallow submergence facilities?
- Addition of submergence facilities as a national facility must be initiated by the operator; it cannot be dictated by the user.
- Support for both operations and maintenance of all submergence facilities must be considered.

The SSSC plans to have an organizational meeting at the February 2002 AGU/ASLO meeting. They have scheduled their first meeting for 1 May at WHOI (prior to the DESSC spring meeting).

**Long-Range and Expeditionary Planning Discussion** – Annette DeSilva reviewed the vehicle requests submitted for ALVIN and ROVs for 2003 and beyond. For 2003, 2004

and 2005 there are 44 ALVIN requests for a total of 356 days. Of these, 21 days are already funded. There are 43 ROV requests for 2003, 2004 and 2005 for a total of 731 days. Of these, 103 days are already funded. Work areas include the Atlantic, Gulf of Mexico, East and West Pacific, Indian Ocean, Hawaii, Equatorial Pacific, Greece and the Arctic. A summary of these requests along with maps is provided in [Appendix XIII](#).

**UNOLS Report** – Bob Knox, UNOLS Chair, gave the report for UNOLS. His viewgraphs include a summary of UNOLS’ goals and activities. They are included in [Appendix XIV](#). Two areas of particular focus for UNOLS are Fleet security and Fleet renewal. Over the past year the Federal Oceanographic Facilities Committee has been drafting a plan for academic research fleet renewal. The draft documents have been shared with the community for review. The UNOLS community provided extensive comments and based on this feedback revisions were made. Just recently the National Oceanographic Research Leadership Council endorsed the FOFC plan. Bob showed Figure 17 from the FOFC report which provides the timeline for ship replacement. The cost for replacement is estimated to range from \$395M to \$560M. Now is the time to begin implementation of the plan. Community support will be needed.

Bob continued his report by discussing security and piracy issues. The severity of the security problems is going up. Bob showed the maps of piracy attacks made in 2000. All attacks are occurring in sight of land. Bob reviewed the RedSox cruise program and the security measures that were taken prior to the operations. This was a known high-risk area. EWING was attacked off the coast of Somalia. After the attack, the ship remained well off shore.

In consideration of the EWING attack, the UNOLS/RVOC has formed a security subcommittee. This group will address the following issues:

- Assessment of risks for planned programs/areas
- Increased preparedness, training, watchfulness
- Responses to impending or actual attacks
  - Shipboard defensive steps
  - Avoidance
  - Law enforcement or military assistance

NSF will draft advice for scientists considering work in potentially high-risk areas. UNOLS will continue to look into security measures that can be taken. Additional information will be forthcoming.

John Delaney commented that the UNOLS report included only ship issues, are there any other facilities being considered? There is an MRE for observatories for \$130M. This will need community support. There will be a whole new set of facility needs to support observatories. NEPTUNE needs include high-speed communication, power, robotic systems and sensor. John recommended that UNOLS be more proactive in their support for other ocean facilities such as observatories.

**Report on the UNOLS DESCEND Technology follow-up plans** - Patty Fryer reported that over the past year plans had been explored to hold a technology workshop, but nothing could be carried out. Instead, it was decided to try to summarize the findings of the many technology meetings that have been held over the past couple of years. Patty is working with Dan Fornari to draft this information into an EOS article.

Patty went on to discuss plans for a NOAA/NASA LINK Symposium 2002, <<http://www.thelinkproject.org/events/link2002.asp>>. The purpose of this symposium would be to promote ocean and space research and exploration through innovative technology. Patty indicated that she has been contacted by NOAA to determine if the symposium could provide a forum to address the DESCEND technology workshop issues.

Patty indicated that it was a recommendation of DESCEND to hold a technology workshop. The purpose of such a workshop would be to explore advances and possible new directions for technology as it applies to supporting research for submergence science objectives defined at the DESCEND meeting. The list of workshop objectives is included as [Appendix XV](#).

Patty has been communicating with Andy Shepard (NOAA) to investigate whether or not breakout sessions can be arranged during the Link symposium to address the types of things that DESSC would want to see in a technology workshop. Patty has been invited to serve as a member of the steering committee. The committee is still being formed and plans for the Symposium are still in the early stages. The meeting is open, and all are invited to attend. There will be a registration process, which has not, however, been established.

The question was asked whether or not there would be an IMAX theater at the facility. This would be a good opportunity for viewing of the *Voyage to the Abyss* production.

Jill Zande reported that there is a MATE component to the Link Symposium. MATE is organizing an ROV competition for high school students. They are also encouraging industry involvement. Jill listed the partnerships that have already been established. They are looking forward to having the students there. The vehicles and posters will be on display at the Symposium.

A lively discussion on the Link Symposium and participation by DESSC followed. Concerns were expressed and reservations voiced regarding the Symposium and participation by DESSC. The question was asked why DESSC does not have a stronger presence at the Link symposium, since it is intended to address submergence technology. There was also a question on why NSF is not involved with the Symposium, especially since they are the major funding supporters of submergence science and deep submergence facilities. It was suggested that a workshop supported by NSF might better meet the needs of the submergence community represented by DESSC. Patty Fryer explained that the agencies which had supported the UNOLS DESCEND workshop did not have funds for a technology follow-up and that the Link symposium is being

organized under the auspices of the NOAA Ocean Exploration initiative. She explained that although it was early suggested that NSF should be asked to contribute in kind to funding the symposium this suggestion was declined by OE. She noted that there would be benefits for the deep submergence science community if it participates in Link. Attendance at the meeting would keep the submergence community abreast of the activities of other organizations interested in technology development.

### **Announcements of future submergence meetings:**

AGU/ASLO Special session (February 2002) – Patty Fryer reported that in an effort to reach out to the biology community, there would be a special DESSC session (OS48) at the ASLO/AGU meeting in Honolulu in February of 2002. The session is to highlight recent advances in understanding submarine biosystems using submergence science approaches. The session will also provide information on the latest upgrades and technological developments available for several facilities, submersibles, and ROV systems. It will provide updates regarding funding from federal science agency representatives and information from facility operators. The session is being modeled after the traditional annual DESSC fall meeting in San Francisco. Time will be reserved for a discussion period at the end of the special session.

Archeology (MIT, April 2002) - Dave Mindell reported that the 2<sup>nd</sup> MIT Conference on Technology, Archaeology, and the Deep Sea will be held on April 26-28, 2002, <<http://web.mit.edu/sts/deeparch/2002conf/2002conf.htm>>. The General Chair for the meeting is David. The first conference was held in 1999 and the results of that conference are provided at: <http://web.mit.edu/sts/deeparch/Conference/Conference.htm>. There will be a publication coming out from the first meeting. The 2002 conference will bring together ocean engineers, archeologists and oceanographers. They are still accepting abstracts.

In other archeology news, there are a couple of archeology proposals being submitted that will request UNOLS ship time. There is an increasing archeological aspect to submergence research.

Spring Benthic Ecology meeting (Cindy Van Dover) – This is scheduled for April.

NOAA/NASA Explorations – Link Symposium, 20-22 May – Plans for this conference were discussed earlier in the meeting, <http://www.thelinkproject.org/events/link2002.asp>.

### **Updates on public outreach activities**

Dive and Discover - Dan Fornari reported on the Dive and Discover website, <<http://science.whoi.edu/DiveDiscover/>>. The site can be used as a template for future outreach programs. SeaNet has been a very useful tool in providing the communication link for the site. Dive and Discover continues to be used as an outreach component for future submergence cruises.

**Extreme 2001** – The Extreme outreach program continued in 2001 with the site, <http://www.ocean.udel.edu/extreme2001/>.

**NOAA Explorations: Deep East 2001** – A written report and material on the NOAA Explorations: Deep East 2001 outreach program was provided by Paula Keener- Chavis and is included as **Appendix XVI**. The Voyage of Discovery was an ALVIN dive program that took place on September 8 – October 1, 2001 on Georges Bank to the Blake Ridge. The educational component includes an educator’s guide and CD-Rom, professional development instructions, daily web logs, a web forum and web chat room, an ocean exploration day, and an evaluation. Paula is the point of contact for the educational program. Examples of the Deep East web pages can be found at:

Education Program:

<http://oceanexplorer.noaa.gov/explorations/deepeast01/background/education/education.html>

Lesson Plan Grades 9-12:

<http://oceanexplorer.noaa.gov/explorations/deepeast01/background/education/dehlessons1.pdf>

Web Forum:

<http://oceanexplorer.noaa.gov/explorations/deepeast01/background/education/webforum.html>

**New Millennium Observatory (NeMO)** – Bob Embley provided a report on the NeMO public outreach and education program. NeMO's goal is to establish a multi-year monitoring and sampling program at Axial Volcano on the Juan de Fuca ridge in order to examine the relationships between volcanic events, chemistry and biology of hydrothermal vents. Axial Volcano was chosen for the NeMO Project because it is the most volcanically active site on the Juan de Fuca Ridge. Within months after the NeMO Project was initiated, a volcanic eruption occurred at Axial Volcano in January 1998. Educational outreach is a major component of NeMO. Through the observatory, real-time events can be communicated to the public, educators, and students. Each NeMO expedition has a teacher at sea and another teacher working onshore to help make research results available via the NeMO web site. Daily updates are posted to the calendar page describing life at sea and scientific results during the expedition. Public lectures are held at the Hatfield Marine Science Center. There have been four NeMO expeditions.

The NeMO website, <http://www.pmel.noaa.gov/vents/nemo/index.html>, contains a variety of interesting outreach features including links to the NeMO expeditions with daily updates from sea, “NeMO Explorer” which provides virtual tours and other multimedia resources, “NeMO Net” which provides a real-time communication to the seafloor, and a teacher’s curriculum.

**Marine Advanced Technology Education (MATE) Internship Program** - Sandra Butcher gave a brief overview of the MATE Technical Internship program. A description of the program was provided as a handout. The program began in 1999 and works to place interns aboard UNOLS ships and ODP's drill ship, JOIDES RESOLUTION. To date, MATE has placed 31 interns on research vessels. MATE is looking for mentors so that additional interns can experience fieldwork. Sandra requested that any one interested in becoming a mentor should contact the MATE Office, <info@marintech.org>. Information about the MATE Intern program is available on the website at: <http://www.marinetech.org/careers/internships.html>. Dana Yoerger commented that he was very impressed with skills of the intern aboard R/V THOMPSON.

**UNOLS Public Outreach and Education Links** – The UNOLS website has a listing of outreach and educational programs that are conducted for research vessels, <<http://www.unols.org/outreach.html>>. Suggestions for additions are always welcome.

**Deep Submergence Lectureships** – The idea for a deep submergence lectureship program came up a few years ago. The program would offer a way to reach out to the undergraduate community to introduce them to the field of submergence science. “Ambassadors” would be selected to provide lectures at various institutions. Outreach to the general public would be a component of the program. Ways to support and implement a lectureship program will be further researched. The program would be similar to the JOI/USSAC distinguished lectureship program.

**IMAX Productions** – Alex Low commented that their IMAX production has an educational component. Alex is responsible for marketing the film. They develop posters and educational packets as a standard for these types of films. They would like to do more to reach every student in the country and are still formulating the ways of doing this. They would like to develop an education class guide to accompany the production. They are working with University of South Florida to develop a program. Education and marketing go hand in hand.

### **Other Business:**

Before closing, the floor was open for discussion. Debbie Kelley suggested that at future DESSC fall meetings an effort be made to encourage student participation.

**Adjourn** – The meeting was adjourned at 5:20 pm.