

DESSC Planning Meeting
Moscone Convention Center, Room 250
San Francisco, CA
Thursday, December 14, 2000

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Introduction - DESSC Chair's Report - Patty Fryer welcomed the meeting participants and reviewed the day's agenda. She announced that reports from deep submergence operators are available in the rear of the room. Over the past year two new members have been added to DESSC, Mark Chaffey of Monterey Bay Research Aquarium (MBARI) and David Mindell of Massachusetts Institute of Technology (MIT). Additionally, Shirley Pomponi from Harbor Branch Oceanographic Institution (HBOI) has joined the DESSC as an ex-officio member. She has been added to help reach the shallow water submergence community. Patty went on to report that the DESCEND executive summary has been published as a brochure. The full Proceedings report is posted on the UNOLS website <<http://www.gso.uri.edu/unols/dessc/descend/descend.htm>>. The brochure is available in the rear of the room along with many other handouts and posters.

The agenda for the meeting is included as *Appendix I*. The participant list is contained in *Appendix II*.

UNOLS Report - Bob Knox, UNOLS Chair, provided the UNOLS Report, see Appendix III. A number of key events took place over the past year. The UNOLS Office moved to Moss Landing Marine Laboratory (MLML) with Mike Prince as the new Executive Secretary. Annette DeSilva stayed on in her role as Assistant Executive Secretary in Rhode Island. Bob extended his thanks to Jack Bash for his many years of service to UNOLS.

A major initiative of UNOLS over the past year has been quality assessment and improvement. The NSF Fleet Review Committee recommended that UNOLS strive to improve the quality of service. There needs to be a better process for assessment and feedback regarding operations. UNOLS with the help of NSF and experts in the field have been studying various quality improvement initiatives. It has become clear that UNOLS as an organization is complex and to institute a program of excellence requires professionals. NSF has put UNOLS in touch with two researchers that study quality of organizations. They plan to submit a proposal to study UNOLS. They will study UNOLS as a Highly Reliable Virtual Organization (HRVO). It looks to be an interesting project.

Bob reported that ship scheduling has been a complex process over recent years. Next year's schedule (2001) is finally coming to a resolution. There will be a letter to the community in the next UNOLS Newsletter explaining the difficulties experienced this year.

A highlight of the year was bringing the US Coast Guard Icebreaker HEALY onboard. UNOLS' involvement with the USCG in conducting science systems tests has been very successful. Our relationship with the USCG has been very healthy. The ship's first science operations are scheduled to begin in summer 2001 in the Eastern Arctic.

Another initiative of UNOLS is the development of a long-range fleet renewal plan. Both the Fleet Improvement Committee (FIC) and the agencies are involved in this activity. The intermediate class vessels are a focus of immediate attention for UNOLS because their retirement age is quickly approaching. The agency representatives have recently drafted a discussion paper on long-range fleet planning in response to their FOFC tasking. The paper will be available for community input.

2000 Science Reports - Patty Fryer continued by reemphasizing the importance of the cruise assessment process. The annual science reports by PIs at the DESSC meeting offer a forum for feedback to the operator of the facilities, as well as presentation of innovations in approach to field operations and research for fellow users. Users of ALVIN and the ROV/AUVs in 2000 have been invited to present a brief report on their cruise program.

Craig Cary – Craig Cary reported on his January cruise aboard ATLANTIS in the Sea of Cortez, see *Appendix 4a*. Craig and George Luther were co-PIs for this NSF funded program. The cruise included scientists from the University of Delaware as well as an international team of PIs. A focus of the cruise was to provide education outreach, which was reported later in the meeting by Craig. The primary research program included eight dives with an objective to survey and sample specific diffuse flow habitats with a new microelectrode array and thermocouples. The program included:

- Intensive geochemical characterization of sulfide structures
- Sampling of beehive/flange structures
- Sediment coring.

Craig reported that the cruise was very successful and great support was provided by WHOI. The cruise allowed a comparison between the vent environments found at Guaymas with those found at 9-degrees North. It was a very enjoyable program.

Anna Louise Reysenbach – Anna Louise was a co-PI on the Luther/Cary cruise to Guaymas in January. She reported on the key objectives and findings of her NSF funded program that included testing the hypothesis that pyrite formation equals energy (H_2). Her viewgraphs are included as *Appendix 4b*. The objectives of the program were to characterize microbial diversity associated with active sulfides, isolate novel microbes H_2 , and study the chemistry. Focus was on the archaea. They discovered that they were wrong in their hypothesis at both JDF and Guaymas. A new species within the chimneys was isolated. It had never been cultured before. They would like to see if the new species is also associated with the new vents discovered on the Mid-Atlantic Ridge.

Anna Louis extended her thanks to NSF, the ALVIN team and the ATLANTIS crew. The ALVIN team was extremely supportive in obtaining samples. She also thanked the co-PIs, Luther and Cary. The program made a lot of progress toward describing the microbiological structures of the vent communities.

Dan Fornari – Dan began by reporting on his dive program at 9°N on the East Pacific Rise in the first part of February 2000. The dive days were supported by a grant for exploratory research and development testing. The program allowed further demonstration of the near bottom gravimeter (NAVO BGM-3) installed in ALVIN. The objective was to conduct near bottom geophysical data collection on closely spaced east-west lines. The science activities included collection of near bottom continuous gravity data and magnetometer data. Jim Cochran was a co-PI on this program. The cruise was a success.

Dan continued by reporting on his NSF funded MELVILLE cruise, “Marine geology investigation west of the Galapagos Islands, and in the Galapagos rift-EPR intersection.” The cruise began in March and ended in May 2000. Three areas on the East Pacific Rise crest were surveyed using DSL-120 and Argo II (3°20’N, 1°40’N and between 9°-10°N). Two of the three survey areas showed good indications of recent eruptions that corroborated the NOAA autonomous hydrophone data Tphase events. This was followed by a 3-day survey at the Galapagos Rift (97.5°W). In addition to the surveys, multibeam bathymetric data was collected and rock dredging was conducted at the Galapagos Rift. The surveys showed strong evidence of recent eruptions.

Dana Yoerger – Dan Yeorger discussed use of the Doppler system and data. During Dan Fornari’s February ATLANTIS cruise, the navigation was enhanced with a new Doppler system. The Doppler provided bottom-lock tracking to fill in the gaps between 15-second long base-line navigation. The Doppler sonar data was also used during Peter Rona’s Jason program to derive the flow rates in the flumes. Dana explained that although the Doppler data has some errors, it works well when integrating it with other systems. Dana showed a sample track line.

Cindy Van Dover – Cindy reported on her two cruises over the past year (her viewgraphs are included as *Appendix IVc*). The first cruise was in “search for phototrophs at deep-sea hydrothermal vents.” It consisted of four dives at Juan de Fuca ridge in July. NSF and NASA supported the project. The cruise operations included use of the “gattling gun” sampler, HPLC extractions and fluorescence spectroscopy, biophysical measures, culture, and direct counts. The bottom line is that they found no evidence of phototrophs. They found evidence of phototrophs in high levels in the upper water level – 0 to 125 meters. This was an important finding. Their first article from this research was published in *Nature* earlier in the year.

Cindy continued by reporting on her three-dive program in October to the South Florida Escarpment. This project studied biodiversity - seep census Florida Escarpment deep-sea mussel beds and was funded by NOAA-NURP. Cindy showed the species effort curves. Cindy pointed out that once the species are known, biodiversity patterns could be studied. Four additional censuses dives have been funded and will be scheduled in late 2001.

In conclusion, Cindy reported that during both of her cruises rookie divers were given the opportunity to participate.

Meg Tivey –Meg Tivey presented a report on her ATLANTIS cruise programs as well as Jeff Seewald’s program. Meg’s project took place at the Juan de Fuca Ridge, Endeavor Segment in June/July, with a return cruise in September. NSF funded 35 dives and two dives were funded by NOAA/NURP. Her cruise titled, “In-situ time series experiments to define thermal and compositional variability in tidally perturbed submarine hydrothermal systems,” utilized both ALVIN and Jason. The program required intense co-registered instrumentation of both high- and low-temperature diffuse vents and round-the-clock water sampling. Scheduling logistics of the instruments became a major issue in planning for the cruise. Many of the problems were related to navigation and will need to be resolved prior to any future operations of this type. For Meg’s cruise, the problems were worked out by May. A diverse set of instruments was deployed. Meg showed a table listing the equipment deployed and utilized and the data collected. See *Appendix IVd*. The logistics of sending the instruments and equipment down to the sea floor were complex. Some items were elevator down. There were some constraints with Jason’s 26 lb lift capability; however, these are being addressed by the new Jason II design. The new high-temp fluid particulate sampler (Butterfield) worked very well. The instrument recorded for the entire summer. The inductively coupled link was used during the cruise. This system, developed by Al Bradley, has been used successfully by a number of parties. It can “eaves drop” on the data. Meg reported that they had no instrument failures. They discovered two new areas, the Cathedral Complex west of MEF and a new field just north of Salty Dawg Field. Meg commented that additional Jason operators should have been assigned to the cruise to support the extensive number of instrument/equipment recoveries. Meg also noted that there were too many PIs assigned to the cruise, nine PIs.

Meg continued by reporting on **Jeff Seewald's** 10-dive program, "Quantitative Investigation of Aqueous Organic Compounds in Ridge-Crest Hydrothermal Fluids." He was a co-PI on Cindy Van Dover's July cruise. The goals of his NSF funded cruise were to develop a gas-tight fluid sampler for quantitative characterization of aqueous organic species and to determine the composition and abundance of organics in Middle Valley and Endeavour vent fluids. His viewgraphs are included as *Appendix IVe*. The system was prototype tested in Sept 99. The sampler was deployed 35 times without malfunction. It was suggested that a reliable, non-hardwired, off-the-shelf, digital communications device such as ICL could improve functionality of the system.

Ian MacDonald – Ian MacDonald provided a report on his ATLANTIS cruise in the Gulf of Mexico in October. NOAA, DOE and MMS funded the program. Ian learned that there was no smooth mechanism for transferring the funds from these agencies to WHOI and this problem should be addressed. Fourteen ALVIN dives were conducted for biological and geological surveying. The science activities included sediment collection at oil seeps, photo/video transects of escarpments, extreme macro, and mussel collections. They were searching for furrows to determine if they are being formed by strong currents and in the present day – yes to both. They were surprised to find that there were no tubeworms at the seep sites. An off-the-shelf Nikon camera placed in a watertight housing was tested using ALVIN. The camera was controlled using a palm-pilot. They hope that this camera will be available to the community in the future. A map of the study area along with photos of the camera are included as *Appendix IVf*.

Peter Rona – Peter reported on his July THOMPSON cruise, Vents Imaging Pacific - VIP 2000. The program was funded by NSF and took place at the RIDGE Observatory - Main Endeavour Field. Peter's viewgraph is included as *Appendix IVg*. The Simrad SM 2000 sonar was adapted for use on ROV Jason to conduct acoustic imaging of the hydrothermal plumes and diffuse flow. Peter reported that the cruise was very productive with eight days on station and seven of these days in the water. The Jason and THOMPSON crews provided excellent support. They did a 24-hour time series at the Grotto vent. Peter showed the views taken from Jason. The group used Doppler sonar data to derive the flow rates in the flumes. They observed low velocities at Grotto. Another innovative method applied during the program was the acoustic scintillation mapping using the SM2000. Peter extended his special thanks to Dan Fornari and Jon Alberts for working out this difficult schedule.

Paul Johnson – Paul reported on his NSF funded "Thermal Grid" program aboard THOMPSON using Jason in September/October 2000. His complete set of viewgraphs is included as *Appendix IVh*. He showed a map of the study site. The goals of the thermal grid program were to:

1. Quantify the thermal budget of crustal formation,
2. Specifically, determine the heat dissipated as diffuse vents and conductive heat flux, and
3. Determine the patterns of crustal fluid circulation.

The cruise was scheduled at the bitter end of the season, but still was very successful. A near-bottom survey of an area of 2500 meters by 650 meters was conducted. The SM2000 was used for high-resolution bathymetry and acoustic scintillation to find diffuse vents. They have been trying to determine if the west wall is venting or has recently vented. The individual sulfide mounds could be observed. They expect to be able to find all of the venting in their survey area. Paul listed the instruments deployed for 12 months. The next leg of Thermal Grid is planned for June 2001. The deployed instruments include MAVs, magnetometer and tiltmeters, thermal blanket, and high- and low-temperature HOBOS. It was non-trivial getting the instruments down to the sea floor. Andy Bowen was extremely helpful. There were a lot of instruments and equipment being sent up and down to the sea floor. The elevator was used non-stop.

Lastly, Paul provided recommendations for equipment modifications for Jason II. The recommendations are included in the appendix. He is advocating that the software be modified so the existing RDI ADCP can be used in a mode that permits collection of water column velocity as well as bottom-track velocity data.

Lisa Levin – Lisa Levin reported on her Jason cruise aboard THOMPSON in October. The operations really pushed the weather window. Lisa's viewgraphs are included as *Appendix IVi*. The program titled, "Patterns of Infaunal Community Structure, Nutrition and Settlement Associated with an Upper Slope Methane Seep" was funded by NOAA/NURP. Lisa reviewed the specific research questions asked by the program. The program required two cruises separated by approximately six months for deployment and recovery of instruments and equipment. Specific requirements included accurate location and relocation of seep patches, precise coring of small-scale seep features, collection of undisturbed core samples, collections of individual specimens, and photographic documentation. They performed stable isotope analyses and sulfide-release colonization experiments. Lisa reported that they had a very successful cruise with five full days of science. The Jason vehicle and its support were excellent. THOMPSON lost a few days at the start of the cruise because of mechanical problems. The video grabs were good, but not publication quality. Lisa recommended a higher quality digital imaging system.

Miriam Kastner – Miriam presented a report on her ALVIN cruise in August 2000 to the Cascadia margin. The cruise, titled "Active C Flux on the Cascadia Accretionary Prism: In-situ Measurement of Hydrocarbon Sequestration as Gas Hydrates and Authigenic Carbonate Deposits" was funded by NSF. She was co-PI with Bobb Carson and Doug Bartlett. The cruise operations included recovery of experimental packages left at ODP Hole 892B and on the seafloor, sampling of gas hydrates and carbonates from the seafloor, and water sampling from ALVIN. Night operations included water sampling from the hydrowire using a rosette and gravity coring. It was a very complicated cruise to determine how methane was coming out of ODP Hole 893B, where it is going in the water column, and whether any is released to the atmosphere. ODP Hole 893B was drilled into a hydrate ridge in 1992. Miriam explained that they deployed the sampling equipment at the site using ALVIN. The ALVIN group was very helpful in advising implementation of the equipment. She showed a schematic of the system, a map of the study area, and charts of the data collected. She showed a photo of the system.

Miriam noted that it was a very interesting and successful cruise. She also recommended that it is very important to be in touch with the ALVIN team early in the cruise planning process. Miriam's viewgraphs are included as *Appendix IVj*.

Break

2000 Science Reports – continued

Dana Yoerger – Dana reported on Russ McDuff's Juan de Fuca cruise, "Precise measurement of the heat flux from a Hydrothermal vent system." The NSF funded cruise took place in August aboard R/V THOMPSON and featured the use of ABE. They have had a lot of successes and the system worked well. Dana showed examples of the various types of data collected including bathymetry data. The last ABE dive of the cruise was 30 hours long and made six passes. In all, ten dives were made with good results on all dives. They achieved coverage of the top and sides of the rectangular volume surrounding the main Endeavour vent field.

Mike Perfit – Mike Perfit reported on his WESTERN FLYER cruise at Blanco Ridge with Maurice Tivey and Debra Stakes. They had ten dives using Tiburon. Maurice Tivey's geocompass and magnetometer were successfully interfaced with the vehicle to permit both instruments to be used on a single dive. A set of 12 wax cores was developed at MBARI for basalt glass sampling from Tiburon. A navigation computer was added to the control room to permit the use of the ArcView-based real-time navigation. The Tiburon rock-coring sled recovered four rock cores in basalt in the Blanco Fracture Zone and the southern Cleft Segment. Two of these will be used for detailed magnetics studies. Nine dives were successfully completed on the Cleft Segment and Blanco Fracture Zone. Only one dive required an early recovery resulting from vehicle problems. An estimated four hours were lost on this dive. All other dives were a minimum of 12 hours duration. One dive was successfully completed at Axial Caldera for instrument deployment and recovery. A total of 137 geological samples, and approximately 700 biological samples were recovered using the ROV Tiburon. They had great success and the vehicle and ship performed well. They made some interesting discoveries.

Marta Torres – Marta Torres reported on her NOAA/NURP funded ATLANTIS cruise in March/April 2000. Seven ALVIN dives were made at the San Clemente Fault Zone and revealed recent rupture of the fault. The cruise objectives included mapping the localities and aerial distribution of venting in a geotectonic/structural framework, evaluating the rates and composition of fluid discharge, determining element fluxes from cold seeps, comparing them to the benthic fluxes on the San Clemente seafloor, and characterizing the mineral deposits associated with the seeps. Marta showed photos of the scarp area. See *Appendix IVk*. Some navigation problems were experienced in the early part of the cruise; however, they were able to find the seeps, which were very rich in barium. The chemistry and biology were very different between the two seep sites. They did a SeaBeam survey and they collected push cores. Marta reported that the new SeaBeam mapping, merged with older data and existing soundings now allows a reconstruction of major faults of the Southern Borderland.

Patty Fryer wrapped up the science presentations by reporting that the ATLANTIS cruise in progress on the Mid Atlantic Ridge (30°N) is very exciting and huge chimneys have been discovered in ultramafic hosted systems. **Donna Blackman** and **Jeff Karson** are co-PIs on the cruise. ALVIN, Argo II and DSL-120 are being used. They are at 30° N.

Public Outreach

Dive & Discover - Dan Fornari reported on the Dive and Discover – Expeditions to the Seafloor program (see *Appendix V*). The program provides near real-time access to deep submergence research via the web, <<http://www.divediscover.whoi.edu>>. The program was coordinated by Susan Humphris, Dan Fornari, and Danielle Fino all of WHOI. The program was aimed at the middle school age level. It offered an opportunity for broad public outreach. More than a million people accessed the site. The website provides daily access to deep submergence and oceanographic research using the WHOI facilities. Dive and Discover was carried out on three different cruises in 1999 and 2000. The next cruise will be in the Indian Ocean in April 2001. The website will be tested and refined during these four cruises. The program provides a stimulating learning environment and promotes a better understanding of ocean sciences. They hope that this will provide a template for future programs. SeaNet was an integral part of this system. Funding for Dive and Discover is provided by WHOI and the National Science Foundation.

SeaNet Status - Steve Lerner reported on the status of the SeaNet system. His report is included as *Appendix VI*. The objective of SeaNet is to extend the Internet to the oceans with worldwide coverage. Six UNOLS vessels have SeaNet installed. They recently received an NSF grant to continue SeaNet operations and install systems on three additional vessels in 2001.

Steve presented some of the highlights of the system. SeaNet supports high speed batch file transfers to and from anywhere on the internet, as well as live interactive Internet sessions at sea. SeaNet offers technical and administrative support. The SeaNet support team is always looking at new technologies. Steve showed the SeaNet usage chart by ship. For additional information on SeaNet, visit their website at <www.seanet.int>.

Steve continued by reporting on the **ROV Virtual Control Van** application. The virtual van is a web-based application that takes “snapshots” of the information that occurs inside the Control Van during vehicle operations and makes this information available for scientists and the public on the web. SeaNet makes this system possible. A demonstration of the virtual van will be available during the lunch break. A description of the system is included in Appendix VI. Steve reviewed the capabilities of the Virtual Van that includes:

- Real-time Monitoring of Control Van for Scientific use and Public Outreach
- On-line Integrated Cruise Synopsis
- Search Capabilities – Keyword, Time, Events
- Plot Capabilities – Geographic and Time series Plots

- Cruise Synopsis Repository Available On-Ship and On-Shore
- Built-in Automatic Data Acquisition System
- Support of Real-Time Playback of Prior Cruise Data Scientific Applications
- Real-time searchable data access for dive planning
- Integrated events, video snapshots, and vehicle data for rapid searching and data analysis
- Plotting capabilities for quality assurance and anomaly detection
- Easily locate specific data within data archive (e.g.; video clips)

The virtual van development was funded by the Keck Foundation as part of the Jason II/SeaNet upgrade effort.

REVEL Project - Veronique Robigou presented a report on the Research and Education: Volcanoes, Exploration and Life (REVEL) program. The project provides general public outreach as well as direct teacher involvement. Selected teachers participate in seagoing research expeditions as formal members of the scientific party. The teachers then bring their experiences from the ship back to the classroom. The program has been running for five years and includes various partnerships including its directors, participating PIs, and webmasters. NSF and the University of Washington support the program. Collaborations have been useful in extending the reach of the program. Collaborators include Pennsylvania State University, the American Museum of Natural History, and Marine Advanced Technology Education (MATE). Since the program's start, they have taken approximately 45 teachers to sea. They have trained some of the earlier participant teachers to be able to bring new teachers to sea. This is helping to make the program more sustainable. The website continues to grow. The daily journal that is maintained by the teachers is updated on the web. Teachers are normally scheduled for their cruises during the summer since this is when the teachers do not have teaching obligations. One teacher participated in Paul Johnson's THOMPSON cruise to Juan de Fuca during the school year; enabling a lot of classroom interaction. REVEL is extending its reach to the European community.

REVEL has been operating on a year-to-year budget. To achieve better long-range planning, they are seeking a 5-year funding source. They hope to include more scientists and expand the program nationally. Information about REVEL is included as *Appendix VII*.

Extreme 2000- Voyage to the Deep - Craig Cary reported on the educational outreach program Extreme 2000 – Voyage to the Deep. During Craig's January ALVIN dive program in Guaymas, students and the public could follow along via an interactive web site, <www.ocean.udel.edu/deepsea>. The site highlighted daily discoveries through video clips, dive logs, journals, and interviews. A resource guide was developed as well as an educational video. *Appendix VIII* includes information about the program. Participation included 800 children from 14 schools. They were provided assistance from a public television station. The project required minimal funding but a lot of effort. There is a lot of similarity between Extreme 2000 and the Dive and Discover program. Craig reported that one of the highlights of Extreme 2000 program was a conference call

between Craig and 11 classrooms in Delaware, New Jersey, and California. Craig provided an audio clip of one of the phone calls. Over a 30-minute period on the sea floor they were able to transmit the phone calls. The students completed a survey at the end of the program and it was very positive. The program received coverage in both the New York Times and on CNN. It was very positive for the students to see this. Another Extreme cruise is planned in 2001.

In closing the outreach presentations, Mike Prince reported that the UNOLS Office will establish a list of outreach programs that are conducted from UNOLS vessels and post these on the UNOLS website.

Agency Reports

National Science Foundation (NSF) - Dolly Dieter began the NSF report by noting personnel changes in the agency. Mike Purdy has moved to Lamont-Doherty Earth Observatory to serve as their new director. Don Heinrichs is serving as the Interim Division Director of NSF's Ocean Sciences. The Division will be reorganized into three sections, Ocean, Integrative Programs, and Marine Geosciences. Facilities falls under the Integrative Programs Section. Linda Goad is joining NSF and will cover scheduling and ship operations funding. Dolly will continue to interact with the DESSC group.

Office of Naval Research (ONR) - Sujata Millick provided the ONR report. The design of the SWATH AGOR 26 is complete. The ship will be operated by University of Hawaii. Vessel construction will begin in January 2001 and should be complete in seven months. The Navy will take ownership in early 2002. The ship is designed to be able to support ROV operations.

Patty Fryer added that the Navy's ATV has been decommissioned. Scripps Institution of Oceanography (SIO) and the University of Hawaii are working on an agreement that will provide shared operational support responsibilities between the two institutions.

National Oceanic and Atmospheric Administration/National Undersea Research Program (NOAA/NURP) - Barbara Moore provided the NURP report. NURP continues to support the National Deep Submergence Facility (NDSF) at \$500k annually. At this time, NURP does not have their budget for 2001. They are currently on a continuing resolution with level funding. However, they have already funded the 2001 NDSF work. They hope to have new funds available to support ocean exploration initiatives in 2002. The funds for ocean exploration will largely fall outside of the NURP budget. They are budgeting 10% of their budget for public outreach and education activities.

National Aeronautics and Space Administration (NASA) – John Rommel provided the NASA report. His viewgraphs are included as *Appendix IX*. Through NASA's Astrobiology Science and Technology Instrument Development (ASTID) program, they are actively looking for instrumentation that will work in the deep ocean. The scope of the program is to develop instrumentation capabilities that will help meet astrobiology

science requirements on future space flight missions, as well as unique astrobiology science objectives on Earth. They would like to advance the development of scientific instruments or instrument components to the point where the instruments could be credibly proposed in response to future flight opportunity announcements. The development of laboratory instruments designed to significantly advance Astrobiology science will also be considered. John reviewed the scientific goals and objectives for astrobiology. They are investigating answers to the questions of "How does life begin and evolve?" and "Does life exist elsewhere in the Universe?" The new instrumentation is desired to address the specific objectives:

- To determine whether the atmosphere of the early Earth, hydrothermal systems, or exogenous matter were significant sources of organic matter;
- To search for evidence of ancient climates, extinct life, and potential habitats for extant life on Mars; and
- To determine the presence of chemical precursors and potential habitats for life in the outer Solar System."

Mars, Europa, Titan, comets, the Space Station, and Earth are areas of interest.

NASA support can be provided for:

- Long lead-time definition studies,
- Innovative approaches that may provide new classes of instruments, and
- Development of new enabling technologies for missions further in the future, and/or for development studies that may advance the technology for a wide range of instrumentation applications.

NASA is receptive to necessary field-testing requirements of new technologies. ASTID Instruments and Technologies will need to operate in harsh environments (temperatures, pressures, vibration, impacts, etc).

John reviewed the types and levels of proposals that will be considered and gave examples of future missions. The ASTID program awards are expected to range from \$30,000 to \$300,000 per year. The proposal deadline is January 19, 2001. Details of John's presentation are included in the appendix. The website <www.nasa.gov>, "research programs" provides additional information.

National Deep Submergence Facility Operator's Report (WHOI) - Dick Pittenger provided a response to some of the user comments. Scheduling continues to be a very challenging process for all parties. There is also a funding problem. In particular, the trickiness of scheduling the NOAA work in 2000 and securing the funds makes things challenging. Dick thanked everyone for his or her patience in this process. The scheduling process and associated logistics needs improving. The demand for use of the facilities has grown; it is not the situation that it was in 1991.

In response to some of the other specific problems identified in the science reports, Dick agreed that there are not enough people onboard to support the Jason operations. This year marked only the second time joint operations with Jason and ALVIN have been carried out. They are still experimenting and will do a better job in the future. As for frame grabs, they are not intended to be of publishable quality. Plans are underway to

obtain recordable material for all video. To address navigation problems, WHOI is implementing RDI on all vehicles. The hand-held digital cameras are very successful. These were funded by a private donor and NSF. Dick addressed weather windows. Operations are often pushing the weather windows. As an example, ALVIN operations in 2000 were scheduled on the Mid-Atlantic Ridge for the middle of December. They got lucky and the cruise was successfully carried out. There are limits to the platforms and this needs to be a driver in creating schedules that work.

Break for Lunch

A Virtual Jason Van demonstration was provided by Steve Lerner during the lunch break.

NDSF Report (Continued) - Dick Pittenger stated that ATLANTIS has now been in operation for four years. A shipyard period is planned in early 2001 as well as ALVIN's overhaul.

NDSF Vehicle Operations Summary - Rick Chandler reported on vehicle operations in 2000. His viewgraphs are included as *Appendix X*. It was a busy year. ALVIN began the year in Guaymas and continued with operations on the East Pacific Rise, off California, at Juan de Fuca, in the Gulf of Mexico, and ending on the Mid Atlantic Ridge in December. The ALVIN operations totaled 330 operating days with 136 dives. The average dive depth was 2200 m. One dive was lost to battery problems and three days were lost to weather. Highlights of the year included the addition of two new pilots and the introduction of the successful Dive and Discovery program.

ROV operating areas included the East Pacific Rise, Juan de Fuca, the Black Sea and the Mid Atlantic Ridge. All three vehicles were used during the year with 20 lowerings for Jason, 13 DSL120 lowerings and 18 Argo II lowerings. The total bottom time was 1273 hours with 1844 km of the seafloor covered. Highlights included the longest Jason lowering of five days.

Vehicle and Ship Upgrades/Overhauls/Synchronization/Response to User Suggestions:

ALVIN - Dudley Foster reported on plans for ALVIN's overhaul. His viewgraphs are included as *Appendix XI*. The overhaul is scheduled to begin on January 2, 2001 and be completed on June 12, 2001. Sea Trials and certification are scheduled for 13-22 June. Progress of the overhaul can be followed on <http://www.marine.who.edu/ships/alvin/alvin.htm>.

The community has provided input regarding improvements and upgrades that they wish to have implemented on ALVIN. Dudley reviewed these suggestions along with WHOI's response.

- Hard mount user video controls – A second pan and tilt will be installed and the observers will be provided with control and flexibility.

- Modify bottom of science racks – Better cushions and more floor space in sphere will be provided for comfort.
- Modify equipment interface for basket – WHOI will provide an interlocking component system.
- Replace external stills with digital camera. – WHOI is not ready to take that step. Digital frame grabs will eventually replace external film cameras. WHOI will retain one Benthos 35mm until a digital camera is available.
- Improved single chips and smaller 3-chip cameras
- Install flat screen displays – pilot and observer monitors will be provided.
- Develop fiber optic penetrator – This is not planned as part of overhaul. WHOI needs to investigate if it is needed. A new penetrator will require an involved certification process.
- Acoustic modem for depth/position telemetry – Increased navigation options will be provided.

Dudley reviewed other planned improvements:

- Digital video recorders – The DV-cam is a professional type system.
- Doppler Navigation - WHOI hopes to have this available when the overhaul is complete.
- Lateral thruster – This will allow for improved position holding.
- Replace port manipulator.
- Install Sunwest SS300 system – This will provide a 100 meter range.
- Beta ALVIN power simulator – This is temporarily at CRCG site, <http://alvin.crcg.edu>

The power requirements of most of these improvements will not have an impact on the length of dive.

Dudley reviewed the ALVIN video duplication process block diagram. He compared the capabilities of the previous duplication system with the new system. The new facility provides 3 channels of simultaneous cloning or overlay of DV Cam tapes, with six identical decks. Twelve hours of video can be cloned in 4 hours. Black and white monitoring of all decks with color monitoring of any selected deck will be provided. The new system is smaller and simpler than the previous one. This is the system that will be used to make first generation video cam tape. The science duplication features were reviewed. The user will need to let the operator know if data overlay on the tape is desired at the start of the cruise. WHOI will provide a list of compatible DV decks. The archive will not have the overlay on it. The master original copy will not have any data burned on it.

A question was asked regarding the cost of a recorder and decoder. The cost is approximately \$5k. The 2-hour DDV tapes cost approximately \$30. There was a discussion on the time stamp issue. The time is always recorded on the data. The PI needs the ability to place it on the video. There was concern that 20 years from now the ability to play these videos will be gone.

Jason, Argo II, DSL-120 – Andy Bowen reported on the upgrade program underway for the ROV and tethered vehicles. His viewgraphs are included as *Appendix XII*. The viewgraphs provide a great deal of information about the new systems. A brief description of some of the plans and features are provided below. A website has been developed that also provides information and status of the upgrade program: <<http://www.marine.who.edu/ships/rovs/upgrades.htm>>. The key project milestones were presented. Acceptance testing of DSL120a sonar electronics is planned for March. Final testing and sea trials of DSL120a will be in June with the first deployment in August on Eli Silver’s cruise in the Huon Gulf. The decommissioning of Jason will be in November 2001. By May 2002 Jason II will be ready for science.

Andy provided the ROV upgrade progress summary. A science design review meeting was held at the June DESSC meeting. Some of the highlights of the project include selecting the telemetry system, adding personnel, 3-D modeling of the Jason II design, completion of the Jason II and DSL120a overall layout, and identification of the thruster candidates. The full list of items is included in the appendix. The new power delivery system plans are well underway. The new system will use .680” cable. The new system will deliver 18kW at 2500VAC, as compared to the current system’s 8kW at 2000 VAC. The final power level may change depending on the cable capability. Andy reviewed the Jason II telemetry specifications. A lot of time has been devoted to the modeling of the system. Jason II will have some unique capabilities, mostly in manipulation and sampling capabilities. Andy presented the computer-automated model of the Jason II vehicle.

The floor was then open to questions:

(Q) When the Jason II design is finalized, will the model be available to the community for viewing? (A) Andy explained that it would be available and in fact it would be a useful cruise planning tool.

(Q) Should two vehicles have been built? (A) This is a funding issue. An estimated cost for the system is roughly \$5.7 m. Funds permitted the construction of one vehicle at this time.

(Q) Is keeping Jason operational an option? (A) Andy explained that Jason’s telemetry system is ten years old and it is not feasible to keep it running.

(Q) Is there a Medea II as well as the Jason II? (A) Yes. It will have the ability to support a tethered support system.

(Q) Will the Jason II manipulators have the same capability as Alvin’s manipulators? (A) Yes, they will use T-handles.

ATLANTIS Shipyard Plans - Dick Pittenger reported that ATLANTIS will arrive at homeport in Woods Hole tomorrow (12/15). Dick’s viewgraphs are provided as *Appendix XIII*. ATLANTIS plans call for dry-docking during its shipyard visit. Dick

reviewed the shipyard plans that include a long list of improvement items. The cost for implementing the total list of improvements is estimated at \$1.2M; however, the funds available for this shipyard period are \$650k. The remaining \$550k of improvements will be deferred based on available funds. The funding came from a variety of sources; ship ops funds, major maintenance reserve, and ONR supplementary funding. The core maintenance includes underwater body, topside painting, renewing doors, new sewage pumps, engine repairs, and ABS and USCG inspections. Other projects include HVAC improvements, bow thruster quieting and improved 01 deck access topside aft. WHOI has decided to remove the air compressors from the ship because they have never been used. This will free up some space aboard the ship. Cavitation and noise problems will be addressed. The anchor problems have already been remedied. Most of the shipyard items are fairly routine. The drain problems identified by Cindy Van Dover will be addressed. The option of adding a work sink on the outside deck will be considered. There was some concern about the items that did not get funded. Dick indicated that community input regarding these items would be helpful.

Archiving Update - Dan Fornari provided an update on WHOI outreach activities and data archiving. His viewgraphs are included as *Appendix XIV*. Dan explained that WHOI, as the UNOLS National Deep Submergence Facility Operator, undertakes outreach activities on behalf of the ocean sciences and deep submergence research communities. Part of this responsibility entails maintaining and providing access to the Deep Submergence Data Archives at WHOI.

Dan gave the status of the archives. Data from ROV and tethered vehicle cruises are current to the Lisa Levin cruise in October, 2000. Data from ALVIN cruises are up to date including Ian McDonald's Gulf of Mexico cruise in October. For ten ROV and Tethered Vehicle expeditions 1,527 video and data tapes have been archived. 745 hi-8 videotapes were archived from ALVIN's twelve dive series. The full list of archived media is included in Appendix XIV. Approximately 35 requests for deep submergence data of various types have been made during 2000.

Dan reviewed Museum and other Outreach Activities. These include the WHOI-BBH "Extreme Deep" Exhibit. "Extreme Deep" is an exhibit that includes models, displays and videos about deep sea vehicles including ALVIN, Jason, ABE, and REMUS; hydrothermal vent animals and geology; a section on shipwrecks; and other displays related to deep sea exploration. "Extreme Deep" has been on display at the Boston Museum of Science, the Children's Museum of Indianapolis, and the Oregon Museum of Sci. & Industry, Portland. Over 700,000 people have viewed "Extreme Deep" at these sites.

In other outreach activities, WHOI maintains an Exhibit Center that provides information and displays of oceanographic and deep submergence science and research technologies. Each year approximately 30,000 people visit the WHOI Exhibit Center. WHOI also maintains a media relations office that handles approximately 2,000-3000 requests per year for visual and other materials related to deep submergence. Printed articles in newspapers and magazines number ~500 per year and are primarily handled through this

office. This office also coordinates use of deep submergence archive footage for educational television programming and film and TV specials. The total number of requests to the WHOI Media Relations Office for imagery during this year was 248 (179 still image requests, 48 video image requests and 21 combination requests)

Dan reviewed the annual expenses and revenues for CY2000. The annual expenses related to WHOI's exhibit center and media relations office is approximately \$400,000. Maintenance of Deep Submergence Archives is approximately \$75,000. The approximate revenue from various sources is approximately \$55,000.

Future outreach efforts include:

- 1) Continuing the national tour of "Extreme Deep" exhibit,
- 2) Collaboration with National Geographic Television on weekly science news programming,
- 3) Assisting S. Lowe and R. Lutz with an IMAX movie on hydrothermal vents partly funded by NSF to be filmed next summer on MAR using Alvin, and
- 4) Continued efforts at contacting various media organizations to encourage highlighting of deep submergence and oceanographic science and technology.

Long-Range Planning, Expeditionary Voyages, and Vehicle Access - Jon Alberts reviewed ALVIN and ROV 2001 scheduled operations. His viewgraphs are included as *Appendix XV*. ATLANTIS will operate in the early part of the year in the SE Atlantic and the Mid Atlantic Ridge (MAR) without ALVIN. ALVIN operations will begin in June on the MAR. The remainder of the year will be on the East Pacific Rise. In 2001 ALVIN will not operate at Juan de Fuca. The ROVs will be busy in 2001 with operations planned in the Indian Ocean, off California, Juan de Fuca, Huon Gulf and the East Pacific Rise.

Jon continued by showing the requested ALVIN and ROV programs for 2002 and beyond. The geographic areas of interest were also shown. Jon explained the difficulties in compiling the lists. Many of the vehicle and ship time requests that are posted on the website have not been updated to show the current funding status. For 2002 there are many requests, of these, quite a few are already funded.

6k to 7k Meter New Occupied Submersible Capability – Bob Brown provided an overview of the WHOI study, "Comparison of Options for an Improved Manned Deep Submersible Vehicle for Research." The study has been posted on the WHOI website at <http://www.marine.whoi.edu/ships/SeaCliff/report.htm>. His viewgraphs are provided as *Appendix XVI*. The study investigated options for maintaining a U.S. 6,000 m manned capability. As part of the study WHOI:

- Assessed SEA CLIFF equipment,
- Surveyed other 6,000 m submersibles,
- Surveyed current technologies,
- Surveyed users and operators,
- Evaluated possible modifications to ALVIN and / or Sea CLIFF,
- Investigated hull replacement / modification possibilities,

- Conducted a cost analysis on depth and construction of a new submersible, and
- Evaluated the various options.

Bob reviewed the options, as well as, WHOI's recommendations. Based on their survey regarding an improved submersible, the study concentrated on efforts to rearrange the viewports, improve imaging, power capacity, bottom time and manipulative capabilities. WHOI's study concludes that a new submersible will provide the best opportunity for the US to regain its 6,000 meter manned capability and to achieve significant improvements in other areas. Bob reviewed the improvements that are listed in the appendix. Lastly, Bob showed a timeline for construction of a new submersible. The entire process is estimated to take four and a half years. Dick added that WHOI is drafting a proposal for conceptual development of the new submersible. The cost for the entire project is estimated at \$14 million. The new submersible would be operated/scheduled the same way as ALVIN is managed.

The topic was open for discussion. (Q) Would the new sub would be a replacement for ALVIN. (A) Yes. (Q) What kind of batteries will be used? (A) The batteries will likely shift to NiCads. (Q) Is a new submersible needed, or should the funds be used to construct say three new ROVs? (A) Patty Fryer indicated that there are a number of justifications for a new submersible:

- Maneuverability
- Un-tethered operations
- Manned presence
- Power capability.

She added that the majority of the abstracts submitted for the DESCEND workshop indicated a desire for a deeper diving capability.

Break

ATV Status Report - Patty Fryer reported earlier in the meeting.

Discussion of follow-up for DESCEND Workshop Recommendations - Patty Fryer reported on the various activities in response to recommendations made at the DESCEND workshop:

Shallow Water Liaison to DESSC – There was concern that the needs of the shallow water community are not being heard or met. To try to address this problem, the DESSC has invited Shirley Pomponi to serve as an advisor to their committee. Shirley introduced herself and explained that at the workshop there seemed to be a consensus that there is both a deep and shallow element to the submergence future facility needs. There is a good deal of interest in gaining access to the full suite of vehicles, those that exist now as well as future developments. Several shallow water facilities exist. The key to their scientific use is access and funding. Availability is not a problem, but funding is the issue. Some of the shallow water facilities will need upgrading. Shirley suggested that a coordinated management and scheduling of all facilities is needed.

DESCEND Website and Brochure –Patty continued with a review of the DESCEND brochure. The document is the executive summary of the DESCEND proceedings report. Patty reviewed the brochure findings and recommendations:

Key Findings

1. The oceans remain a scientific frontier for the 21st century, with broad societal and academic relevance to issues such as the role of the oceans in moderating global climate change, and the limits of life-processes in extreme environments on Earth and other planets.
2. Dramatic advances in submergence vehicle technologies and instruments, including autonomous underwater vehicles (AUVs), occupied submersibles, remotely operated vehicles (ROVs), specialized sensors, and in situ samplers, now provide the potential for unprecedented access to the oceans and sea-floor. These new technologies and vehicles will foster a revolution in our ability to synoptically measure the chemical, biological and physical processes that occur in the oceans.
3. New mechanisms are required to improve access to all types of submergence vehicles and tools by the scientific community. These should be developed in order to address issues relating to scheduling existing assets, conducting field work outside traditional operating areas, and the need to respond to time-sensitive processes at the seafloor or in the water column (e.g. submarine eruptions). The broadest range of vehicle capabilities needs to be provided to investigators throughout the U.S. while preserving the existing capabilities achieved by our National Deep Submergence Facility.
4. Long-standing U.S. leadership in submergence science and technology is being challenged by other countries, principally France, Germany and Japan. These countries have greater funding levels for submergence science and vehicle facilities and long-standing support for the advancement of submergence technologies.

Recommendations

- Develop new sensors and tools
- Accelerate development of autonomous underwater vehicles (AUVs)
- Construct a new, state-of-the-art, deep diving (>6000 meter) occupied submersible
- Plan for a new, robust deep-diving (>7000 meter) ROV for science
- Increase access to submergence vehicles and tools
- Convene a submergence technology meeting

The full proceedings of the DESCEND workshop as well as the brochure are posted on the UNOLS website at: <<http://www.unols.org/dessc/descend/descend.htm>>. The brochure is being widely distributed throughout the community.

Technology workshop - As a next step, we would like to convene a technology workshop. The workshop would provide an opportunity for engineers, scientists, and technicians to review the available technologies and future technological directions. The workshop participants will be asked to identify research and development priorities and strategies for acquiring new sensors, tools and approaches to submergence science. Jim Bellingham is planning a robotics workshop at MBARI. His plans include a day aboard WESTERN FLYER with the ROV Tiburon. His workshop would include hands-on demonstrations and would address vision systems, navigations, imaging, etc. His workshop would be complimentary to the DESCEND technology workshop. The option to hold a joint workshop instead of two separate meetings will be further explored. A UNOLS proposal for support of a technology workshop will be submitted to the agencies.

The Ocean Exploration Panel Report - Dan Fornari reported on the Ocean Exploration Panel that he participated in over the past year. Shirley Pomponi was also a member of the panel. Realizing that there is still much to learn about the oceans, former President Clinton directed the Department of Commerce to convene a panel to recommend a national strategy for ocean exploration. The panel included ocean explorers, scientists and educators from both academia and industry. Agency Science Advisors interacted with the panel. The recommendations of the panel are just released and a Press Conference is planned tomorrow during the AGU Meeting. The panel's report is titled, "Discovering the Earth's Final Frontier: A U.S. Strategy for Ocean Exploration". Information about the Ocean Panel and can be found on the web at: <http://oceanpanel.nos.noaa.gov/>. Some of the recommendations of the panel report dovetail nicely with the interests of deep submergence science. The panel identified the following key objectives of an Ocean Exploration Program:

- Mapping the physical, geological, biological, chemical and archeological aspects of the ocean to broaden the U.S. knowledge base.
- Exploring ocean dynamics and interactions at new scales.
- Developing new technologies.
- Public outreach and education is a major goal.

The panel recommends that an Ocean Exploration Program be established for an initial period of ten years at the \$75M/year funding level. The objective is to get new funding into the system.

NEPTUNE - John Delaney continued with a discussion of the NEPTUNE Project. Details of the NEPTUNE project can be found on the website, www.neptune.washington.edu. NEPTUNE proposes real-time, long-term ocean and earth studies at the scale of a tectonic plate. They have conducted a feasibility study of the project. The study was funded by NOPP and the NEPTUNE Phase I partners. The proposal calls for laying out 3000 km of cable and 31 nodes on the plate. Some of the characteristics of NEPTUNE include:

- tectonic plate scale
- huge data capacity
- real-time data return
- robust design

- available for 20-30 years.

There are events at the plate scale that have not been observed. Distributed sensors that report back to land are needed. No single group can afford this; it must be a coordinated effort. Some potential benefits of NEPTUNE include a new approach at research, educational and outreach, and digital, high-resolution images that can be beamed back to the classroom in real time. John reviewed the timeline and progress made to date.

General Business

- 2001/2002 DESSC Planning Meeting – Patty Fryer reported that we hope to have a DESSC meeting at The Oceans Science meeting in 2002. We need to reach out to the biological community. Stay tuned. DESSC also plans to hold their traditional meeting at the Fall AGU meeting in 2001.
- The DESSC Terms of Reference are awaiting endorsement from the UNOLS Council they are on the web.
- DESSC Call for Nominations – Thanks goes to Cindy Van Dover for her service on DESSC. There are four members who are completing first term, all have agreed to run again. A call will go out for Cindy's vacant seat.

Adjourn