UNOLS DEep Submergence Science Committee
Planning Meeting
December 5, 2002

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Meeting Summary Report

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Welcome and Introductions - Patty Fryer, DESSC Chair, called the meeting to order at 0815. The meeting agenda is included as ***Appendix I***. A list of meeting participants is contained in ***Appendix II***. Patty reviewed the activities of the Committee over the past year. DESSC members Joris Gieskes and Marv Lilley rotated off the committee in the spring and were replaced by Hedy Edmonds and Debbie Kelley.

Over the past year, DESSC has been making an effort to better reach the biological community. They held a Special Session at the ASLO/AGU conference in February 2002. They are also making an effort to be ambassadors at various biology meetings.

Patty reported that Woods Hole Oceanographic Institution (WHOI) has formed an internal committee to review the National Deep Submergence Committee (NDSF) and their marine operations program. The Committee is chaired by Fred Sayles. A replacement for Dan Fornari as the NDSF Chief /scientist replacement has not been identified. WHOI is in the process of conducting a design study for a new ALVIN, a 6500+ meter human occupied vehicle (HOV). They have formed a New ALVIN Design Advisory Committee (NADAC) made up of HOV users and some DESSC members to provide input on the study and design features.

The DESSC has considered the general design goals for a new HOV, relative merits of HOV/ROV, and the desired depth capability of a New ALVIN. Some of the desired capabilities that could be designed in a replacement for ALVIN include:

- Greater speed
- Improved science sensors and tools
- Improved maneuverability
- Increased power for propulsion and payload
- Greater endurance and improved ergonomics
- Better visibility and lighting
- Improved navigation

Improved safety systems

- Improved manipulation ability
- Greater external sample storage and increased science payload
- Better communications
- Improved data collection, logging and interface capability to science instruments
    - Depth capability to 6000-7000m (depending on the technical feasibility and cost-benefit analysis)

Over the past year the DESSC has considered the science justification for HOVs, as well as, the desired depth capability for a new HOV. They have prepared a paper that provides a science justification for HOVs. Some of the HOV benefits include:

- Engagement of the operator
- Visibility in 3-D
- Maneuverability/reliability
- Unobtrusiveness
- Capacity for outreach education and recruitment.

Other activities of DESSC have been included outreach and educational efforts. These will be reported later in the meeting.

At the Link Symposium in May 2002 a discussion on a "Full" ocean depth (11,000 m) HOV vs. a ~6500 m HOV came up. In response to the full-ocean depth issue, DESSC recommendations include:

- Concerns regarding effective use of resources
- Current effort (6500m +) is outgrowth of community-wide discussions and workshops
- Maintain the deployment capability from the existing support ship (no major modifications to the ship design, or submersible launch-recovery system)
    - Meet the stated needs of the scientific community

A copy of Patty's viewgraphs is contained in ***Appendix III***.

Approval of Minutes of May 2002 DESSC meeting – The minutes of the May 2002 DESSC meeting were approved as written.

2002 Science Reports - Presentations by Principal Investigators – Users of the NDSF facilities and other facility assets provided reports on their cruises over the past year.

Karen Von Damm had the first ATLANTIS/ALVIN cruise of 2002 starting on 6 January and ending on 10 February. The cruise plan called for 5 dives at 21N East Pacific Rise (EPR), then transit to 9-10N for 20 dives in five areas. In Karen's opinion it was the worst mechanical cruise since 1984. Problems were related to both ALVIN and ATLANTIS failures.

ATLANTIS problems:

- Generators resulting in loss of propulsion and lighting
- A-Frame – resulting in hard deck landings and a hard stop mid-air
- Low water pressure
- Drains that overflow
- Hydrowinch problems resulting in loss of rock coring abilities on some days.

ALVIN problems:

- Computer failures resulting in major problems
- No data collection on several dives
- No navigation data
- No overlays on several dives.

The WHOI engineers were very busy throughout the cruise trying to correct the problems. In spite of all of the difficulties, over 200 water samples were collected.

Dan Fornari reported on **Jim Cowen**'s 2002 ATLANTIS/ALVIN cruises. The first was to Guaymas Basin, Gulf of Mexico on April 26 to May 11th and the second cruise was to the Endeavour Segment, Juan de Fuca Ridge (August 4-25, 2002). Both cruises involved a combination of ALVIN dives and CTD operations. The ALVIN operations were highly productive and they were able to make more dives than originally anticipated on both cruises, despite losing dive days to bad weather during the Endeavour cruise. They completed 15 CTD casts during the first cruise and 20 casts during the second cruise. This is essentially two casts per night. Only one equipment problem was experienced with the CTD. This was a failure of the CTD pylon on the next to last day of operations at Guaymas Basin.

Jim credits the tremendous efforts, cooperation, and competence of the ALVIN and ATLANTIS crews for two highly successful cruises. A written report from Jim is provided as ***Appendix IVb***.

Dan continued by reporting that there would an AGU poster session by **Rachel Hayman and Ken McDonald**'s on their May 2002 ATLANTIS/ALVIN cruise. Details are provided in ***Appendix IVc***. The poster will report on off-axis hydrothermal activity on the EPR near 9^{o} 28'N. During two ALVIN dives, they mapped over 100 sediment mounds, which appear to be hydrothermal in origin. Eleven sediment push cores were collected in the mounds, within the craters, and in ambient surrounding sediments. Other samples collected during the dives include three "slurp" samples of mossy material on the fault scarp, and rock samples with moss-covered surfaces.

Dan concluded by thanking NSF for adding dives to Hans Schouten's cruise in May 2002. Dan then emphasized the need for additional ALVIN engineering dives.

Hans Schouten reported on his ATLANTIS cruise at 9^{o} 55'N on 14-23 May 2002 (same cruise as MacDonald/Hayman). An objective of the cruise was to ground-truth November 2001 survey results with ALVIN dives. The science activities included four ALVIN dives, ABE lowerings, CTD operations, and use of a

digital camera on the CTD wire, rock cores and rock dredges. Hans showed maps from the survey. He showed the various bathymetry features at 9° 29'N – 104W.

Tim Shank began his report by stating that the importance of engineering dives cannot be understated. His ATLANTIS cruise operations were flawless in May/June 2002. His cruise, titled Galapagos Rift Exploration 2002 on 24 May to 4 June used ALVIN, ABE, the Tow Camera, and a CTD. They carried out nine ALVIN dives at depths from 3788 to 3796 meters and seven ABE dives. Tim remarked that using ABE and ALVIN in tandem was fabulous. By 7:30 a.m. each morning, ABE surveys would be available for ALVIN dives. Tim showed an example of ABE's micro bathymetry survey. They had five Towed Camera (TowCam) lowerings and 4,100 pictures were taken. Six CTD tows/vertical casts were made. Twenty-six scientists from 10 institutions participated in the cruise.

Highlights from the cruise included:

- Surveyed three regions of the Galapagos Rift (86°13'W, 88°59'W, 89°37'W)
- Rose Garden (86°13'W) considered an area of recent eruption- "paved over"
- Recent lava flows and young communities at Rosebud (86°W)
- Discovery of clam field (Calyfield) at 1660m
- New species of vent-endemic sponge
- Discovery of extinct high-temperature sulfide chimneys (89°36W)
- Effective vent detection with ABE and synergism with ALVIN operations
- Education: 25th An. CD; Dive and Discover, NOAA, NGeo; NPR; NGeo TV

Viewgraphs from Tim's presentation are included as ***Appendix IVe***.

Paul Johnson reported on his ATLANTIS/Jason II cruise on 29 August to 23 September. This was the first scientific use of the ROV Jason II. This was a Life in Extreme Environments (LEXEN) program and sampled fluid for microbial and chemical analyses from young and old sites. Five sites were studied: Baby Bare, Wuzza Bare, Axial Seamounts, Endeavour axis and ODP Hole 1026b. Eleven individual Jason II dives were made with for a total bottom time of 323 hours. Ten elevators were deployed. Other operations included:

- 18 thermal blanket deployments
- 850 LITERS of fluid from the barrel sampler during 6 deployments
- 60 liters of fluid from the LANG sampler
- 136 discrete fluid samples taken in the Butterfield sampler
- 9 gas tight and 13 major fluid samplers taken,
- 9 push cores
- 4 bio-grabs
- 9 rocks recovered
- 3796 digital still images taken
- 11 CTD casts
- A 10-meter piston core
- 5 sets of larvae settling experiments deployed.

The entire cruise was successful and almost all of the scientific goals for the first year of the two-year field program were reached. Major factors for this success include good weather and few instrument or equipment failures. No Jason dives were terminated due to equipment/system failures. The officers and deck crew of the ATLANTIS contributed to the success of the cruise.

Paul remarked on the need for a sub-bottom profiler for Jason II.

Paul's viewgraphs are included as ***Appendix IVf***. Copies of his EOS article, *Probing for Life in the Ocean Crust*, were available at the meeting.

Next, **Fred Duennebier** reported on his THOMPSON/Jason II cruise, which was the second science cruise for the vehicle. The cruise took place off Hawaii in October-November 2002. Pictures from Fred's cruise are included as ***Appendix IVg***.

One task during the cruise was recovery of rock samples from the Mauna Loa South Rift. In about 12 days, JASON 2 recovered more than 2 tons of rock samples (Figure 1). The second task was recovery of the Hawaii Undersea Geo-Observatory (HUGO) Junction Box from Loihi volcano that had been on the ocean floor for five years. HUGO was inactive because the fiber-optic cable to shore had developed an electrical short. Information about HUGO can be found at: http://www.soest.hawaii.edu/HUGO/hugo.html. Figure 2 is a digital image from JASON 2 of the HUGO Junction Box when it was first located on the dive. Figure 3 shows Jason II attaching a ring to the HUGO Junction Box so that MEDEA can lift it to the surface. Figure 4 shows Jason II fishing the fiber-optic cable from the mud in front of the HUGO Junction Box so that Jason II can cut it prior to lifting the Junction Box to the surface. Figure 5 shows the Jason II crew with the HUGO Junction Box on the deck of the THOMPSON. The box is in great shape and will hopefully be able to be redeployed in a couple years. Lastly, Figure 6 shows one of the recoveries of Jason II on THOMPSON. They experienced some weather problems during the cruise preventing ROV work, but were able to do survey work with THOMPSON's EM300 system. The Jason support team was terrific.

Patty Fryer commented on the need for a rock drill that could be used with the ROV.

Bob Embley reported on the Submarine Ring of Fire 2002 - Explorer Ridge expeditions on June 28 - July 11 and July 23 - August 5, 2002. Details of the cruise can be found on the web at, <*http://www.oceanexplorer.noaa.gov/explorations/02fire/background/plan/plan.html*>. The cruises were on THOMPSON and used a suite of vehicles and tools including specialized sonars, a CTD, AUV ABE, and ROV ROPOS.
The first expedition conducted initial surveys of the seafloor and the water column above the Explorer Ridge using a CTD, ABE and THOMPSON's EM300 multibeam. ABE sensors that were used included:

- Altimeter
- Pressure gauge
- CTD transmissometer
- Magnetometer
- EH sensor
- Imagenex scanning sonar
- SM200

Bob showed a comparison of Imagenex data and the SM2000 data and remarked that they got a lot more data with the SM2000. Without ABE, Bob remarked that he is sure they would have been able to find the most active vent area. There were more than 40 active vents and extensive extinct chimneys.

ROPOS operations were conduced during the second cruise. There is a lot of seismic activity at Explorer Ridge. They had a new digital camera on ROPOS and this worked remarkable well.

Dana Yoerger commented on ABE 2002 operations. ABE has been used to collect bathymetry and magnetic data. On the Explorer Ridge expedition the ABE data was taken while ALVIN was in the water. This was an important capability. Multibeam mapping sonar SM2000 is working well and provides dramatically better coverage.

John Delaney reported on NEPTUNE related activities over the past year. The Keck Foundation has provided $5 million in funding to support the NEPTUNE observatory initiative (***Appendix IVj***). The objective of the observatory is to document the linkages in time and space involved in plate tectonic modulation of microbial productivity. The participants in the NEPTUNE program include

- MBARI

- SIO
- Pacific Science Center
- JPL
- WHOI
- UW
- NOAA

In August 2002, John led a cruise funded by the Keck Foundation using TIBURON from WESTERN FLYER. They instrumented two sites one at the Endeavour Segment of the Juan de Fuca Ridge and at the intersection of the Nootka Fracture Zone and the Cascadia Subduction zone. This was the first field effort of the project. Boreholes were made in the basaltic basement at the Endeavour Ridge to provide deployment sites for short-period seismometers. The instruments will be deployed in 2003. The MBARI drill was used successfully. Debbie Kelley has developed a system (funded by NSF) that uses a drill called RAMBO.

Tom Shirley could not attend, but provided viewgraphs (***Appendix IVk***) in advance of the meeting. His cruise, titled, GOASEX: Gulf of Alaska Seamount Exploration took place on 22 Jun - 15 Jul 2002. Fifteen ALVIN dives were made to study crab distributions.

Patty Fryer completed the science presentations by reporting on the NDSF "Most Valuable Asset," Chief Scientist Dan Fornari. She noted his dedication, energy, and commitment to making the NDSF the most capable facility available to meet the deep submergence community's research needs. Patty read a poem prepared by Susan Humphris, "An Ode to Dan" (***Appendix IVl***). Dan was presented with a print from artist Alp Ozberker in gratitude for all of his contributions to DESSC and the National Deep Submergence Facility.

Break

National Deep Submergence Facility (NDSF) Operator's Report:

Dick Pittenger began the report for the NDSF operator by remarking that the year has seen good times and bad times. As Karen Von Damm reported, there were problems experienced with both ALVIN and ATLANTIS. On the positive side, Jason II is in service and initial operations have been successful.

Operations Summary - NDSF vehicle systems – Rick Chandler reported on the vehicle operations in 2002. His viewgraphs are included as ***Appendix Va***. ALVIN operations included 328 operating days with 97 dives. Even though ALVIN has been operational for the entire year, there were fewer dives than normal due to ATLANTIS maintenance in the spring and the Jason and non-ALVIN cruises in the fall.
The average dive depth was 2121m with and average duration of 7.5 hours. The average depth this year was less than the previous few years due to a high percentage of relatively shallow dives for the IMAX work, at the Galapagos and on the seamounts in the Gulf of Alaska.
The 4.9 hrs average bottom time is up from 4.5 hours last year, also due to the high percentage of shallow dives. In addition to the science highlights reported, this year also included 25th anniversary dives at Galapagos. Three dives were lost in 2002, all due to weather.

In 2002 ROV Jason II joined the NDSF. Sea trials were conducted in July off Oregon. Two science cruises (Juan de Fuca and Hawaii) have been made for a total of 26 lowerings and 455 hours of bottom time. The deepest dive has been to 4,650 meters.
✓The DSL-120 sonar is currently at sea on THOMPSON off Guam with Maurice Tivey.

NDSF operating costs in 2002 was $4,100,134. Personnel salaries continue to be the largest part of the budget, with dive-related supplies second. Overall costs have remained stable for the past five years.

Diving this year was fairly evenly divided among the three major scientific disciplines with minor shares for IMAX imaging and engineering.

Rick continued with a description of the newly revamped Marine Operations web site.
The vehicle overview page, reached by clicking on 'NDSF Vehicles' from the welcome screen, gives information access for each of the four vehicles and also a "Cruise Planning Tool Kit." There are links to the cruise-planning questionnaire; UNOLS ship time request form, port agent, and contact listings. They have tried to standardize the organization of each vehicle and ship section so that information can be quickly and easily found.

From the Jason II/Medea menu, there is access to ROV cruise summaries. The ROV operations team publishes a brief cruise report, with an abstract of scientific goals, methodology and results.
An added feature is a page of highlights, with descriptions of tools used and operations requested.

The ALVIN page includes a new section, 'Dive Site Charts.' This provides a menu of charts available showing locations of all ALVIN dives up to the present. The charts provide not only geographic location, but also information on dive depth using the color-coding at the bottom.

John Delaney commented that this information and resource is needed for all of UNOLS ship use. Dolly commented that to some degree this is being addressed by UNOLS and Oceanic.

Upgrades to the NDSF vehicles, sensors, navigation systems and ATLANTIS

Barrie Walden continued with a review of ALVIN upgrades. His viewgraphs are included as ***Appendix Vb***.

Barrie reported that the data logging & display software problems experienced earlier in the year have been resolved. There were indications that there might be problems with the in-hull data logging just before Karen's cruise. The individual microprocessors had bad PCU fans that were slowing down and experiencing glitches in the code. The manufacturer has provided new PCUs and these seem to be solving the majority of the problems.

The hardware required for the video overlay process for dupe stations is in-house and the required software is in-progress. It had been suggested that they use the Jason laptop for overlay and they are submitting a proposal to NSF to put this on ALVIN's computer. It can generate the cruise track, frames, and data associated with the frame. It provides a good way to scroll through the dive and locate things that they would like to pull out. They would like to modify the code so that this will work on ALVIN's computer. Hopefully this can be accomplished in the coming year.

The Imagenex profiler integration has been completed. A second camera and pan and tilt are on order. Controls for both will be hard mounted prior to 2003. Acoustic modem integration has been completed, but further testing is required. ROV evaluation of the force-feedback manipulator is in progress. If it performs well on Jason II, it will be installed on ALVIN this year. Funding has been requested for an exterior still camera digital replacement. Dan's camera worked well but is difficult for the ALVIN support group to maintain and operate. They are still looking for alternatives. There are about five different systems that they are looking at.

Louis Whitcomb has written software that changes the way we can navigate.

ATLANTIS - Improvements and repairs - Dick Pittenger reported on the problems experienced on ATLANTIS and the repairs that have been made. His viewgraphs are included as ***Appendix Vc***. The motors developed grounds and caused the ATLANTIS propulsion problems.
The motors were removed and renovated.
Corrective actions were implemented:

- Electrician hired
- New brushes were installed to reduce carbon dust
- Extensive preventive maintenance
- Several design options being evaluated

The ATLANTIS A-frame system was built in 1982. It is a metric system with marine and non-marine features. It has many one-off custom parts. The A-Frame was reconditioned and moved to ATLANTIS in 1996. Recent A-Frame failures were with the anti-swing cylinder and leaking main cylinder adaptors. They have implemented a revised maintenance plan with monthly maintenance inspections for early identification of problems. This will identify items for crew/shipyard work lists. An independent professional assessment of the A-Frame is planned for January 2003.

Dick commented that there is an ATLANTIS maintenance and improvement backlog. The things that were not funded during the overhaul will not get done. Correction of the drain problems would be a $60K- $90k project. ATLANTIS has become a 24-hour ship. This puts increase demand on the ship and crew. ATLANTIS has scheduled shipyard visit at Atlantic Marine Inc. at the end of the year.

ROV (Jason II, DSL-120, and Argo II) Upgrades – Andy Bowen continued the NDSF report with an update on the ROV upgrades, field trials and initial operations. His viewgraphs are included as ***Appendix Vd***. Andy acknowledged help from MBARI and ROPOS during the upgrade process. WHOI tried to take advantage of the lessons learned from the other operators. Features of Jason II include:

- 250 lbs. of payload, with total tool sled
- Multiple 24,48 and 240 VDC power circuits
- RS232/485, Hi-speed RS422 and Ethernet
- Two spatially correspondent master-slave manipulators
- 5 auxiliary hydraulic circuits with flows to 6GPM and pressures to 3000 psi.
- 500 lbs. of thrust in each axis
- Large telescoping sample drawer with two side mounted swing arms
- Doppler Sonar

Andy went on to report ROV upgrade plans for 2003. These include:

- Addition of Doppler and SM2000 to DSL
- Work to correct difficulties with Kraft manipulator
- Formalize pilot training policies
- Launch/recovery swing crane damping
- Improvements to science operations vision system
- Data logging manuals and pre-cruise science training material
- DVD recording and improved control van displays
- Dedicated “major” water samples
- Improve payload and trim – purchase more syntactic foam
- Acoustic navigation – report to DESSC in June.

Jim Bellingham congratulated Andy on his accomplishments. He suggested that ROV tool sleds should be made swappable throughout the community (Tiburon, ROPOS, Jason II, etc)? As vehicle operators, they need to be doing more in coordinating their efforts. Jim would like to make the MBARI systems more portable. There are benefits to standardizing to a degree. The concept of portable modules was suggested. The community needs to establish the requirements for such modules. Andy suggested that DESSC take this on as a task and consider requesting funds for a small workshop.

There was a question regarding the cost for Jason 3? It cost approximately $3M and includes the handling system, cable, and control vans.

NDSF Scheduling for 2003/2004 - Jon Alberts reported on schedules for 2003 and 2004. His viewgraphs are included as ***Appendix Ve***. ATLANTIS and ALVIN will end 2002 with Chuck Fisher’s cruise. Jon reviewed the programs that have been proposed for 2003. In addition to science cruises, they will need to include maintenance time, INSURV and a shipyard period for ATLANTIS. ATLANTIS will also be used to field test

Southampton's new ROV and recover moorings. The first part of 2003 will be spent in the Atlantic at the Mid Atlantic Ridge and the New England seamounts. Work will continue in the Gulf of Mexico before transiting the Gulf of Mexico. The second half of the year will be spent in the Pacific with work areas in the Galapagos Rift, East Pacific Rise, Juan de Fuca, and off California.

There are already many days requested for ALVIN and ROVs in 2004 and beyond. Some of these programs are already funded. Most of the work is distributed in the traditional yo-yo work areas.

Archive Update - Dan Fornari gave an update on the archives. His viewgraphs are included as ***Appendix Vf***. The archives include a selection of the best ALVIN images from dive 1 to 3245. They are migrating ALVIN data logging data. Dan reviewed the types of storage media that are contained in the archives (3/4-inch tape players, 8mm players, VHS players, hi8 video player, and DVCam digital video player). 35mm reel films can be seen with a light table. These films are being scanned with internal WHOI funds.

For data, all readable floppies have been converted to CD. For audiotapes, the archives holds both reel-to-reel and cassette players.

The URL for ALVIN 'Best Hits' Photos to dive 3245, July 1998 is <http://www.marine.whoi.edu/alphotos.nsf?OpenDatabase>.

Dan reviewed the NDSF related licensing revenue:

- Video and Still Imagery = $29k
- National Geographic = $25k (2001 not reported)
- Total Income = $54k

Details are provided in ***Appendix Vf***.

NDSF Chief Scientist – Dan reviewed the desired criteria for the next NDFS Chief Scientist:

- Must have an active research program that used deep sub facilities.
- Must represent the broad spectrum of deep sub research community
- Must proactively works with the NDSF.

Dick Pittenger reported on the status of the Chief Scientist position. An internal review of marine operations and the National Deep Submergence Facility is underway. The committee is being chaired by Fred Sayles. Dan has agreed to stay on while the process is ongoing. WHOI will first look within WHOI for a replacement, then if necessary expand the search externally.

Break for Lunch

Other Facility Operator Reports

Harbor Branch Oceanographic Institution (HBOI) - Shirley Pomponi could not attend the meeting, but provided a written report in advance of the meeting. Patty Fryer summarized the report.

Johnson Sea Link I (J-S-L I) underwent routine maintenance of all systems from Nov. 2001 to Feb. 2002 before beginning the operating season in March 2002. In addition to normal maintenance, the power distribution system was upgraded to the new HBOI-designed power bottles and all associated cabling to improve reliability and replace obsolete power blocks. Also, a new set of main battery cells was installed.

JOHNSON-SEA-LINK II (J-S-L II) underwent major maintenance from Nov. 01 to April 02. During that time, all systems were serviced or replaced. The pilot sphere was replaced incorporating a redesigned hatch and lower penetrator. All of the internal high-pressure valves, tubing and fittings were replaced. All external valves, tubings and fittings were rebuilt, pressure tested or replaced. The submersible's hydraulic system was

overhauled.

In addition to the general maintenance, a new Sunwest SS-300 CTFM Sonar was installed with a 12" display monitor to match J-S-L I.

CLELIA underwent routine maintenance during Jan-March 02 and successfully completed an ABS Special Periodical Survey

All thrusters on the three subs underwent preventative maintenance.

Monterey Bay Aquarium Research Institute (MBARI) - Mark Chaffey gave a report on MBARI operations in 2002 and plans for 2003. In 2002 TIBURON operated off Monterey and at Juan de Fuca. Recent cruise highlights included deployment of the new laser Roman spectrometer. MBARI has received increased external funding for vehicle use. This included:

- NURP funded 4 days.
- Ocean Exploration funded 7 days.
- The Keck Foundation funded 14 days.
- The BBC funded 2 days.

MBARI has been collaborating with U. Washington and Canada to support a cabled observatory system, which is a test bed for the Neptune seafloor observatory. TIBURON equipped with a cable laying tool sled was used during the observatory operations. MBARI now has six application-specific tool sleds.

In 2003, TIBURON operations are planned in the Gulf of California.

MBARI's Ventana ROV system has been operating in support of the:

- MOOS portable mooring system
- MOOS test mooring
- Verification of engineering design

The MOOS mooring system capabilities will include:

- 4000 m depth
- 10 km benthic runs
- Power and data to the seafloor
- Support for AUV docking
- Support for vertical profiler

MBARI outreach activities have included:

- A BBC program of the abyss. They have been transmitting live form Monterey Bay, the Cayman Islands, and the Mid-Atlantic Ridge.
- Monterey Bay Aquarium (link to the vehicle)
- MBARI ROV

Marine Physics Lab (MPL) - Fred Spiess reported on the SIO/MPL vehicles, the Advanced Tethered Vehicle (ATV), the Control Vehicle and the Towed vehicle. SIO has been evaluating ATV to determine if it can be brought back into service to support science operations. The vehicle was transferred from the Navy. It has a maximum depth capability of 20,000 feet. The system is large, 9' x 14' x 7.5.' ATV has not been operated for three years.

Fred continued by reviewing MPL's Control Vehicle capabilities and operations. The Wireline Reentry system consists of a Control Vehicle and a logging tool designed to inspect deep sea drill holes and install monitoring equipment in them. The Control Vehicle has been used as the interrogation vehicle for near bottom geodetic experiments. System characteristics include:

- Two thrusters to control lateral position
- 6,000 m. depth capability
- Sonars
- Long baseline transponder navigation

MPL Deep Tow system includes a pressure case, wire termination, telemetry, transponders, and topside electronics. Sensors include a pair of 110-kHz side-looking sonars, a 4-kHz sub-bottom profiler, a 40-kHz obstacle avoidance sonar, a 12-kHz navigation sonar, a 23.5-kHz up-looking sonar, a CTD unit, a transmissometer, a complement of still and TV cameras, and a 100-kHz multibeam echo sounder.

Three geodetic operations are scheduled for this year. Fred's viewgraphs are included as ***Appendix VIII***.

Hawaii Undersea Research Laboratory (HURL) – Patty Fryer reported that Keith Crook has provided a written report, which is available in hardcopy. The report summarized research accomplishments in 2002 with a table of dives by PI. A highlight of this year included finding the midget submarine. Most funding for PISCES operations comes from NURP. In 2003 HURL will have ten test and training dives on PISCES IV and PISCES V. As part of the test plan the subs will be deployed simultaneously. HURL plans to advertise a request for proposals for research in the main and NW Hawaiian islands and in American Flag SW Pacific waters.

ROPOS – A written report was provided by ROPOS and is available in hardcopy. The report provides information on 2002 operations and plans for 2003. Additional information is contained on their website at, www.ropos.com.

Agency Reports:

NOAA (NURP and Ocean Exploration Initiative) – Barbara Moore provided a report on NOAA's undersea programs. Her viewgraphs are included as ***Appendix X***. NOAA falls under the Department of Commerce. Its mission is to describe and predict environmental changes and to provide stewardship of coastal and marine resources to ensure sustainable economic opportunities.
Research conducted by NOAA includes:

- Weather forecasting
- Climate prediction
- Fisheries management
- Coral management
- Understanding living resources

NOAA programs that carry out deep submergence science include NURP and Ocean Exploration. NURP operates nationally with six centers, www.nurp.naoo.gov.

NURP's Infrastructure includes access to a wide variety of vehicles and tools including HOVs, ROVs, and AUVs. Some assets are owned, but many are leased.

NOAA's Ocean Exploration programs funds internal and external programs. For more information see: http://oceanexplorer.noaa.gov

Barbara provided information on NOAA funded deep-science projects and trends in deep diving. The projects have been consistent, but the number of deep dives has been going down and the wet diving has gone up. The high cost of deep submergence research is driving this. They are going to try to increase the funding for deep work.

In 2003 there are a variety of operating areas for Ocean Exploration. An RFP will go out in mid month for this Fiscal year. Time is blocked on the ALVIN schedule for this work. They also have time scheduled on the RON BROWN and 60 days off Hawaii.

A question was asked if there has been any effort to get Ocean Exploration funding decisions more in sync with UNOLS scheduling. This issue has come up repeatedly in recent years. Barbara commented that Admiral Lautenbacher's matrix management plan should address this issue.

Office of Naval Research (ONR) – There was no ONR Representative present.

National Science Foundation (NSF) - Dolly Dieter and Jim Yoder provided the report. Dolly reported that NSF currently has no budget and is operating on a continuing resolution. She stressed that the community needs to stay engaged in the submergence science issues and provide their input to DESSC and the agencies.

Jim Yoder continued and commented that by having no budget, NSF is only authorized to spend at level funding based on the FY02 budget. Congress' budget had included a generous increase of 13 percent for NSF. If the budget remains unauthorized, it is likely that the budget increase will disappear. This can be a bad sign for the FY04 budget request.

Jim continued and discussed ALVIN and issues related to its potential replacement:

1) Why not build an HOV to full depth? There would need to be a science justification.
2) Why build an HOV at all?

NSF has asked the Ocean Studies Board (OSB) to study what science can be done using an HOV versus an ROV. What is the most effective way to carry out submersible science? Are HOVs, ROVs, or a mix of vehicles needed? A task statement for the study is being drafted. There will be opportunity for community comment. The OSB and NSF will also gather the reports from past workshops and consider their recommendations. The study will likely begin in early 2003.

The question was asked if the community would have the opportunity to review the task statement before it gets finalized. Dan Fornari emphasized that the tasking should not require the committee to consider HOVs versus ROVs, an either/or option.

6500 m Sub and New ALVIN Design Advisory Committee (NADAC) – Patty Fryer opened the discussion by reminding the participants to read the letter drafted by Dan Fornari, "A perspective on two decades of deliberations regarding deep submergence facility requirements and suggestions for the future." Additionally, Patty has created a matrix that includes a list of papers and workshop reports along with their respective recommendations. The matrix is included as ***Appendix XI***. All reports seem to be saying the same thing; a suite of vehicles is needed to support deep submergence science.

Bob Brown (WHOI) continued with a report on the status of WHOI's new ALVIN study. The study is in the Concept development phase. They are evaluating the Lokomo hull. This is the same hull that is used by the Russian MIR subs. Three hulls were originally made and the third was never put into service. American Bureau of Shipping (ABS) is conducting a survey of the hull. A finite element stress analysis of the hull and ATLANTIS A-frame analysis have been completed. Conceptual design of the vehicle and pressure sphere is in progress.

Bob presented the construction schedule for the new manned sub. Design and construction is estimated to take approximately 6.5 years. Currently they are half way through the conceptual design.

They have developed mission requirements. Operational cycle issues have been reviewed. They are currently preparing the functional specs for science related areas. Some of the activities that are planned include:

- Observer fields of view and viewport placement
- Science sensor placement
- Operational capability tradeoffs
- In-hull equipment selection and placement

Bob reviewed the Functional mission requirements that have been developed. These are contained on the New ALVIN website at <http://dsg.whoi.edu/nadac/home.htm>.

An interim review meeting for the study is planned for February 2003. They hope to have the technical effort complete and a review meeting in April 2003. Inputs for an RFP package are scheduled to be complete in June 2003.

WHOI has two sub-contractors involved in the project, Southwest Research Institute (SwRI) and International Submarine Engineering (ISE).

Hull materials under consideration include Ti6A1-4V, Ti Beta C, and maraged steel. Hull construction options include:

- Forging with welded inserts
- Forging with no inserts
- Casting

WHOI is carefully evaluating window designs including size, number, and orientation. They have also considered energy source options. Battery options considered include:

- Li ion
- Li polymer
- NiCd
- Lead Acid

Investigation of the viewport placement options will include computer modeling as well as full-scale modeling. Discussion followed:

Question – Will there be side ports?
Answer - SWRI has been asked to look at 4 and 5 windows.

Question - Why design an HOV with a 7,000-meter capability when none of the other NDSF vehicles (ROVs) can go to 7K?
Answer - This is what the science wants. The sub will have to last many years, so we need to be forward thinking.

Question – Could we have an 11,000 m vehicle, but still use it routinely for 6500-meter work.
Answer - ATLANTIS probably could not support the weight of an 11,000-meter vehicle.

Question - What are the parameters for operation of the new vehicle? Will it be able to have a 12-hour dive duration?
Answer – They will need to look at the science justification and do a cost/tradeoff study.

Comment - DESSC has recommended a full-ocean depth AUV capability.

Question – Has the capability for two dives a day been considered? There should be an easy method for dropping out the batteries. The new vehicle should also have increased bottom time.
Answer – Two dives a day will require additional support requirements (man hours). This can be evaluated.

Break

Future Deep Submergence Facility Needs:

Ocean Floor Observatories - John Delaney gave an update on the NEPTUNE Observatory project and observatories in general. Information about Neptune can be found on their website at <http://www.neptune.washington.edu>.

John commented that we don't like to work in hostile seas. Another way of observing the oceans is needed. There is currently an expanded network of coastal observatories. As an example, LEO-15 off New Jersey has been successfully operating. One thing that is missing is the link between the coastal observatories and the oceans. Regional observatories are needed to provide this link. A regional observatory should:

- Span coastal to global systems linking all processes
- Document variability over many scales of space and time
- Expand satellite and mooring coverage to an entire volume
- Generate a new cycle of real-time modeling and assimilation
- Maximize the scientific return

What capabilities are required for a high-end full-ocean presence?

- High bandwidth communications
- Abundant power
- Robotic systems
- Extensive in-situ sensor networks
- Real time control for interactivity
- Data management, archiving, visualization

John remarked that an optimal location for the first regional observatory is the site planned for Neptune. Plate tectonics can be studied. Neptune is designed to be a network of submarine laboratories with 100 kW of power and high bandwidth.

John asked the question, what role should HOVs, ROVs, AUV and others have in observatory support and operations? What should they look like? The facilities that will be required to support Ocean observatories need to be identified. This expands to the UNOLS fleet. The Canadians have already set aside $60m for a network in the Pacific NW. John recommended that a committee be formed by DESSC to address this issue.

It was remarked that DESSC does not have the expertise to identify the facility needs for observatories. Individuals familiar with observatories need to explain the types of operations that are planned. Patty suggested a workshop that brings DESSC and observatory experts together is needed. Alan Chaves suggested that industry representatives also need to be included. They have experience with operations in rough ocean environment handling heavy items and cable.

John commented that observatories can transform the way the public seas the oceans. It could greatly expand outreach capabilities. This would link the public by Internet to the sea floor.

Jim Bellingham stated that the MARS observatory is being installed and should be available by 2005. They would like to get community input into the plans.

Dale Chayes suggested that the UNOLS Fleet Improvement Committee should be included in plans to evaluate facility needs. Observatories are certain to impact ship time demands.

Bob Detrick remarked that the assets that have a long lead-time for acquisition and construction need to be identified now. Bob is chairing a National Academies study on ocean observatories. As part of the study facility needs will be addressed. They would like input from DESSC on this issue. The committee will meet next in mid-February.

Shallow-water Submergence Science Ad Hoc Committee – Shirley Pomponi could not attend the meeting. A written update of committee activities will be made available.

Long-Range and Expeditionary Planning Discussion

South Atlantic and Arctic - Tim Shank provided a report on the interest for deep submergence operations in the south Atlantic and the Arctic. There is a lot of interest for work at the Gakkel ridge. The Gakkel Ridge is

the slowest-spreading mid-ocean ridge on Earth (full rate 1.33 cm/year at its western end, near Greenland; 0.6 cm/year at the Laptev Sea shelf). It is geographically and oceanographically isolated from other mid-ocean ridges. There is at least one vent site every 100 km. Previous studies (Müller & Jokat, 2000; Tolstoy et al., 2001) showed that there had been a seismic swarm here in early 1999 Sidescan data from a SCICEX cruise a few months later suggest there may also have been a volcanic eruption (Edwards et al., 2001). Tim's viewgraphs are included as ***Appendix XV***.

Ridge 2000 - Mike Perfit provided an update of RIDGE 2000 program activities. His viewgraphs are included as ***Appendix XVI***.

Ridge 2000 began in Oct 2001. They are one year into a planned 12-year program. The program has two themes, time critical studies and integrated studies. There are three initial Integrated Studies sites (ISS). These are located at
8-11˚N EPR, Endeavour segment of the Juan de Fuca Ridge and the East Lau back-arc spreading center. There have been two major workshops. The R2k Data Policy has been approved. August 15th is the first target date for postdoc, data management and ISS proposals. The budget for Ridge is currently $9.5M and includes office and ship costs. The revised R2k Science Plan will soon be available as well as the first R2k Newsletter.
Upcoming Workshops include:

- Fall 2003 –MAR site selection workshop (Providence, RI)
- June 2003 –Exploratory studies workshop (with ChEss, InterRidge and NOAA's OE (SOC)
- Aug/Sept 2003 –Iceland Summer School: Magmatic-Tectonic Interaction
- 2004 –RTI (with InterRidge) Back-arc spreading centers (Korea)

2004 will be first season for R2k ISS cruises. Three legs are anticipated in Lau Basin with use of ROV, AUV, and more. There will be continuous work at EPR and Endeavour (continued use of NDSF vehicles and instruments).
See the R2k website for more info: r2k.bio.psu.edu

Announcements of future submergence meetings – Patty reported that DESSC would try to hold meetings or special sessions at the:

- Fall AGU – 8-12 Dec 2003, San Francisco, CA
- 2004 Ocean Sciences Meeting, AGU – 26-30 Jan 2004, Portland, OR
- 2004 Ocean Research Conference, ASLO – 15-20 Feb 2004, Honolulu, HI

The DESSC will work to better engage the biology community.

Report on LINK Symposium results - Patty's viewgraphs summarize the activities of the NASA/NOAA LINK Symposium. Her viewgraphs are included as ***Appendix XVII***. She and other organizers of the LINK Symposium have drafted a summary article that has been published in the Marine Technology Society (MTS) Journal. Some of the hoped-for products from the symposium include a web-based inventory of tools and sensors and recommendations for new technologies.

NOAA and NASA jointly supported the Link Symposium. Priority actions suggested from the symposium include:

- Investigate potential new energy sources (including in situ energy sources)
- Work toward miniaturization of sensors and tools (to reduce energy requirement)
- Develop means to determine orientation of samples

There were also recommendations regarding the types of samplers to develop. These included:

- Larva samplers
- Sterile sampling capability
- Unobtrusive sampling devices (for capture, tagging, tracking)
- Ability to collect volumes of sediment for assessing microorganism populations
- Samplers that maintain in situ conditions

- Measure absolute seafloor pressure (to eliminate the problem of instrument "drift").
- Rock corers with the ability to take oriented samples
- Manipulators with force sensitive feedback mechanism for delicate samples

Jim Bellingham led the LINK session on AUVs. AUV thrust sessions were divided up based on general operational concepts. This included mapping, under-ice operations, adverse conditions, seafloor observatories, and deep ocean exploration. Fred Duennebier, Rob Sonne and Dave Mindell lead group discussions. Jim commented that he was concerned prior to the workshop because key people were not participating in the workshop including industry representatives, NSF, and technologists. However, he felt that the symposium useful in trying to get people to think out of the box.

Archeology Programs:

Bob Ballard discussed activities and plans for the Institute for Exploration and Inner Space. His viewgraphs are included as ***Appendix XVIII***. He began by remarking that there are different support needs for archeology operations and those for MG&G research. Also, as the Jason ROV continues to grow in popularity, it would be difficult to have access to it. These factors contributed into the decision to design a platform for archeology support. Bob has joined URI. His vision is to develop a program that integrates deep-water oceanography, marine archeology, ocean engineering and history.

The Institute for Exploration (IFE) has developed a suite of underwater vehicles dedicated to marine archaeology surveying. IFE's vehicles and systems are designed to operate up to a maximum depth of 3,000 meters. These vehicles include Argus, an optical imaging tow-sled; Echo, a dual-frequency side-scan sonar and sub-bottom profiler; and Little Hercules, an imaging ROV. ROV Hercules is under development. Information and specifications about the vehicles are available on the web at <http://www.ife.org/latestdiscoveries/iferesearch/dstd.asp>.

HERCULES will be a neutrally buoyant and equipped with a High Definition video camera. It will be specially designed for excavation in the deep ocean and will have the same manipulators as Jason and ALVIN. A new control system for the vehicles is being built at WHOI and URI. There will be two vans. One will be for the tech support group. The other van will be the immersion van, equipped with plasma displays.

Bob has a major expedition in July/August 2003 for work in the Black Sea and Mediterranean.

Bob continued by describing the EDS system under construction. During the Black Sea operations a radar system will be on the KNORR, and the ship will serve as a node to link to the Internet. This will extend their research to shore endlessly. The question was asked, what are the economics of running the satellite time? Bob replied that for the 45-day operations with 24 hrs/day of satellite time the cost is approximately $150k. Currently, there are 40 nodes for Jason and 1.4 million school children are being reached. These kids can experience the KNORR expedition. There are another 50 3-screen facilities on shore. The KNORR system is portable.

David Mindell reported that in 1999, MIT held a conference on
Technology, Archaeology, and the Deep Sea. Approximately 100 people attended and enthusiasm was very high. A second conference was held on April 26-28, 2002. Approximately 300 people attended. The conference convened experts in archaeology, engineering, and oceanography. There is an increasing interest in Archeology programs.

Updates on public outreach and education activities

Dive and Discover – Susan Humphris reported on Dive and Discover activities. Information about the program and expeditions is posted at <http://science.whoi.edu/DiveDiscover/>. There have been a variety of cruises in

recent years. Dan Fornari and Susan Humphris participated in previous Dive and Discover cruises. They are now planning a cruise in which they will not participate. The program will be carried out by a Non-WHOI scientist and will include Abe and ALVIN operations. They will try to recruit RIDGE to help develop a curriculum for the program. Dive and Discover had been designed as a template in the hope that other non-WHOI facility users could use it.

Extreme 2002 – The program has been very successful. Information can be found on their website at <http://www.ocean.udel.edu/extreme2002/home.html>.

NOAA Explorations – 2002 Plans – Bob Embley remarked that NOAA Explorations was a major sponsor of the Black Sea work in 2002. Information about their program is contained on the web at <http://oceanexplorer.noaa.gov/explorations/explorations.html>.

REVEL – Veronique Robigou reported that the REVEL program has been funded for a three-year term. This was a major achievement. The program continues to take teachers to sea for operations in the NW Pacific. They will participate in the Keck supported cruises. REVEL is collaborating with RIDGE. The teachers have been very engaged and are becoming experts in the at sea science operations. Information about the program can be found at <http://oceanexplorer.noaa.gov/explorations/explorations.html>.

Dive and Explore – Bill Chadwick reported on the Dive and Explore program, which is an interactive exhibit that simulates making an ROV dive to a submarine volcano. Bill's viewgraphs are included as ***Appendix XX***. A mockup of the ROPOS control module was made. It has been a very popular exhibit and they have been very pleased with the response. The exhibit is located at the Marine Science Center in Newport, OR. They hope to make it into a traveling exhibit.

MATE Program – ROV competition - Jill Zande provided an overview of the ROV competition in 2002. Forty-six organizations helped to support the event and more than 45 professionals volunteered their time as mentors, technical assistants, and judges. Jill extended a special thanks to Bill Kirkwood. Jill's viewgraphs are included as ***Appendix XXI***.

Jill reported that they are planning a 2003 MATE Center/MTS ROV Committee ROV Competition for High School & College Students. It will be held at
Massachusetts Institute of Technology on June 19-21, 2003. She encouraged everyone to get involved as a sponsor, advisor, or team mentor. Jill can be contacted at jzande@marinetech.org or visit the website at <www.marinetech.org/rov_competition/index.html
>.

Jill encouraged everyone to visit the MATE website to learn more about their programs and activities www.marinetech.org.

Lectureship program in association with RIDGE2000 – Patty reported that efforts are being made to develop a lectureship program. R2K will lead the effort.

IMAX movie – The IMAX footage from the vent sites that was viewed during the 2001 fall AGU conference is now expected to be open in spring 2003.

Discovery Channel series – In the past year UNOLS and NOAA have been contacted for potential cruise opportunities that would provide interesting material for a series of television programs on deep submergence science. The series would appear on the Discovery Channel.

Joyce Hollister commented that the History Channel has been viewing programs on technology. Deep submergence technology developments could be candidates.

RIDGE 2000 Outreach Programs – Liz Goehring reported on R2k outreach activities. Her viewgraphs are

included as ***Appendix XXII***. Activities include a workshop on "Exploring the Deep with Teachers." Their education & outreach plan has been posted to community. A GIFT Workshop is planned during the AGU conference. Major 2003-2004 projects include:

- Ridge Science Curriculum Modules
- "Live" cruise coverage each year
- Lectureship Series
- General Public Website
- Cooperation with REVEL

Additional information about RIDGE 200 Education and outreach is contained on their website at http://ridge2000.bio.psu.edu/eotest.html.

Patty thanked everyone for attending this year's DESSC meeting. The meeting adjourned at 5:15 pm.