DEEP SUBMERGENCE SCIENCE COMMITTEE

28-29 May 1996
Carriage House, Woods Hole Oceanographic Institution
Woods Hole, MA

MEETING MINUTES
EXECUTIVE SUMMARY

Appendices

DATE: July 22, 1996
TO: U.S. Deep Submergence Community
FROM: Mike Perfit, DESSC Chair
SUBJECT: Executive Summary of May DESSC Meeting and Status of Deep Submergence Science

The current status and future potential of U.S. deep submergence science continues to be positive. Several factors have contributed to this favorable outlook. They include: 1) the completion of the new deep submergence support ship R/V ATLANTIS (expected in early 1997), 2) major overhaul of ALVIN which will be completed in spring 1997, and 3) excellent capabilities and greater demand for the ROV Jason, ARGO-II and the 120 kHz sonar which have a full operating schedule into 1997 and funded work into 1998. The integration of the UNOLS deep submergence facilities and expanded capabilities afforded by submersible, fiber optic-based ROV and tethered vehicles have placed U.S. deep submergence research on the threshold of a new era of scientific discovery.

Many of the details of the ATLANTIS delivery and ALVIN overhaul were recently discussed at the DESSC

meeting held at Woods Hole on May 28-29. The minutes of the meeting are available on the UNOLS WWW site (http://www.gso.uri.edu/unols/unols.html). In order to facilitate access to DESSC and deep submergence information, in the future, the community will be notified electronically when the minutes or other important new items are posted on the UNOLS Web Site. Hard copy will be available only upon request to the UNOLS Office.

In this memo, I have highlighted some of the results of our most recent and very productive meeting. I would also like to keep you apprised of the current timetable for R/V ATLANTIS delivery and testing, and the tentative 1997 schedule for ALVIN, Jason and the tethered vehicles.

R/V ATLANTIS is well on it's way toward completion and is expected to be delivered to WHOI at the end of the first quarter of 1997. The conversion to support the launching and recovery of the National Deep Submergence Facility vehicles will already have been implemented on delivery. I had the opportunity to see the ATLANTIS (and the REVELLE) in the shipyard in March and was very impressed with the shipboard facilities. The ATLANTIS II was retired from service in early July and sold. The proceeds from the sale will be used by the Federal agencies and WHOI to help defray the costs of the ATLANTIS conversion. The ATLANTIS II will sail to a shipyard in the Gulf of Mexico in late July for cross-decking the stern frame and other equipment. ALVIN was off-loaded at WHOI in preparation for a major overhaul that will commence in the fall of 1996 and continue into the spring of 1997. WHOI expects that ALVIN will be loaded on the ATLANTIS after a short certification period, and will be ready for science trials in June, 1997. The time for the integration of the ROV systems into the new ATLANTIS is still uncertain because of the busy ROV schedule projected for spring and summer of 1997, however, WHOI, DESSC and the Federal funding agencies recognize the importance of fully integrating the systems, and an effort is being made to work out the logistics so that ALVIN and the tethered systems can be operated from R/V ATLANTIS in the summer/ fall of 1997.

The ALVIN schedule for 1996 was very light with only 49 dives and 93 operating days. This resulted from a variety of factors including: budgetary constraints, declines of field proposals, the requirement to take the AII out of service in order to avoid further costs in maintaining the vessel to ABS standards, and to coordinate the cross-decking of various pieces of ALVIN related handling equipment (e.g. A-frame) from the AII to R/V ATLANTIS.

ROV Jason and tethered vehicles have three funded field programs that will be carried out in calendar 1996. Another five programs are very likely to be funded for 1997-1998 and a few additional programs remain under consideration. DESSC had hoped that the ROVs could be integrated with ALVIN as early as this summer during engineering tests, but due to heavy science usage this may not occur until later in 1997. We will continue to support the integration of the deep submergence systems at the earliest possible time. In the meantime, the ROV and tethered vehicles will remain in a "fly-away" mode for use on appropriate UNOLS vessels. Recent reports from the KNORR, which is working at the Lucky Strike hydrothermal site on the Mid-Atlantic Ridge near 37°N, indicate that ROV Jason, ARGO-II and the 120 kHz sonar systems have been functioning very well and that the initial data are of excellent quality and resolution. In addition, Jason has been very successful sampling hot (>300°C) hydrothermal fluids, various biological specimens and basalt and sulfide samples. A mid-cruise report on their progress will be posted on the WHOI DSOG web site (http:// dsogserv.whoi.edu/). Look under "New" to find this report.

DESSC has worked with the operator and the community to define a priority list for ALVIN upgrades (see DESSC meeting ***Appendix VII***). Top priorities include upgrades of the power system and of the data logging and video systems for the vehicle. WHOI provided the committee with a study of power usage, battery types, and future power options for ALVIN (see DESSC meeting ***Appendix IV***). WHOI DSOG is currently testing different batteries which seem highly promising and it appears likely that new batteries and battery monitors will be installed during the next overhaul. The final work to be completed as part of the ALVIN Imaging Upgrade Proposal funded two years ago will be to install a pan-and-tilt unit, and new 1- and 3-chip color cameras during the ALVIN overhaul. These new cameras will provide compatibility and expanded sparing of imaging systems for both ALVIN and Jason. The new navigation software (Pelagos WinFrog) for LBL and SBL navigation has been purchased and is being implemented by WHOI DSOG.

DESSC is working with the operator to structure an upgrade proposal that provides for commencing and implementing as many of the high-priority upgrades as possible during the 1996-1997 overhaul period, and completing them in 1997-1998 as permitted by funding and engineering time. Additional upgrade items relating to vehicle systems (e.g. variable ballast system for ALVIN) and science sensors are being prioritized for the funding agencies so that they can consider them and plan for them appropriately. In addition, DESSC will work on upgrades for Jason and in long-range planning for technology upgrades that will continue to improve the capabilities of the National Deep Submergence Facility.

Long-range planning for deep submergence research is essential if we are to take the vehicles to distant parts of the ocean. A group of ALVIN and tethered vehicle proposals for research along the southern EPR near 17oS now have been funded and it appears fairly certain that R/V ATLANTIS will be in the southeast Pacific during the late fall-winter of 1997-98. The ATLANTIS must return to San Diego for post shakedown availability and final contract trials between in the spring of 1998. After that time period, work in the traditional operating areas of the Juan de Fuca Ridge, California Borderlands and the northern EPR is most likely. Operational plans beyond late 1998 are uncertain and will be dictated by proposal pressure. However, both WHOI DSOG and the Federal funding agencies are supportive of expeditions to the Hawaiian Islands and the western Pacific in the near future.

DESSC will work with WHOI DSOG, the Federal funding agencies, and the community to try to coordinate work in other remote areas so that they can be planned for effectively. This includes alerting the community to logistical opportunities for future work, and trying to organize planning meetings/workshops to foster coordinated proposal efforts outside the traditional operating areas of the Juan de Fuca Ridge, northern EPR and Mid-Atlantic Ridge, that could take place over the next five-ten years. Patty Fryer (new DESSC member) will be participating in a workshop in Japan in late July that will be exploring the possibility of joint U.S.-Japan deep submergence research in the Izu-Bonin-Marianas arcs. She has agreed to act as the contact person for coordinating and promoting research plans for the western Pacific.

Proposal pressure to use the National Deep Submergence Facility vehicles remains a top priority in order to keep the schedule for work as robust as possible, within the constraints of available funding. I ask all of you interested in deep submergence research to be aggressive in terms of planning your future field work and making the most of the new integrated deep submergence facilities available to the community. DESSC and WHOI DSOG are committed to assisting proponents as much as possible in regards to providing technical and logistical information that can be used for planning purposes. Alternate sources of funding for deep submergence work (i.e. outside the primary U.S. Federal funding agencies) are also being sought. WHOI has

worked closely with the Federal funding agencies and DESSC to bring to fruition some external funding for applied deep submergence work in 1997 for Jason and the tethered vehicles. I encourage all of you who have been waiting for the expanded capabilities of the new support ship and vehicle facilities to come on-line, to start submitting research proposals for field programs in the coming years and into the next century at the earliest possible time.

Meeting Minutes

The following minutes represent a summary of the activities and discussions that took place at the DESSC Committee meeting that was held at WHOI on the 28-29 of May, 1996. The meeting followed the agenda, ***Appendix I***, except as noted in these minutes. The attendance list for the meeting has been included as ***Appendix II***.

Tuesday, May 28

I. **Welcome, Introductory Remarks, New Members, Agenda Items:** Mike Perfit, DEep Submergence Science Committee Chair, called the meeting to order at 0830 hrs and welcomed the Committee and the new members, Patty Fryer, University of Hawaii and Marvin Lilley, University of Washington. Marv will need confirmation by the Council when it meets in July. Mike announced that J.C. Sempere regretfully resigned from the Committee having taken a position in industry. Marvin Lilley will be his replacement on the Committee. Mike also welcomed Barbara Moore of NOAA/NURP to the meeting.

   The terms of Dan Orange, Jim Bellingham and Bob Collier will be up this year. All three are eligible for a second three year term. Dan and Jim agreed to serve and were confirmed by the Committee. Mike will contact Bob and encourage him to stand for re-appointment. (Bob has since agreed to serve another term.)

   The UNOLS report was given by the UNOLS Chair, Ken Johnson. Ken reported that the publication, "Projections for UNOLS' Future - Substantial Financial Challenges", (referred to as the Betzer report) has been distributed to the community. It presents a projection of a significant shortfall in funding for the UNOLS Fleet by the year 2000 unless major changes are forthcoming. Finding new partnerships is one of the recommend efforts. This seems to be happening with NOAA and NAVOCEANO with both of these agencies looking toward UNOLS for ship time. Ken also noted the CORE efforts for a National Ocean Partnership Act which includes $7.5M in the 1997 budget for the Navy to use additional ship time for survey work. Ken reported that a UNOLS subcommittee consisting of himself, Bob Knox, Bob Wall and Jack Bash are meeting with NOAA to establish the process by which NOAA can make better use of the UNOLS Fleet. There will also be a subset of this group who will work with NOAA on fisheries issues and their need for ship time. The White Paper, "UNOLS: Celebrating 25 Years as the Nation's Premier Oceanographic Research Fleet", explains the advantages of using UNOLS vessels.

   Ken told the Committee that UNOLS will be establishing another committee to work with the U.S. Coast Guard and their icebreaker fleet. The committee will be named the Arctic Icebreaker

Coordinating Committee (AICC) and will be chaired by Jim Swift. Ken reported that the Fleet Improvement Committee (FIC) was developing an Interim Fleet Improvement Plan (IFIP) that would address the dynamic activities currently being experienced with respect to funding shortfalls and ship time availability. Also in this consideration is the 1997 DOD budget item that will authorize $45.5M for U of Hawaii to build a SWATH vessel.

II. **Accept Minutes:** The minutes of the December, 1995 and May, 1995 meetings were accepted as written. The community can access the minutes on the UNOLS WWW site (http://www.gso.uri.edu/unols/unols.html). From this meeting on, only the DESSC will receive a hard copy but the rest of the community will be notified that the minutes are on the WWW and a hard copy is available from the UNOLS Office. UNOLS has integrated their master address list with that of the RIDGE Office.

III. **National Facility Operators Report:** Rick Chandler opened with a brief summary of the 1996 schedule of the ATLANTIS II and ALVIN. This will be a short year with 49 dives and 93 operating days. AII will return to WHOI on 2 July after its final cruise. ALVIN will be off-loaded for overhaul and the ship will sail to a shipyard in the Gulf of Mexico for cross-decking the stern frame and other equipment.

Andy Bowen reported that the ROV/tethered vehicles have four funded cruises but the schedule is not fixed at this point. Discussion followed regarding the end of the year ROV operations. The tentative schedule for the summer to fall of 1996 looks good with Fornari, Johnson and Haymon cruises. There was discussion regarding where the Hey cruise could fit into the 1996 schedule. With a busy end of 1996 and a busier 1997 schedule coupled with the ALVIN overhaul, the DSOG operating personnel will be stretched tight.

Dick Pittenger passed out a brochure that documented the facilities and dimensions of the ATLANTIS (***Appendix III***) and reported that the conversion to a submersible/ROV handling ship is well underway. AII's A-frame will be installed on the ATLANTIS with some revisions. The hanger will be extended and winches/booms installed. The ATLANTIS will look like it was designed from the keel up as a support ship. The ATLANTIS is scheduled to be delivered by the shipyard 15 April '97 arriving at WHOI 6 May '97. After a short certification period during transit, ALVIN will be loaded aboard having completed its overhaul. The time for the integration of the ROV system into the new ATLANTIS is still unknown because of the busy ROV schedule projected for spring and summer of 1997. More discussion on the ROV cruise scheduling for that time period is necessary. The Committee stressed the need for testing the combined ALVIN/tethered vehicles operations before funded science programs begin. Funding constraints and a busy ROV schedule will make this difficult. The timetable for bringing the ship and deep submergence vehicles into service is included in Appendix III. At the present time, the ATLANTIS is scheduled to be ready for science in June of 1997. Post shakedown availability and final contract trials for the ATLANTIS are scheduled for the window of 30 January '98 to 30 March '98.

Barrie Walden recently had provided the Committee with a study titled, "ALVIN Battery Evolution", which documents a study of power usage, battery types and future power possibilities for ALVIN (see ***Appendix IV***). Several members of the Committee praised Dudley Foster (author of the study) for the thorough and excellent work. A discussion of the study followed. The WHOI operators are currently testing Trojan batteries which seem highly promising and it appears likely that new batteries, (Trojan, Exide or Chloride Canada) will likely be installed during the next overhaul. New battery monitors will

also be installed at this time. The Committee offered several suggestions concerning power use aboard ALVIN. These included the need to rewrite the information for ALVIN's different power requirements. Scientists need to know their options. There is a need for pilot and scientist training with regard to power usage and conservation. The possibility of adding a third battery was discussed, however, this increases weight requiring the need to add flotation. The Committee suggested that a discussion of the ongoing evaluation of battery technologies could be included at the next DESSC meeting. The timing for new battery configurations was discussed. No conclusions were reached, however, it appeared that the 1999-2000 overhaul period seemed most likely because of the necessity to do the required engineering and planning for any major battery/power change to ALVIN.

Barrie continued with a discussion of several upgrade projects funded as part of the imaging proposal. The only two items remaining to be completed from that work are the pan-and-tilt which has not progressed as quickly as originally intended because of a lack of shore-based engineering time and ongoing evaluation of commercially available pan and tilt mechanisms. One unit was tested during engineering dives in September, 1995. Discussions are ongoing with that vendor and MBARI regarding that product and WHOI is evaluating other options for building the pan-and-tilt in-house. Because of the current availability of the Osprey 3-chip camera on ALVIN since 1993, the purchase of a new 3-chip has been postponed until the 1996 overhaul to continue to take advantage of improvements in video technology and decreasing costs for these cameras. Both the pan-and-tilt and the new 3-chip color camera will be installed during the ALVIN overhaul. In addition, the new 3-chip camera will also be able to be used with Jason. WHOI was asked to provide the DESSC and NSF with documentation regarding their final implementation of a pan-and-tilt and purchase of a new 3-chip camera.

Andy Bowen provided the Committee with information about the ROV integration on the ATLANTIS. It is estimated that the time necessary to mobilize should be significantly less than that required for ALVIN. Power cables will be permanently installed which will facilitate installation. Port-side deployment of the vehicle is planned. The WHOI traction winch, which will have a fiber optic cable on it, will be mounted below deck. At present there are no plans for deploying the ROV concurrently with ALVIN although it was noted that Jason had operated concurrently with DSV TURTLE in the Gulf of California in 1993.

Andy provided a slide showing the DSOG Unmanned Vehicle Status. This is included as ***Appendix V*** and provides information on Jason/Medea, ARGO II and DSL 120. Andy continued with details on the Jason manipulator tests and the navigation upgrades carried out in 1995 and 1996. This information also is included in ***Appendix V***. The WinFrog navigation software system, purchased as part of the ONR-funded contribution to the DSOG navigation upgrade, is being installed and will work in parallel with the present DSOG navigation system until it has been thoroughly tested and incorporated. This navigation system will also be available for ALVIN when it is operating off the ATLANTIS. Recent upgrades and changes to the ROV systems will be incorporated into DSOG's "blue book" (and WWW site) on technical specifications early next year. The Committee noted that it will be very important to keep scientists aware of the changes in the systems and to make sure that new users are brought up to speed before using the equipment.

Dan Fornari provided a demonstration and discussion of a remote temperature logger that will be used with the high-temperature, major fluid samplers. The device is based on an inductive couple link that

will permit a small sending unit and sensor at the nozzle tip of each bottle to transmit the temperature of the fluid being sampled in real time to inside the sphere in order to maximize the quality of the samples. The logger was funded through a WHOI technical grant. The instrument was tested on the EPR during a dive series in April. With the exception of an alignment problem, which was resolved, the design works well. The unit is being modified so that it can also be used for Jason water sampling operations and it will be tested on the ROV cruise to Lucky Strike on the MAR in July, 1996 (as we go to press, reports from KNORR indicate that the water sampling and temperature measurements have been very successful).

A Benthos DSC Camera was tested on ALVIN with only marginal results A complete summary and interim report on digital imaging systems for the National Facility deep submergence vehicles has been completed and posted on the WHOI-DSOG web site (http://dsogserv.whoi.edu/HDTV/hdtv.htm) and distributed to DESSC and UNOLS.

The Committee broke for lunch.

Mike Perfit provided the Committee with recent ALVIN user comments. Most were quite laudatory praising the shipboard operations group and crew for professionalism and dedication. The few corrective comments were related to coordination of information and an apparent lack of communications. As in the past, concerns over morale of the shipboard technical group were sighted and the operator was asked to continue to make improvements in this regard.

IV. **Review and Summary of Submitted Proposals:** Jack Bash and Don Moller presented a summary of ALVIN/ROV requests for 1997. The summary included letters of intent. This summary is included as ***Appendix VI***. Dolly Dieter informed the Committee that science funding decisions were not yet complete for 1997. Even though funding decisions are not complete, the ROV schedule has the potential to be quite full in 1997. Possible scheduling conflicts in 1997 may mean that it will not be possible to integrate the ROV and tethered vehicles into the new ATLANTIS and ALVIN shipboard routine until later in 1997. There is a British governmental proposal to use the ROV system in the Western Pacific in early 1997 that is still under consideration. In addition, R. Ballard has also proposed a cruise in the Mediterranean for late spring/summer 1997. If these cruises materialize, they would provide funding from outside the normal sources and would help both the DSOG and the Class I ship operations. The schedule for funded cruises will depend on vehicle logistics, UNOLS vessel availability, and whether the British work is funded.

V. **Presentation and Discussion of ALVIN Upgrade List:** Dan Orange and Cindy Van Dover assembled a list of ALVIN upgrades which were developed from community input. The summary is included as ***Appendix VII***. A suggestion was made that ROV upgrades also be considered in the future as additions to the list. Upgrades have been ranked by priority based on compilation of the evaluations made by all the DESSC members. Significant discussion followed causing a reordering of some priorities and additions to the list. An updated list will result from these discussions and further study.

Barrie Walden replied to a number of points raised during the discussion of upgrades and informed the committee that his ALVIN group does not have a great enough number of engineers to integrate the navigation, data logger and video systems. The integration of the ALVIN organization with the ROV group provides an excellent pool of engineers. In the long run, this should help with improvements but additional funding is needed. For now, they must focus on the top priority overhaul tasks.

Discussion regarding the strategy to approach upgrades during overhaul continued during the second day of the meeting (also see Section VII). The Committee stressed that this overhaul period would be an opportune time to attempt some of the upgrades. In particular, upgrades to the batteries/power systems, digital imaging, vertical ballast system and the integrated video/navigation/data logger systems were noted as being first priorities (see ***Appendix VIII***). A lack of personnel because of the busy ROV schedule will limit the extent to which any upgrades can be accomplished during the upcoming overhaul. It was suggested that engineering studies should be part of the operations proposal for 1997 and beyond and that these studies should be initiated as soon as possible. D. Fornari, J. Bellingham and H. Milburn agreed to serve as the DESSC Technology Subcommittee to aid in writing the proposal and act as an advisory body to work with WHOI personnel. It was agreed that the subcommittee and WHOI operators would decide on a path to follow for the proposal before October when the proposal is due.

8:30 a.m. Wednesday, May 29

VI. Agency Reports:

NSF - Don Heinrichs first reported on staff changes at NSF (***Appendix IX***). Sandy Shor will move from the Ocean Drilling Program to be Instrumentation and Technical Services Program Director replacing Lisa Rom who will be on one year maternity leave from Aug '96-Aug '97. Sandy will also be Program Director of Interamerican Institute (IAI). Don followed with a summary of those NSF persons who will be the UNOLS Liaisons: Council, D. Heinrichs; RVOC, SSC and DESSC, D. Dieter; RVTEC, L. Rom/S. Shor; FIC, D. West.

Don reviewed the 1996 budget which has been approved by Congress. The Ocean Sciences budget is $194M which includes a $0.9 M or 0.5% increase. Ocean Science Research will receive a $2.3M increase, Oceanographic Centers & Facilities a $1.5M decrease and the Ocean Drilling Program received a $0.1M increase. NSF is planning to increase emphasis on research although funding is expected to be flat for the immediate future. Funding for unsolicited proposals will increase from $120.6 to $121.9M but imbedded in this figure is support for the Deep Submergence Facilities.

ONR - Sujata Millick gave the ONR report. She informed the Committee that the REVELLE is a fantastic ship. The ATLANTIS changes are going well. There will be no deep submergence science days funded by ONR in 1997. ONR funding for deep submergence science is not predicted to change much over the next few years. However, ONR will stay committed to supporting the facilities for ALVIN and Jason. The ONR budget for 1996 is level funded with $400M of which $100M will go to Ocean Sciences. The facilities budget is $5M.

NOAA/NURP - Barbara Moore (replacing Hank Frey) reported that NURP is in flux undergoing a reinvention of the way of doing business. The NURP centers have had abbreviated research programs this year because of funding problems. The six centers have not been included in the Administration's budget for 1997. The program is being revised with proposals from the National Level Advisory Council and the National Level Review Panel. The status of the budget will not be known until the fall. Barbara is confident that NURP will survive. She reassured the Committee of the importance of ALVIN to NOAA/NURP and their commitment for funding. The NURP budget summary is: FY 1994 - $18.1M; FY 1995 - $14.5M; FY 1996 - $12M; FY 1997 $0 (expecting a $12M markup from Congress).

Memo of Understanding (MOA) - The three agency MOA for the support of deep submergence science and facilities which had expired in 1995 has been extended for the present because of the current uncertainties in government funding.

Lead Federal Agency - This item was tabled.

Funding Paradigm - No action was taken on this item but there was discussion regarding funding deep submergence science in the future.

VII. **Integrated Deep Submergence Facility:** The Committee discussed the present status of the organization of the integrated Deep Submergence Facility. The Committee was not sure of the present form of the ALVIN and ROV groups, how they will be merged, and how many people are involved in the various shore-based and at-sea operations. DESSC requested that WHOI produce a white paper on the organization that would include a personnel wiring diagram, management structure outline, and task/responsibility summary for the various positions at the National Facility for Deep Submergence. The document should also include various scenarios as to how the organization of the facility will be implemented for the different shipboard and shore-side infrastructure and the mobilization plans that may be required when operating off the new ATLANTIS, and also when the ROV and tethered vehicles may be required to operate on another suitable UNOLS vessel. There was particular concern about the costs involved in maintaining the ROVs in a "fly-away" mode once they were integrated into the new ATLANTIS. Safety and reliability should be the highest priority. A funding strategy that takes into account the facility operational and ongoing engineering requirements should also be included in the plan so that operations in 1997 and beyond can be properly considered by the Federal funding agencies and DESSC. The Committee asked that a draft of the document be prepared for circulation to DESSC and the Federal agency representatives by September, so that a more final document would be available for the 14 December meeting of the DESSC with the deep submergence community.

The Committee broke for lunch.

VIII. **Long Range Planning for Deep Submergence Research:** The Committee discussed the long range plans for deep submergence research. Once the new ATLANTIS is ready for routine, global science operations, there should be a dedicated effort to carry out funded programs on the southern EPR. The ship and deep submergence vehicles are likely to head to the western Pacific if sufficient proposal pressure is demonstrated. The Indian Ocean should also be considered as an option. Coordinated operations with the Japanese could materialize for the Atlantic in 1998 and in the western Pacific in 1999.

The polar regions could be an area for NOAA/NURP ROV operations.

The Committee concluded that Mike should write a letter to the community with the possibilities of expeditions outside of the traditional areas to solicit possible interest. It was discussed that UNOLS could post a map on the Web with proposed cruises to stimulate interest in potential future operational areas.

Bob Stern, U of Texas, is coordinating a workshop in Japan funded by NSF and the Japanese (including JAMSTEC). Mike Perfit and Patty Fryer have been invited. Mike will provide an overview of the UNOLS deep submergence capabilities, the current status of the ATLANTIS, and the planned

ALVIN overhaul. There will be a tour of JAMSTEC facilities. They will discuss the possibility of ALVIN working jointly with SHINKAI 6500.

The British are discussing the use of ALVIN for a BRIDGE project on the Mid-Atlantic ridge. Four biology proposals have been funded by BRIDGE which require five to six submersible dives. BRIDGE is considering the use of either ALVIN or NAUTILE to do the work in the summer of 1997. The British Broadcasting Company (BBC) has also expressed an interest in buying two ALVIN dives to be piggy-backed onto another program that is planning to visit a Mid-Atlantic Ridge high-temperature vent site, to do filming of a BBC television special entitled, "Earth Story".

The Canadian ROPOS will be used by several U.S. investigators including Mike Perfit, Marv Lilley and Dan Orange this summer during cruises on the German research vessel SONNE in the Northeast Pacific area. The majority of the costs for a new 5000+ meter cable were covered by the charter rate the Germans paid to use ROPOS. NSF, through a grant to R. Lutz, contributed about 25% of the charter costs for one leg of the cruise.

It was decided to reestablish the DESSC Coordinating Subgroups to help with global expedition efforts. Assignments to lead these groups were: Western Pacific, Patty Fryer; Southern EPR, Marv Lilley; Indian Ocean, Cindy Van Dover; Mediterranean, Dan Fornari; Polar regions, Dan Orange.

In the discussion beyond 2000 the Committee felt there was a need for more PR to the community and nation. We could use the WWW for more exposure and to attract children. Educational funds to support students and teachers could be available. Patty Fryer will check the NSF Education and Human Resources for possible funds and public relations. A DESSC initiated proposal may be appropriate.

Jim Bellingham reported to the Committee on the developments in AUVs. The thrust is to make these vehicles small and inexpensive. Their operating profile is designed for 30 to 100 hours and a unit cost range of $75-$85K. Many small vehicles are cheaper than one large ROV. They can be used in high latitude applications for rapid response and under the ice and are complementary to ALVIN and ROVs.

IX. **Third Party Tools:** The Third Party Tool Policy will need some revision. As presently written it conflicts with agency policies. A draft revision is being prepared by Dan Fornari to correct these inconsistencies. Dolly Dieter will be the NSF contact for the policy revision and Mike Perfit will follow up on the changes. Jeff Karson has an instrument that could qualify as a third party tool. The Committee will review the design specifications and report to Mike Perfit.

UNOLS homepage/WHOI homepage - Jack Bash reported that the shiptime request form is being tested for on-line application from the UNOLS homepage. The application should be ready to go this summer. The UNOLS Office also would like to put the ALVIN time-request on-line.

X. **Other U.S. Deep Submergence Activities:**

MBARI - Dan Orange reported that Peter Brewer was stepping down as Director and Ross Heath is taking over as Interim Director for one year. Dave Clague will be heading the science department as a replacement for Bruce Robison. The WESTERN FLYER is undergoing sea trials and all seems to be going well. The future use of this ship for cooperative use is still under discussion.

NOAA/NURP - Gene Smith reported that NURP lost one third of its budget in 1996 from $18K to $12K. The program in the past did not tie into NOAA's plan, however, they plan to correct this. The Headquarters will be working with the NURP Centers to develop the plans. HURL is expecting summer operations with KOK/PISCES V and hopes to get outside funding.

U.S. Navy - Cindy Van Dover provided information about the Navy submersibles. Her presentation is included as ***Appendix X*** which includes the 1996 Navy field programs. Cindy reported that there is pressure increasing for deep water exploration in the Gulf of Alaska. The Navy vehicles will be brought to the Gulf in 1996 followed by a planned three year initiative.

XI. **Other:** A meeting between WHOI operators, Federal agency representatives (including program managers) and some DESSC members may be held in September prior to the UNOLS Annual meeting.

The meeting adjourned 4:45 p.m.

DEep Submergence Science Committee

Carriage House, Woods Hole Oceanographic Institution
Woods Hole, MA
May 28-29, 1996

Agenda

Day 1 - 8:30 a.m. - Tuesday, May 28, 1996

I. Welcome, Introductory Remarks, New Members, Agenda Items (M. Perfit, DEep Submergence Science Committee Chair)

1. Terms for J. Bellingham, R. Collier and D. Orange expire. All are eligible for re-appointment. Review and discuss re-appointments for membership.
2. UNOLS Report (K. Johnson, UNOLS Chair)

II. Accept Minutes of the December, 1995 DESSC Planning Meeting and the May, 1995

DESSC Meeting at WHOI.

III. National Facility Operators Report (WHOI personnel)

1. 1996 Operations Summary and Projections.
2. R/V ATLANTIS - Status, delivery and 1997-1998 logistics
3. ALVIN Overhaul Planning/Timing
4. Integration of ALVIN and tethered facilities at-sea ops.
5. Ongoing Upgrade/Development/Information Efforts
    a. ALVIN power
    b. Pan and Tilt for ALVIN and Jason
    c. Navigation Upgrade - Engineering Tests - Mar. '96
    d. Jason manipulator tests
    e. Remote Temperature Loggers
    f. Electronic still camera

IV. Review and Summary of Submitted Proposals (J. Bash/D. Moller/R. Chandler)

1. UNOLS Office and WHOI tabulation.
2. Comments by Funding Agency Representatives.

V. Presentation and Discussion of ALVIN Upgrade List (D. Orange & C. Van Dover)

1. WHOI response to DESSC prioritization.
2. Discussion of applicability of upgrade efforts to Jason and tethered vehicles.
3. Identification of Short-Term and Long-Term Upgrade Items and selecting lead DESSC members to follow through on various initiatives/proposals for upgrades.

5:00 - 7:00 p.m., Tuesday, May 28th
DEep Submergence Science Committee Social
Carriage House

Day 2 - 8:30 a.m. - Wednesday, May 29, 1996

VI. Agency Reports (Agency reps.)

1. NSF
2. ONR
3. NOAA
4. Discussion of Existing Memorandum of Understanding between NSF, ONR and NOAA.
5. Discussion of Need for Lead Federal Agency for Deep Submergence.
6. Funding Paradigm for Deep Submergence Facilities Support.

VII. Integrated Deep Submergence Facility

1. Critical operational and scientific needs - planning document
2. Funding Strategy

Lunch 12:15 p.m. - 1:30 p.m. - Executive Meeting

VIII. Long-Range Planning for Deep Submergence Research

1. 1998-2000 (M. Perfit and DESSC)
    - Southern East Pacific Rise
    - Western Pacific and Hawaii
    - Indian Ocean
    - Mediterranean
    - Polar Regions
2. Traditional Operating Areas and RIDGE Observatory MAR, Juan de Fuca,
    - Northern EPR, California

3. Collaboration with UK, Japanese, and French Programs
    a. JAMSTEC initiative (M. Perfit)
    b. BRIDGE activities (D. Fornari)
    c. Sonne/ROPOS cruises (D. Orange/M. Perfit)
4. Reestablish DESSC Coordinating Subgroups (to keep momentum going for global operations.
5. Deep Submergence Science Initiatives - Beyond 2000

IX. Third Party Tools

1. J. Carson proposal review.
2. Discussion of revised policy.
3. WWW pages

X. Other U.S. Deep Submergence Activities

1. NOAA/NURP (G. Smith)
    a. ALVIN support
2. U. S. Navy (C. Van Dover)
3. MBARI (D. Orange)
    - Request for statement of intent/policy re: utilization of MBARI deep submergence facilities.

XI. Meeting End

1. Plans for next meeting: September?

APPENDIX II

List of Attendees

NAME	AFFILIATION	TELEPHONE	FAX	EMAIL ADDRESS
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APPENDIX III

Deep Submergence Science Committee

28, 29 May 1996
Woods Hole, MA
R. Pittenger

Woods Hole Oceanographic Institution

Features of the
New Deep Submergence Facility
(After Spring 1997)

ATLANTIS

- Lab Space, General Purpose Capacity
- Berthing
- Endurance
- Speed
- Sea-keeping/Sea-kindliness
- Power
- Dynamic Positioning

Combined Deep Submergence Operations Group

- ALVIN
- ARGO II, DSL 120, JASON

ROV's also available in "fly-away" mode

- For now?

ATLANTIS

Schedule of Key Events

- *ATLANTIS II* out of service - Sept. '96
- *ALVIN* Overhaul - Sept. '96- Apr. '97
- *ATLANTIS* (AGOR-25)
    - Launch Date - 1 Feb. '96
    - Conversion Complete - April '97
    - Arrive WHOI - May 6 '97
    - DSOG Demo/Trials - May 20 '97- June 3 '96
    - Available for Science - June - Dec. '97 (contiguous to USA)
    - Available for Science - >Feb. '98 (unlimited)

		AGOR 25		
	LULU	ATLANTIS II	KNORR	ATLANTIS
LOA	105 ft	210 ft	279 ft	274 ft
Beam	48 ft	44 ft	46 ft	52.5 ft
Displacement	480 Ltons	2.300 Ltons	2,685 Ltons	3,250 Ltons
Crew	9	22	22	22
Science				
DSV/Tech	9	9	13	13
Party	8	19	21	24
Generators	150 kw	600 kw	1,780 kw	2,145 kw
Cruising Speed	6.5 kts	10.5 kts	12 kts	12 kts
Endurance	20 days	30 days	60 days	60 days
Range	2,000 mi	9,000 mi	12,000 mi	11,300 mi
Labs	1 van	4 labs	6 labs	6 labs
		1.031 sq. ft	1,981 sq. ft.	3,890 sq. ft.

Individual documents can be viewed by selecting the appropriate item below.

1996 ALVIN/ROV Operations
1997 ATLANTIS/ALVIN/ROV Schedule
AGOR 25/ATLANTIS II/ALVIN Schedule (3 Years)

ATLANTIS SHIPBOARD INFORMATION SYSTEM
Outboard Profile of R/V ATLANTIS with Deep Submergence Modifications Highlighted
Plan View of ATLANTIS Main Deck

New Features:

- ALVIN A-Frame and Tracks
  A-Frame will be taken from ATLANTIS II, completely refurbished and new, more powerful hydraulic system.
  Positive control traversing and track system to move ALVIN into and out of hangar.
- ALVIN Hangar
  To provide secure,covered storage and easy access for maintenance.
- Shops (Mechanical, Electric, and Electronics)
  Near Hangar for efficiency.
- ROV Bay
  For storage and maintenance of WHOI ROV's.

ALVIN Dive Weight, Battery Charging and Spare Part Storage

- Co-located conveniently immediately below ALVIN hangar.
- Battery service facility includes charger, storage for replacement battery and hyraulic lift for removing/installing heavy battery units.
- ALVIN uses 1,000 lbs. of steel as descent weights on each dive.
- Typically the ship will carry 75,000 lbs. of expendable. weights.
- Having an adjacent dedicated large spare parts storage for submersibles will greatly enhance the at-sea groups' efficiency.

Upper Level of ALVIN Hangar

- Cat-walk provides easy access to submarine.
- Adjacent shop.
- Air compressors for servicing ALVIN.
- Work boat is used in ALVIN launch/recovery.

Remotely Operated Vehicle (ROV) Shipboard Equipment

- Storage, maintenance and launch facilities will be provided.
- An innovative scheme to launch these vehicles from the port side (from a new dedicated hydroboom).
- The control station will house the control for the A-frame, both hydrobooms, both hydrowinches, and the large traction winch (located below decks). Remote controlled video cameras will assist

the operators.

ALVIN Surface Control Station

- The central nerve center (surface control station) for ALVIN dive operations will contain navigation and plotting systems, underwater communications equipment for talking to the submarine during dives, video monitoring equipment for dive and recovery sequences, and radio equipment.
- The surface control station is located adjacent to the bridge to facilitate coordination between the ship control and submersible control stations.

Schedule of Installation

APPENDIX IV-A

ALVIN POWER EVOLUTION

Notes:

1. C/L is Cycle Life
2. WW is total Water Weight of battery tanks
3. Cost is for installed cells only, no spares for rotation

1964-1966

- Tanks: 3
- Cells: (75) 2v cells (Olympic)
- (30) 12v cells (Exide)
- Cap: 2v = 05ah, 12v=60ah (37.35kwh total)
- Volts: 30/30/60 (9.45kwh sci/6.3kwh cont./21.6kwh prop.)
- C/L: <50 cycles
- WW: 1600#
- Cost: ?

Comments:

1. As delivered design
2. Separate batteries for science, control and propulsion functions

1967-1985

- Tanks: 3
- Cells: (45) 6v batteries
- Cap: 150 ah (40.5 kwh total)
- Volts: 30/60 (13.5 kwh cont./27.Okwh prop.)
- C/L: >200 cycles
- WW: 1740#
- Cost: $3,760

Comments:

1. Greater capacity
2. Simplified circuitry (science/control combined and prop

3. Better tank design (less ground potential)
4. Common battery throughout
5. Longer life
6. Heavier batteries

1986-1987

- Tanks: 3
- Cells: (I 50) 225ah 2v cells, (I 5) 150ah 2v cells (Exide tubular)
- Cap: 450ah@120v propulsion/450ah@30v control/150ah@30v reserve (67.50kwh)
- Volts: 120/30/30 (54kwh propulsion, 13.5kwh control 4.5kwh reserve)
- C/L: >200
- WW: 3545#
- Cost: $19,035

Comments:

1. Heavier batteries
2. Added -1 000# of foam flotation
3. Removed reserve steel ballast
4. Increased propulsion power
5. Changed propulsion to electric thrusters

1988

- Tanks: 3
- Cells: (I 50)200ah 2v cells (KW tubular plate), (I 5) 150ah 2v Exide tubular
- Cap: 400ah @)120, 400ah@30v, 150ah@30v, (60.Okwh useable)
- Volts: 120/30/30 (48kwh propulsion/12kwh control/ 4.5kwh reserve)
- C/L: >200
- WW: 3145#
- Cost: $8,721

Comments:

1. Exide source unreliable, changed to KW tubular plate
2. Increased payload
3. Decreased cost
4. Decreased propulsion power
5. Still have control/propulsion imbalance

1989

- Tanks: 2
- Cells: (120) 200ah 2v cells (KW tubular)
- Cap: 400ah @ 120v (48kwh useable)
- Volts: 120 (all useable as mission demands)
- C/L: >200
- WW: 2500#
- Cost: $5,670

Comments:

1. Added 120vdc-24vdc converters to eliminate 30V battery requirement
2. Reduced weight
3. Reduced power
4. All power available as required

1991-present

- Tanks: 2
- Cells: (120) 190ah 2v cells (Douglas flat plate)
- Cap: 380ah@120v (45.6kwh useable)
- Volts: 120
- C/L: >200
- WW: 2900#
- Cost: $7,169

Comments:

1. KW tubular plate stopped production (EPA), Douglas 190ah flat plate closest fit
2. 1991 design study of battery configuration alternatives (***Appendix A***)
3. Unsuccessful pressure tolerant controller effort to reduce weight for third battery
4. Increased weight
5. Reduced power
6. Instituted battery rotation program (four MO in service, not six MO) to maintain capacity.
7. Large equipment growth (cameras, HMI's, Mesotech, video equipment)

1997-Future options

	Trojan Pb	Cl Can. Pb	Saft NiCd	Ovonic NiMH
Tanks:	2	2	2	3
Cells:	(120)2v	(120)2v	(200)1.2v	(60)12v

AH/cell	260	180	208	90
Cap:	62.4kwh	43.2kwh	49.9kwh	64.8kwh
Volts:	120	120	120	120
CL:	>1000	>1000	>1000	>600
WW	2600	1950	2000	1400
Cost:	$9,168	$11,213	$140,000	$42,000
Risk:	low	low	high	very high

APPENDIX V

DSOG Unmanned Vehicle Status

JASON/Medea

- Addition of Auxiliary Hydraulic System - completed
- Installation of Benthos DSC - underway
- Documentation/Training - underway
- Revision of Manipulator Gripper - underway
- Revise design of lower payload Skid/Basket - complete
- Test HiDef Video - underway
- Install Zoom Color Video Camera - underway

ARGO II

- Improved Obstacle Avoidance Forward Looking Sonar complete, not tested
- Thrusters for Heading Control - complete
- Resolve Noise on LBL Transducer - complete
- Install Benthos DSC - complete
- Test HiDef Video - underway
- Documentation/Training - underway

DSL 120

- Replace Depressor - complete
- Refine Low Speed Tow Dynamics - underway
- Addition of Auxiliary Data Channels - complete
- Determine suitable Upgrade Path for Surface Processing proposal pending
- Documentation Training - underway
- Addition of audio uplink for LBL Nav. - complete

JASON Manipulator Test Program

Objectives/Status

- Improve reliability
    - conducted approx. 150 hours of operations during pressure tests and dock trials
- Test at maximum rated pressure
    - Tested to 6,800 meters

- Develop techniques for handling and triggering "double major" hydrothermal vent fluid samplers
    - installed auxiliary hydraulic system and associated triggering mechanism
- Design and test new elevator system
    - Mid water design/docking transfer
- Redesign gripper
    - Improve gripping force and address pressure related failure
- Improve spares and documentation
- Demonstrate ability to work with temperature probes and "bio. boxes"
    - Underway

DSOG Navigation Upgrade Status

- Three copies of Winphrog software and associated hardware purchased
- Initial interface to Benthos 455 ASP completed
- Field trials during ALVIN engineering dives:
    1. Winphrog functioned in parallel to ACNAV
    2. In hull test completed
- Interface to ROV system underway and will be tested during upcoming field programs
- Presently determining suitable upgrade path for ALVIN in hull system
- Preparing phase two proposal to address ALVIN in hull system and advanced capabilities (i.e. doppler/USBL, replacement of portable LBL system for ROVS)

APPENDIX VI

Summary of 1997 ALVIN/ROV Requests

Listing of ROV Letters of Intent - Summary 1997 and Beyond

MAP of ROV Areas of Interest

Listing of ALVIN Letters of Interest - Summary 1997 and Beyond, Page 1 and Page 2.

MAP of ALVIN Areas of Interest

Details of ALVIN/ROV Letters of Interest - Summary 1997- 1999

- Page 1
- Page 2
- Page 3
- Page 4
- Page 5
- Page 6

WHOI individual scientists ROV requests 1996 - 1997

ALVIN 1996 Highlights

1996 ALVIN/ROV Operations

1997 ATLANTIS/ALVIN/ROV Operations

APPENDIX VII

U.S. Deep Submergence Community Request for ALVIN Upgrades

APPENDIX VIII

Current Data/Video Systems and Options

APPENDIX IX

Oceanographic Centers & Facilities

NSF Ocean Sciences Division

APPENDIX X

West Coast NURC

- Gulf of Alaska Initiative
- 1996 Deep Submergence Field Programs, Page 1 and Page 2

APPENDIX IV-B

ALVIN BATTERY EVOLUTION

Presented to the
UNOLS DEep Submergence Science Committee
May, 1996
by Dudley Foster

Introduction

Since ALVIN was first launched 1964, lead-acid battery technology has provided a source of power that has been reliable, readily available, easily maintained, and cost effective. As in all electrical systems, there has been a continual increase in the need for more power as technology has provided new equipment for science instrumentation and imaging applications. The paramount factors in power consideration are safety and service reliability. The following report discusses several battery technologies considered for use in ALVIN. When factors of serviceability, reliability, cost, payload and space are considered, the higher capacity lead-acid cells still have an overall advantage compared to other relatively mature battery technologies.

Background

Appendix A is a summary of ALVIN's battery and power distribution evolution. The first design philosophy was to separate power for control (instrumentation, communication, life support, etc.), propulsion (thrusters and lights), and science applications. The design insured that if science equipment depleted its power, propulsion and control would still be available. Also, if propulsion power were depleted, control power was still available for critical surfacing, life support and communications functions. Since ALVIN was very much a prototype and development vehicle at that time, this conservative approach was prudent. The fundamental concern for safety as the primary design criteria has not been neglected in all subsequent design evolutions of the power system. However, experience has safely allowed changes resulting m equal power distribution throughout the submersibles systems.

By 1967, having three different battery systems was proving to be unreliable and a major maintenance problem. At this time a two-voltage system was implemented, essentially combining the science and control batteries into a single 30 volt system. The 60 volt propulsion batteries were retained as a separate power source. The resultant change allowed all batteries to be of the same type (six volts each), allowed design of a lower maintenance battery box, allowed simplification of the power distribution system, increased the battery power, but also decrease the payload due to heavier batteries.

In 1986 continued failures of the Hoover propulsion motors at increased operating depths necessitated

conversion to DC motors. The hydraulic propulsion system was replaced with individual electric thrusters. These motors required 120vdc and the combined 60/30 volt battery tanks were replaced with two 120 volt battery tanks and one 30 volt battery tank. In the previous configuration, both 30 volts and 60 volts were combined in each battery tank. Either battery tank could therefore provide all necessary submersible voltages in the event of a failure in the other tank. In order to retain the safety features of this power redundancy, the new 30 volt battery tank had three separate 30 volt strings. One string had lower capacity, lighter, batteries that went to an auxiliary 30 volt bus. In the event of a problem with the primary 30 volt bank the auxiliary 30 volt string could be brought on line to allow uneventful return to the surface. The disadvantage of this was that all the 30 volts were in one tank, and if that tank flooded or had to be dropped, only emergency batteries in the sphere were available for surfacing. At this time, the added batteries resulted in a 67% power increase but required filling almost all available space with a total of 1000 pounds of syntactic foam.

In 1988 the source of the 225ah Exide batteries became unreliable and they were replaced with 200ah KW batteries. Although these cells had less power, they were fighter, less expensive, and of better quality.

Even though the sub now had more power than pre-1986, many missions were still limited by the depletion of either the 120 or 30 volt batteries. Dive profiles requiring heavy lighting, hydraulics, or propulsion usage would deplete the 120 volts when the 30 volts still had power available. Conversely, missions with heavy instrumentation would deplete the 30 volt battery with power left in the 120 volt propulsion batteries.

The Current Battery System

In 1989, the 30 volt batteries were completely eliminated by installing 120vdc to 30vdc power converters inside the sphere. This had the advantage of allowing all the power available in the batteries to be consumed regardless of the mission profile. At this time the sub started to carry only two 120 volt battery tanks. This allowed 100% power redundancy because all systems could be run from either battery if one were flooded or dropped. Although there was space for a third 120 volt battery tank, there was insufficient payload to install one. A study was done in 1991 to determine how we could accommodate another battery and increase overall capacity. This was the motivation to develop the pressure tolerant motor controllers (PTA). By adding a large piece of syntactic under the stern removing reserve steel ballast, and removing the motor controller pressure cases, there would be sufficient payload for a third tank. ***Appendix B*** shows the results of that design study. Since the pressure tolerant controller program was unsuccessful, we are still limited to two battery tanks using lead acid cells in the 190-260ah range.

Another factor limiting the use of the rated power of the batteries was the depletion of water in the cells over time. The normal loss of water in the cells during charging eventually exposed the battery plates to compensating oil and reduced the battery capacity until the battery could be removed for servicing. Due to operating demand, this service took place every six months, and experience showed that the last few

cruises before a service period usually suffered from reduced battery capacity. To try and maintain battery capacity, and allow more operational days, a battery rotation program was implemented that replaced one of the two batteries every two months. As a result, each battery is serviced every four months and is less likely to suffer from water shortage and exposed plates. This method eliminated the need for a two-week maintenance stand-down every six months and allowed an additional 30 operational days per year. Installing three battery tanks with fighter and lower capacity batteries was evaluated. By using three tanks of 165ah cells, the total capacity could be increased by 24%. This would force us to go back to stretching the service period to six months, or to four months with a two-week stand down three times a year (six weeks out of service). Numerically we could replace one of the three batteries about every port stop, but this becomes logistically impossible. The final evaluation was that more sustained power was available with a two-tank rotation than would be available with a 24% larger battery capacity serviced every six months. Improvements in battery charger control also allowed us to customize the charging profiles to maximize charging and minimize water consumption.

It should be noted that during the battery evolution, the power demands have continually increased, payload demands have continually increased and the average dive time has remained about constant since 1986. The design tradeoffs and efficiency improvements have given more performance with less cost and have maintained the payload capacity. ***Appendix C*** illustrates the average dive time over the last three decades for each of the design change periods.

There are two areas which can improve dive duration. The most effective is to maximize the power available and to use it more efficiently. The second is to provide a raw increase in available power. Without doing the first, even the second would not provide satisfactory results. Power efficiency and capacity must consider the whole system, not just the battery. The system also includes personnel performance, battery maintenance and performance monitoring.

Appendix D is a comparison of recent dive statistics for four pilots. This is an average of 30 dives over a similar time period to minimize the effects of different mission profiles between each individual. The average difference between the shortest bottom time and the longest is about 40 minutes, or 15%. Without more data regarding the reason for completion of a dive, it is impossible to determine the reasons for the variability. It is possible that the work was generally completed which suggests the longer bottom time is due to slower work at reduced power, whereas the shorter time is due to faster work at a higher power rate. If the dives were terminated due to lack of power, it would indicate more emphasis should be placed on pilot training to improve their efficiency. In either case, the total health of the battery may have been an issue. To gather better data about pilot efficiency and battery performance, future pilot debrief sheets will include a comment about why the dive was terminated, whether it was lack of power, work completed, weather, equipment failure, etc. If the comment is lack of power, this should give the electrician daily feedback about the condition of the battery and the need for some corrective action.

Maximizing Available Power

Battery maintenance has a major affect on battery performance. Problems with battery chargers not delivering a full charge, insufficient battery equalization, battery age, and electrolyte levels all interact to establish how much power is available on a given dive. When a battery starts to loose capacity, the corrective action usually requires several battery discharge/charge cycles to regain the capacity. Even with the current four month battery rotation, a delicate balance must be maintained between slightly overcharging daily, periodic equalization and battery water consumption. Manufacturers recommend equalizing (periodic overcharging) batteries every 5-7 cycles to maintain their full capacity. These maintenance requirements are not unique to lead-acid batteries. All other vented aqueous type cells need similar care. This also results in the need to add water to the batteries every couple of weeks. Various automatic watering devices have been investigated by the ALVIN group to allow watering without removing the batteries. AR the devices have a large risk involved in the event that one of the devices failed, resulting in an electrolyte overflow within the battery tank, subsequent short circuit, and possible fire or explosion.

To better monitor the battery condition and maintain maximum capacity, the electrician needs daily feedback about battery performance. By the time a pilot makes a comment about the battery performance, the battery has deteriorated to the level that mission performance is noticeably affected. Better instrumentation is required to monitor the daily and gradual change in the battery condition. WHOI is pursuing two courses of action to provide the necessary instrumentation. A prototype microprocessor based electronic circuit which resides within the battery tank has had some initial testing on the submersible. This circuit monitors volts and amps on charge and discharge, battery tank temperature, and electrolyte level in four cells. It has a SAIL data interface to log the battery data in real time. There have been several design refinements to the circuit based on the results of the field trials, and continued testing and evaluation is required to demonstrate reliability before the circuit can be considered operational. ALVIN does not presently have a SAIL system, and refinements to the logging system would be required as well as development of data evaluation software. Another device to be evaluated is a microprocessor based commercial product with an RS-232 interface that measures volts and amps during charging and discharging with respect to time. The data output includes volts, amps, number of cycles, deepest discharge, average depth of discharge, coulomb efficiency (power out/power in), etc. Testing and evaluation of this product will start in late July 1996. If it provides useful and accurate information, and a safety evaluation of the necessary wiring is satisfactory, the device may be incorporated in ALVIN during the next overhaul. In addition to potential use on the submersible, this device may also be used to log the performance of our Exide brand battery chargers which do not have a computer interface.

The overall performance of a system is also a function of the power usage efficiency. In addition to the pilot factors and battery maintenance already mentioned, the power efficiency of individual electrical and electronic equipment should be maximized. A design or selection criteria for any new equipment should include an evaluation of energy efficiency, especially for equipment that will be in continual use during a dive. Video cameras are an example of how of efficiency tradeoffs need to be evaluated. One way to get a better picture is to provide more light on the subject. This increases power requirements. An alternative way is to use a camera that needs less light to get a better picture which reduces the power requirements. Another power conservation method is to periodically assess the need for existing power

consumers. This is constantly done on ALVIN and is a natural selection process. Those items that are not frequently used are removed from permanent installation. This helps control weight growth and reduces maintenance. Reducing obsolete or underutilized equipment means less power consumption. In designing the next generation of ALVIN data logger and display systems, an evaluation of what information is actually required in real time, and what is not necessary, will be considered. By reducing the complexity and demand for real time information, weight and energy savings may be possible.

Battery Technologies

In addition to striving for maximum performance and efficiency from the current power systems, the ALVIN Group is continuing to evaluate sources that might provide more power with less weight in the existing space available. ***Appendix E*** shows performance comparisons of four battery technologies considered for ALVIN. [***Table*** used to develop Appendix E.] This data is based on production cell dimensional and weight information supplied by the manufacturers and should not be confused with specifications relating to laboratory test data. The total Kwh value is based on the possible installation configurations as discussed below. Three of these batteries represent technologies that are mature and are available in capacities suitable for electromotive applications such as ALVIN. The NiMH cells cannot be considered mature since they have not been broadly applied to electromotive applications but may have future applicability.

Nickel-Cadmium batteries are used in the Russian MIR submersibles to replace the Nickel-Iron batteries that were no longer available. The cells were made by SAFT-NIFE of France and are available in the U.S. through their facility in Georgia. The Russians first started to evaluate these cells in 1989. There was a problem with the battery case material and a different cell was evaluated in 1992. In 1995 they replaced their nickel-iron batteries with the present NiCd's. This suggests they had a five year development and evaluation program before committing to this type of cell. Discussions with the MIR program manager and SAFT indicated the cells are performing well but require watering every 20 dives. In a full ALVIN diving schedule the battery would need to be removed and serviced every month, which would be operationally unacceptable. One of the Russian design requirements was for the cells to take a 30-degree roll without spilling the electrolyte. With an appropriate vent cap, it may be possible to increase the electrolyte volume and extend the watering interval. Presuming this shortcoming could be overcome, two new battery tanks containing 285ah cells (a 50% increase over Douglas) would fill the complete battery compartment and result in a 150-pound loss of payload. Alternatively, two tanks with 208ah cells (a 9% increase over Douglas) could be installed with a 700-pound increase in the payload. NiCd cells are not susceptible to damage by over discharging as opposed to lead-acid batteries which may be damaged if discharged below 80%. This suggests the NiCd cells could be discharged closer to their rated capacity as opposed to the 80% discharge limitation of Pd-acid cells. If one were to presume a 90% discharge for the 208ah NiCd, and a 70% discharge for the 190ah Pd-acid, the net useable power gain would be 41 %, not the 9% suggested by just the amp-hr rating of the cells. For a 260ah Trojan lead acid cell, the above analysis results in only a 3% useable gain. Either of the NiCd battery packs would result in loss of the science space in the present third battery position. The French source for these batteries might present a logistics problem. The only other source of high capacity NiCd batteries

identified is VHB Industrial Batteries of Canada, a subsidiary of Varta. Their construction methods result in a cell with 47% fewer watt-hrs/liter and a weight 92% more than the SAFT cell. The SAFT battery cost for three tanks (including one rotating for service) would be approximately $210,000. New battery boxes and base plates would cost approximately $50,000. This is more than a 1000% increase in battery cost for a potential 41%, (or 3% with Trojan cells) increase in power.

A Nickel-Metal-Hydride battery in the 90 ah range is manufactured by Ovonic Battery Co. These batteries are being developed for use in electric cars and provide about 60% more power/weight than the best lead acid cells. The cell is proprietary and details about internal construction are not known. The standard cells are a sealed, no maintenance design which relies on recombining the hydrogen or oxygen generated during discharge/charge cycles. They use an aqueous potassium hydroxide electrolyte so there is a possibility that the cells could be applied to deep ocean applications. However, at the present time it is not known if the sealed nature of the cell is required to retain cell fife or if the chemical reactions will effectively take place at 6,000 psi. The Ovonic cell life is only 600 cycles (compared to 1000+ for other types) and mass production quality has not been established since these cells are not yet generally available. General Motors expects to market vehicles with these cells in 1997. Because this technology is in its infancy, these cells are not appropriate for use in ALVIN at this time. With assistance from high level contacts at GM, VMOI plans to look more closely at the possible deep sea application of these cells. This will probably require a meeting with Ovonic engineers in Michigan to gather more information and start a pressure test evaluation program if appropriate. We have recently received word from VHB/Narta that they may have NIMH cells which are of high enough energy density to be of interest to us. We will be working with them to evaluate the potential for application of their product.

Silver-zinc batteries (Yardney) were investigated. Two sets of 750ah batteries (including one rotating spare) would cost approximately $336,000, could provide a 97% increase in power over Douglas, are light weight (a 1000 pound increase in the payload), have a short lifetime (only 70% capacity guaranteed after 12 months), have a poor reputation for reliability, and only one 120-volt battery could fit in ALVIN, eliminating the safety of having a redundant power source. Overall, these were not considered a viable alternative power source.

Lead acid Chloride Canada tubular plate cells have been a candidate for installation in past years. The most likely cell is a 180ah unit which is fight enough that three tanks could be installed resulting in a net power increase of 42% over the present Douglas cells. There would be a 250-pound loss in the payload. This company also offers a 190ah cell that would require completely new battery boxes. With three tanks installed, there would be a 1000-pound payload loss and a 50% increase in power. In both cases, the third battery space would not be available for science applications and would have all the disadvantages of the three-battery configuration discussed above (six month services, electrolyte depletion, etc.).

Exide has gone through some reorganization in recent years, and two of their current 225ah cells have been purchased for evaluation. Initial cycle testing indicates they do deliver the advertised capacity. Assuming that the Japanese purchase of the company has solved the previously experienced delivery and quality control problems, these are an option for installation in the coming overhaul that could

provide a power increase of 18%. A major disadvantage is that they will reduce the payload by 200 pounds. With the increase in science payloads since these were last used, this could have a major act on science capabilities. One possibility for offsetting the payload loss is to add syntactic to the third battery space. That space is being used frequently for science equipment such as altimeters, down looking cameras, lights, strobes, and down looking sonar systems. Syntactic in that area may impact those capabilities.

Testing of some Trojan Battery Co. lead acid cells rated at 260ah is currently in progress. Each of these cells is 0.5 pounds lighter than the existing 190ah cells and has a potential to increase power 37% while increasing payload 60 pounds. The manufacturer claims the cells require 40-50 cycles to achieve maximum power. However, after more than 40 cycles, they are delivering 83%-88% of their advertised capacity, or approximately 215-228ah. When sufficient cycle testing is complete, the test data will be discussed with the manufacturer. If these cells eventually deliver at least the capacity of the Exide cells (225ah), these would be an excellent candidate to replace the existing Douglas cells during the next overhaul. This company is the country's largest supplier of deep cycle industrial batteries for fork trucks, golf carts, commercial floor scrubbers, etc. Being a domestic company, there should be a reduced risk of supply problems in the future.

Summary

As can be seen in ***Appendix C***, there has only been a 3% variation in average dive times since 1986, yet there has been a continual increase in power demand and the total power available has decreased 33%. This efficiency improvement can be attributed to improved power distribution, better battery maintenance through charging improvements and battery rotation, constant efforts to improve equipment efficiency, pilot training to improve efficiency of power utilization, and constant awareness of all involved in the operation and use of the facility to be conscious of power consumption. There is still room for improvement in power utilization and sustaining maximum output from the current lead acid battery technology. Daily charging records indicate the batteries are seldom delivering rated capacity. Additional work is needed to determine the threshold of heavier battery charging without prematurely depleting battery water. This effort requires better logging and record keeping over many operational months. Only incremental changes can be made to determine the point of diminishing returns and not adversely affect our primary mission of supporting science diving requirements. Our continued effort to install suitable instrumentation and adding daily commentary of battery performance should help us improve battery performance in the future.

Of the alternate battery technologies presented, the NiCd cells probably have the highest possibility of successful implementation in the future. Although many arguments based on the life cycle cost of the cells (including dollars/minute on the bottom) can be made, it is very difficult to justify the high initial expense to change to the NiCd cells for a theoretical 3% increase in power (@90% discharge) over the potential of the Trojan lead acid cells (@ 70% discharge). NiCd's are not widely used in the proposed application, and data for long term performance is not known. Contact with manufacturers of these cells indicates they know very little about deep sea applications of their products. For WHOI to commit to the

usage of this cell, extensive evaluation and testing would need to be done to establish low temperature, high pressure performance, water consumption rates, reliability, quality, and extended service requirements as well as literature search of historical data, and possible direct consultation with manufacturers and MIR operators. This would be a labor intensive and time-consuming effort, require battery procurement, chargers, test instrumentation, and thus would need support from a funded proposal. There would be no guarantee that the study would result in positive recommendation for use of NiCd batteries.

In the immediate future, Trojan, Exide or Chloride Canada lead acid cells will likely be installed during the next overhaul. With the efficiency improvements since the last use of the Exide cells, an 18% increase in power might be achieved over the existing cells without the need to redesign the battery tanks. Part of the payload penalty may be compensated for by adding a partial block of syntactic in the third battery hole and still leave some room for science equipment installations in that area. If the Trojan test program is satisfactory (>225ah capacity), these cells would be an excellent choice for installation. They have the potential to increase power by 37% without redesigning the battery tank and there should be no need to add syntactic in the third battery bay. If the overhaul indicates there is a substantive loss in the payload due to either science equipment additions (HMI's, four cameras, two VCR's, etc.) or gradual deterioration of syntactic foam the lower capacity (180 ah), fighter, Chloride Canada cells may need to be seriously considered.

The power sources elaborated on in this report are not the only technologies that have been reviewed. Carbon pile hot air turbines, kinetic energy flywheel storage, and numerous specialized battery chemistries and laboratory curiosities have also been reviewed. When all factors of reliability, maintenance, payload, mass production quality, cost and implementation impacts are considered, most of these alternatives have been deemed impractical for current applications.

To better monitor the development of possible future power sources, WH0I will try to improve the dialog with Ovonic and VHB to determine the applicability of the NiMH cells for deep ocean applications. We also plan to attend the annual Power Source Symposium each June to closely monitor power technology developments.

DEEP SUBMERGENCE SCIENCE COMMITTEE

PLANNING MEETING MINUTES

DECEMBER 10, 1995
Moscone Center, Room 220
San Francisco, CA

APPENDICES

I. INTRODUCTION:

The Fall DESSC planning meeting was held on December 10, 1995 in Room 220 of the Moscone Center, San Francisco, CA. The meeting was called to order at 9:00 a.m. by Mike Perfit, DEep Submergence Science Committee (DESSC) Chair. He welcomed the community by indicating that the

time is now to plan for operations in 1997 and beyond. The meeting agenda is included as ***Appendix I***. These minutes reflect the order in which items were addressed. A list of meeting participants is included as ***Appendix II***.

II. 1995 SCIENCE REPORTS:

PI's who conducted science cruises using deep submergence assets over the past year were invited to present brief overviews of their science programs along with critiques of the ALVIN operations. Viewgraphs presented by the PI's are presented in ***Appendices III*** through ***X***. These viewgraphs provide summaries of the science objectives, maps of the dive regions and dive results. A very brief review of each program is provided below.

Bob Embley began with a review of his ALVIN dive series (2940-2951), AII Voyage 132 - Leg IX. A total of 12 dives were conducted; ten for NOAA and two for Meg Tivey, an NSF funded program. Bob's group carried out chemistry and biology time-series operations and focused on the CoAxial site with concentration on the FLOC and Source sites, see ***Appendix III***. One dive was made on Axial Volcano. This was a revisit after seven years. Big changes in macrofauna were observed. Bob commented that the Mesotech scanning altimeter was a very useful ancillary tool for mapping small-scale structures at vent field scale. The on-board NOAA GIS system provided a user friendly interface and was helpful in dive planning. He expressed concern over the limited number of people in ALVIN's operation group. The lack of personnel appears to be placing a strain on the existing ALVIN at-sea group.

Mike Perfit presented the ALVIN dive summaries for **Meg Tivey** and **Al Bradley**, see ***Appendix IV***. The purpose of dives were for recovery of a thermocouple/thermistor array package. Two instruments had been deployed in summer, 1994 at the Monolith and Table Vent sites, Cleft Segment of the Juan de Fuca Ridge. They were recovered on June 27 and 30, 1995. Deployment and recovery of the instrument packages went relatively smoothly, owing in large part to strategic planning with the ALVIN group during instrument development and prior to each cruise.

Mike Perfit also gave the report for **Dave Kadko's** dive program, see ***Appendix V***. The cruise was conducted at the TAG site on 2/20/95 through 3/16/95. In addition to Dave, other PI's included Schultz, Van Dover, Von Herzen, Edmond, Becker and Kleinrock. The objectives of the cruise were to: 1) Retrieve instruments monitoring the TAG mound; 2) Re-survey areas studied prior to ODP drilling; 3) Perform extensive heat flow, water sampling, sulfide sampling and sediment coring; and 4) camera tows. All of the objectives were met. The submersible operation went smoothly, although at times there were navigation problems. Eight WHOI towcam camera tows were successful until the last night when the cable parted on recovery of the vehicle and the system was lost. The system was insured and WHOI has rebuilt the towcam, and it is now available. The new system was used for a night program on the Batiza dive series in October.

The next presentation was provided by **Geoff Wheat**. A list of the cruise participants along with their

cruise functions was provided, see ***Appendix VI***. Geoff investigated Baby Bare upward fluid velocity data from ALVIN cores. Calcium and sulfate vent samples were taken. The heat flow probe was broken by the manipulator. A spare probe was rigged by the ALVIN group at sea and the measurements were able to be made. The remainder of the cruise went well.

Paul Johnson presented results from both his ALVIN cruise and **Maurice Tivey's** dive program. Maurice's dive program took place on 13-30 July 1995. The objective of Maurice's cruise was to map the spatial variation of magnetic anomaly polarity reversal boundary with depth in oceanic crust, see ***Appendix VII***. Eleven dives were made traversing the scarp face of the Blanco Transform (Southern Juan de Fuca), one dive was lost to weather. Two additional dives were made on ODP Hole 892 Oregon Margin for Keir Becker. Magnetic field data and mesotech data was collected. There were 23 gravity stations. Rock sampling and dredging was conducted. The new WHOI towed magnetometer system was used to collect 750 km of sea surface magnetic field data. There were two deeptow magnetic tows. Six ABE launches and recoveries were successfully conducted.

Paul continued with a review of his own program. He conducted a near-bottom geophysical study of a new eruption site on the CoAxial Segment of Juan de Fuca Ridge, see ***Appendix VIII***. The cruise dates were 26 August to 10 September 1995. Thirteen dives were conducted, twelve funded by MG&G and one by Larry Clark's program. This is part of a continuing time-series measurements of the Co-Axial New Flow eruption. The goals of the cruise were to: 1) determine the time-dependent changes in magnetization and density of the New Flow and surrounding crust, 2) characterize the geophysical signature of the "diking event" associated with the New Flow eruption and 3) determine the details of the thermal budget of crustal formation process. All experiments worked. This included work with ALVIN's magnetometer, the NAVO Bell BGM3 gravimeter in the ALVIN sphere, and ABE near-bottom magnetometer surveys. A new bare-rock heat flow blanket was deployed with very good results. ABE was a great night time vehicle and a good compliment to the ALVIN cruise. In summary, both the Tivey and Paul cruises were very successful. ALVIN worked very well along with the gravimeter. Thanks go out to Dan Fornari, Randy Herr and Dave Epp for their time and efforts in making the gravimeter accessible to WHOI and ALVIN operations.

John Delaney was the next presenter. John's cruise program was on the Endeavour Main Field, Juan de Fuca Ridge. They successfully implemented a new technique for in-hull surveying and refinement of transponder positions. John encouraged ALVIN users to conduct extensive survey work prior to ALVIN diving. The 3000th ALVIN dive was conducted during his cruise. He noted that the Bambi and Godzilla chimneys have grown substantially. During John's cruise, 85% of the science goals were achieved despite some rough operation conditions at sea. The ALVIN group continued to pull through.

Rody Batiza reported on his recent dive program to study hyaloclastites at 15 degrees North along the East Pacific Rise, see ***Appendix IX***. Nine dives were conducted on Seamount (SMT) 6. The Holloway-Stakes drill was used along with night-time WHOI towcam surveys. The science reveals that deposits are thin, there are no gradients in thickness, and no localized vents. Glass shards were produced during active sheet flow eruptions. ALVIN, the rock drill and camera all worked well.

Rich Lutz reported on his multi-PI (M.Lilley, K. VonDamm, C. Cary, R. Haymon and D. Fornari) cruise to 9 degrees 49-51 minutes and 13 degrees North on the East Pacific Rise. The research involved resurveying the 1991 eruption site, water sampling at high and low temperature vent sights, and monitoring the biological and geological changes in this area. Two cameras were used; a three-chip and high definition black and white camera both provided by W. Lange of WHOI. The high definition camera has a 2k x 2k pixel image. Rich showed the exceptional video footage from each of these cameras. Both videos were of extremely high quality.

Marv Lilley, who was on the same cruise as Rich, echoed the words of previous PI's by praising the ALVIN operation. He indicated that in his view the next priorities for upgrade of ALVIN should be power and payload. Another hour of bottom time could greatly increase science potential. **Dan Fornari** also indicated that he had success with the new time-lapse temperature sensors (HOBOs) for monitoring hydrothermal fluids funded by Lisa Rom at NSF.

All in all, PI's with operations in 1995 had high praise for the ALVIN and ATLANTIS II operation groups. Dives lost to weather and mechanical failures were few. Suggestions for ALVIN operation improvements and upgrades included increasing power for longer bottom times, navigation upgrades and addition of an improved video system such as that presented by Rich Lutz. A proposal for the first phase of the navigation upgrade has been submitted to ONR and a second phase proposal is being developed.

The final 1995 science report was provided by **Cindy Van Dover**. Cindy conducted her program on the gametogenic ecology of a hydrothermal vent community using the Navy's SEA CLIFF and ATV, see ***Appendix X***. Although a number of problems occurred during Cindy's cruise she had some successes. Additionally, the Navy offered extra dives to make up for down time. The ATV was her tool of choice for sampling. She found it very easy to use and could be brought into the smokers for temperature measurements. A SeaBeam survey was done on arrival. Use of ATV allowed for 24 hour operations to maximize bottom time. Launch and recovery could be performed in sea-state 4, even at night. Problems experienced with SEA CLIFF included a non-functioning Schilling arm. Maneuvering SEA CLIFF is not easy and two pilots are needed. Problems on the ATV included flooding the compass, breaking the fiber optic cable and losing power to the control van. Cindy had high praise for the SEA CLIFF/ATV crew citing their professionalism, competency and courteousness.

III. UNOLS REPORT:

Ken Johnson, UNOLS Chair, reported on UNOLS activities. He indicated that there is some good and bad news. The ship scheduling committee met in the fall to review 1996 ship schedules. In 1996, there are roughly 4300 days scheduled, in contrast to approximately 4900 days in 1995. Budgetary constraints continue to be a problem. A UNOLS subcommittee chaired by Peter Betzer was convened to develop a fiscal plan to prepare for anticipated budget constraints. By the end of the century we could be facing a $15M deficit for UNOLS Fleet operations. As recommendations, the report suggests building new

partnerships, accommodating the ship time of non-traditional users and working with FOFCC for future planning. UNOLS recognizes that it is easy to remove a ship from the fleet, however, the process of adding ships can be quite lengthy. Assessing the coastal science needs will continue to be a high priority.

Plans for the Arctic Research Vessel are presently on hold. UNOLS will most likely become more involved in the science planning of the USCG Ice Breaker, HEALY.

IV. NATIONAL FACILITY OPERATOR'S REPORT (ALVIN AND ROVS):

A. Operational Statistics - Rick Chandler, WHOI, presented operational statistics for the past year, including ALVIN bottom time averages per leg, see ***Appendix XI***. In 1995, ATLANTIS II had 282 operating days and ALVIN was scheduled to complete 170 dives. This equated to 1084 hours submerged with an average dive duration of 8.1 hours and average bottom time of 4.7 hours in 1995. Thirteen science cruises were scheduled. As of the DESSC meeting, 96% of the scheduled dives had been completed since the start of the year. Rick also provided a breakdown of the operating costs for ALVIN. Salaries/Benefits/Overhead account for 72.6% of the cost. The remaining 27.4% is broken into three categories: dive expendables (12.6%), repairs and maintenance (8%) and other expenses (6.8%).

Consistent with previous years, the number of ALVIN days lost to weather and mechanical failures is low. A ten year chart of ALVIN dives lost versus completed is included in ***Appendix XI*.**

The Deep Submergence Operations Group at WHOI now has a home page. The address is http://dsogserv.whoi.edu. Features include information on ALVIN including its user manual and dive log, ROVs, AUVs, WHOI's shipboard scientific services group, links to other related WHOI sites and links to other submersible/submarine sites.

B. Status of Ongoing Development, Upgrade or Technical Efforts -

1. DSOG Tethered Vehicle Status - Andy Bowen reported on DSOG projects that have been completed or are presently underway. His viewgraphs are included as ***Appendix XII***. Jason/Medea completed projects include control van rewiring, Medea replacement and debugging telemetry lockups. Underway projects for Jason/Medea include improved documentation, manipulator testing, revising the design of the lower payload skid and improving self-rescue capability.

ARGO II projects which were completed this year include improvement of obstacle avoidance forward looking sonar and implementation of single van operations. Projects underway include determining camera focus problems, improving thrusters for heading control, resolving noise on the LBL transducer and improving documentation.

120 kHz projects underway include replacing the depressor, refining low speed tow dynamics and improving documentation.

2. DSOG Sonar Upgrade Proposal - Andy continued by explaining that the DSOG Sonar Upgrade Proposal has been submitted to NSF. The goals of this effort are to: (1) eliminate many potentially catastrophic reliability problems and (2) streamline the data pipeline from collection to map making and analysis by the scientist, see ***Appendix XII***.

3. DSOG Acoustic Navigation Upgrade - The proposal for the navigation upgrade has been split into two phases. The Phase I proposal has been submitted to ONR. The efforts in Phase I will include purchasing the Winphrog software & PCs, installing and testing the system on ATLANTIS II, integration into portable navigation and control, testing Winphrog as an in-hull navigation processor and display, determining the preferred in-hull installation and reviewing DESSC subcommittee recommendations. In Phase II the DESSC subcommittee recommendations will actually be implemented.

4. Jason Manipulator Development Program - Over the past year a program to improve the manipulative capabilities of Jason has been underway. This effort was funded by ONR. The objectives are to improve reliability, test the manipulators at the maximum rated pressure, develop techniques for handling vent fluid samplers, design and test a new elevator system, redesign the gripper, improve spares and documentation and demonstrate the ability to work with temperature probes and bio-boxes.

WHOI dock side tests along with pressure tests have been performed using the improved manipulators. Andy showed a video of various manipulator demonstrations. Future plans include a demonstration of the integrated system (Jason with the manipulator) at David Taylor pressure test facility in Baltimore, MD in January.

5. New ALVIN Equipment Used, Tried or Evaluated in 1995 - Dudley Foster reviewed a list of equipment used, tried or evaluated in 1995, see ***Appendix XIII***. ABE was tried this year with great success during an ALVIN cruise on Juan de Fuca Ridge. Equipment used, tried or evaluated with ALVIN included the Stakes-Holloway rock drill, NAVO gravimeter, pan/tilt camera mechanism, Harbor Branch's 10 mw micro-lasers, DSP&L thallium iodide light, TriTech & Imagenex sonars, new Moog motor controllers and various cameras (small 1-chip color, small ICCD, HiDef B/W, macro and Benthos/ Kodak ESC).

6. Battery Power - Dudley reported that WHOI continues to look at ways of improving bottom time. They have done a comparison of on-bottom times for different subs, see ***Appendix XIII***. ALVIN's average bottom time over the past ten years for dives greater than 1500 meters and two hours in duration, was four hours and 47 minutes. WHOI also performed a comparison on battery characteristics and cost factors for different submersibles. The cost comparison shows that ALVIN costs $208/kwh, NAUTILE is $1,141/kwh, SHINKAI-6500 is $30,440/kwh and SEA CLIFF is approximately $3,044/ kwh. The MIRs have begun using NiCad batteries. WHOI plans to wait and see how NiCad batteries perform.

WHOI analyzed long- and short-term variables which could affect ALVIN power and bottom time. The long-term variables include power characteristics of the battery type, charging equipment and power consumptive equipment. A few of the short-term variables affecting power and bottom time include the science mission objectives, piloting style, dive depth, type of terrain, lights and battery condition. WHOI is implementing improvement efforts. They will continue to: (1) monitor the battery market, (2) optimize charge cycle, (3) optimize battery maintenance, (4) implement pilot efficiency training and (5) develop electronic monitoring.

7. Increased ALVIN Payload Possibilities - Dudley reported that in an effort to increase ALVIN payload capability, WHOI is evaluating new motor controllers, ways to reduce battery weight, and methods of monitoring variable ballast.

8. Imaging Proposal Status - Dudley Foster reported on the status of the imaging improvements, see ***Appendix XIII***. ***WHOI has purchased a computer; additional shipboard recorders, monitors and editing station; new HMI lights and scaling lasers. They have completed a long baseline navigation upgrade investigation and have evaluated the EXACT system on ALVIN. Efforts that are still pending include purchasing an additional 1-chip color camera and 3-chip color camera. A pan/tilt mechanism will be purchased in early 1996.***

9. Motor Controllers - Dudley reported that housings for the motor controllers have been completed. WHOI is in the process of testing new endcaps and connectors.

10. Electronic Still Camera - Dan Fornari reported that many advances in electronic still camera technology have been made in the last couple of years. The community needs to determine their priority for this upgrade relative to other improvements. WHOI will continue to identify the best system for the National Deep Submergence facilities.

11. Autonomous Benthic Explorer (ABE) - Dana Yoerger reported that ABE was tested with great results this year on a hydrothermal vent area. It descends using low power and has demonstrated to be very stable and quiet. Exciting data was obtained from ABE's temperature probe. Other equipment used with ABE included a magnetometer & CTD. Although ABE at this time is somewhat power limited, it does have some payload capability.

V. NEW DESSC MEMBERS:

Mike Perfit announced that J.C. Sempere (UW) & Cindy Van Dover (U Alaska) have been appointed to DESSC as new members. Karen VonDamm resigned from DESSC this fall to assume new responsibilities as RIDGE Chair. A replacement member will be nominated.

VI. NEW DEEP SUBMERGENCE SUPPORT VESSEL:

A. Decision from Agencies, Operator, and DESSC on ATLANTIS - Jim Andrews, ONR, reported that ONR and NSF have decided to pursue the option of making ATLANTIS the new support ship for deep submergence operations. ONR, NSF and WHOI will share the cost of modifications. Halter Marine Inc (HMI), the shipyard constructing ATLANTIS, developed a great design to accommodate submersible operations. Additionally, the design will not impact the general oceanographic capability of the vessel. NAVSEA is in the process of negotiating the cost of this modification to ATLANTIS with the shipyard.

Jim showed a viewgraph comparing the capabilities of various past and potential platforms, see ***Appendix XIV***. The comparison shows that between LULU, ATLANTIS II, KNORR and ATLANTIS; ATLANTIS will offer the most science bunks, speed and lab space. Jim finished his discussion by showing the ATLANTIS/AII/ALVIN time line for 1996 through 1998. It is estimated that integration of the modifications to make ATLANTIS a submersible platform will not impact the scheduled delivery date of the vessel. ATLANTIS is scheduled to be delivered with handling capabilities in April, 1997.**

** Post-DESSC Meeting Note:

The Navy and HMI successfully negotiated a cost for the ATLANTIS conversion in mid-January, and ATLANTIS was launched on February 1, 1996.

B. Capabilities, Berthing, Lab Space, Facilities - Dick Pittenger continued by elaborating on the features of ATLANTIS. He showed various views of the ship's layout, see ***Appendix XV***. The ATLANTIS design includes SeaBeam 2112, P-code GPS, ASHTEC, IMET and a dual traction winch. A fiber optic cable will be part of facility. The submersible handling design calls for the cross decking and overhaul of AII's ALVIN A-frame. Other features include a submersible hanger and shops, an aft control station for A-frame and winches, a battery room, an ROV bay and a telescoping boom crane.

C. Timing/Logistics/Shakedown/Engineering dives - Dick reviewed the schedule of key events for ATLANTIS II, ALVIN and ATLANTIS, see ***Appendix XV***. At the completion of science operations in 1996, ATLANTIS II will come out of service. ALVIN's overhaul will take place between September 1996 and April 1997. The actual overhaul should take approximately six months, however, some added time will be needed for the DSOG to become familiar with the new ship. It was noted that any major ALVIN changes suggested for the overhaul period will need engineering, but time and funding are limited.

Modifications to make ATLANTIS a submersible support ship are expected to be complete by April 1997. The ship will arrive at WHOI on 6 May 1997. DSOG demonstrations and trials will be conducted between 20 May 1997 and 3 June 1997. ATLANTIS will be available for science in traditional operating

areas (MAR, NEPR, JDF, etc.) between June and December 1997. The ship will be available for unlimited science operations by approximately February 1998. At this time, a global expedition to the more non-traditional ALVIN operating areas can begin. Given the long lead-times needed to obtain funding, the science community needs to gear up quickly for operations in 1997, both for ALVIN and ROVs.

VII. AGENCY REPORTS:

A. National Science Foundation (NSF) - Don Heinrichs gave the report for NSF by first announcing that Mike Purdy had taken over as the Director of the Ocean Science Division at NSF. Don informed the DESSC community that the 1996 NSF budget was still not signed but they were trying to get funding to the fleet to permit the first six months of operations. The final budget will not be known until it is signed, but NSF is planning on a budget that would be one to two percent below that of 1995.

Don reported that an agreement had been reached between ONR, WHOI and NSF for the conversion of ATLANTIS to a submersible handling ship. Each party will share in the cost of the modification. Don was not optimistic to the chance of getting major improvements funded for ALVIN's overhaul period. He gave no illusion that there will be any funds available for additional overhaul work. NSF expects to get all approved dive programs to sea in 1996 with the ALVIN program winding down in the summer. NSF does not expect to participate in the IMAX program that is planned for 1996.

B. Office of Naval Research (ONR) - Jim Andrews provided the ONR report. The Defense budget has been signed so that ONR can function. The good news is there was no decrease in funding but the bad news is there was no increase. Jim said ONR is interested in deep submergence science but at this time it is not their focus. Jim explained the CNO's new direction for oceanographic research will be divided into 40% littoral, 30% deep ocean and 30% overlap. ONR is very interested in ATLANTIS being a key part of the deep submergence infrastructure. Jim also explained that the Navy has a great interest in the Autonomous Ocean Sampling Network.

Jim introduced Sujata Millick. Sujata is now on-board as the new Research Facilities Program Officer taking over for Annette DeSilva.

C. National Oceanic and Atmospheric Administration (NOAA) - Hank Frey sent a memo which was read by Mike Perfit, see ***Appendix XVI***, describing the status of the NOAA/NURP program. Hank needed to stay in Washington to respond to NURP's reduced appropriation of $12 M. In summary, his memo indicated that NURP's appropriation of $12M was out of conference, but not voted on. This would represent a 1/3 cut from the FY94 and FY95 original appropriations. The chance of Presidential veto of the appropriation is high. The conference language requires NOAA to fund the centers at $1,560K and distribute the excess to the three centers that suffered cuts during the FY95 recision. The FY94 and FY95 appropriations were $18.1M and $18M respectively. A $3.5M recision occurred in FY95, reducing the budget to $14.5 M.

NURP will do everything possible to preserve funds to support ALVIN but may have to do so at a reduced level.

Award for Annette DeSilva - Steve Ramberg presented Annette DeSilva with a citation and Merit Award (which includes a medal) from the, Office of Naval Research, signed by Admiral Mark Palaez. Steve praised Annette for her untiring efforts in support of the Research Facilities Program, filling the gap before Sujata Millick's arrival. Annette received a warm round of applause from the DESSC community present.

VIII. 1996 SCIENCE OPERATIONS AND LOGISTICS:

A. ALVIN 1996 Operations - ALVIN has been scheduled for 53 dives in 1996 with the operations ending at Woods Hole in June, see ***Appendix XVII***. WHOI is trying to fill the down-time with possible BRIDGE MAR diving and commercial work in the late Spring/Summer. With a short operating year, the ALVIN group can use the extra time to become more familiar with ROV operations. There is a great concern, however, about keeping the ALVIN group together during the extended down-time. The ATLANTIS II crew will be laid off much earlier than was originally planned; this is also of great concern to the operator. ATLANTIS II's Master and Chief Engineer have been announced to fill the same respective positions on ATLANTIS.

B. ROV 1996 Operations - Three ROV cruises are planned in 1996 for a total of 117 days, see ***Appendix XVII***. Work will be at: Lucky Strike on the Mid-Atlantic Ridge, Juan de Fuca Ridge and the Southern East Pacific Rise.

IX. OTHER FACILITIES OPERATIONS:

A. Navy Deep Submergence Operations - Commander John Green reported that the Navy has been supporting 60 days of science operations per year using their deep submergence facilities. This year, six operations were conducted during the time frame of 28 April to 28 October using TURTLE, SEA CLIFF and ATV. Areas of operations included sites off California and Juan de Fuca Ridge. A summary of these operations is as follows. ***Appendix XVIII*** provides details on each specific cruise along with the associated Principal Investigator.

- Total days on station: 40 days (four lost to weather)
- Depth: 923-10,500 ft
- TURTLE dives: 7 dives/48 hours
- SEA CLIFF dives: 20 dives/ 123 hours
- ATV dives: 33 dives/294 hrs (longest 37 hrs)
- Total hours of bottom time = 215 hrs.

John Green also reviewed the military operations performed during this same time period.

The Navy has been pursuing various science related initiatives. Select projects are being done jointly with WHOI and SIO-MPL. These include:

- lighting studies/upgrade for ATV and SCORPIO ROVs
- SeaBeam post processing system
- integrated data logging
- ATV tether and telemetry upgrades
- tracking upgrades
- video frame grabber
- MARSAT e-mail

B. MBARI ROV Operations - Debra Stakes provided a report on the activities at MBARI. MBARI is in the process of moving from Pacific Grove to their new facilities at Moss Landing. Construction of MBARI's new ROV support vessel, WESTERN FLYER, is nearing completion. The ship is in the water and undergoing trials. It should be at MBARI in February 1996. Limited operations are to begin in 1997 as they integrate the ship with their ROV, TIBURON. Full operations should begin in 1998. The ship is a SWATH design of 117 feet in length. It features a wet lab, moon pool for ROV launching and berthing for 15 scientists/ROV pilots/technicians.

TIBURON is their new ROV under construction. The vehicle will have a depth capability of 4000 meters, six HMI lights, dual 3-chip cameras and a series of tool sleds.

Debra showed a video demonstrating deployment of various instrument packages.

C. ROPOS - Steve Scott provided information on the Canadian ROV program. ROPOS is a Remotely Operated Platform for Ocean Science, see ***Appendix XIX***. A newly incorporated not-for-profit company has been formed to oversee its operation. Steve Scott is president. ROPOS system features include:

- fiber optic tethered ROV
- 5000m capability
- 2 manipulators
- variety of specialized sampling tools
- EM experiments
- 2 video cameras
- 7 simultaneous RS232 connections
- deep water system with cage - 6 pilot/engineers for 24 hour day operations
- shallow water system without cage - 3 pilots/engineers for 8 hour days

Ship requirements for ROPOS were reviewed by Steve. They are working out problems which include heave compensation and navigation. Steve provided the ROPOS system rates. The Canadians have used it for two cruises and the Germans are planning a cruise in the Aleutian trench region. The Germans will be purchasing a 5000 meter cable for this operation.

D. German (GEOMAR) Operations - Rich Lutz reported that GEOMAR was interested in another ROV operation in 1997 and could be open to other deep submersible activity.

E. West Coast NURP Center Initiatives - Cindy Van Dover reviewed the NURP's West Coast Center plans for work in the Gulf of Alaska. The plans call for three field seasons. It is scheduled to be a $1M, five-year project.

X. LONG-RANGE PLANNING:

A. 1997 and Beyond - Mike Perfit began the discussion by stating that the community needs to decide where we would like to take ALVIN in 1997 and beyond. From recent letters, it appears the interest in going to the western Pacific is low. The community can contact Mike Perfit with areas of interest. Also, Mike indicated that anyone with suggestions on how to get the agencies more involved with supporting deep submergence operations should contact him. DESSC will try to hold a third meeting in the spring to plan for the future deep submergence operations (funding permitting).

Don Heinrichs emphasized that budget pressures are real. The community needs to start thinking about the 15 February submittal deadline. Future expeditions need to be planned now. There is concern that NSF is supporting most requests for ALVIN and ROV time. Support from other agencies is needed.

B. Letters of Interest - Annette DeSilva provided a summary of ALVIN/ROV letters of interest for 1997 and beyond, see ***Appendix XX***. Forty-nine letters of interest and ship time requests were received. These include new letters, letters on file and ship time requests. Of the 49 letters/requests, 31 were for ALVIN and 18 were for ROVs (one indicated both ALVIN and ROVs for the same cruise).

The numbers of letters received for ALVIN use in 1997 was relatively low compared to past years. This was most likely due to the uncertainty of when and where ALVIN would be operating during that time frame. Interest for operations in the Southern EPR was high during 1997 and many of these requests indicated 1998 as an alternate time frame. A summary of other ALVIN dive areas of interest were: North Pacific, 75 dives; Atlantic, 37 dives; West Pacific, 60 dives (1998); Indian Ocean, 31 dives (1998); Equatorial Pacific, one dive and Southern Latitude, 25 dives.

ROV interest continues to increase. Interest areas are dispersed and include the Atlantic, Mediterranean, Juan de Fuca Ridge, Northern EPR, Southern EPR and the Indian Ocean. Highest interest was for work in the Atlantic with 61 days and JDF with 58 days.

An announcement to the community will need to go out quickly informing them of where and when ALVIN can operate.

C. Global Deep Submergence Science Initiatives - NSF has indicated that they are feeling budgetary restraints. Most requests for ALVIN and ROVs have been coming to NSF. Now is the time to start

planning global deep submersible initiatives. Mike Perfit challenged the community to seek other ways/ agencies to support submersible science operations.

D. Programmatic Ties to other National Programs - The need for collaboration among the various national deep submersible programs was deemed important in this scarce funding environment.

E. Vehicle Assets and Technology - DESSC has sent a letter to NSF which presents a 3rd party tool policy. This outlines the responsibility for development and maintenance of these tools. WHOI expressed a concern that the science need and justification of 3rd party tools should be clearly defined. The 3rd party tool policy developed by DESSC will be distributed to the community.

XI. OTHER BUSINESS AND ISSUES:

A. IMAX - John Delaney, reported that not much progress has been made in the past 9-1/2 months on the IMAX project which involves filming ridge axes and deep-sea vents from submersibles. The cost for the program is estimated at $6M. Industry will provide $3M if the other $3M can be found elsewhere. ALVIN could be featured in the filming. John reported that a pre-proposal has been submitted to NSF, however, funding does not look promising (see ***Appendix XXI***). Discussion followed as John asked whether or not we should pursue this project and if so, how would we get funding? No definitive answers were found. Logistics, funding and timing to integrate the program into ALVIN's 1996 operations were cited as a concern.

Those interested in discussing the IMAX issue further were invited to convene following the DESSC meeting.

The meeting was adjourned at 5:15 p.m.

DESSC EXECUTIVE SESSION: A brief gathering of the DESSC was held immediately after adjournment to discuss possible dates and locations for the next meeting.

UNOLS DEep Submergence Science Committee

Carriage House, Woods Hole Oceanographic Institution
Woods Hole, MA
May 31, June 1-2, 1995

Meeting Minutes

APPENDICES

PREFACE: Over the past year a sequence of events have transpired relating to the Deep Submergence Support Ship (DSSS) conversion. These events are outlined below and the correspondences referenced in the outline are included in ***Appendix Ia***. We encourage you to refer to ***Appendix Ia*** prior to reading these minutes. The correspondences will help bring you up to date on the status of the conversion options and schedule.

1. Pre-December 1994: KNORR is the designated platform for DSSS conversion. WHOI working

with The Glosten Associates and the DESSC KNORR Conversion Subcommittee prepare a preliminary design package.

2. February 9, 1995: KNORR Conversion Subcommittee Chair, Karen Von Damm, sends a letter to WHOI and the community. The letter reviews plans for the KNORR Conversion and provides the operator with community input and recommendations, see ***Appendix Ia***.
3. February 27, 1995: Jeff Fox, Mike Perfit and Dick Pittenger meet with NSF, ONR and NOAA in separate meetings to present the proposed KNORR Conversion plans.
4. March 1995: Agencies advise WHOI and DESSC that the planned 1996 conversion KNORR will be delayed approximately six months. The delay will allow KNORR to conduct science operations on its return trip from the southern oceans in the first half of 1996. Additionally, the delay allows the agencies to explore alternative options for the DSSS Conversion.
5. April 6, 1995: Jeff Fox sends a letter to the community advising them of the delay in planned conversion of KNORR. He requests input on areas of interest for ALVIN diving in 1996, see ***Appendix Ia***.
6. April 1995: ONR requests NAVSEA to assess feasibility of converting AGOR 25, ATLANTIS, to handle DSRV ALVIN.
7. April 24-25: At the UNOLS Council Meeting, Mike Perfit reviews community interest in ALVIN diving in 1996. Agencies, WHOI and UNOLS discuss DSSS Conversion issues, options and schedule.
8. May 31, June 1-2: DESSC Meeting is held at WHOI. DSSS conversion issues are deliberated. The meeting summary report follows.
9. June 2, 1995: DESSC sends letter to agencies recommending preferred DSSS conversion options, see ***Appendix Ia***.
10. June 2, 1995: NAVSEA provides ONR with results from their study to assess the feasibility of converting AGOR 25 to a handling platform for ALVIN. Study indicates that this option is feasible subject to further design and analysis.
11. June 28, 1995: Mike Perfit, DESSC Chair, sends letter to Deep Submergence Research Community providing a status of DSSS conversion efforts. The letter also offers projected 1996/97 operating areas for ALVIN and ROV/Towed vehicles. This correspondence is provided as the ***Cover Letter*** to these meeting minutes.

Wednesday, 31 May:

I. WELCOME, INTRODUCTIONS AND MEETING GOALS: Jeff Fox, DESSC Chair, called the meeting to order at 8:30 a.m. The agenda was reviewed and is included as ***Appendix I***. These minutes reflect the order in which items were addressed. A list of meeting participants is included as ***Appendix II***. Jeff noted that Mike Perfit's appointment as the new DESSC Chair was endorsed by the UNOLS Council.

II. ACCEPT MINUTES: The minutes of the December, 1994 DESSC meeting were accepted as written.

Bob Gagosian, Director of WHOI, welcomed the DESSC. He stated that WHOI is dedicated to the support of the National Deep Submergence Facility. WHOI is willing to do everything they can to help with the transition of the submersible platform from KNORR to ATLANTIS if this is the preference of the agencies. WHOI will do what they can to help the community through this process. WHOI is also dedicated to the future of both submersible and ROV/towed vehicle operations.

STATUS REPORTS

III. REPORT ON WHOI/DESSC MEETINGS WITH NOAA/NSF/ONR: In February Mike Perfit, Jeff Fox and Dick Pittenger met with NSF, NOAA and ONR. The objective of their meeting was two-fold: 1) To make one agency the lead agency for the deep submergence facility. This agency would be responsible for maintaining the funding for the facility. The agencies response to this concept was that they are dedicated to supporting the deep submergence facility, but they do not wish to change the structure of the Memorandum of Agreement (MOA). In other words, they do not support the concept of a lead agency at this time. 2) The second objective of the meeting was to present plans for conversion of KNORR to a deep submersible support platform. Under the Woods Hole plan, KNORR would return to Woods Hole and begin the conversion in the early part of 1996. This would mean that the ship would have to transit directly back from Kenya. The agencies did not support this time schedule and indicated that KNORR would have to work its way back to Woods Hole. WHOI also proposed to provide the funding to begin the conversion. They could be reimbursed by the agencies when funding was available. The agencies had not budgeted for the conversion and therefore did not have the funds to start the conversion in 1996. The agency response was to delay all plans for six months. ATLANTIS II would return to Woods Hole in August 1996. During the six month delay, the agencies would look at all of the options for providing a submersible platform for deep submergence. The feasibility of making AGOR 25 the submersible platform would be explored.

In April, Jeff Fox wrote to the community and gave them the status of the KNORR conversion plans. He asked that the community generate letters of interest for ALVIN work that might be able to be accomplished in 1996.

Mike Perfit continued with a summary of the DESSC report from the UNOLS Council Meeting. The Council and agencies stated that they were very concerned with the future utilization of the large ships in the UNOLS Fleet. NSF had been asked to develop budgets for a reduction of 20% by the year 2000. Their priorities are first, people; second, instruments and third, infrastructure/facilities. It was also noted at the Council meeting that overall ship use by agencies other than NSF is down. The budget does not appear to be able to support the conversion of KNORR along with the operation and maintenance of the other large ships in the UNOLS fleet. Don Heinrichs presented his "modest proposal" which shows retirement of ATLANTIS II in mid 1996 and some realignment and downsizing of the fleet (See Section V). The near term future of ALVIN operations was unclear. If ALVIN were available for science in 1996, proposals would need to be submitted and funded. Depending on which vessel is selected to be the ALVIN support ship and the timing of construction, ALVIN could potentially be out of service for a period of 18 months. During the Council meeting, Mike Perfit stressed that the initial response to the

DESSC's request for letters of interest for ALVIN use in 1996 was very high. Additionally, Mike voiced concern over the potential for an ALVIN down period of 18 months, indicating that this could impact the future stability of the National Facility and deep submergence science programs.

Dolly Dieter responded to Mike Perfit's report of the Council Meeting by indicating that with NSF bracing itself for a 20% reduction by the year 2000, the option of amortizing the KNORR Conversion would not be feasible. Presently, NAVSEA is conducting a study on the feasibility of outfitting ATLANTIS (AGOR 25) as the support ship for ALVIN operations. Woods Hole was concerned that through this support ship transition phase, the ALVIN team must be kept viable. Ways to keep the pilots trained must be addressed. DESSC was also concerned with the effects of ALVIN downtime on science programs and time-series work. Dolly pointed out that NSF has always included a submersible support ship in their future fleet plans. She also noted scheduling for the large ships was looking grim because of the decrease in funded science.

IV. NATIONAL DEEP SUBMERGENCE FACILITY OPERATIONS AT WHOI:

A. 1995 Deep Submergence Field Programs: Completed and Scheduled -

1. ALVIN/ATLANTIS II - Barrie Walden gave the update on ALVIN/ATLANTIS operations in 1995, see ***Appendix III***. The year began with a standown in Woods Hole. Operations resumed with a Jeff Karson dive program. Unfortunately, power problems were experienced during the first half of his cruise because the batteries were not charging adequately. Problems with the CTFM were also adversely affecting the science objectives. However, Jeff was able to complete most objectives of the cruise despite the problems. The engineering dives prior to the Karson cruise did not encounter the battery and CTFM problems and it was not until actual diving that the problems were revealed. Compounding the situation was the difficulty in troubleshooting the problem both onboard and at WHOI. It was felt that additional engineering dives may have revealed the problem sooner, and lessened the impact on the science program. DESSC recommends that the agencies be asked to fund more deep-water engineering dives after standowns.

Following Karson's cruise, work continued in the Atlantic with dives for Von Herzen, Becker and Schultz at the MAR-TAG site before transiting to the Pacific. In April, there was a Mullineaux/Fisher cruise at 9o-10oN in the early part of the month. The month ended with ten dives off California by Smith and Druffle. In May, ALVIN had a two week stand-down period in San Diego. In 1995, 170 ALVIN dives are planned, corresponding to 317 ATLANTIS II operating days. 47 dives have been completed as of 25 May, with one day lost to weather. It was noted that NOAA funding for operations in 1995 has been received at WHOI.

2. Tethered Systems - Andy Bowen provided the status of tethered systems at WHOI, see ***Appendix IV***. Proposal interest using DSOG unmanned vehicles appears to be growing. The first viewgraph shows the proposals submitted by agency for the years 1992 through 1995. He continued with a review of 1994 and 1995 operations for JASON/MEDEA, ARGO II and DSL 120.

JASON/MEDEA underwent dock trials from August through December of 1994. Additional dock trials are planned for July through September of 1995. Dock trials are for proof of concept work for Dana Yoerger and Ken Stewart programs. Maintenance and upgrades were conducted during the first five months of 1995. In June, JASON/MEDEA operations are planned off of R/V ENDEAVOR in support of GLOBEC. Manipulator improvements have been conducted and will continue throughout 1995.

ARGO II and DSL 120 were used in operations at the Mid Atlantic Ridge TAG site in June of 1994. A second cruise is planned for the last two months of 1995. Both ARGO II and DSL 120 received maintenance and upgrades in July of 1994.

B. Equipment/Instrumentation Upgrades and Improvements -

1. DSOG Unmanned Vehicle Status - Andy Bowen continued his report with the status of upgrades and improvements planned for the unmanned vehicles, see ***Appendix IV***. Plans for JASON/MEDEA include rewiring the control van, finding a MEDEA replacement, telemetry debugging and continued manipulator testing. Plans for ARGO II include improving the obstacle avoidance forward looking sonar, analyzing video camera focus problems, upgrading thrusters, resolving LBL transducer noise and performing single van operations. The ARGO II operations planned this year off R/V ENDEAVOR will be from a single van. DSL 120 improvements include replacement of the depressor, low speed tow dynamics refinement, design and installment of a weight dropper and examining potential surface processing upgrades. Documentation for all unmanned systems will be developed.

2. ROV - JASON Manipulator Program - Andy Bowen provided the status of the JASON manipulator improvement program, (***Appendix IV***). As of June 1995, fiber optic connector mating/ unmating has been demonstrated. Operational pressure tests of the arm have been completed. The gripper is being redesigned to achieve more gripping force. There is 7 pounds force now, and the goal is to get 20 pounds force. At full extension JASON's manipulator can lift 60 lbs. DSL has been working to identify a hydrothermal fluid sampler trigger mechanism. Development of mechanical and electrical documentation is ongoing. DSL is also working to identify samplers to demonstrate the manipulative capabilities during the dock test program. Prior to the end of the year, they hope to complete installation and testing of the new gripper. DSL will implement polar coordinate control. Additional dock trials are planned. JASON with the manipulator installed will be pressure tested to 6,000 meters at the Navy's David Taylor facility. In November, the manipulator will be installed on ALVIN and tested during a science cruise to the EPR at 9°50'N.

3. Video System: Pan and Tilt Camera; New 3-chip Video - Andy reported that WHOI has studied the present 3-chip market and technology. They have analyzed present 3-chip performance and specifications and have monitored the MBARI 3-chip development effort. Specifications and a Request for Quote (RFQ) for compatibility with both ALVIN and JASON have been developed. The new camera is planned to be installed during the 1996 overhaul period.

A survey of pan and tilt commercial vendors has been conducted. Remote Ocean Systems (ROS) has been identified as the preferred vendor and a quote has been obtained. The performance history of the ROS units has been discussed with the users. The pan and tilt will be installed during the 1996 overhaul period, (***Appendix IV***).

4. Electronic Still Camera for JASON, ARGO II and ALVIN - Andy reviewed the vital and desirable characteristics for the Electronic Still Camera (ESC), see ***Appendix IV***. The selected system must be adaptable to both ALVIN and ROV power and telemetry. WHOI has used a system from a local vendor, but decided that this would not be the most desirable unit. Cost of that system is prohibitive and performance spotty. Vital characteristics include analog display, time stamp, real-time control, high dynamic range and resolution, capability of data telemetry to the surface, minimization of custom software and hardware and a standard data format. Real-time control of focus, zoom and viewfinding are desirable. It is also desired to have image processing and mosaic capabilities. Presently, high quality mosaics have largely been generated at WHOI although other software packages are under development (e.g. University of Hawaii - Dr. M. Edwards). DESSC endorsed the need for electronic still camera capability for ALVIN and JASON in order to permit routine digital image mapping of seafloor sites.

5. Navigation Proposal Status - Jim Bellingham gave the status of the navigation proposal, see ***Appendix V***. He began by outlining the features of the proposed system. It utilizes the Pelagos navigation software (Windows-based), has a mission replay capability, and can utilize customized software. The in-hull navigation can be satisfied by a Pentium-based computer and flat panel displays. The recommended surface ship hardware is the Nautronix 916 USBL/LBL. This system will be provided on the new AGORs. If KNORR is to be the new ALVIN support ship, a Honeywell 906 could be acquired from the Navy, then upgraded to a 916 system. Other aspects of the navigation upgrade include purchasing intelligent transponders and implementing a Doppler Velocity Log (DVL) for dead-reckoning in ALVIN.

Jim reviewed the list of constraints that had been imposed at the last DESSC meeting. All constraints can be met with two exceptions. The in-hull interface upgrade will require the present system to be disabled. Also, the constraint that the present system not be disabled until the new system is functioning will need to be relaxed if the volume and power are to stay within the present system envelop in-hull. WHOI plans to perform the in-hull modifications while ALVIN is undergoing its overhaul. A number of navigation upgrade concerns have been identified and are in the process of being addressed. Some of the concerns can be resolved by additional documentation.

Long BaseLine (LBL) upgrades and transponderless navigation were also addressed by Jim Bellingham and are included in ***Appendix V***. Common hardware/software across ALVIN's surface and in-hull navigation and ROV/AUV navigation is planned. The software upgrade will be accomplished through a cooperative effort between a commercial vendor and WHOI. A free post-processing tool set will be provided for scientists. WHOI will need to ensure that the navigation software supports integration of the new systems and that users are provided with clearly presented documentation. Well documented data files with raw data will be provided. The merging of surface and in-hull data files still needs to be

addressed.

DESSC noted that excellent progress had been made on the navigation upgrade proposal by Jim Bellingham, Dana Yoerger, Andy Bowen, and Dudley Foster. They are ready to go to the agencies with a proposal for the upgrades. The next step in the proposal process will depend on which ship is selected to be ALVIN's support platform. There are still a number of uncertainties, but WHOI is ready to go ahead as soon as the support ship issue is resolved. DESSC recommends that the upgrade on ALVIN be complete when it comes out of its overhaul period. The navigation upgrade will be compatible with the unmanned systems and should be available on the unmanned vehicles for 1996 operations.

C. Plans/Options/Issues for 1996-1997 Operations -

1. ALVIN Overhaul: Scope and Timing - Barrie Walden provided an overview of the ALVIN overhaul and inspection schedule performed since 1989, see ***Appendix VI***. Hull inspections should be performed every five years, the last one was done in 1989. The ALVIN hull inspection is overdue and needs to be performed in 1996. NAVSEA has indicated that they will entertain waivers to extend the ALVIN hull inspection date past August 1996.

Barrie reviewed the work tasks planned for ALVIN's next overhaul period, see ***Appendix VI***. The tasks include the hull inspection, frame inspection and repair, testing of the VB/HP air spheres, navigation upgrades and items necessary for ALVIN to be compatible with the support ship conversion. Under ideal conditions, WHOI likes to perform the overhauls over the winter, so that it falls into two calendar years.

2. Support Ship: WHOI Perspective - Dick Pittenger began the discussion by reemphasizing Bob Gagosian's words from the morning; WHOI is dedicated to the National Deep Submergence Facility. Also, Dick stated that although various options are presently being explored for the future submersible support ship, the option of converting KNORR should be kept alive.

WHOI is prepared to move forward with KNORR's conversion as stated in their April 1991 proposal to operate AGOR 25. They have downsized their original KNORR Conversion plans presented to the agencies in February to one that would be no cost to the agencies but still complies with the spirit and letter of the April 1991 proposal. The new plan would still allow KNORR to be a capable support ship for submersibles. An overview of the KNORR Conversion features is included as ***Appendix VII***. The A-frame would be along the center-line of the ship versus offset to port. This is less expensive and uses less main deck lab space, but would require more deck space. The traction winch would be located on deck, versus below decks, and the crane would be moved off the main deck. Weight storage and handling would be as on ATLANTIS II. Navigation upgrades would be proposed separately per the DESSC subcommittee. Dick reviewed sketches of the proposed modifications. It was noted that this plan significantly differs from the original KNORR Conversion plan and has not been reviewed by the KNORR Conversion subcommittee chaired by Karen Von Damm. The Von Damm committee needs to continue to look at the effects of the proposed changes. Dick gave a comparison chart of the features of

the past two WHOI support ships with that proposed for KNORR. It appears that KNORR would certainly have some benefits over the present ship, almost doubling the lab space. There was discussion regarding the fly-away capabilities of the tethered systems and overlap in expertise between ALVIN/ ROV group members.

Short term objectives for WHOI include maintaining science support continuity and excellence, keeping ALVIN and ROVs viable, minimizing the impact on marine crews and minimizing the cost to agencies. The long-term objective is to build a first class national facility.

3. Timing Options for Deep Submergence Operations - Dick reviewed the schedule for implementing the revised KNORR modifications should it be selected as the support platform. Phase II design would be completed by late 1995. An RFP could then be issued in February of 1996. Long lead time material would be delivered by mid-1996. In October 1996, ATLANTIS II would return to Woods Hole for retirement and ALVIN would begin its overhaul. KNORR would enter the shipyard in November 1996 to begin the conversion process. KNORR with ALVIN would be ready for science by May 1997.

Dick continued by reviewing the AGOR 25 post-delivery schedule. Delivery is scheduled for April 1997 to be followed by a series of tests and a fitting-out period in July 1997. A post shakedown availability period is scheduled for the first two months of 1998. Ship construction funds run out in April 1998. Dick has a number of concerns regarding the AGOR 25 conversion to DSSS. Interfacing with the shipyard under the present contract could present difficulties. Dick ended his presentation with a summary of possible scenarios for deep submergence operations for 1996 and 1997, see the timelines included in ***Appendix VII***.

V. UNOLS: Jack Bash provided a brief summary of the activities of the UNOLS Council meeting held in Monterey, CA on 24-25 April 1995. Jack's report was confined to those issues that were germane to the DESSC. The UNOLS meeting was dominated by a discussion on potential changes for the UNOLS fleet as a result of declining budgets. Don Heinrichs made the point that the funding shortfall was due primarily to declining support from other agencies. NSF has increased it's budget over the past three years by 22% while all other funding combined decreased by about 23%. Don said that projected funding would not be adequate to support the entire fleet when the two new AGORs come on line. NSF has been asked to develop plans for level funding for the next three years, to be followed by a one year 3% reduction, and then a 2% reduction per year for three years. With this gloomy outlook and no great influx of non-NSF funding on the horizon, Don predicted that the UNOLS fleet would be facing a reduction in size. He presented a strawman "modest proposal" which called for the retirement of five ships (ATLANTIS II, COLUMBUS ISELIN, GYRE, ALPHA HELIX and MOANA WAVE). This proposal further suggested the realignment of two ships, MELVILLE to Hawaii and OCEANUS to Alaska. Don also said that it is possible to require the retirement of one of the present active large ships. These dire predictions stimulated significant discussion.

In other UNOLS matters, the University of Miami is negotiating with Harbor Branch to combine their ship operations. This includes the technician organization of University of Miami operating from Harbor

Branch ships as well as academic collaboration between the two institutions. COLUMBUS ISELIN has been repaired and is at the dock at Harbor Branch. The ship has no 1996 schedule and has been offered for sale.

Jack reported that Barry Raleigh of SOEST attended the UNOLS Council meeting and informed the group that SOEST would not be pursuing the acquisition of a SWATH ship as a replacement for MOANA WAVE. NOAA's Jim Baker met with Barry and suggested that an academic institution may be considered as the operator of the new NOAA AGOR and that Hawaii could be a candidate. Barry suggested that SOEST was interested and that they would envision a 50/50 NOAA/UNOLS operation with the AGOR. Barry also said that they would accept the transfer of MELVILLE if that decision were made.

VI. AGENCY REPORTS:

A. National Science Foundation (NSF) - Dolly Dieter gave the report for NSF. She began by reviewing the NSF budget for FY95 and the request for FY96, see ***Appendix VIII***. The total Ocean Science Division budget for FY96 is $205.6M. This may represent a 6.3% increase over FY95. The feeling is that may see an increase of 2% at most, but level funding is highly probable. Level funding means there is not enough money to keep all of the big ship's funded. There does not appear to be any financial help available from ONR or NOAA in the near future either. The future potential funding restraints are fleet wide and not just for ALVIN. NSF would prefer to see the older ships in the fleet tied-up if faced with lay-ups. NSF's future large ship requirements include:

- 1 MCS/MGG Ship
- 1 Deep Submersible Support Ship
- 3 General Purpose Ships.

The six ships that Don Heinrichs' "modest proposal" slated for retirement won't reduce NSF's budget as much as many perceive. NSF's support for these ships this year is approximately:

- ISELIN = $250K
- GYRE = $0
- MOANA WAVE = $1.5M
- ATLANTIS II = $3-4M
- ALPHA HELIX = $800K

Dolly pointed out that since Navy owns ALVIN and most of the large ships, they will need to be a player in any decisions regarding realignments and lay-ups.

NSF is also concerned with the potential for a long hiatus in ALVIN operations and the effects it might have on crew/pilot stability. DESSC noted that with the 15 August proposal deadline quickly approaching, they need to be ready to provide guidance to the community. Agencies will meet to discuss

the MOA within the next three months.

B. Office of Naval Research (ONR) - Jim Andrews provided the report for ONR. The change in ONR's course over the years has changed the amount of use of ALVIN. ONR does not have plans to support ALVIN cruises in the next few years.

The CNO Executive Board is scheduled to meet in June. They will look at the future of the Navy and its potential for taking the lead in oceanography. Hopefully this will have positive influences on blue water science and deep submergence asset use.

ONR, NAVSEA and Halter Marine, Inc. (HMI), the shipyard constructing AGOR 25, plan to meet in June to discuss HMI's interest in making AGOR 25 a submersible support ship for ALVIN. An initial study by NAVSEA indicated that it is feasible and will be at lower cost than converting KNORR. AGOR 25 can provide the community with a long term solution for submersible handling. ONR is aware of the short term problems that may be associated with making AGOR 25 the support ship. They would like to work in cooperation with DESSC and WHOI in this transition if AGOR 25 becomes the preferred platform. Jim noted that these conversion plans have not yet been approved at the highest levels of ONR. If HMI will outfit AGOR 25 as a submersible support ship during construction, there may be a window of opportunity for ALVIN operations in fall 1997. These operations would need to be relatively close to Woods Hole since this would fall within the warranty period for the ship. It was noted that any AGOR conversion time table was very "soft" at this time.

In other issues, ONR's Research Facility Program budget appears to be level funding for next year.

C. National Oceanic and Atmospheric Administration (NOAA) - Hank Frey gave the report for NOAA. He gave the recent history of FY95 funding woes regarding support for NURP. NURP was not included in the original NOAA 1995 budget, but Congress appropriated $18M. NURP then awarded three of their six centers one year grants for support. On February 27th, Congress recommended a recission of the $18M for NURP. Later this recission was reduced to $3.5M. The three centers that did not receive their annual support are being funded month to month. The plan is to fund these centers through September, reduce spending at the National Office, pay off all obligations and distribute what ever may be left over among the National Office and the Centers. There will be no NURP/Navy operations coordinated from the National Office this year. Had there been funding, the operations would have been carried out on DOLPHIN.

One of NURP's top priorities is to continue support for ALVIN operations, but at what level is unclear. Jim Baker and Department of Commerce put NURP in the FY96 budget, but OMB removed it. An authorization bill is needed for NURP. The Centers are encouraging support from Congress. Funding in FY96 will depend on the success of the NURP Centers.

VII. NOAA and U.S. Deep Submergence Operations:

A. NOAA/HURL Program - Hank Frey gave the report for Alex Malahoff who regretfully could not attend the DESSC meeting. He prepared a paper describing HURL's Project Unity, see ***Appendix IX***. Project Unity was developed in response to HURL's rectification review of June 1994. The project concentrates on the completion and full integration of the ship, submersible and ROV into a smoothly operational 2000 meter diving system. Alex's paper addresses each element of the integration. Tests of the integrated system are planned for the spring of 1996 with a full science program in the summer of 1996. It is unclear what funding will be available for 1996. Western Pacific operations will be delayed for at least 2 years.

VIII. Recommendations on 1996 Operations at the National Facility:

A. Assessment of Letters of Intent and Tally of Funded Programs - A summary of ALVIN and ROV letters of intent were provided to DESSC and are included as ***Appendix X***. It was noted that this summary was compiled from all messages received at the UNOLS Office in response to Jeff Fox's memo to the community dated 6 April 1995.

The summary also included letters of intent, proposals, and ship time requests received by the UNOLS Office for ALVIN and ROV work. It was noted that some of these letters may no longer be current and as a result the total dives for each operating area may be a bit high.

Dolly Dieter commented that in the future, DESSC should consider moving the DESSC meeting back a bit. The NSF panels just met last week. As a result, the science program managers may not have had an opportunity to contact PI's proposing to use ALVIN on the outcome of their funding decisions. In reviewing the summary of letters of intents and proposals, Dolly can not give the status of specific proposals submitted. Additionally, it was also pointed out that the UNOLS Ship Scheduling Meeting may also need to be moved back a few weeks, since that meeting often constrains when DESSC needs to meet.

Annette DeSilva reviewed the summary and based on the latest information, it appears that approximately 65 funded dives are planned for 1996. This can be broken down to 26 dives in the Atlantic, 20 dives in Eastern North Pacific, four dives along the North East Pacific Rise and 15 dives on the Southern EPR. NERC-BRIDGE (British) has shown interest in using ALVIN in the Atlantic in 1996 and 1997. Purchase of some submersible time from US and French submersible operators is being considered by BRIDGE. Although the 15 August 1995 and 15 February 1995 NSF proposal deadlines are intended for 1997 operations, Dolly encouraged DESSC to prompt the community to submit proposals for 1996.

ROV science programs were reviewed. There are currently three funded field programs which will utilize ARGO II and the 120 kHz sonar, two of those programs will also utilize JASON. One program is on the Mid-Atlantic Ridge, one is on the Juan de Fuca Ridge, and the third program is on the southern East Pacific Rise near 17.5oS. The first two programs will be fielded in 1996 and the southern EPR program will likely occur either in late 1996 or early 1997 depending on logistics in mobilizing the ROV

and towed vehicle equipment. Proposal pressure for ROV/towed vehicle programs continues to be good with approximately 5-7 proposals having been submitted to the last three NSF target dates. WHOI is working with potential PIs in helping them prepare proposals for use of ROVs. In DESSC's guidelines to the community, towed unmanned system's availability in 1996 and 1997 must be stressed.

To end the discussion for day one, it was emphasized that we need to develop a means for keeping the National Facility strong through this transitional period. It appears that there is some funded work in 1996 to put together a limited AII/ALVIN schedule. DESSC will request confirmation from NSF regarding additional support for 1996 and 1997 and the possibility that ALVIN/ROV proposals declined in June be allowed to be resubmitted in August. The timing for these operations will depend on a number of factors: The overhaul of ALVIN, ATLANTIS II inspection schedule and the support ship conversion schedule.

Day 2 - Thursday, June 2, 1995

US NAVY/NOAA Programs - CDR John Green provided the US Navy deep submergence presentation with a sequence of view graphs which are included as ***Appendix XI***. John started with the operational activities of the Advanced Tethered Vehicle (ATV) and DSV-3 TURTLE. These vehicles worked in the Catalina Basin from 29 April to 8 May in a very successful operation with Craig Smith studying whale-fall communities. TURTLE made three dives for a total of 24.7 hours and ATV made seven dives for a total of 69.3 hours in the water. From 8 to 14 May these platforms supported a successful cruise at the San Diego Trough for Gordon Hendler of the Natural History Museum of Los Angles in a study of deep-sea brittlestar fish. TURTLE accomplished four dives for a total of 23.9 hours, and ATV made five dives for a total of 58.6 hours. Military operations were conducted in the fall of 1994 through March 1995 logging over 200 hours of ROV bottom time and recovering over $50M in hardware. Future operations include an 18 to 21 day operation off Hawaii with ATV and TURTLE to search for a Navy delivery system. LANEY CHOEST and the systems should be back in San Diego by 2 July. In August and September, approximately 20 days of scientific operations are planned using ATV and SEA CLIFF. Investigators Paul Dayton and Eric Vetter will study submarine canyons off the southern California coast. Cindy Lee Van Dover will investigate hydrothermal vents on the main Endeavor Field and Martin Fisk will conduct operations on the Mendocino Ridge.

John reviewed some of the recent projects and upgrades to their deep submergence vehicles. This included the acquisition of 3-chip CCD cameras for TURTLE and SEA CLIFF and the unmanned vehicles. They completed a lighting upgrade for the ATV and TUWVs. A Micro-laser scaling system was installed and navigational upgrades made. Improvements were made to the support ship's Sea Beam post processing and their e-mail capability. SCORPIO received a depth upgrade to 20,000 feet..

Navy plans to convert from a multimode cable to a single mode cable for ATV. This tether should have the same life as the vehicle. It will take approximately four months for the manufacturer to make the cable plus extensive conversion efforts before the new cable is ready for use. The conversion may begin in December.

The scientific operations presently carried out by the Navy's deep submersible assets are made possible through an MOA between NURP and Navy. Navy is in the process of developing another MOA with EPA for environmental monitoring operations. John commented that if NURP is disbanded, an MOA with another organization would be necessary to continue science operations.

B. Recommendations for a 1996 Schedule of Operations - Don Moller started this segment by providing a 1996 schedule for ATLANTIS II based on the information available which included 50 dives, (excluding Southern EPR funded work), see ***Appendix XII***. His schedule had ATLANTIS II returning to Woods Hole in late 1995 and standing down for six months while ALVIN is overhauled. The ship departs Woods Hole in July 1996 to start engineering dives and operations in the Atlantic. It then transits to the Pacific in September for work in Guaymas Basin, off California and the Northern EPR. The ship and ALVIN would complete the year in the Panama area permitting it to return to Woods Hole or continue operations into 1997 in the Pacific.

C. Implications for 1997 and Beyond - Dick Pittenger presented possible options and schedules for ALVIN's support ship conversion. These options and schedules are provided as part of ***Appendix VII***. Dick pointed out that ATLANTIS II must complete a USCG inspection as well as an ABS inspection by November of 1996.

NSF is willing to consider extending AII's operating schedule, but the final decision will depend on the timing of the DSSS conversion, budget and proposal pressure. Since AII is scheduled for retirement at the completion of operations, the added maintenance expense plus inspections and dry-dock to extend operations into 1997 is a major consideration.

NSF will explore entertaining proposals for 1996 operations in their 15 August submittal deadline. They do not wish to see a long hiatus in ALVIN operations. WHOI will need to provide NSF with cost estimates for the ALVIN overhaul and the ATLANTIS II maintenance and inspections. DESSC endorsed the 1996 operating schedule presented by Don Moller which shows ALVIN's overhaul in the first half of 1996. They felt that PIs would have a better chance of getting their work fielded by the end of the year.

The DESSC summarized the constraints facing the future ALVIN schedule and support ship conversion:

1. ALVIN requires a major overhaul (six months)
2. KNORR will work its way back to WHOI from the southern oceans.
3. ATLANTIS II will require ABS certification and USCG inspections in 1996.

D. Guidelines to the Community - DESSC reviewed the characteristics of ATLANTIS and noted features that would make it an attractive submersible handling platform. The Committee agreed to write a letter (see ***Appendix Ia***) to the federal agencies with their recommendation and concerns regarding the conversion of a ship to be the submersible handling platform. It was the consensus of the Committee that

the conversion of ATLANTIS (AGOR 25) would be the overall best option for the community. On the plus side, this ship is new and therefore has a longer anticipated life. The ship offers more science berths, more lab space and more deck space. Also, the traction winch is located below deck. DESSC noted a few concerns with designating ATLANTIS as the support ship. The effectiveness of ATLANTIS' bow thruster for use in ROV operations needs to be explored. The other potentially problematic aspect of going with ATLANTIS is the timing of its entrance into the fleet. With ATLANTIS II scheduled to be retired in 1996 and ATLANTIS not available until 1997 or 1998, there could be a long hiatus in ALVIN operations. With these concerns noted, DESSC felt that ATLANTIS would provide long term health for Deep Submergence Operations. DESSC's letter to the agencies would emphasize the need to maintain the integrity of the National Facility through these transitions. Also, DESSC would recommend to the agencies that the option to convert KNORR should be kept alive until the concerns regarding ATLANTIS can be adequately addressed. A subcommittee of Mike Perfit, Jeff Fox, Dan Fornari and WHOI personnel was formed to draft the letter. A copy of the letter, dated June 2, 1995, is included in ***Appendix Ia***.

It was pointed out, that a new guideline at NSF prohibits PIs from resubmitting proposals for the next panel following original submittal. In light of recent events and the potential for ALVIN operations in 1996, DESSC would like NSF to reconsider this rule for the 15 August panel. They will include this request in their letter to the agencies.

DESSC plans to send a letter to the community regarding future deep submergence plans. However, they will wait a few weeks until they have further guidance from the agencies and information regarding the ABS certification. The intent of their letter will be to keep the community informed while also giving them some guidance on the timing for proposal submittal and potential geographic areas of operation. At this time, it appears that work along the southern EPR and the western Pacific will be postponed until after the deep submersible facility is integrated on a new support platform. (Note: This letter has been written and sent to the community. It is included as the ***Cover Letter*** to these minutes.)

IX. Third Party Tool Review:

A. Finalize Announcement for Third Party Tool Policy - A draft Third Party Tool Policy was sent by Barrie Walden and Jeff Fox to Don Heinrichs and Lisa Rom for review. A copy of this is included as ***Appendix XIII***. The intent of the policy is to coordinate the community's efforts in developing third party tools. It also will provide a structure for prioritizing use of the assets. The policy addresses DESSC's role and the process of developing tools.

The tool policy was reviewed and endorsed by DESSC and will be distributed appropriately. Mike Perfit, Hugh Milburn and Dan Fornari were tasked with drafting an Announcement to the community relative to the 3rd Party Tools Policy. It was decided that an ad-hoc committee will be assigned to address third party tool issues as needed. Dan Fornari will start compiling a list of third party tools.

B. Status Stakes/Holloway Drill - Debra Stakes provided an e-mail message providing a status report

on the on-going development of the Stakes/Holloway drill, see ***Appendix XIV***. They continue to maximize capabilities for use with ALVIN. Efforts include modification and addition of valves. Also, where possible, aluminum components have been replaced with titanium. The drill is planned for use on Rodey Batiza's cruise this October. Debra Stakes conveyed to the Committee her concern about the issue of insurance for the Stakes/Holloway drill. Obtaining insurance by the party making use of the drill has proven to be very difficult. The committee discussed the issue and recommended that WHOI investigate purchasing insurance for the drill and other future third party tools. If insurance is purchased by the operator, the cost would be passed on to the user. Lisa Rom noted that the government considers itself to be self-insured and therefore will not purchase insurance. It was also pointed out that the cost of replacing the drill may actually be less expensive than insuring it. NSF indicated that they will entertain a proposal for replacement of the drill.

C. Other Systems - Hugh Milburn described the new NOAA manifold sampler which is still in the development stage. The old manifold has been used quite a bit in the past on ALVIN. There are also requests for its use on SHINKAI and ROPOS. Development of the new manifold is progressing along. They are experimenting with a new material "PEEK", a plastic with a high temperature rating. The major samplers on the manifold will have electric actuators, replacing the hydraulic actuators now used on ALVIN. The new manifold is planned to be modular and will be adaptable for use on ROPOS, ATV and possibly JASON. Other systems under development include WHOI's new temperature probe and water bottle system. WHOI is also in the early stages of developing a fiber optic data link that could pass data through an ALVIN view port eliminating the need for a through-hull penetration.

D. DUMAND Request for ROV Assets - DOE is funding a program, DUMAND Neutrino Astronomy Project, off the Island of Hawaii that has need of an ROV. The DUMAND Project spokesman and director, John Learned, has sent an e-mail to DESSC with a description of the DUMAND Project, a description of the ROV services needed, and a request that DESSC determine whether or not NSF ship and ROV time can be arranged, see ***Appendix XV***. The proposed use of the ROV is outside of oceanography and is intended to service the DUMAND system. Since DUMAND provides a means for interesting science, DESSC endorsed the principal and nature of the application of JASON. However, the issue of funding is out of the realm of DESSC. Learned indicated that funding for ROV and ship time had not been included in their budget. They would like NSF to support the facility time. NSF has indicated that since it is a DOE funded science program, DOE should pay for the ship and ROV time. DESSC will respond to John Learned's correspondence reflecting the above view.

E. SONNE Program - Dan Orange brought the Committee's attention to the German funded SONNE program which plans the use of JASON and DSL 120 for investigation of cold seeps discovered in the Aleutians last year. The program would be a two leg operation in July and August, 1996, with a total of 47 funded ship days and 20 days of tethered vehicles. The German, GEOMAR principle investigators are Edwin Suess and Peter Linke. They are looking for U.S. support to fund the ROV time. Rich Lutz would be the main contact for the U.S. A science proposal for the U.S. participation in this project has not yet been submitted. The Committee enthusiastically endorsed the project providing it does not conflict with other JASON scheduling.

X. DESSC Discussion and Recommendations on Development Upgrades:

A. ALVIN Power - Dudley Foster provided the Committee with the history of ALVIN batteries. His view graphs, ***Appendix XVI***, provide a comparison of on-bottom time for ALVIN, NAUTILLE, CYANA, SHINKAI, 2000 and SHINKAI 6500. Also provided was a comparison of battery characteristics and cost factors. ALVIN and NAUTILLE both utilize Pb acid batteries. SHINKAI 6500 uses AgZn batteries. Although they have a very high power capacity, the AgZn batteries only get approximately 75 dives per set and are very expensive (approximate cost is $2 million per set).

Dudley showed a viewgraph of ALVIN's estimated bottom times over ten years, 1985 to 1995. Dan Fornari provided a graph showing the data used to generate these statistics. Over the ten years and nearly 1500 dives covered by the data used for this study, ALVIN's bottom time has shown a general decrease of approximately 45 minutes, however, there have been dives recently which have had bottom times as long as nearly six hours, which is equivalent to some of the longest dives in previous years. Compared to NAUTILLE and SHINKAI, on average ALVIN has had longer bottom time and costs much less per dive. Dudley reviewed the long and short-term variables affecting ALVIN power and bottom time, see ***Appendix XVI***. Dudley suggests that this trend is primarily attributed to an increase in power needs for the installed equipment. In an effort to improve battery life, WHOI is: a) continuing to monitor the battery market, b) continuing to optimize the charge cycle, c) continuing to optimize battery maintenance, d) increasing pilot efficiency training and e) continuing electronic monitoring development, and f) educating users on efficiency of power use. It was noted that pilots who astutely manage power use get significantly more time out of the batteries. John Green stated that the Navy had a study on NiCad batteries for SEA CLIFF and would share this report with WHOI.

Dudley and Barrie sent a fax to Jeff Fox dated 10 May, that reviews the status of ALVIN batteries and the hydraulic system. This fax is provided as ***Appendix XVII***. DESSC thanked Barrie, Dudley, Dan Fornari and Rick Chandler for their efforts in researching the battery issues. Dan Orange and Jim Bellingham offered to provide DESSC with some battery calculations. These are provided as ***Appendix XVIII***. The Committee suggested that the design of ATLANTIS should be investigated to determine if a new battery handling system could be accommodated.

B. Other - ALVIN continues to use the older hydraulic motor controllers which have proven reliable, however, use more power. MBARI has worked with MOAG, the manufacturer of the new pressurized motor controllers, for over a year and seems to have worked out the problems. It was suggested that WHOI continue to follow the progress of MBARI. Other items mentioned by the community that need improvement are the hand-held camera and the submersible's tape recorders. DESSC will continue to compile a list of equipment that the community needs.

The Committee suggested that WHOI develop and implement a strategy for improvements to ALVIN. With ALVIN's overhaul planned for 1996, this could offer the perfect opportunity for integrating improvements.

XI. DESSC DISCUSSION AND RECOMMENDATIONS ON CALIBRATION OF SCIENCE SENSORS: Barrie Walden began the discussion of the science sensors. He indicated that there is a need for a calibration schedule for routine equipment. Many scientists have requested calibrations before or just after cruises. Lisa Rom indicated that the policy is if scientists want equipment calibrated more than once a year, they need to pay for it out of their science budgets. Regardless, there is still the issue of scheduling calibrations. Lisa commented that WHOI should have a marine technician that coordinates this whole process. Other institutions routinely handle calibration scheduling and implementation though their marine technician programs. Additionally, the ALVIN manual should be modified to state that calibration of the CTD is performed once a year. If the scientists wish to have it done more often, they will have to pay for it.

XII. REVIEW OF USER COMMUNITY ASSESSMENTS OF THE NATIONAL FACILITY: Mike Perfit and Jeff Fox surveyed the users of ALVIN for the past year and reported on their comments. All were pleased with the operations and reported noticeable advancement. Many cited the professionalism of the ALVIN pilots and crew. Dan Fornari's efforts were reported as being very positive. Several users expressed their concern with the morale of the pilots and the stability of this vital group. Also of concern was the lack of pre-cruise coordination. There has been difficulty in getting responses for planning questions in that there are so many different persons to deal with at WHOI. Users do not see logical, coordinated and responsive shore support. A more comprehensive brochure and users manual would assist in this matter.

Mike listed some of the operational concerns:

1. Navigation is off by 10's of meters when transferring between transponders.
2. Overlays are needed for the 3-chip camera.
3. Pan and tilt cameras are needed.
4. More time should be devoted to engineering dives.
5. Strobes and hand-held cameras did not work 50% of the time.

Jeff Fox echoed Mike's comments about the supportive sea operations and the positive trend of improvement with the AII and ALVIN crews. Jeff also noted that delayed maintenance to ATLANTIS II was beginning to show.

XIII. RECOMMENDATIONS FOR DESSC MEMBERSHIP: Three members of the DESSC have terms expiring. Gary Taghon has just completed his second term and is ineligible for another. DESSC recommended potential candidates with benthic biology backgrounds for replacements. Carl Wirsen and Hugh Milburn both completed their first terms and have agreed to serve second terms. DESSC also discussed increasing their membership by one to have representation from someone with background in remote systems use. Potential candidates were identified. Mike Perfit will contact the candidates recommended by DESSC to determine their willingness to serve.

XIV. Other DESSC Issues:

A. DESSC and the Millennium - Two issues were discussed in regard to DESSC in the millennium: 1) the Memorandum of Agreement (MOA) and 2) deep submergence needs in the next century. A number of questions arose: Do we need a manned presence in the next century? If so, how would we like it to be characterized? How will AUVs and ROVs be folded into this picture? What will be the suite of instruments? It was noted that the Abyss Report had been widely distributed throughout the community, but there has been relatively little feedback.

From the agency reports, it was learned that initiating a new MOA is presently on hold. They would like to determine who the partners will be in the next agreement before proceeding. At that time, they will begin to identify the facilities that will be included as part of the facility. There was general agreement between the agencies that the agreement will be a partnership. The MOA will not identify a lead agency for the National Facility. It was noted that many times facilities and programs can gain better backing when supported through partnerships.

Dick Pittenger sketched a timeline depicting the deep submergence assets in the future from 1996 through the year 2020. It showed ATLANTIS coming on line in 1997 and operating beyond 2020. In 2005 ALVIN will be forty years old. The need for manned submersibles continues, but the characteristics of a new or replacement platform are unclear. The need for ARGO and JASON/MEDEA continues into the next century with next generation ROVs coming on line periodically. AUVs and other deep submergence tools also will be integrated into the deep submergence suite of assets. Dick also pointed out that the Federal Agencies have shown a long term dedication to deep submergence by designating ATLANTIS as the new support ship. Perhaps consideration of deeper diving manned submersible should begin to be considered.

There was a discussion on what assets should make up the National Facility. Barrie pointed out that the National Facility provides a means for the community to gain access to expensive assets. The less expensive items should not be included in this facility since they can be accessed relatively easy. The National Facility provides assets and services that other institutions cannot provide. This does not mean that just because some assets are not part of the National Facility they should not exist. Agencies should not be discouraged from funding other facilities just because they are not part of the National Facility.

DESSC's responsibility is to serve as an advisory/focal group on deep submergence issues for the community. The National Facility comprises a major component of their responsibilities. However, DESSC needs to continually look over the horizon and see where technology is going. If DESSC is to speak for the whole deep submergence community, they must encompass all elements. This will include being informed about happenings at other deep submergence activities such as HURL, MBARI and Navy. DESSC strengthens their voice if they welcome the views of all other assets. It is to DESSC's advantage to bring in ancillary groups to learn what they are doing so that we can maintain our National Facility to the highest standards. Communication links are important.

DESSC continued the discussion on the MOA and what they would like to see as elements of the MOA. The agencies have indicated that only the agency partners will be involved with drafting the agreement.

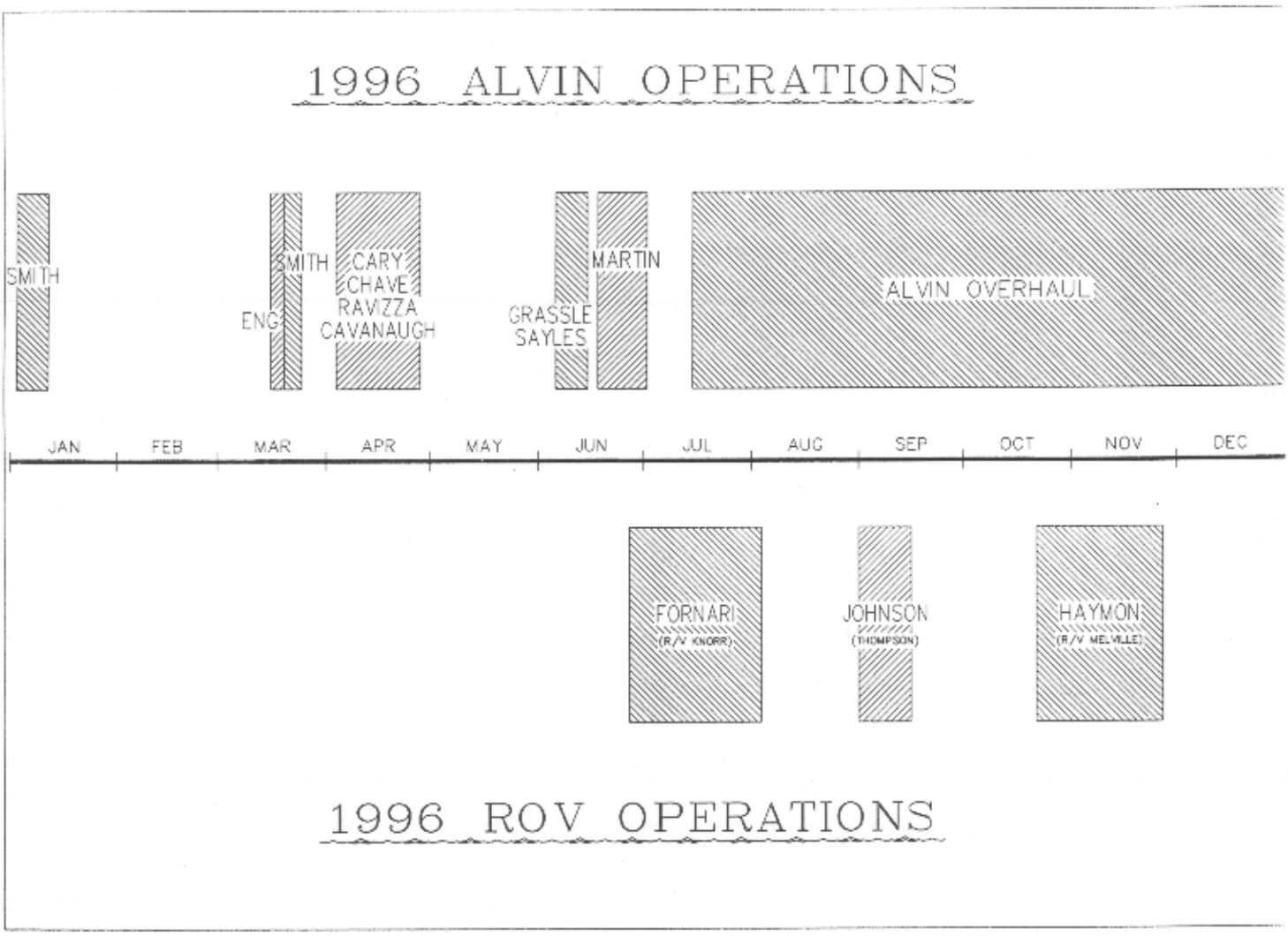
DESSC believes that the MOA is necessary because of the specialized nature of the National Facility. The manned submersible should continue to be the main focus; however, sophisticated ROVs and AUV platforms should be considered. Research and development should be considered an integral part of our plans for the future. Ways of integrating smaller operations within the infrastructure with viable funding means needs to be addressed. Also, it was recommended that DESSC should begin to look forward with respect to ALVIN becoming older. Innovative funding sources to support the possible replacement of ALVIN in the long term should be considered. DESSC also discussed the future of JASON and modifications to the funding process. They recommend that the funding should be transparent to the other science programs as it is with ALVIN.

DESSC will request a meeting with the agencies at the appropriate time to provide them with an important prospective on science issues and future needs for consideration while developing the MOA. Prior to the Fall AGU Conference, DESSC will begin to communicate on the characterization of DESSC in the millennium.

XV. MEETING PLANS: Mike noted that a meeting may be necessary prior to the annual fall Planning Meeting at AGU. It appears that the September time frame in Washington, DC might be the best time and site if the additional meeting is necessary. In the mean time, DESSC will communicate via e-mail regarding upcoming agency decisions, ALVIN future operations, and the submersible support ship. As in the past, DESSC will hold their annual planning meeting on the Sunday prior to the AGU Conference in San Francisco. If necessary, arrangements can be made for the DESSC to convene on Saturday afternoon prior to the planning meeting.

Farewell to Jeff - The DESSC, UNOLS and WHOI extended their deep appreciation for Jeff Fox's dedication and long hours of support for the Committee and promotion of the National Deep Submergence Facility. They wished him well in his new venture.

The meeting was adjourned at 11:00 a.m.


1996 ALVIN OPERATIONS
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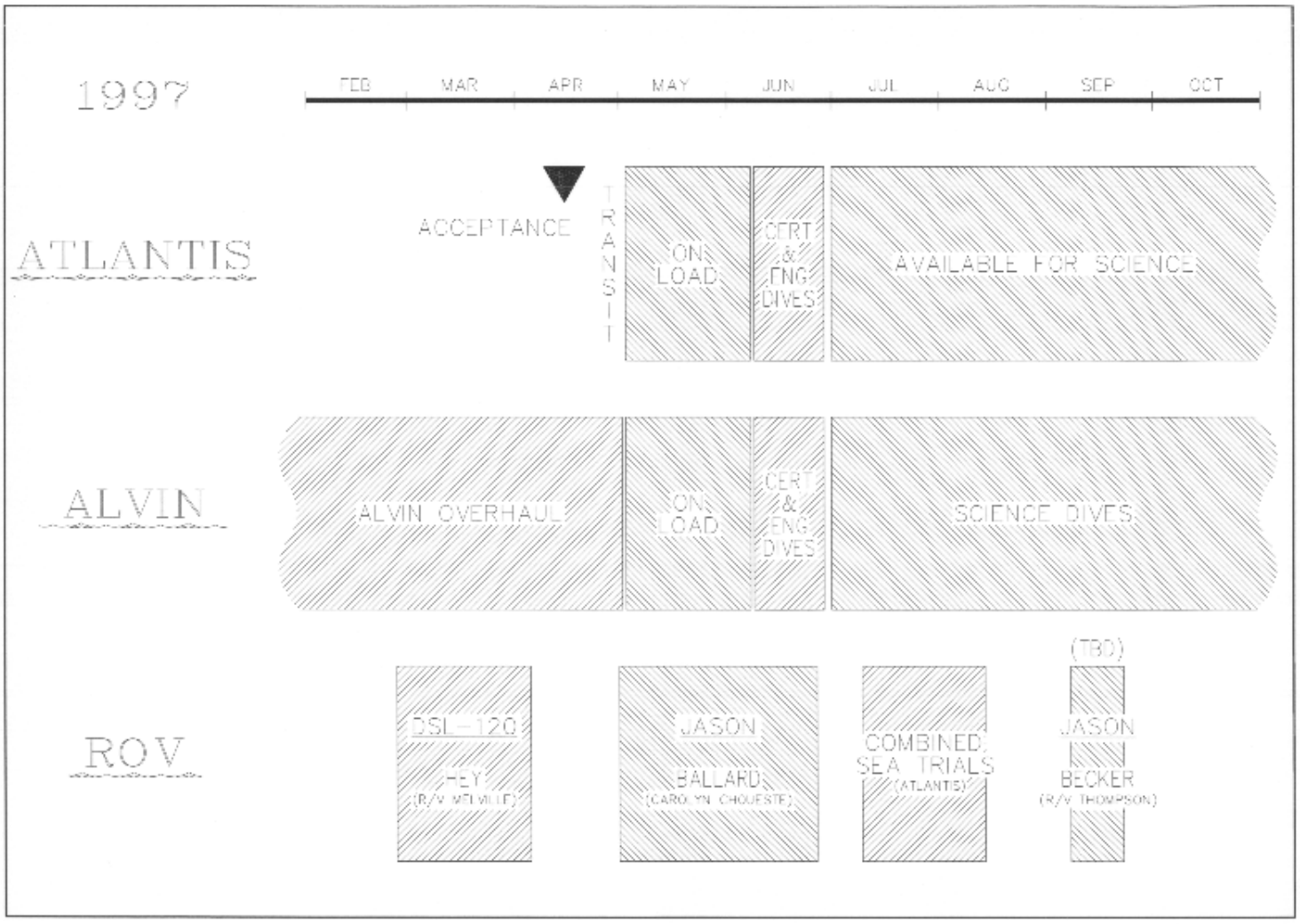
1996 ROV OPERATIONS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SCIENCE DIVES
ROV
DSL-120
FEY
(R/V MELVILLE)
JASON
BALLARD
(CAROLYN CHOUEST)
COMBINED SEA TRIALS
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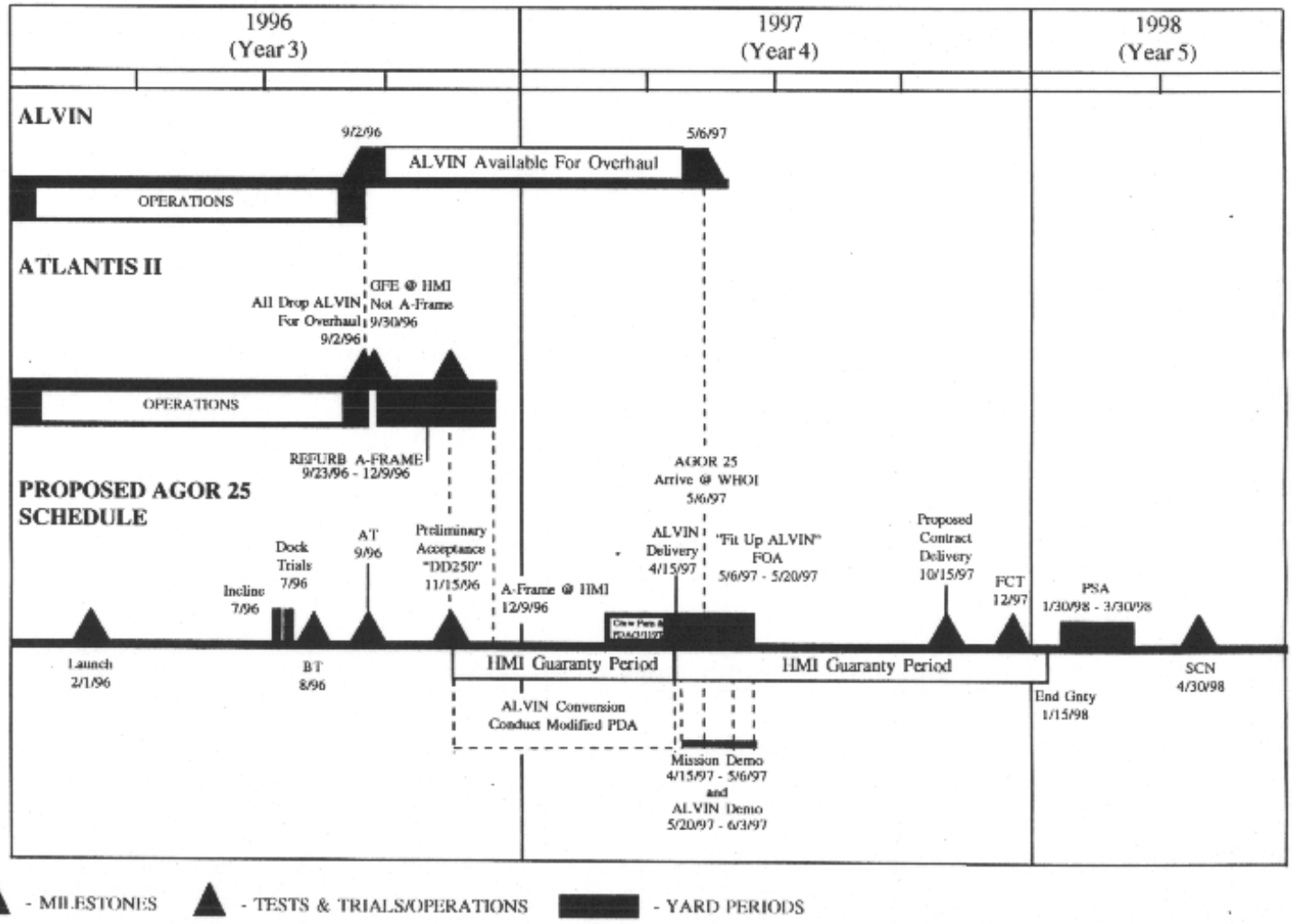
JASON
BECKER
(R/V THOMPSON)

20 Nov 95

AGOR 25/ATLANTIS II/ALVIN Schedule



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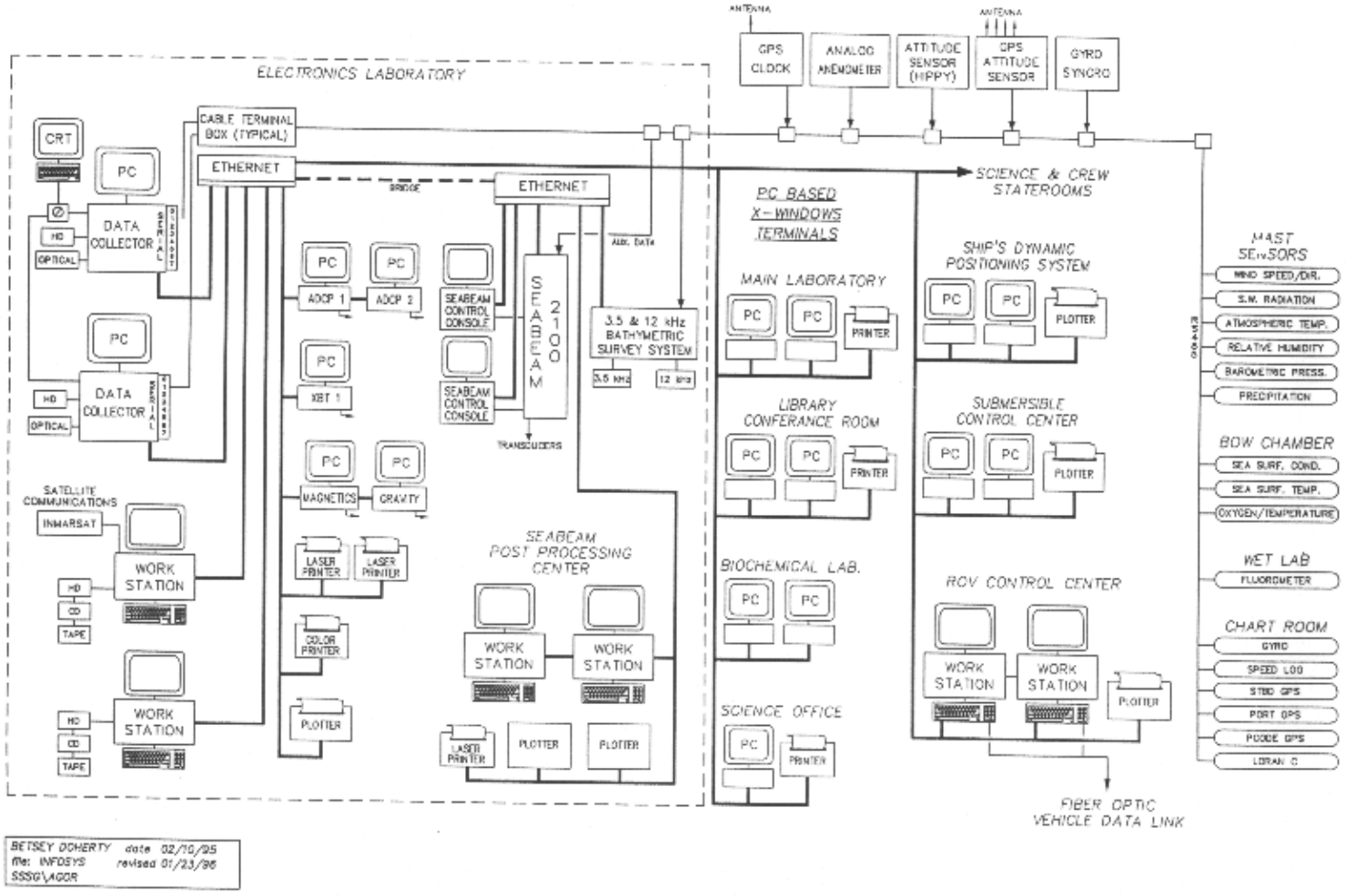

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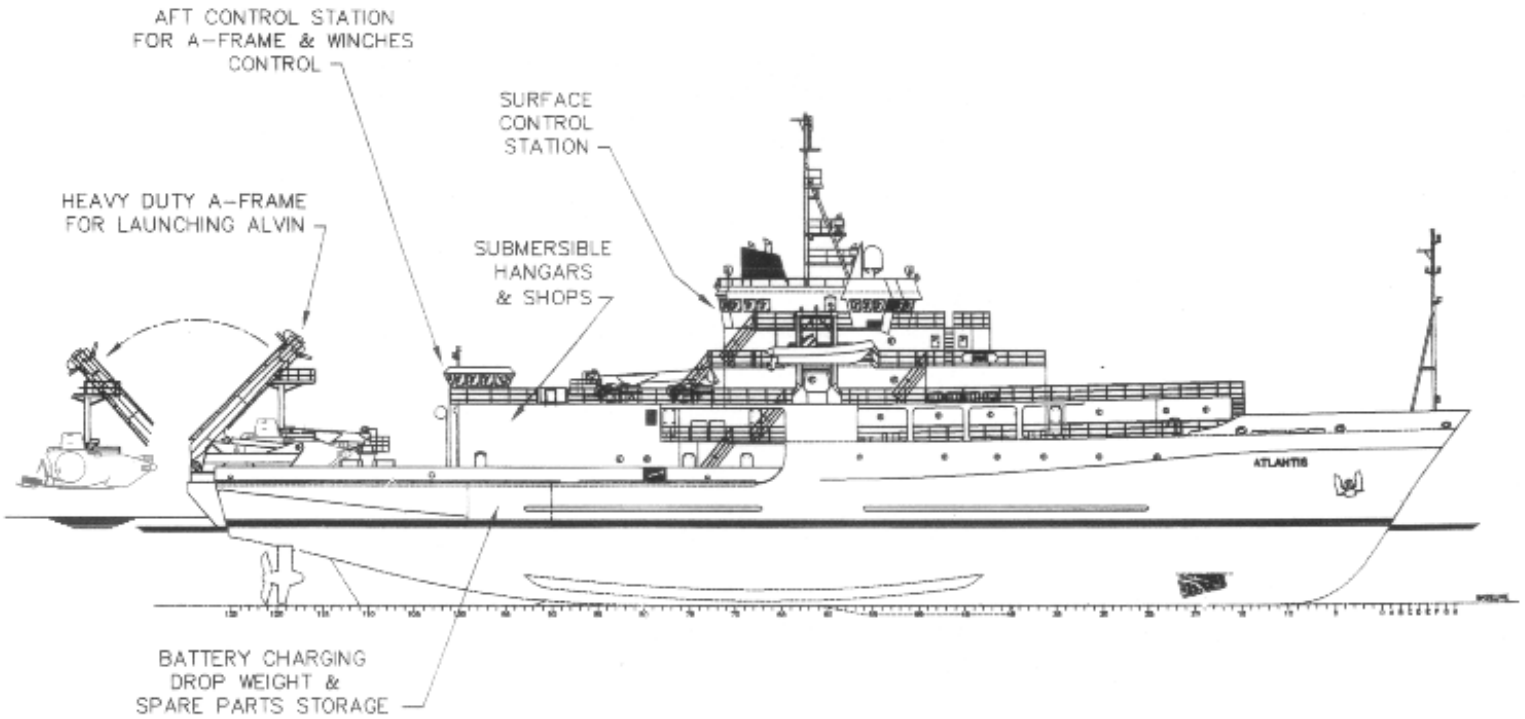
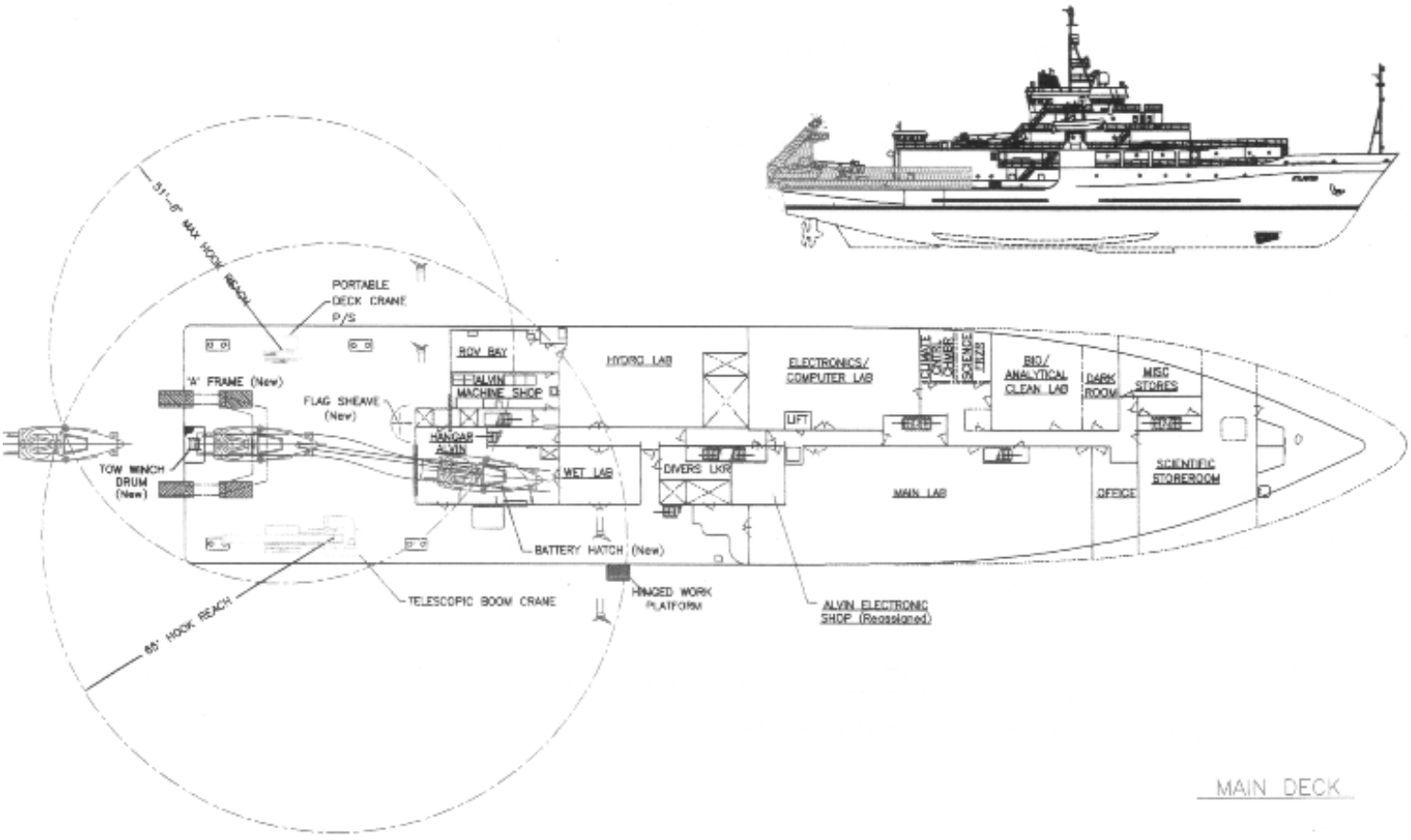
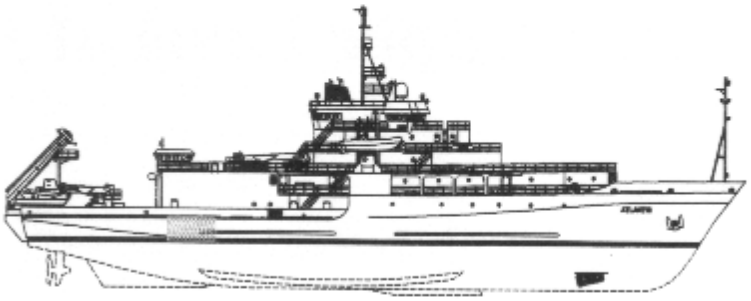
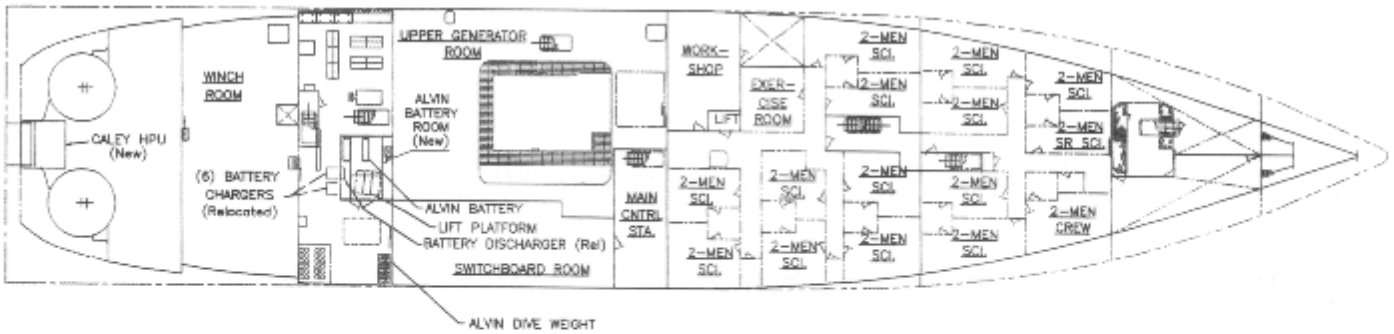


ATLANTIS OUTBOARD PROFILE STARBOARD

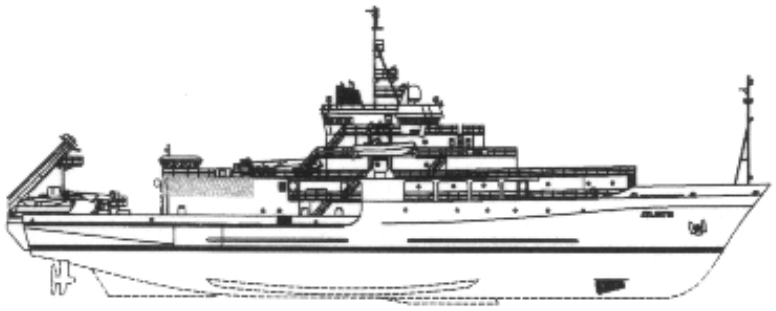

51'-6" MAX HOOK REACH
PORTABLE DECK CRANE P/S
'A' FRAME (New)
FLAG SHEAVE (New)
TOW WINCH DRUM (New)
ROV BAY
ALVIN MACHINE SHOP
HANGAR ALVIN
HYDRO LAB
ELECTRONICS/ COMPUTER LAB
LIFT
WET LAB
DIVERS LKR
MAIN LAB
BIO/ ANALYTICAL CLEAN LAB
DARK ROOM
MISC STORES
OFFICE
SCIENTIFIC STOREROOM
BATTERY HATCH (New)
TELESCOPIC BOOM CRANE
HINGED WORK PLATFORM
ALVIN ELECTRONIC SHOP (Reassigned)
65' HOOK REACH

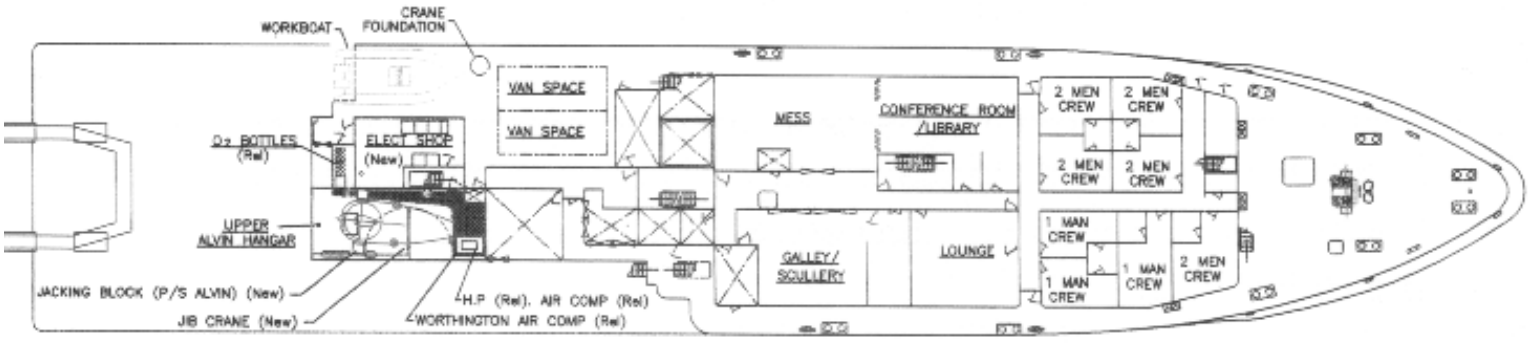
MAIN DECK



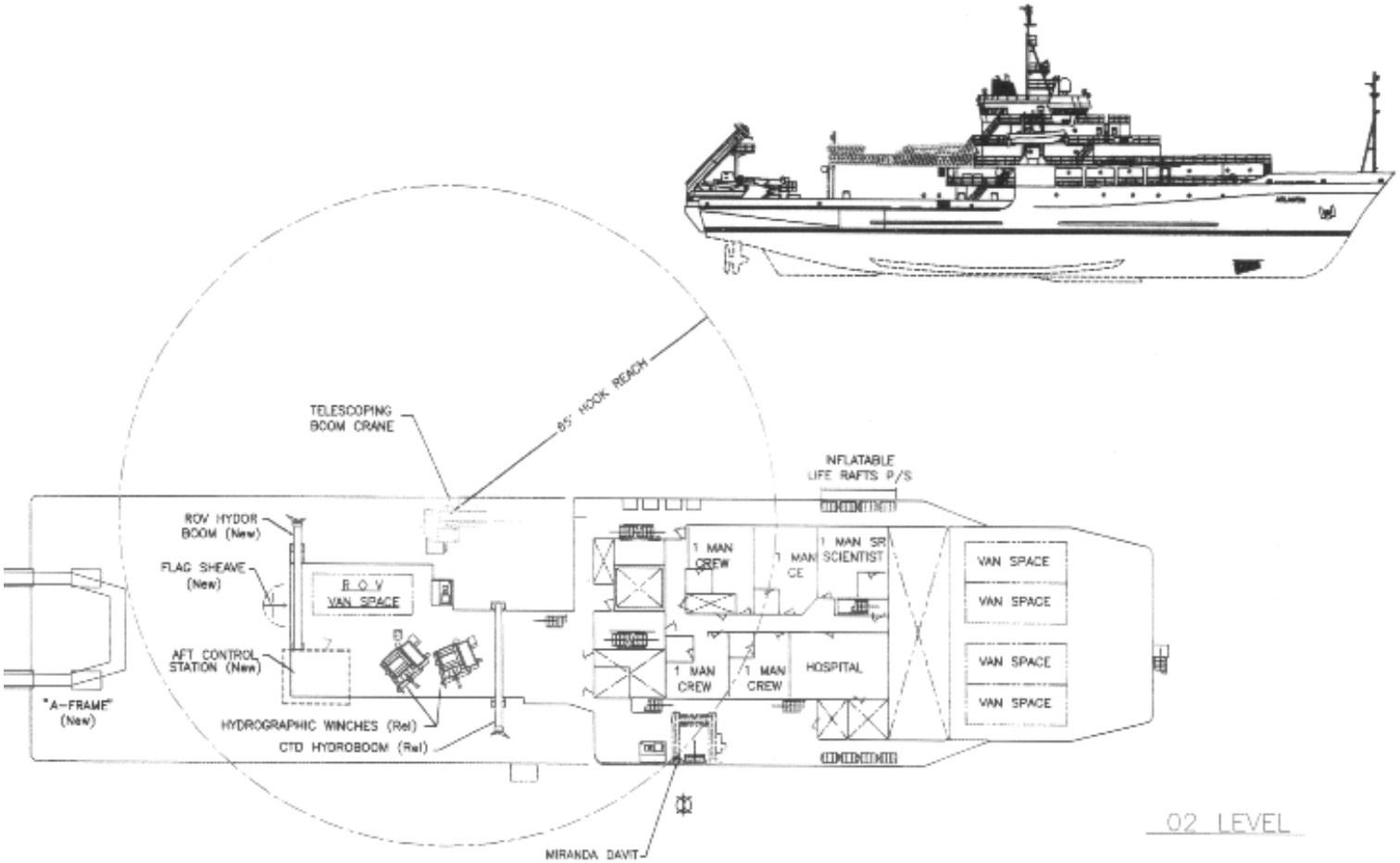


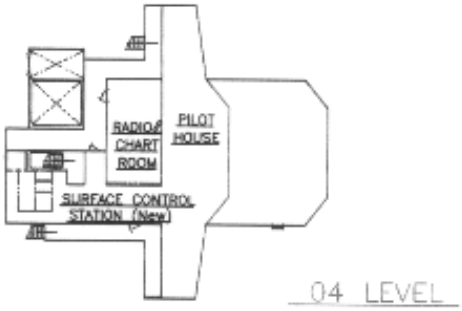
1ST PLATFORM DECK



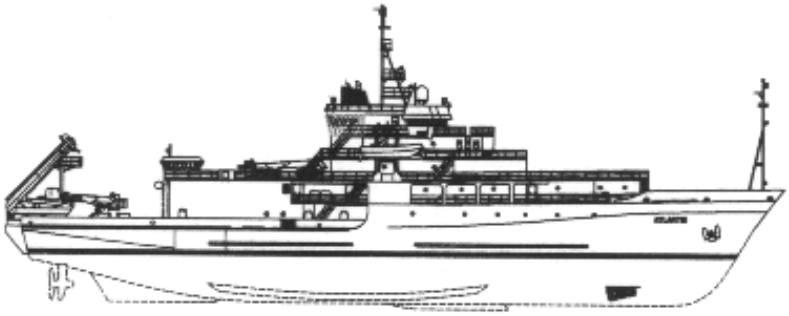


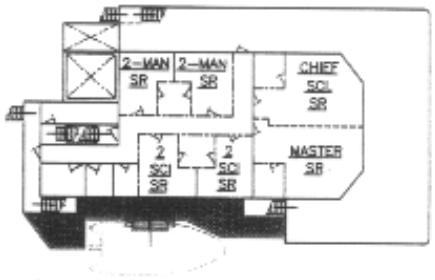
FOCSLE DECK (01 LEVEL)


TELESCOPING
BOOM CRANE
85' HOOK REACH
INFLATABLE
LIFE RAFTS P/S
ROV HYDOR
BOOM (New)
FLAG SHEAVE
(New)
R.O.V
VAN SPACE
AFT CONTROL
STATION (New)
"A-FRAME"
(New)
HYDROGRAPHIC WINCHES (Rel)
CTD HYDROBOOM (Rel)
1 MAN
CREW
1 MAN
CE
1 MAN SR
SCIENTIST
1 MAN
CREW
1 MAN
CREW
HOSPITAL
VAN SPACE
VAN SPACE
VAN SPACE
VAN SPACE
MIRANDA DAVIT
02 LEVEL



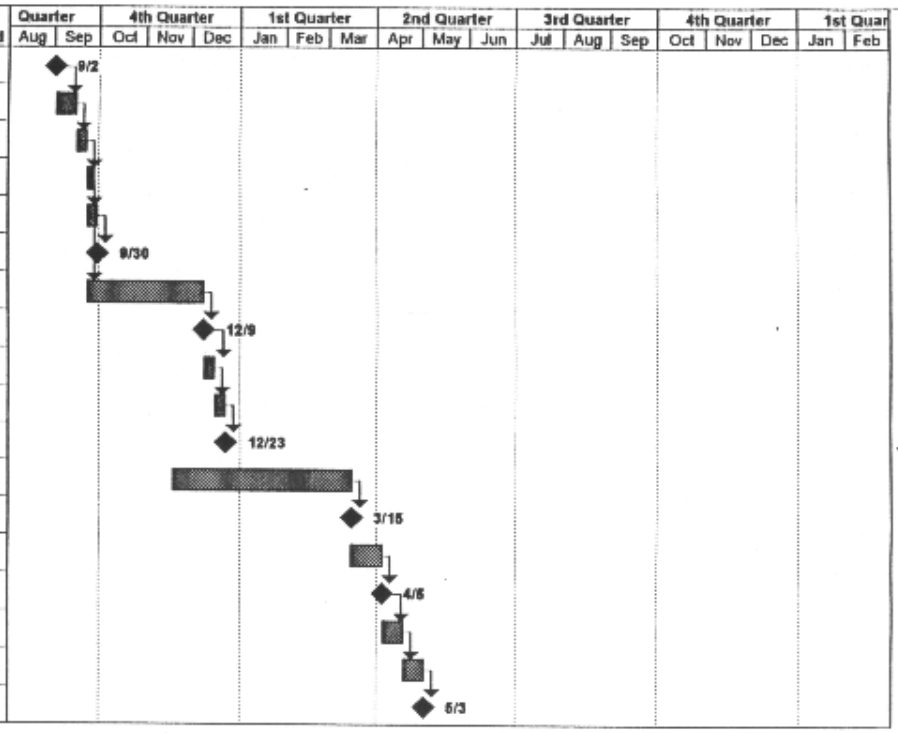
04 LEVEL





03 LEVEL

ID	Task Name	Duration	Start	Finish	Pred
1	Atlantis II Arrival WHOI	0d	9/2/96	9/2/96	
2	Atlantis II Unload at WHOI	2ew	9/2/96	9/16/96	1
3	Atlantis II Transit to Caley	1ew	9/16/96	9/23/96	2
4	A-frame off load at Caley	0.5ew	9/23/96	9/26/96	3
5	Atlantis II GFE not A-frame	1ew	9/23/96	9/30/96	3
6	GFE at HMI	0d	9/30/96	9/30/96	5
7	A-Frame refurbishment	11ew	9/23/96	12/9/96	3
8	A-Frame at HMI	0d	12/9/96	12/9/96	7
9	A-Frame installation (Calley e	7ed	12/9/96	12/16/96	8
10	A-Frame testing	7ed	12/16/96	12/23/96	9
11	A-Frame Completed	0d	12/23/96	12/23/96	10
12	Alvin Conversion Period	86d	11/18/96	3/15/97	
13	Atlantis Delivery	0d	3/15/97	3/15/97	12
14	Mission Demo	21ed	3/15/97	4/5/97	
15	Arrival WHOI	0d	4/5/97	4/5/97	14
16	Alvin Fit up @ WHOI	14ed	4/5/97	4/19/97	15
17	Alvin mission demo	2ew	4/19/97	5/3/97	16
18	Ready for Science	0d	5/3/97	5/3/97	17



Project: ATLANTIS/ALVIN CONVERS
Date: 11/17/95

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress

Page 1

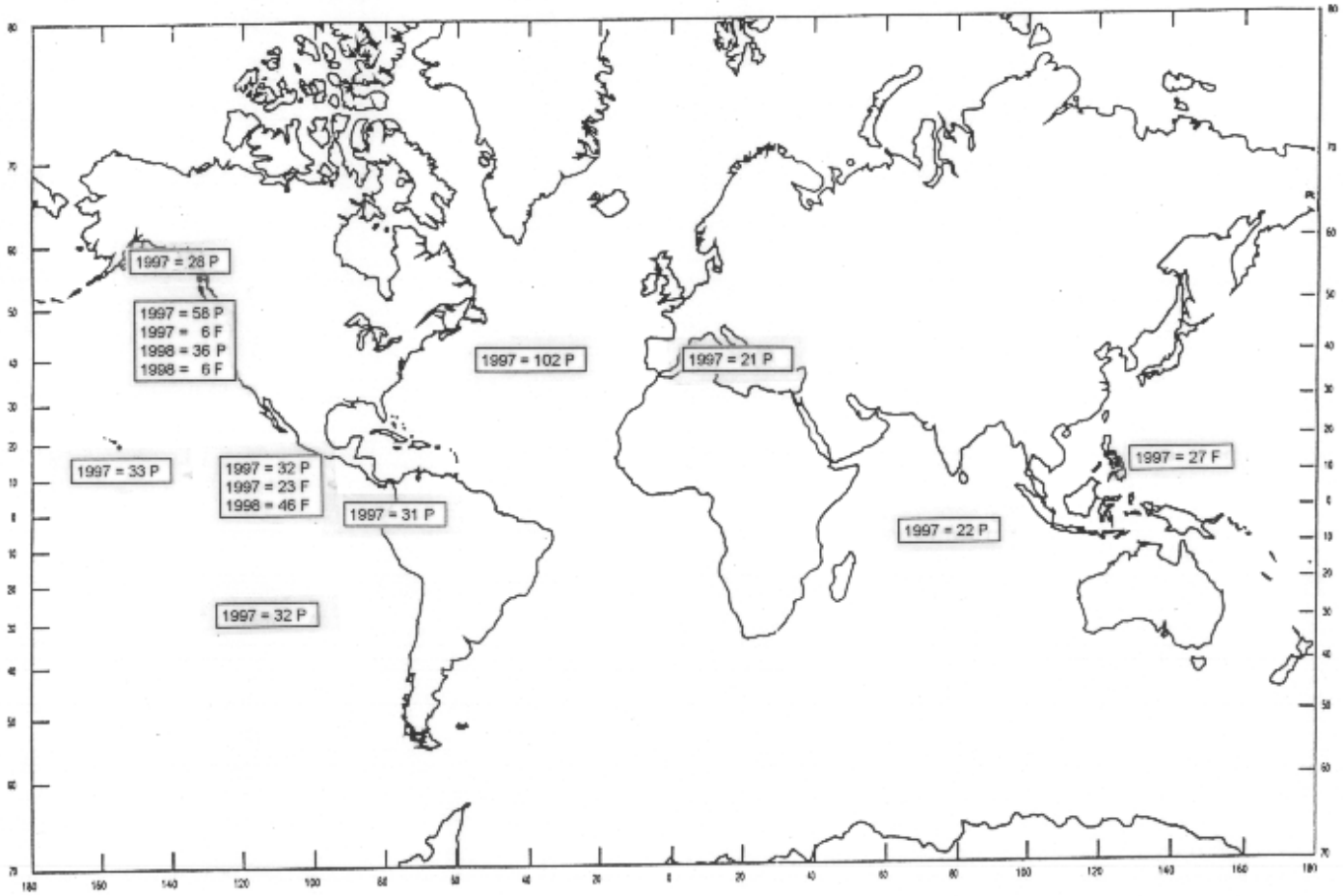
ROV Letters of Interest - Summary 1997 and Beyond

		1997 Prop.	1997 Funded	1998 + Prop.	1998 + Funded
ATLANTIC					
3	Sempere	37			
4	Smith	24			
6	Fornari	8			
9	Smith (use of UK TOBI Veh.)	33			
	Total	**102**	**0**	**0**	**0**
MEDITERRANEAN					
12	Ballard, Yoerger/, indell	21	0		
	Total	**21**	**0**	**0**	**0**
JUAN DE FUCA					
13	Becker		6		6
14	Chadwick	4		9	
15	Delaney	33		27	
17	Lilley/Mottl	21			
	Total	**58**	**6**	**36**	**6**
PRINCE WILLIAM SOUND					
20	Cowan (ROV Not identfied)	28			
	Total	**28**	**0**	**0**	**0**
NORTH EAST PACIFIC RISE					
26	Carbotte, Ryan, Fornari	32			
27	Lutz		23		46
	Total	**32**	**23**	**0**	**46**

		1997 Prop.	1997 Funded	1998 + Prop.	1998 + Funded
EQUATORIAL PACIFIC					
33	Karson, Klein, Hurst, et al	15			
34	Detrick (Canadian ROBOS)	16			
	Total	**31**	**0**	**0**	**0**
SOUTH EAST PACIFIC RISE					
36	Hey/Baker/Lupton	29			
41	Sinton	2.5			
	Total	**32**	**0**	**0**	**0**
Hawaii					
43	Chave, Butler, et al				10
44	J.R. Smith	7			
45	Smith, Long, Parfitt, Gregg	26			
	Total	**33**	**0**	**0**	**10**
WESTERN PACIFIC					
50	Fryer		27		
	Total	**0**	**27**	**0**	**0**
INDIAN OCEAN					
51	Dick (Canadian ROBOS)	22			
	Total	**22**	**0**	**0**	**0**

SUMMARY	1997 Prop.	1997 Funded	1998 + Prop.	1998 + Funded
Total	**359**	**56**	**36**	**62**

ROV AREAS OF INTEREST - 1997 AND BEYOND



ALVIN Letters of Interest - Summary 1997 and Beyond

		1997 Prop.	1997 Funded	1998 + Prop.	1998 + Funded
ATLANTIC					
1	Calder			2	
2A	Chave, Van Dover,Tyson		6		
22ALT	Lutz, Delaney, Humphris			12	
5	Rona, Kleinrock, Tivey	10			
6	Fornari	4			
7	Johnson, Tivey, Honnorez	21			
8	Vrijenhoek, Lutz	14			
10	Becker				2
52	Martin		12		
	Total	49	18	14	2

		1997 Prop.	1997 Funded	1998 + Prop.	1998 + Funded
NORTH EAST PACIFIC RISE					
22	Lutz,Delaney, Humphris			12	
23	Mullineaux, Peterson, Fisher	14		10	
24	Manahan, Mullineaux, Young	10		20	
25	Mann, Manahan, Mullineau, Yo	28		63	
28	Tolstoy, Orcutt, Fornari	8		4	
29	Childress	6		6	
30	Taylor, Wirsen	5			
31	Felbeck,Childress, Fisher, Lutz	10			
32	Cary, Epifanio, Dittel	4		8	
	Total	85	0	123	0

ROMANCHE TRENCH					
11	Bonarti	16			
	Total	16	0	0	0

EQUATORIAL PACIFIC					
33	Karson, Klein, Hurst, Gillis, Ma	15			
	Total	15	0	0	0

JUAN DE FUCA					
2B	Chave, Van Dover,Tyson		6		6
13	Becker, Davis, Pettigrew		8		8
16	Karsten	10			
18	Tivey, Bradley	5			
19	Seyfreid, Tivey	3		3	
	Total	18	14	3	14

SOUTH EAST PACIFIC RISE					
2B ALT	Chave, Van Dover, Tyson				4
32 ALT	Cary, Epifanio, Dittel	4		8	
35	Edmond			30	
37	Lilley, VonDamm		27		
38	Lupton	25			
39	Lutz,Vrijenhoek			14	
40	Mullineaux, France			8	
41	Sinton	21			
42	Childress			6	
	Total	50	27	66	4

S. CAL/SAN DIEGO TROUGH					
21	Smith, DeMaster		3		
	Total	0	3	0	0

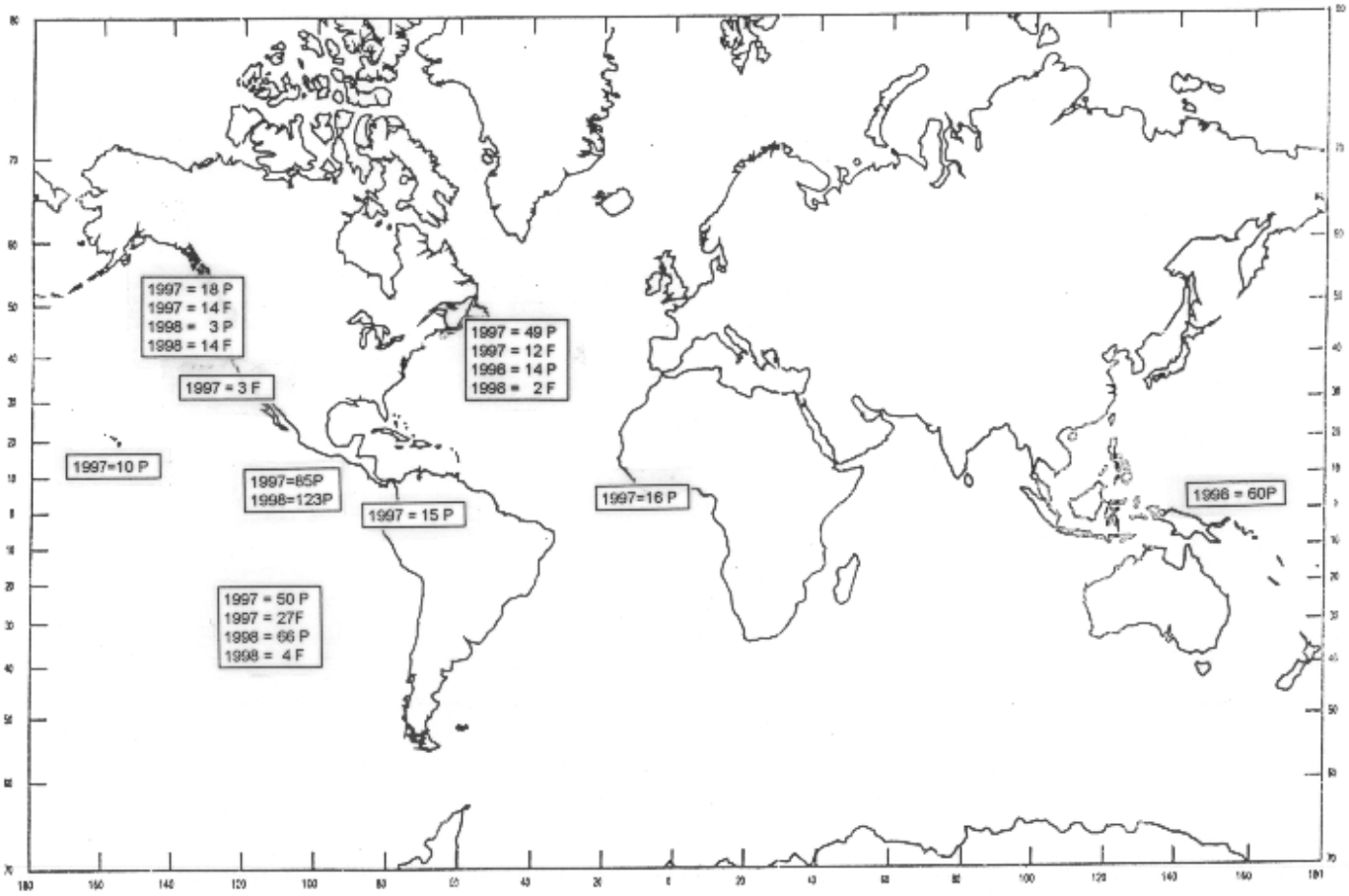
ALVIN Letters of Interest - Summary 1997 and Beyond (Cont'd.)

		1997 Prop.	1997 Funded	1998 + Prop.	1998 + Funded
HAWAII					
46	Garcia, Rhodes, Kurz	10			
	Total	10	0	0	0

		1997 Prop.	1997 Funded	1998 + Prop.	1998 + Funded
WESTERN PACIFIC					
47	Perfit et al.			20	
48	Stem			20	
49	Stem, Cleft			20	
	Total	0	0	60	0

SUMMARY	1997 Prop.	1997 Funded	1998 + Prop.	1998 + Funded
	243	62	266	20

ALVIN AREAS OF INTEREST - 1997 AND BEYOND



5/24/96

ALVIN/ROV Letters of Interest - Summary 1997 - 1999

#	Source	Investigator	Area	Title	Sponsor	Date	Alternate	Dives	Platform/Remarks	Disc.
ATLANTIC:										
1	reconfirm	D. Calder, ROM	Bermuda Pedestal 32 35'N, 64 55' W	Bathymetric zonation of hydroids, from shallow-waters to deep-sea, at Bermuda	Canada Sub 10/15/95	Jul-Aug 1997/8		2	ALVIN	Biol.
2A.	831 7/21/95	A. Chave, WHOI C. Van Dover, U.Alask J. A. Tyson, AT&T	MAR TAG/Snakepit hydrothermal areas	ALISS: Ambient light Imaging and Spectral System	NSF FUNDED OCE 9407774	Oct-Nov 1997	Jan-Feb 1998	6	ALVIN	Biol.
3	831 8/8/95	J.-C. Sempere, UW	MAR, 28 N	Fine-scale segmentation and structural variability within a slow-spreading segment	NSF RIDGE	1997		37	DSL-120 AGOR II	G&G
4	831 8/11/95	D. K. Smith, WHOI S. Humphris, WHOI W. Bryan, Whoi M. Tivey, WHOI	25 35'N, 45 05'W, 24 50'N, 45 30' W, 25 55 N, 45 05'W, 25 16 N, 45 25 W	Linking Morphology, Petrology and Geochemistry to understand crustal construction at the Mid-Atlantic Ridge	NSF RIDGE	Feb - Jul 1997		24	AMS 120 & ARGO II	G&G
22 Alt	No 831	R. Lutz, Rutgers J. Delaney, UW S. Humphris, WHOI	TAG - MAR or 9-10 NEPR	Research and Educational Opportunities Associated with Production of an IMAX documentary on Deep-Sea Hydrothermal Vents	NSF Sub 11/96	Feb-Jun 1998		12	ALVIN	Biol
5	831 5/14/96	P. Rona, Rutgers Kleinrock, Vanderbilt M.A. Tivey, WHOI	TAG 26N, 45 W	TAG Relict Hydrothermal Zones: Role in Evolution of the TAG field	NSF sub 2/15/96	1997		10	ALVIN	G&G
6	831 2/14/96 NEW	D.J. Fornari, WHOI	32 N, 64 30'W 36-38 N, 30-31 W	Science Testing of UNOLS Integrated Deep Science on R/V ATLANTIS: Sequential use of vehicle systems for data acquisition	NSF	Jun 1997	JUL 1997	4 5 days 3 days	ALVIN, MEDEA-JASON 120 kHz Sonar	other
7	831 2/8/96 NEW	H.P. Johnson, U Wash M Tivey, WHOI J Honnorez, Strasbourg	10-12 N, 43 W	A geophysical study of a vertical section of ocean crust: the southern transverse ridge of the Vema Fracture Zone	NSF			21	ALVIN	G&G
8	NEW No 831	R.C. Vrijenhoek, Rutge R.A. Lutz, Rutgers	14 46'N 37 36'W	Gene Flow and Species Diversity in Deep-Sea Hydrothermal Vent Communities	NSF	1997	1998	14 Dives	ALVIN	Biol.
9	831 2/12/96 NEW	D.K. Smith, WHOI S. Humphris, WHOI M. Tivey, Whoi L. Parson, SOC W. Bryan, WHOI	MAR 35 N	Geological and Geophysical Investigation of Two Constrating Segments at the Mid-Atlantic Ridge, 35 Degrees N	NSF	Feb-Jul 97		33 Days	UK Tobi Vehicle	G&G
10	NEW MSG 1/22/96	K. Becker, RSMAS	MAR	Instrumented Borehole 395A Seals	NSF FUNDED	1999	1999	2	ALVIN	Other
52	831 10/20/94	W. Martin, WHOI	NW Atlantic	Benthic Fluxes and Sediment Irrigation on the Continental Margin, NW Atlantic	NSF FUNDED	Jul-97	Jun, Aug 97	12	ALVIN	Chem.

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ALVIN/ROV Letters of Interest - Summary 1997 - 1999

#	Source	Investigator	Area	Title	Sponsor	Date	Alternate	Dives	Platform/Remarks	Disc.
ROMANCHE TRENCH										
11	831 8/30/95 NEW	E. Bonatti	Start 1N 15 W End 0 30'S 17 30"	A Submersible Study of Exposed Mantle Mesozoic Crust and Drowned Reefs of the Eastern Romanche RTI	NSF	1996	1997	16 Days	ALVIN	G&G
MEDITERRANEAN										
12	No 831	R.D. Ballard, Inst. for E D. Yoerger, WHOI D. Mindell, MIT	Straits of Sicily north of Skerki Bank	Exploration of the Straits of Sicily	ONR	Jun/Jul 1997		21	MEDEA-JASON	Other
JUAN DE FUCA										
28	831 7/21/95	A. Chave, WHOI C. Van Dover, U.Alask J. A. Tyson, AT&T	Juan De Fuca Ridge	ALISS: Ambient light Imaging and Spectral System	NSF FUNDED OCE 9407774	Jun-Jul 1998	Jul-Aug 1998	6	ALVIN	Biol.
13	831 8/15/95	K. Becker, UM E. Davis, PGC T. Pettigrew, ODP	JDF Ridge - ODP 48 n, 129 W	Instrumented borehole seals for 1996 ODP drilling on the Juan de Fuca Ridge.	NSF ODP FUNDED	1) Sum 97 2) Sum 98		1) 8 Days 2) 8 Days	1) JASON 2) ALVIN	G&G
14	831 5/21/95	W. Chadwick, OSU	JDF Ridge, Cleft Segment	Acoustic Extensometer: A seafloor Observatory Experiment	NSF RIDGE sub 8/15/95	1) Sum 1996 2) Sum 1997 3) Sum 1998 4) Sum 1999 5) Sum 2000		1) 12 2) 4 3) 3 3) 3 3) 3	MEDEA-JASON (Could be added on to P. Johnson 1996 Cruise)	G&G
15	831 3/1/96	J.R. Delaney, UW	ROBE sites 44 N 130 W 44 N 129 W	Spatial Control for Temporal Variability Studies: 3-D Multiscalar Mapping of seafloor features and Water Column Plumes within the RIDGE observatory (ROBE) sites.	NSF	ul 15-Aug 1 1997 1998	Jul 15-Sep 15 1997 1998	33 27	JASON, DSL 120	G&G
16	831 2/20/96	J. Karsten, UH J. Head, Brown et al	Endeavor Seg. JDF 48 N, 129 W	Submersible and petrologic study of the recent magmatic history of the Endeavour Segment, Juan de Fuca Ridge: Establishing a time-series of ridge axis volcanism.	NSF Sub 2/15/96	Summer 1997		10	ALVIN	G&G
17	831 3/19/95	M.D. Lilley, UW M. Mottl, UH et al.	1) JDF, 48 N Middle Valley) Escanaba Trough Gorda Ridge, 41 N	Temporal variations in sedimented-ridge hydrothermal systems at Middle Valley and Escanaba Trough: an ROV study	NSF - MGG proposal ODP	late spring early sum '96 and Summer 97		1996 1) 14 2) 7 1997 1) 14 2) 7	JASON	G&G
18	831 2/14/95	M.A. Tivey, WHOI A. Bradley, WHOI	Juan de Fuca: 48N, 129W	Development of Flow Sensors for Active High and Low Temperature Seafloor Vents	NSF RIDGE	Jun-Sep 1997		5	ALVIN any active site would be acceptable if ALVIN	G&G
19	NEW No 831	W.E. Seyfreid, U of M. M.K. Tivey, WHOI	Endeavour Main Field 47 58'N 129W	In-situ Measurement and Monitoring of Dissolve H2, H2S, and pH in Mid-Ocean Ridge Hydrothermal Fluids	NSF	1997 1998		3 Dives 3 Dives	ALVIN ALVIN	G&G

5/24/96

ALVIN/ROV Letters of Interest - Summary 1997 - 1999

#	Source	Investigator	Area	Title	Sponsor	Date	Alternate	Dives	Platform/Remarks	Disc.
PRINCE WILLIAM SOUND										
20	831. 8/3/95 NEW	E. Cowan, Applachian R. Powell, No. Ill Univ	rince William Soun 60 15'N 147 44" 59 58' N 139 35'	Collaborative Research: Sedimentary Forcing of Temperate Marine Glacier Behavior During Climate Change	NSF	May 15-30 97 Jul 15-30 97	Aug 1-15 97	14 Days 14 Days	Some ROV-not identified	G&G
SOUTHERN CALIFORNIA/SAN DIEGO TROUGH/MONTEREY CANYON										
21	No 831	C. R. Smith, U.H. D. DeMaster, NCSU	S. California 32d 12'N, 118d 30' W	Age dependent bioturbation of deep-sea sediments: tests at three bathyal sites.	NSF FUNDED OCE 9022116	Jul-Dec 1997	Jan - Mar 1998	4	ALVIN (MEDEA-JASON if ALVIN not available)	Biol
NORTH EAST PACIFIC RISE										
22	No 831	R. Lutz, Rutgers J. Delaney, UW S. Humphris, WHOI	9-10 NEPR or D168TAG - MAR	Research and Educational Opportunities Associated with Production of an IMAX documentary on Deep-Sea Hydrothermal Vents	NSF Sub 11/95	Feb-Jun 1998		12	ALVIN	Biol
23	831 2/9/96 Reconfirm 5/20/96	L. Mullineaux, WHOI C.H. Peterson, UNC C.R. Fisher, Penn S	9-10 N. EPR	Role of Larve Settlement, Species Interactions and Physiological Adaptations in colonization and Community Development of Hydrothermal Vents	NSF sub 2/96	Oct-97 Oct-98		14 10	ALVIN	Biol
24	831 2/15/95	D. Manahan, USCal L. Mullineaux, WHOI C. Young, HBOI	9-10 N, EPR	Dispersal Potential Hydrothermal Vent Animals: Larval Energetics, Depth regulation and Field Distribution	NSF RIDGE Sub 2/96	1) late 1997 2) 1998 3) 1999		1) 10 2) 10 3) 10	ALVIN	Biol.
25	831 2/14/96 NEW	R. Mann, VIMS D. Manahan, USC L. Millineau, WHOI C. Young, WHOI S.C. Cary, U Del	9-10 N, EPR	Quantitative studies of temporal and spatial variability in reproduction of communities associated with hydrothermal vents	NSF	1) Oct 97 2) Mar 98 3) Oct 98 4) Oct 99		28 21 21 21	ALVIN	Biol.
26	831 2/19/96 NEW	S. Carbotte, LDEO W.B.F. Ryan, LDEO D. Fornari, WHOI	9 30'N 104 30'W	Collaborative research: Exploiting high resolution Digital elevation models and imagery to study deformation and volcanic processes at a fast spreading ridge	NSF	Oct-Dec 97	Jan-May 98	32 Days	dag-120kHz sonar	G&G
27	NEW No 831	R.A. Lutz, Rutger	9 50'N EPR	Temporal Changes in Biological Community Structure and Associated Geological Features at Newly-Formed Hydrothermal Vents on the EPR	NSF FUNDED	1) 1997 2) 1998 3) 1999		23 23 23	JASON/MEDIA	Biol
28	831 2/19/96 NEW	M. Tolstoy, SIO J. Orcutt, SIO D.Fornari, WHOI	9 51' N 104 17' W	An experiment ot measureground ddrformation at a fast fpreading Mid-Oceanridge	NSF RIDGE	1)Oct-Dec97 2)Oct-Dec98	Jan-May 98 Jan-May 99	8 Dives 4 Dives	ALVIN ALVIN	G&G G&G
29	NEW No 831	JJ. Childress UCSB	9 & 13 N EPR	Studies on the Ecological Physiology of Hydrothermal Vent chemoautrotrophic	NSF RIDGE	1997 1998		6 Dives 6 Dives	ALVIN ALVIN	Ecog.

5/24/96

ALVIN/ROV Letters of Interest - Summary 1997 - 1999

#	Source	Investigator	Area	Title	Sponsor	Date	Alternate	Dives	Platform/Remarks	Disc.
30	831 12/19/95 NEW	C. D. Taylor, WHOI C.O. Wirsen, WHOI	9 51'N 104 17.5" NEPR	Microbiology and Ecology of filamentous sulphur formations	NSF RIDGE	?	?	5 Dives	ALVIN	Biol.
31	831 2/9/95 NEW	H. Felbeck, SIO Childress, UCSB Fisher, Penn State Lutz, Rutgers	N EPR	Metabolic Charactertyization of a Symbiotic System, the Hydrothermal Vent Tubeworm Riftia Pachyptile	NSF	1997		10 Dives	ALVIN	Biol
32	831. 2/14/96 NEW	S. Cary, U Del C. Epifanio, U Del S. Dittel, U Del	9 50'N 104 17'W	Reproduction, Dispersal, and Recruitment of Hydrothermal Vent Crabs: a Tractable System	NSF	Nov-97 May-98 Nov-98	Oct-97 Jun-98 Oct-98	4 4 4	ALVIN ALVIN ALVIN	Bio
EQUATORIAL PACIFIC										
33	831 2/21/96 NEW	J.A. Karson, Duke E. Klein, Duke S. Hurst, Duke K. Gillis, U Vic. (Canada) C. Macleod, IOS (UK) J-L. Cheminee, U Vic (Canada)	Hess Deep 2 22' N, 101 17W	Jason/Media and ALVIN Investigation of the Uppermost Oceanic Crust of Hess Deep	NSF	May-97	Jun-97	15 15	ALVIN Jason/Media	G&G
34	831. 8/6/95 NEW	R. Detrick, WHOI M. Tivey, WHOI G. Christenson, UTIG M. Sen, UTIG K. Gillis, U of Victoria	Hess Deep 2 20'N 101 30'W	Orgin of the Seismic Layer 2A/2B Boundry: Correlation of Geophysical Structure and Outcrop Geology in the Walls of Hess Deep	NSF	Feb-97	Jan-May 97	16 Days	Candian Robos System	G&G
SOUTHERN EAST PACIFIC RISE:										
2B ALT	831 7/28/95	A. Chave, WHOI C. Van Dover, U.Alaska J. A. Tyson, AT&T	SEPR - 17 S	ALISS: Ambient light Imaging and Spectral System (This is alternative to Item 2B)	NSF FUNDED OCE 9407774	Jan-Feb 1998	Mar-Apr 1998	4	ALVIN - Alternate for 9 N EPR site	Biol.
35	on file	J.M. Edmond, MIT	Southern EPR Easter Island and vicinity	Hydrothermal Studies on the Easter Microplate.	NSF 9312950	Austral Summer 1997/8		30	ALVIN	Chem
36	No 831	R. Hey, UH E. Baker, PMEL, NOAA J. Lupton, PMEL	S. EPR between Easter & Juan mandex microplate 28-32 S, 112-113 W	Hydrothermal and structural investigations along the fastest spreading center: The 28-32 S EPR reorganizing plate boundary.	NSF FUNDED	southern summer 1996/1997		29	120 KhZ side-looking Sonar	G&G
37	831 5/10/94	M.D. Lilley, UW K.L. Von Damm, UNH L.E. Lupton, NOAA	17 S, 113 W 21 30 S, 113 W	Gas and fluid chemistry of hydrothermal systems on a superfast spreading center: Southern East Pacific Rise	NSF RIDGE FUNDED	1997		27	ALVIN	Chem

ALVIN/ROV Letters of Interest - Summary 1997 - 1999

#	Source	Investigator	Area	Title	Sponsor	Date	Alternate	Dives	Platform/Remarks	Disc.
38	Letter 4/20/95	J. Lupton, NOAA	S. EPR 13.5 -20 S, 112-113	Investigation of hydrothermal systems This is in collaboration with the Japanese Ridge Flux Project.	NOAA NURP	Austral Summer 1997-1998		25	ALVIN	G&G
39	No 831	R. Lutz, Rutgers R. C. Vrijenhoek, Rutg	17 22 S EPR	Gene Flow, Dispersal, and Systematics of Deep-Sea Hydrothermal Vent Organisms	NSF FUNDED will submit renewal 2/96	1996, 1997, 1998		14	ALVIN (may be able to use JASON)	Biol
40	No 831	L. Mullineaux, WHOI S. France, UNH	Sala y Gomez Ridge 22 S - East of Easter Is.	Genetic diversity and gend flow among populations of deep-seamount invertebrates	NSF	1998		6	ALVIN	Biol
41	Upated No 831	J. Sinton, U of Hawaii	18 40'S 113 24' W 17 25'S 113 13"W SEPR	Volcanological investigation of a superfast spreading ridge	NSF	Oct-97	Early 1998	21 Dives 2.5 Days	ALVIN DSL 120	G&G
42	No 831 NEW	JJ. Childress UCSB	18 & 20 S SEPR	Studies on the Ecological Physiology of Hydrothermal Vent chemoautrotrophic	NSF RIDGE	1998		6 Dives	ALVIN	Ecog.
32ALT	831. 2/14/96 NEW	S. Cary, U Del C. Epifanio, U Del S. Dittel, U Del	S EPR	Reproduction, Dispersal, and Recruitment of Hydrothermal Vent Crabs: a Tractable System	NSF	Nov-97 May-98 Nov-98	Oct-97 Jun-98 Oct-98	4 4 4	ALVIN ALVIN ALVIN	Bio
HAWAII										
43	831 2/10/95	A. Chave, WHOI R. Butler, IRIS Duennebeir, U Hawaii D. Yoerger, WHOI J Catipovic	awai 2 Observator 28 N, 140 W	Hawaii 2 Observatory - install a junction box and sensor on a submarine cable between Hawaii and California	NSF ARI FUNDED	Sep-98	Aug-98	10	JASON	EGR
44	No 831	J.R. Smith, U of Hawai	Hawaii Hot spot 19 20N 155-157 W	High-resolution magneto-stratigraphic and U-series dating of giant submarine landslides and their correlation with explosive volcanism on the Hawaiian Hot Spot	NSF	Jan-Feb 97	Aug-Sep 97		ARGO II	G&G
45	831 2/12/96	D.K. Smith, U of Hawa L.Long, U of Hawaii E. Parfitt, U of Leeds (UK) T. Greeg, WHOI	Puna Ridge 19 50' N 154 10'W	Understanding Volancanic Processes at the Submarine Puna Ridge	NSF	97/98		18 Days 8 Days	DSL-120 AGRO-II	G&G
46	No 831 NEW	M. Garcia, U of Hawaii M. Rhodes, U of Mass M. Kurz, WHOI	Mauna Loa	Geology Evolution of Mauna Loa	NSF	Summer 199	Fall 1997	10 Dives	ALVIN	G&G

5/24/96

ALVIN/ROV Letters of Interest - Summary 1997 - 1999

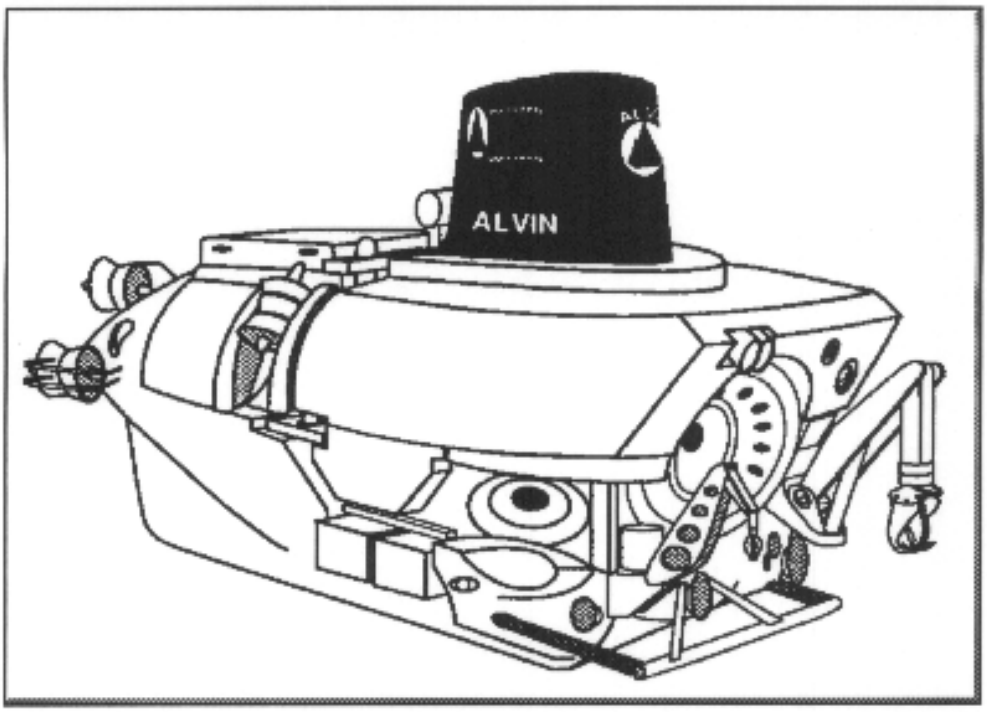
#	Source	Investigator	Area	Title	Sponsor	Date	Alternate	Dives	Platform/Remarks	Disc.
WESTERN PACIFIC										
47	831 2/15/95	M/R. Perfit, U. Fla K. Farley, Cal Tech B. McInnes, CSIRO D. Colodner, LDEO V. Tunnicliffe, U. Vic.	Solomon Is., Papua New Guinea S.W. Pacific	ALVIN Investigation of Hydrothermally Active Submarine Volcanoes in the New Ireland and Soloman Island Fore-arcs, S.W. Pacific	NSF (maybe ARC) ReSub 1996	Fall 1998	Early 1999	20	ALVIN (possibly MEDEA-JASON & 120 KhZ Sonar)	G&G
48	No 831	R.J. Stern	13 15'N, 144 30 E 16 N, 145 40 E	Submarine Volcanism in the Southern Seamount Province of the Mariana Arc	NSF sub 2/15/96	TBA 1998?		20	ALVIN	G&G
49	No 831	R.J. Stern P. Cleft, WHOI	Mariana Trough 24 N, 141 E 22 n, 142E 22N, 143 E	Volcanic and Tectonic Activity in the Northern Mariana Trough - ODP Site Survey	NSF sub 2/15/96	TBA 1998?		20	ALVIN, ROV one site avoid Typhoon season	G&G
50	No 831	P. Fryer,	Mariana Arc	Survey of Mariana Arc	NSF FUNDED	1997	1998	27 Days		G&G
INDIAN OCEAN										
51	831 2/21/96 NEW	H. Dick, WHOI J. Natland, RSMAS J. Hirth, WHOI J. Robinson, Dalhouse et al	32 40'S 57 E	The Plutonic Foundation of a Very Slow-Spreadong Ridge	NSF OPD	Jan-Feb 97	Prior Oct 97	22 Days	Canadian ROBOS	G&G

1996 — ROV — 1996

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
FORNARI	(MAR)											
JOHNSON	(J de F)											
HAYMON	(S. EPR)											
S. EPR HEY	(S. EPR)											

1997 — ROV — 1997

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
(S. EPR) HEY												
DERBYSHIRE (W. PAC)												
BALLARD (MAR)												
FORNARI (MAR)												
BECKER (J de F)												
LUTZ (EPR)												



1996 Highlights

So Far:

✓ *4 cruises, January-April, in Pacific*

✓ *27 of 28 proposed dives completed*

✓ *4 engineering dives*

Coming Up:

✓ *2 cruises to the NW Atlantic Continental Margin (24 dives)*

✓ *Major overhaul*

US Deep Submergence Community Request for *Alvin* Upgrades
(prioritized by DESSC) 5/23/96 page 1 of 3

Priority Rank: 1 = highest

Rank	System	Proposed Action	Cost Estimate	Comments
1	VB/ Hydraulics	Purchase new VB pump.	2@ $10K	Replace one-of-a-kind pump. Failure of existing pump could result in lost dives.
1	Power	Upgrade battery system to increase bottom time.	?	Alvin engineers are continuing to research battery options. A new vendor of lead-acid batteries with advertised greater capacity has been identified and several cells are being tested at WHOI. Alvin Group is preparing a detailed assessment of power management and potential modifications for DESSC.
1	Power	Continue training sessions on power management during dives. Provide scientists with a shipboard orientation session on power consumption by various Alvin systems and suggestions on how to optimize bottom time.	N.C.	Initiate and continue efforts to maximize science time.
1	Navigation	Replace existing gyro	2@ $30K ea.	Purchase ring-laser gyro. This would replace the existing gyro, saving space and power. COst includes interface development.
1.5	Payload	Increase the general payload.		Alvin Group is working toward this with modifications in Motor Controller Cans (miniaturization of electronics to eliminate one or more cans) and improvements of VB system monitoring. Additional syntactic foam can be added.
1.5	Systems Integration	Make sure Alvin upgrades are integrated as a whole		Insure power/data management will support new systems that will result in an integrated, user-friendly platform

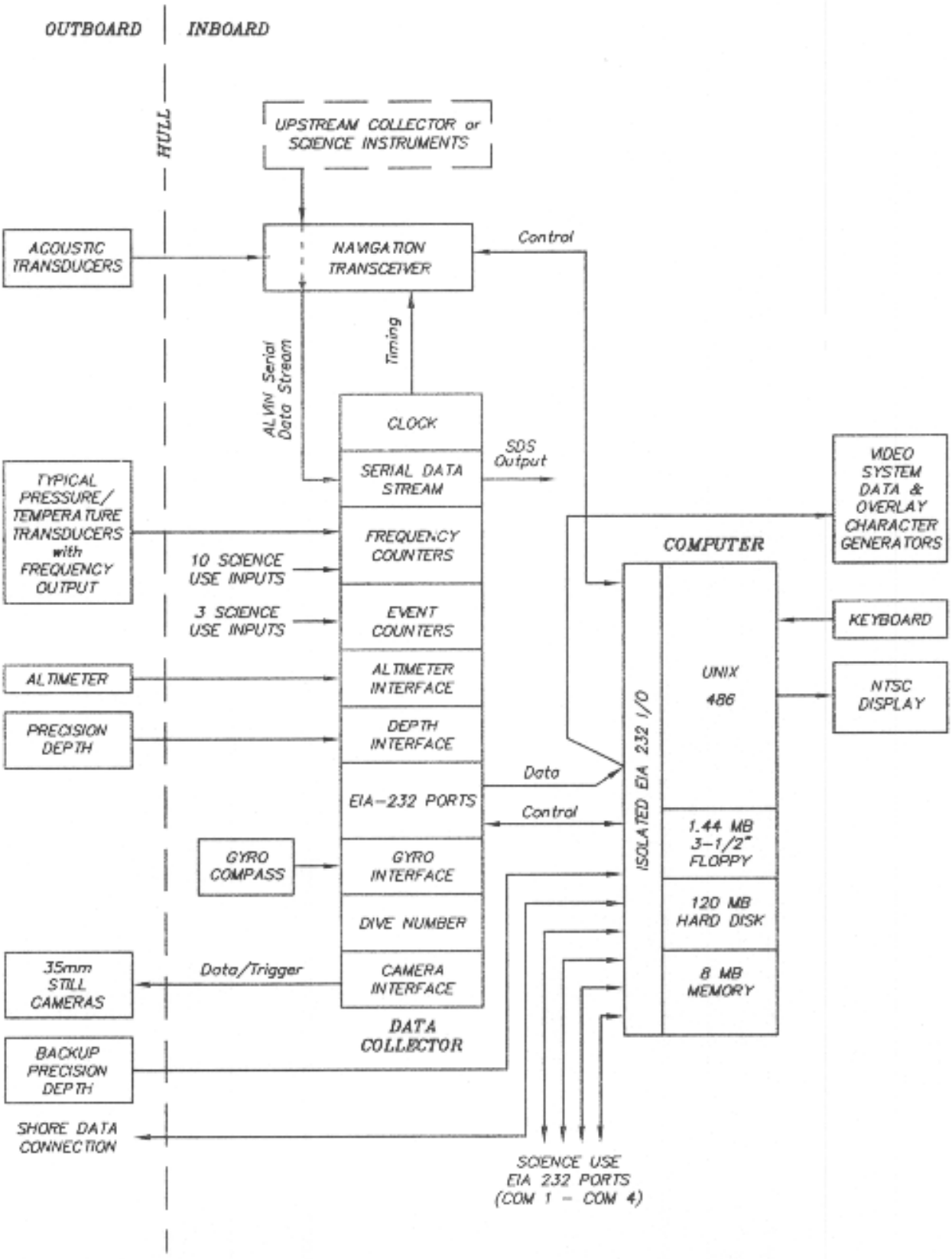
US Deep Submergence Community Request for *Alvin* Upgrades
(prioritized by DESSC) 5/23/96

Rank	System	Proposed Action	Cost Estimate	Comments
2	Imaging	Add overlay displays of time, depth, alt, hdg, dive number, date, etc. to all camera feeds.		Part of complete datalogger/video display upgrade issue.
2		Place camera(s) on pan and tilt mechanisms with controls (including zoom, focus, iris) conveniently placed for operation by scientists.	paid for	A prototype pan and tilt has been funded for Alvin and is currently under development/evaluation. Consider adding position sensors and scaling device.
2		Replace b&w video monitors in-hull with color monitors for observer viewing.		This is related to navigation upgrades and improvements to video switching capabilities. Cable upgrade required? Possible use of LCD displays.
2	Navigation	Use an in-hull nav program that uses travel times from all available transponders to calculate a position.		Navigation upgrade with WINFROG will accommodate this.
2		Replace in-hull navigation receiver with an off-the-shelf item.	4@$5,000 ea.	More reliable, improved capabilities.
2		Provide in-hull graphic display with bathymetry (and side-scan) and target overlays with tracking that differentiates current, recent, and old fixes.		Phase 2 of Navigation Upgrade. Potentially part of WINFROG capability.
2		Provide as standard a re-crunch of the transponder net and navigation data based on in-hull travel times.		WINFROG will accommodate this.
2		Implement standard inductively-coupled modem transceiver unit on Alvin with published design so anyone can build equipment that can communicate to laptops inside without needing through-hull connections.		Still in development/conceptual evaluation stage. This approach is being taken in development of a remote temperature sensor for Ti water samplers.
2	Sonar	Replace CTFM.	2@125K ea	Straza digital unit is the only suitable replacement with equivalent capability. Important to have distance capability

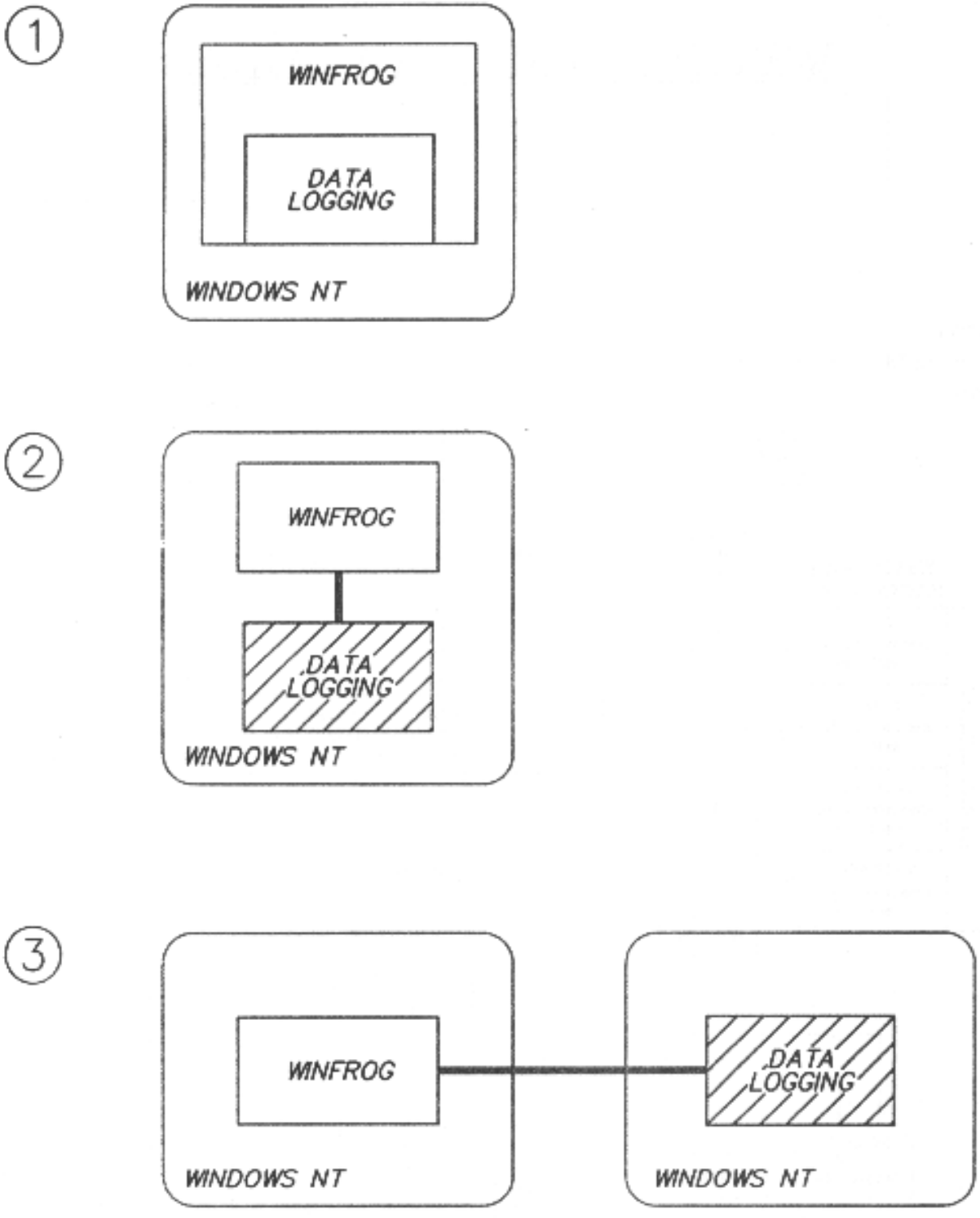
US Deep Submergence Community Request for *Alvin* Upgrades
(prioritized by DESSC) 5/23/96 page 3 of 3

2	Sampling	Purchase a pump to increase usefulness of Alvin CTD and develop a good mounting position on the sub for routine CTD profiling.		Science needs to define "good" mounting positions for quality data by all users. Upgrades include position sensors, pump and data management protocols, moveable sensors
3	Imaging	Add a digital ccd camera to the array of external imaging devices routinely carried on Alvin, with hardware and software for post-processing on board the ship.		Fornari is experimenting with this technology. Perhaps appropriate when resolved.
3		Obtain two pencil cameras (DSPL or equivalent) for view-finding or other monitoring requirements and long cables for mounting in various locations on Alvin.		
3		Ensure internal/external wiring/switching capabilities are adequate for imaging requirements.		Part of complete rework of existing datalogger/display problem.
3	Sampling	Provide push cores with core catchers.	$200 ea	
3		Improve Paroscientific depth gauge up to spec. This should be just a programming issue. Sample at 4 Hz.		Requires upgrade of datalogging system to sample at 4 Hz.
3		Develop a remote temperature sensor for Ti water samplers.		In progress. To be tested in April 1996.
3		Develop slup-gun for general use		Muliple chamber system (SEALINK)
3		Develop a micro-water sampler (ml volumes rather than liter volumes).	~$4K ea	

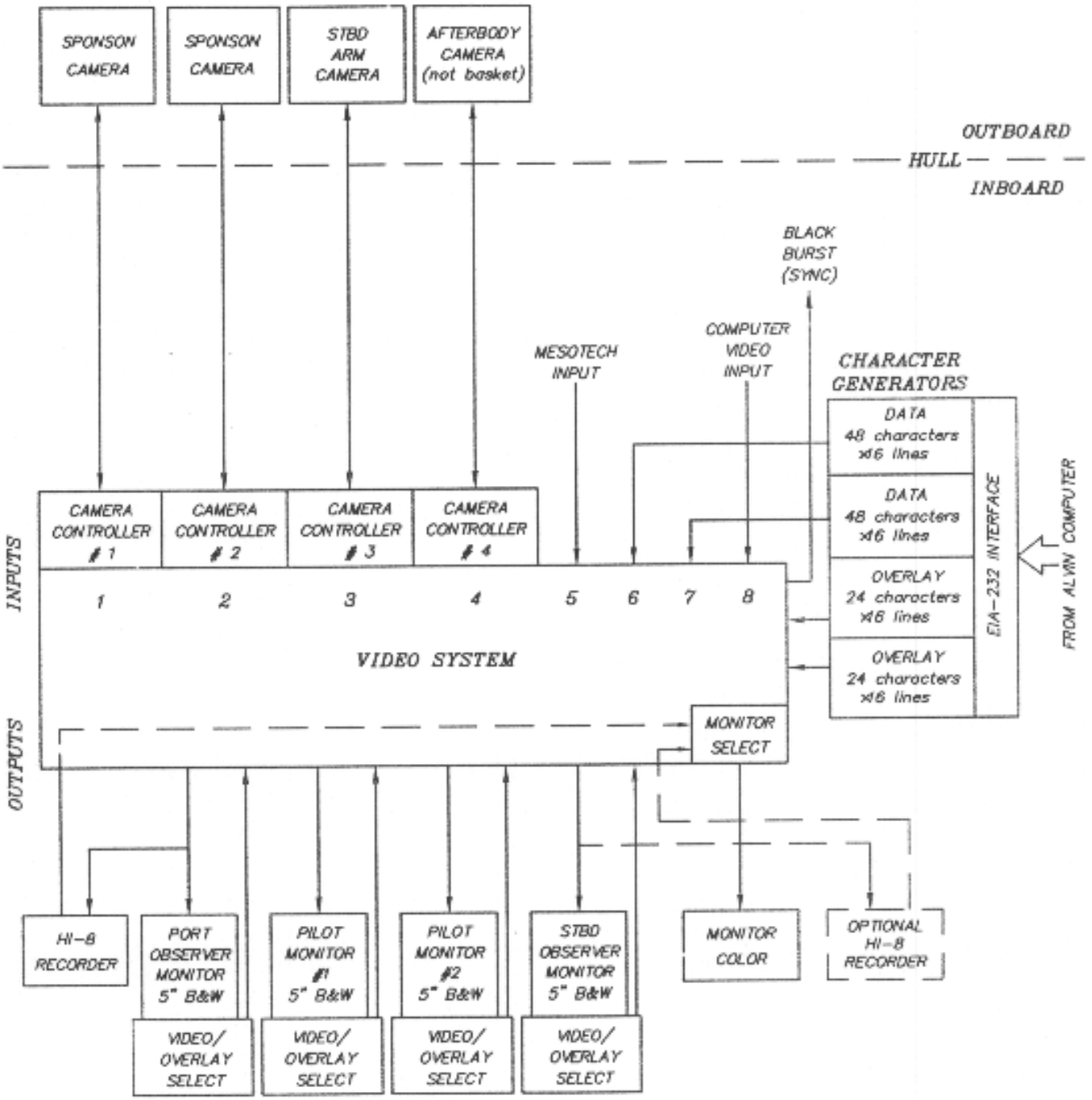
CURRENT DATA SYSTEM



DATA SYSTEM OPTIONS

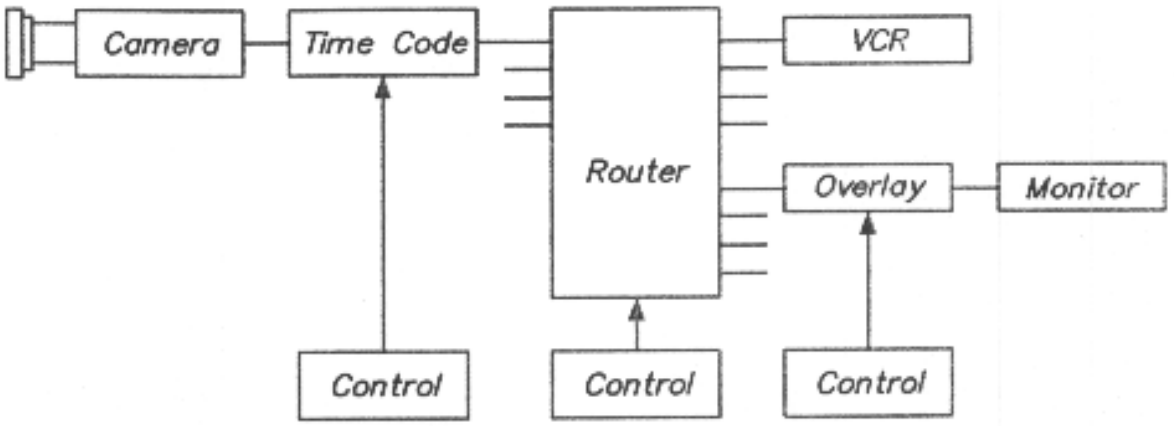


CURRENT VIDEO SYSTEM



VIDEO SYSTEM OPTIONS

1



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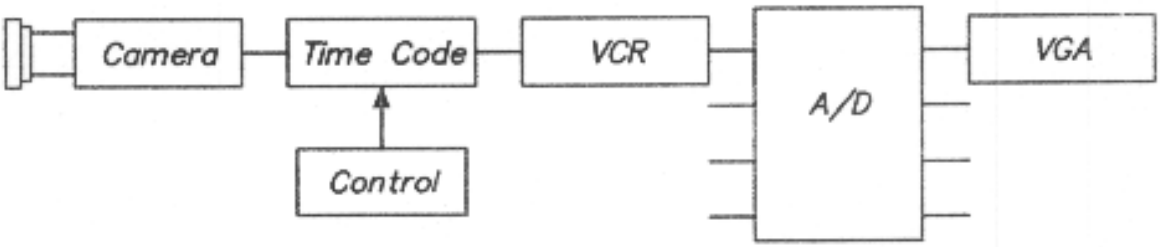

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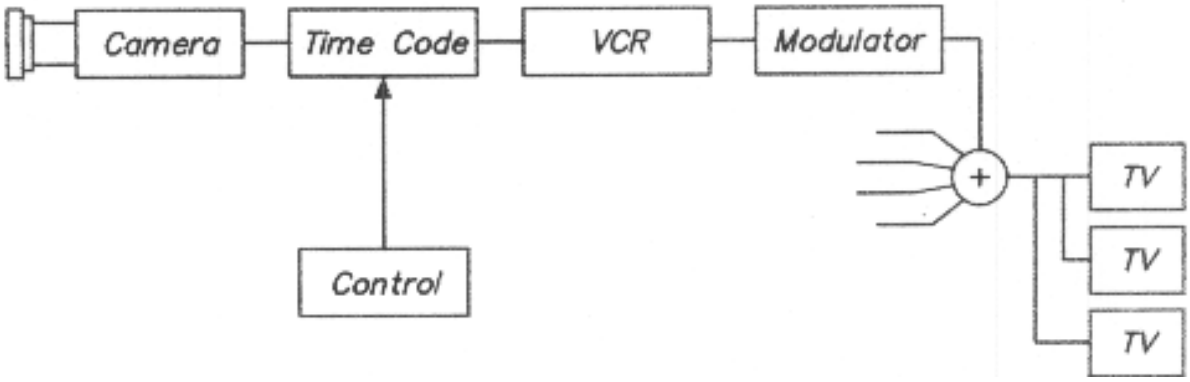
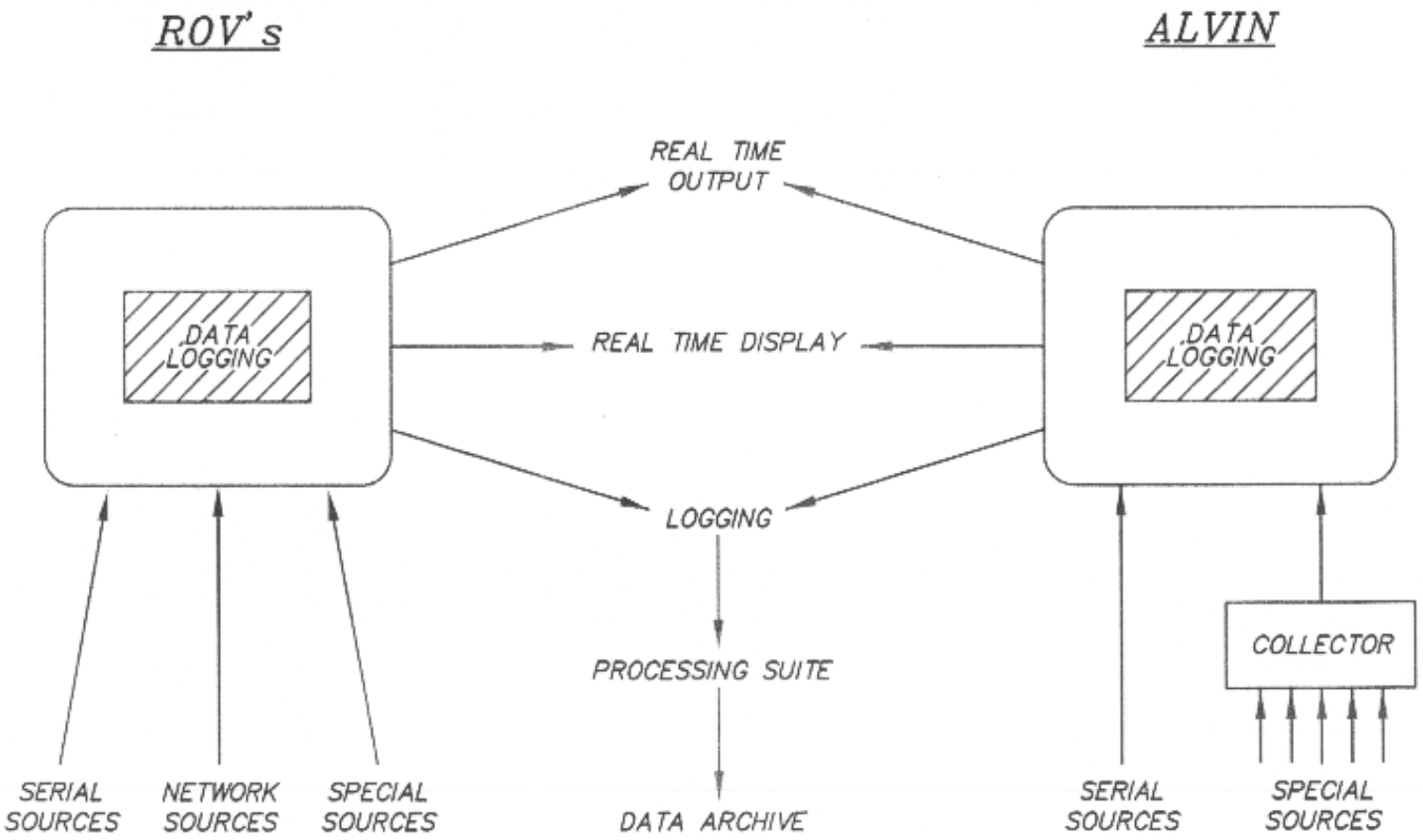


MANNED/UNMANNED DATA SYSTEM CONSOLIDATION



Oceanographic Centers & Facilities

- Staff Change
  * Lisa Rom, Instrumentation and Technical Services (ITS)
    - one year leave. August 1996-August 1997
  * Sandy Shor, ITS Program Director
    - IPA, University of Hawaii, August 1996-August 1997

- Program Addition
  * Interamerican Institute (IAI)
  * Line budget in OCFS ($1.6M)
  * OCE "center" management
  * Global Change Program

- UNOLS Liaisons

  Unols Council - Don Heinrichs
  RVOC
  Ship scheduling — Dolly Dieter
  DESSC
  RVTEC - Lisa Rom/Sandy Shor
  FIC - Richard West

NSF Ocean Sciences Division

Ocean Sciences

- Budget estimate is $193.7 Million
- Increase of $0.9 Million or 0.5%

	FY 1994	FY 1995	FY 1996
Ocean Sciences Research	$100.0 M	$102.6M	104.9M
Oceanographic Centers & Facilities	50.3M	50.4M	48.9M
Ocean Drilling Program	38.7M	39.8M	39.9M
	$189.0M	$192.8M	193.7M

- Major Research Initiatives

	FY 1994	FY 1995	FY 1996
Global Change Programs	$53.7M	$57.7M	57.6M
Biotechnology	4.0M	3.6M	3.0M
High Performance Computing	0.4M	0.8M	0.8M
Environmental Research	7.3M	7.7M	7.3M
SMETE (EHR)	2.1M	2.9M	3.1M
	$67.5M	$72.7M	$71.8M
Other Research Activities	$121.5M	$120.6M	$121.9M

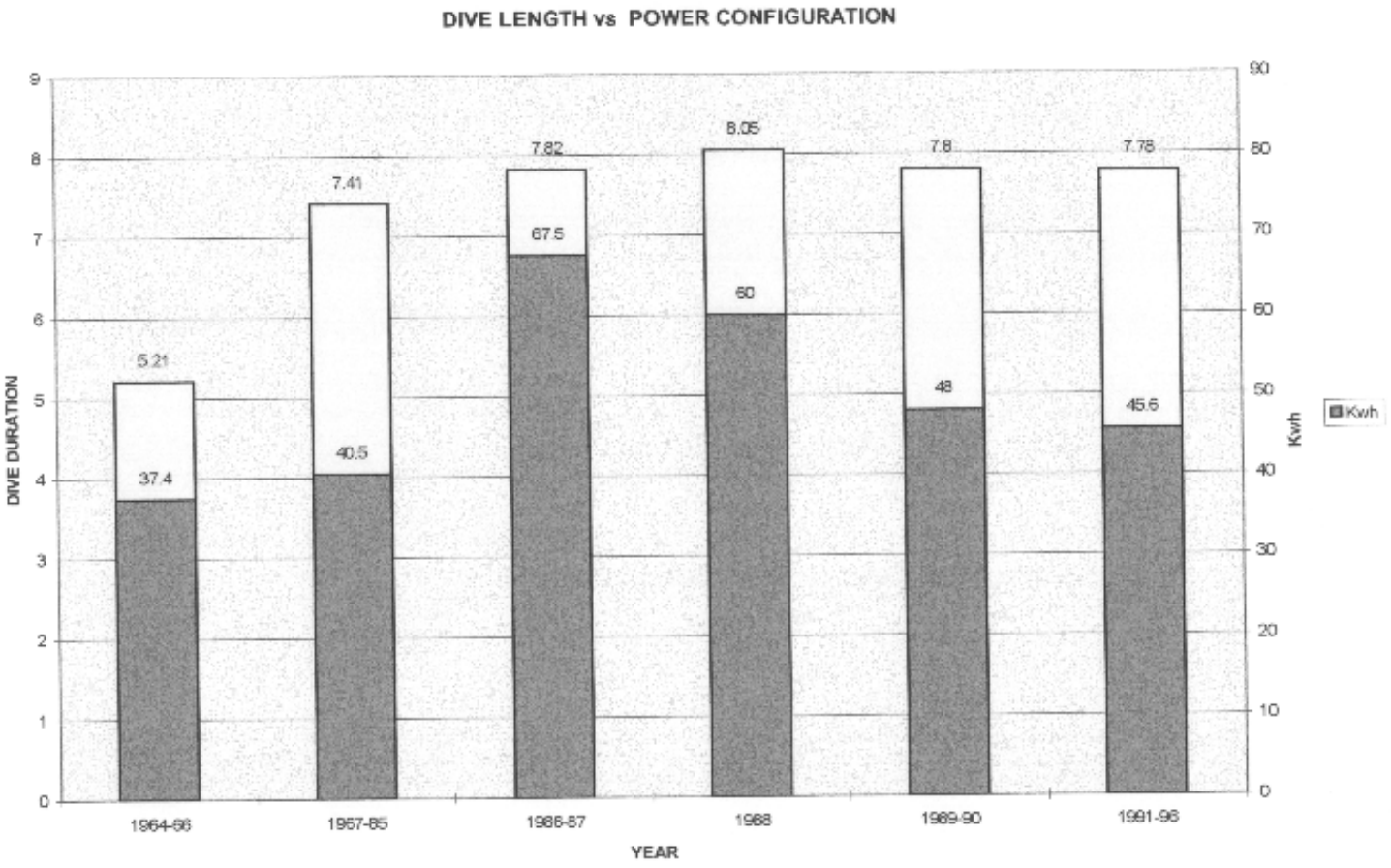
(May 1996)

Appendix B

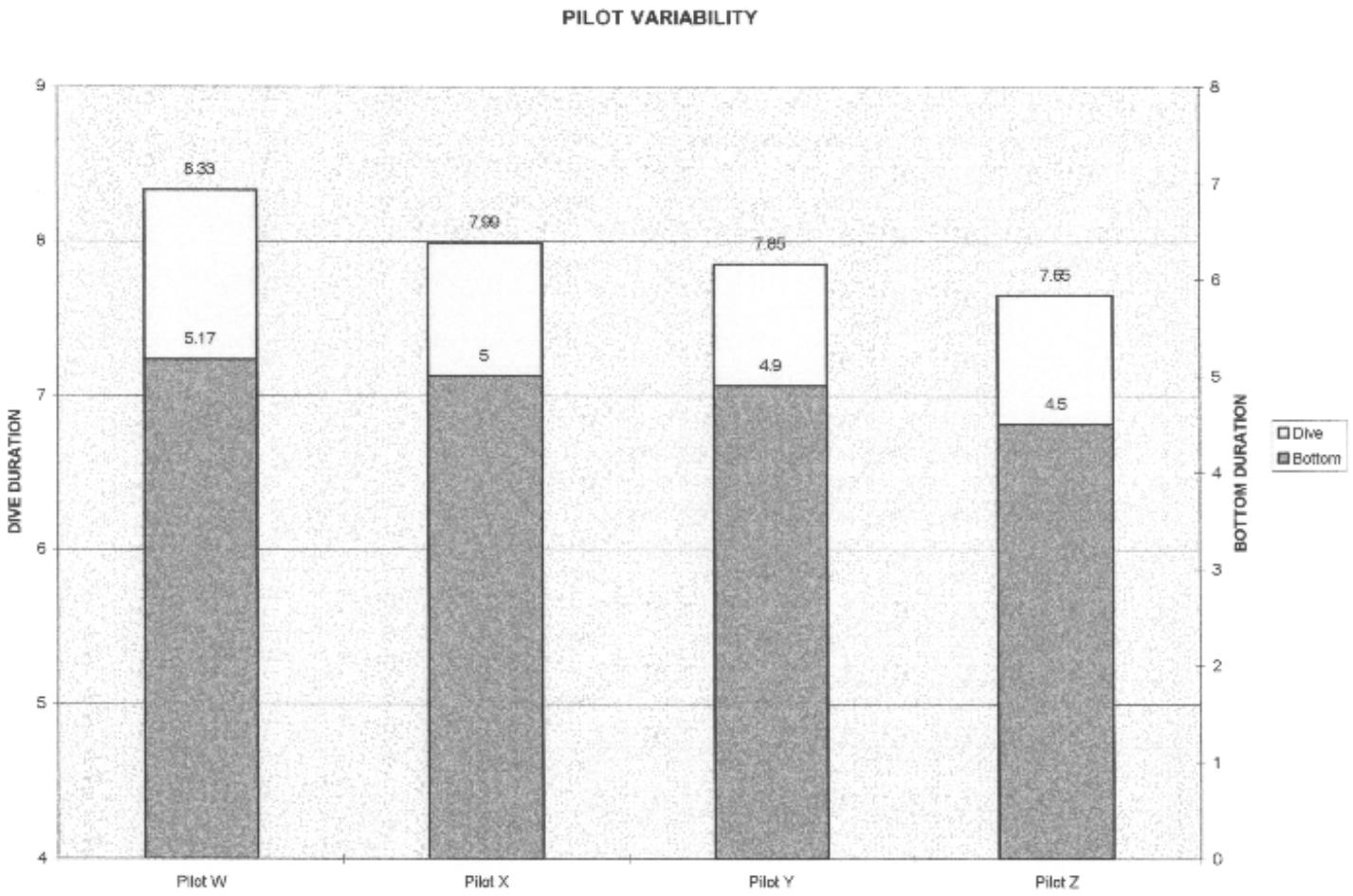
1991 BATTERY EVALUATION

w/wo PTC	Vendor	# Tanks	Model	AH	Water Wt.	Total AH
wo	CI Canada	2	3ET205	190	1800	380
wo	CI Canada	3	3ET205	190	2700	570
wo	CI Canada	3	XILF7	180	2900	540
wo	GNB	2	65C-7	195	2665	390
w	GNB	3	55C-7	165	3440	495
wo	Douglas	2	65-7	195	2650	390
wo	Exide	2	E75-7	225	2845	450
wo	Exide	3	E55-7	165	2900	495
wo	KW	2	50T-200	200	2495	400

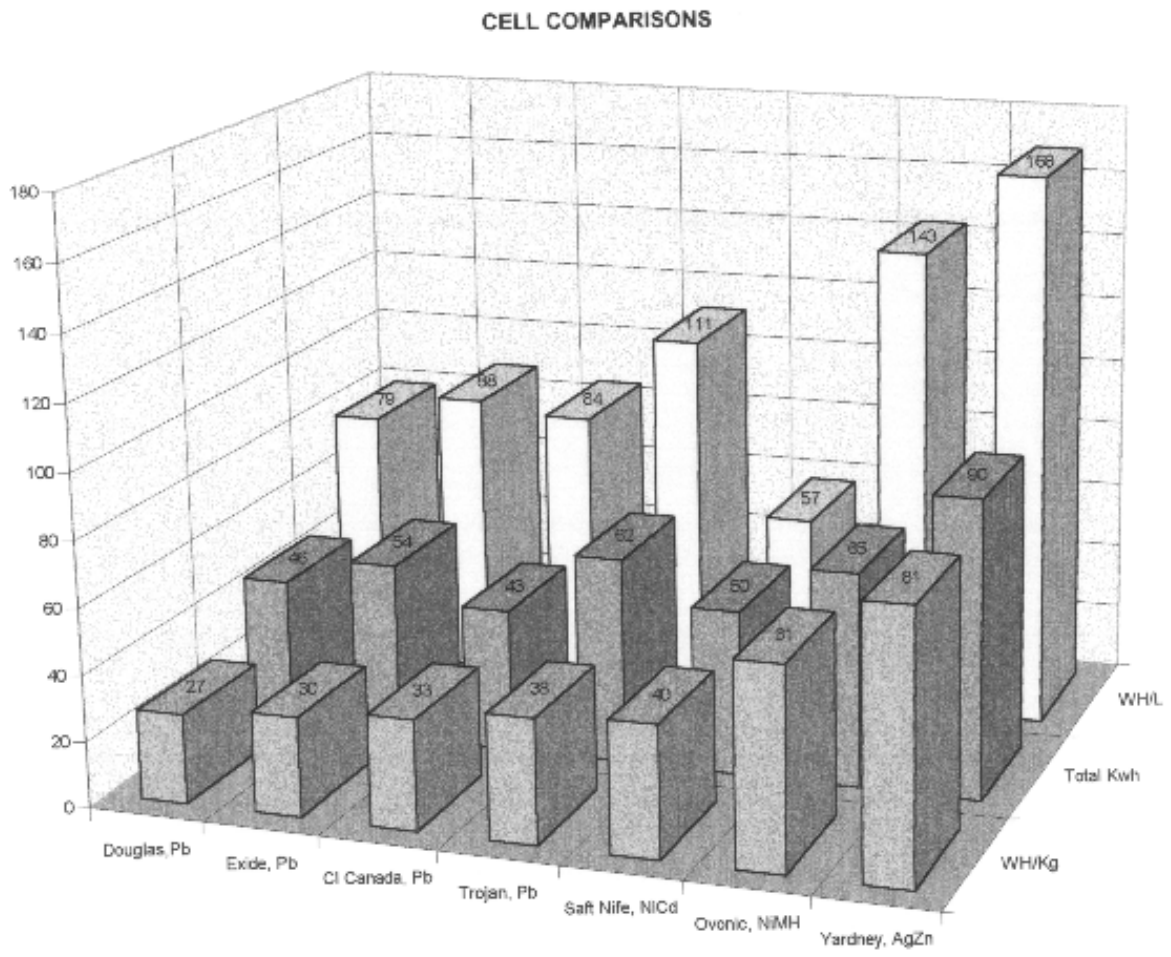
Appendix C


DIVE LENGTH vs POWER CONFIGURATION
DIVE DURATION
Kwh
YEAR
5.21
37.4
7.41
40.5
7.82
67.5
8.05
60
7.8
48
7.76
45.6
1964-66
1967-85
1986-87
1988
1989-90
1991-96
Kwh

Appendix D

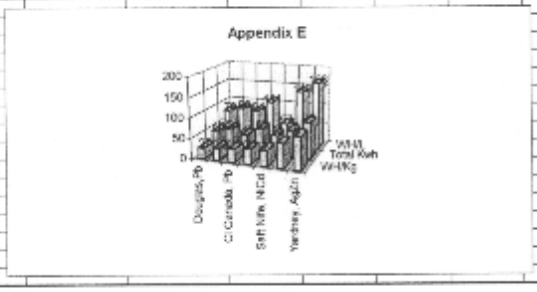

PILOT VARIABILITY
DIVE DURATION
BOTTOM DURATION
9
8
7
6
5
4
3
2
1
0
8.33
7.99
7.85
7.65
5.17
5
4.9
4.5
Pilot W
Pilot X
Pilot Y
Pilot Z
Dive
Bottom

Appendix E


CELL COMPARISONS
180
160
140
120
100
80
60
40
20
0
79
98
84
111
57
143
168
46
54
43
62
50
65
81
90
27
30
33
38
40
31
WH/L
Total Kwh
WH/Kg
Douglas, Pb
Exide, Pb
Cl Canada, Pb
Trojan, Pb
Saft Nife, NiCd
Ovonic, NiMH
Yardney, AgZn

Appendix E

Manuf	Model	WH/Kg	Total Kwh	WH/L	Volts	AmpHr	Pounds	Kg	Length	Width	Height	Liters	$/cell	$/AH	$/WH	# required	$/set+1
Douglas,Pb	8S-7	27	46	79	2.0	150	31.00	14.06	2.75	6.19	17.25	4.81	50	0.32	0.16	180	10800
Exide, Pb	E7SL-7	30	54	88	2.0	225	33.00	14.97	2.75	6.19	18.42	5.14	175	0.78	0.39	180	31500
CI Canada, Pb	XLF7	33	43	84	2.0	180	23.80	10.80	2.42	6.22	17.3	4.27	93	0.52	0.26	180	16740
Trojan, Pb	CEB-269	38	62	111	2.0	260	30.50	13.83	2.75	6.19	16.75	4.67	76	0.29	0.15	180	13680
Saft Nife, NiCd	SEH 200	40	50	57	1.2	208	13.89	6.30	3.07	6.54	13.23	4.35	700	3.37	2.80	300	210000
Ovonic, NiMH	Production90	61	55	143	12.0	90	39.24	17.80	4.02	7.05	16.22	7.53	700	7.78	0.65	80	56000
Yardney, AgZn	LR750DS-5	81	90	168	1.5	750	30.80	13.97	3.78	5.52	19.53	8.68	2100	2.80	1.87	160	336000



Cell Comparisons

DEEP SUBMERGENCE SCIENCE COMMITTEE

PLANNING MEETING AGENDA - FALL AGU
Moscone Center, Room 220
San Francisco, CA

09:00-09:15 Welcome, Introductory Remarks (M. Perfit, DESSC)

09:15 1995 Science Reports

a. Brief reports from PIs on science and facilities

10:30 National Facility Operators Report (ALVIN and ROVs)

a. Operational Statistics (including bottom time average per leg)
b. Status of Ongoing Development, Upgrade or Technical Efforts
    - Navigation upgrades (J. Bellingham)
    - Electronic Still Camera (D. Fornari)
c. Major Overhaul - Impact and Upgrades to Operational and Science Systems

12:00 Break for Lunch (Lunches can be purchased for $7.00 at the meeting site)

12:45 Status of New Deep Submergence Support Vessel (J. Andrews, ONR & D. Pittenger, WHOI)

a. Decision from Agencies, Operator, and DESSC on new ATLANTIS
b. Capabilities, Berthing, Lab Space, Facilities
c. Timing/Logistics/Shakedown-Engineering Dives

13:30 Agency Reports

a. NSF (D. Heinrichs)
b. ONR (J. Andrews)
c. NOAA Supported Operations

14:00 1996 Science Operations and Logistics (WHOI)

a. ALVIN and ROVs - 1996 Schedule

14:30-14:45 Coffee Break

14:45 Other Facility Operations

a. Navy Deep Submergence Operations (Cdr. Green)
    - Operational Statistics (including bottom time average per leg)
    - Key Areas of Operational/Equipment Effort or Problems
    - Status of Ongoing Development, Upgrade or Technical Efforts
b. MBARI ROV Operations (D. Stakes)
c. ROPOS/ROV Operations (S. Scott)
d. NOAA/HURL

15:15 Long-Range Planning (M. Perfit)

a. 1997 and Beyond (Impact of delivery of new support ship)
b. Letters of interest (A. DeSilva)
c. Global Deep Submergence Science Initiatives
    - Manned versus ROV/AUV science in the 21st Century
    - Utilization and Funding of Deep Submergence Assets
d. Programmatic Ties to other National Programs (RIDGE, ODP, DOE)
e. Vehicle Assets and Technology - 3rd party tool development update

16:15 Other Business and Issues

17:00 Meeting Adjourned

APPENDIX II

ATTENDEES DESSC Meeting - December 10, 1995

NAME	AFFILIATION	PHONE/FAX/E-MAIL
Jim Andrews	ONR	(703) 697-3031/(703) 697-8368/andrewj@onrhq.onr.navy.mil
Jack Bash	UNOLS	(401) 874-6825/(401) 874-6486/unols@gso.uri.edu
Rodey Batiza	U of Hawaii	(808) 956-5036/(808) 956-2538/rbatiza@soest.hawaii.edu
James Bellingham	MIT	(617) 253-7136/(617) 253-5730/belling@mit.edu
Andy Bowen	WHOI	(508) 457-2643/(508) 457-2191/abowen@whoi.edu
Richard Chandler	WHOI	(508) 289-2272/(508) 457-2107/rchandler@whoi.edu
Larry Clark	NSF	(703) 306-1584/(703) 306-0390/lclark@nsf.gov
Peter Clift	WHOI	(508) 289-2437/(508) 457-2187/pcliff@whoi.edu
Bob Collier	OSU	(541) 737-4367/(541) 737-2064/rcollier@oce.orst.edu
Mary D'Andrea	UNOLS	(401) 874-6825/(401) 874-6486/unols@gso.uri.edu
Annette DeSilva	ONR	(401) 874-6825/(401) 874-6486/unols@gso.uri.edu
Robert Embley	NOAA	(541) 867-0275/(541) 867-3907/embley@pmel.noaa.gov
David Epp	NSF	(703) 306-1586/ /depp@nsf.gov
Richard Fiske	Smithson. Inst.	(202) 357-1384/(202) 357-2476/mnhms3@sivm.si.edu
Dan Fornari	WHOI	(508) 289-2857/(508) 457-2187/fornari@tone.whoi.edu
Kantaro Fujioka	JAMSTEC	(81) 468-67-5565/(81) 468-66-5541/fujiokak@jamstec.go.jp
David Graham	OSU	(541) 737-4140/(541) 737-2064/dgraham@oce.orst.edu
John Green	US Navy	(619) 553-0360/(619) 553-7131/jwgreen@telnet1.jete.jcs.mil
Robert Grieve	MIT	(617) 253-3438/(617) 258-5730/rgrieve@mit.edu
Rachel Haymon	UCSB	(805) 893-3718/(805) 893-2314/haymon@magic.geol.ucsb.edu
Don Heinrichs	NSF	(703) 306-1576/(703) 306-0390/dheinric@nsf.gov
Richard Hey	U of Hawaii	(808) 956-8972/(808) 956-3188/hey@soest.hawaii.edu

H. Paul Johnson	U of Wash.	(206) 543-8474/(206) 543-0275/johnson@ocean.washington.edu
Yuka Kaiho	JAMSTEC	(81) 468-67-3839/(81) 468-5541/kaihoy@mstunx.jamstec.go.jp
Randolph Koski	USGS	(415) 354-3208/(415) 354-3191/randy@octopus.wr.usgs.gov
Emory Kristof	Nat. Geographic	(202) 857-7411/(703) 538-2454
Marvin Lilley	U of Wash.	(206) 543-0859/(206) 543-0275/lilley@ocean.washington.edu
Bruce Malfait	NSF	(703) 306-1581/ /bmalfait@nsf.gov
Takeshi Matsumoto	JAMSTEC	(81) 468-67-3833/(81) 468-66-5541/matsumotot@mstkid.jamstec.go.jp
Hugh Milburn	NOAA	(206) 526-6169/(206) 526-6744/milburn@pmel.noaa.gov
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APPENDIX III

ATLANTIS II VOYAGE 132 - LEG IX

DIVES 2940-2951

10 NOAA VENTS PROGRAM/2 NSF (M.K. TIVIEY)

JUAN DE FUCA

- NORTH CLEFT
  - NSF - RECOVER INSTRUMENTS...
  - CONTINUE VENT FLUID TIME SERIES
- COAXIAL
  - TIME SERIES CHEMISTRY AND BIOLOGY AT FLOC AND SOURCE SITES
  - GEOLOGICAL MAPPING AND SAMPLING OF YOUNG LAVAS AND HYDROTHERMAL ACTIVE FISSURE SYSTEM
- AXIAL VOLCANO - (1 DIVE)
  - REVISIT AFTER 7 YRS
  - +20°C (AVERAGE OF 4 SMOKERS)
  - BIG CHANGES IN MACROFAUNA

OTHER COMMENTS:

MESOTECH SURVEY - VERY USEFUL ANCILLARY TOOL AT VENT FIELD SCALE AND FOR MAPPING- SMALL STRUCTURES

ON BOARD GIS SYSTEM - USER FRIENDLY INTERFACE VERY USEFUL FOR DIVE PLANNING

This appendix also contains two bottom contour charts of the dive area.. These are available from the UNOLS office.

APPENDIX IV

ALVIN dives 2941 and 2944, Recovery of thermocouple/thermistor array package (Meg Tivey and Al Bradley (WHOI))

- Two instruments, each with 2 working pods, were deployed in summer, 1994 at the Monolith and Table Vent sites, Cleft Segment (JFR), and were recovered June 27 & 30, 1995.
- Approach produced continual records of fluid temperatures, recorded once per minute, at 18 to 20 discrete points in each of 4 areas (2 of high temperature and 2 of low temperature diffuse flow).
- A chimney grew inside the stainless steel ring and through the thermocouple array at Monolith. Data recorded during the first 16 days provide an account of wall temperature during growth of the chimney.
- (Unfortunately by the end of the 16th day the inconel-sheathed thermocouples had corroded; titanium-sheathed thermocouples will be used in the future).
- The 5.5 month records of temperatures associated with the other 3 sites are being examined.
- Deployment and recovery of the instrument packages went relatively smoothly, owing in large part to working out strategy with the *ALVIN* group during instrument development and prior to each cruise.
- An inductively coupled link was used during instrument deployment in 1994 to interrogate the instruments to make sure they were working properly once deployed.
- Results will be presented on Thursday in Session S41B, Geology and Geophysics of the Juan de Fuca Ridge I Posters.

APPENDIX V

TAG 1995

R/V ATLANTIS II LEG 132-02

Dates: 2/20/95-3/16/95

PIs: Kadko, Schultz, van Dover, von Herzen, Edmond, Becker, Kleinrock

OBJECTIVES:

1. Retrieve instruments monitoring the TAG mound:
    - Plume Thermistor Array (von Herzen)
    - Medusas (Schultz)
    - Gamma Spectrometer (Kadko)
    - Time Lapse camera (British)
    - Daibutsu (Japanese)
2. Re-survey areas studied prior to ODP drilling to identify changes to the system.
3. Perform extensive heat flow, water sampling, sulfide sampling and sediment coring program.
4. Nighttime work involved camera tows led by M. Kleinrock.

All of the expedition objectives were met. This included the recovery of all previously deployed instruments and the short term deployments of instruments during the dive series. A large suite of heat flow measurements were taken, and numerous water, sulfide, rock and sediment samples were collected.

The monitoring instruments detected changes in the vent field over a period of 6 months. Some of the changes are possibly related to the ODP drilling. The data is currently being analyzed.

The submersible operation went quite smoothly, although at times there were navigation problems

The camera tows were successful until the last night, when the cable parted and the system was lost. Perhaps the cable is aging.

APPENDIX VI

- University of Alaska Fairbanks
  - Geoff Wheat
- University of Hawaii
  - Mike Mottl
  - Frank Sansone
  - Craig Moyer
  - Nathan Becker
  - Rex Miyashiro
- University of Miami
  - Dave Kadko
  - Burtin Dixon
- University of Washington
  - Marv Lilley
  - Eric Olson
- NOAA Vents Program
  - Gary Massoth
  - Richard Feely
  - Ed Baker
  - Geoff Lebon
  - James Gendron
  - Sharon Walker
- University College, Galway, Ireland
  - Anthony Grehan
- IOS Sidney, Canada
  - Rick Thomson

This appendix includes two figures that show the results of some of the data gathered during these dives. They are available from the UNOLS Office.

APPENDIX VII

BLANCOVIN 1995

Chief Scientist: Maurice A. Tivey

Dates: 13th July - 30th July 1995

Location: Western Blanco Fracture Zone, Southern Juan de Fuca

Objective: To map the spatial variation of a magnetic anomaly polarity reversal boundary with depth in oceanic crust.

Results:

- 11 Dives traversing the Blanco scarp face
- 1 Dive lost to weather
- 2 Dives on ODP Hole 892 Oregon Margin (Keir Becker)
- Deepest dive 4337 m
- Average bottom time 4.3 hrs.
- Magnetic field data collected on all traverses
- Mesotech data on 10 dives
- 23 gravity stations
- 61 rock samples
- 12 oriented samples using geocompass
- 45 cored samples for paleomagnetic measurements
- 1000 lbs dredged rock samples from Parks Plateau
- 750 km sea surface magnetic field data using new WHOI system
- 2 deeptow magnetic tows
- 6 ABE launches and recovery

NSF Grant OCE-9400623

Title: Direct Measurement of a Polarity Boundary with Depth in Ocean Crust

P. I.: Maurice A. Tivey

Summary

The main goal of the research project referenced above is to determine the nature of a magnetic polarity reversal within the upper oceanic crust. It has been shown previously [Tivey, 1995] that measuring the magnetic field of a steep scarp face where oceanic crust is exposed can provide a high resolution picture of crustal magnetization and by inference crustal architecture. The first data collection phase of this project has been successfully completed. During July 1995, eleven ALVIN submersible dives (one dive was lost to weather) were carried out on the Blanco escarpment located at the western end of the Blanco fracture zone at the southern end of the Juan de Fuca Ridge in the northeast Pacific. The dives successfully measured magnetic field data on all dives and clearly defines the Jaramillo normal polarity anomaly as it intersects the steep scarp face. In addition to the magnetic field data, we also obtained mesotech scanning sonar data, high quality 3-chip video observations of the scarp, 61 rock samples of which 12 were oriented for paleomagnetic reconstructions. 21 high quality on bottom gravity stations were also obtained. Rock samples were measured for paleomagnetic properties of susceptibility and natural remnant magnetization. In addition to the submersible program, we also collected 750 km of sea surface magnetometer data to better constrain the magnetic anomaly stripes as they intersect the scarp face. The night-time program also included 8 successful rock dredges over the surrounding region but mostly focused on the Parks Plateau which forms the southern boundary of the Blanco fracture zone in the study area. Four test dives of an small autonomous underwater vehicle being developed at Woods Hole, the Autonomous Benthic Explorer (ABE), were also completed in preparation for a later research cruise. Magnetic data were collected on one of these ABE dives.

- Second year

In the second year, processing- of the ALVIN data will be undertaken. These data include submersible magnetics, mesotech sonar data, and geological observations. Also, the deeptow magnetic profile obtained along the scarp top will be processed along with the sea surface magnetic data. The analysis of the ALVIN magnetic data will utilize the vertical magnetic approach developed in an earlier project [Tivey, 1995]. Other data collected during- the cruise will also be analyzed at no cost to this proposal. These data include oriented sample data and paleomagnetic data from rock samples and seafloor gravity stations. Once all the data has been processed, the submarine data will **be** integrated into an overall picture of crustal magnetization and architecture.

Tivey, M. A., A measurement of the vertical magnetic structure of ocean crust using near bottom sensors, *EOS Trans. AGU, 73,* 14, 90, 1992.

Tivey, M. A., The vertical magnetic structure of ocean crust determined from near-bottom magnetic field measurements, Jour. Geophys. Res., in revision, 1995

Tivey, M. A., C Fleutelot, S Hussenoeder, H P Johnson, R M Lawrence, D D Naidoo, D van Patten, C Waters and F B Wooding, BLANCOVIN: A Submersible Study of Oceanic Crust at a Magnetic Polarity Reversal Boundary, EOS Trans. AGU, Fall meeting, 1995.

Fleutelot, C., T Juteau, M A Tivey and BLANCOVIN Scientific Team, The Parks Plateau Unveiled EOS Trans. AGU, Fall meeting, 1995.

BLANCOVIN 1995

Cruise objectives

The main goal of the BLANCOVIN research cruise was to map the spatial variation of a magnetic anomaly polarity reversal boundary with depth where exposed in a cross-section of oceanic crust. The nature of the reversal boundary is of prime importance to the question of the source of the magnetic anomalies. While numerous models have been inferred and proposed for the configuration of the reversal boundary with depth, there have been no direct measurements of this feature. Just as magnetic anomalies can be used to define isochrons on the seafloor, likewise, the magnetic boundaries at depth can also define isochrons through the crust. These timelines provide important insight into the nature and timing of the crustal processes that both form and subsequently modify oceanic crust. The BLANCOVIN ALVIN dive program was designed to address these fundamental issues by directly measuring a magnetic reversal boundary with depth using new survey strategies and analysis techniques developed for magnetic data obtained on scarps. The vertical magnetic profiling technique [Tivey, 1992, 1993a] has been successfully tested using the French submersible NAUTILE in young, ca. 1.2 Ma old crust, exposed at the Blanco Scarp in the northeast Pacific Ocean. Results from this study show- that a large magnetic anomaly contrast (7000 nT) is found at the dike to extrusive lava contact and that the extrusive basalts contribute over 80% of the source of the magnetic anomaly signal measured at the sea surface. The NAUTILE survey was located in a region of constant reversed polarity crust (Matuyama epoch), providing the basic framework for the variation of magnetization with crustal depth. This dive program seeks to survey the crust adjacent to the NAUTILE] survey site, where the normal polarity Jaramillo magnetic anomaly clearly intersects the Blanco Scarp. The survey strategy will be to progressively increase the level of resolution of the crustal magnetic signal by starting with a close fine spacing sea surface magnetic survey, followed by a near-bottom survey of the seafloor using a deeptow magnetometer, and culminating in magnetic traverses by the ALVIN submersible on the scarp face. These surveys are designed to carry out a kind of .1 magnetic tomography" of the crust. The main magnetic objectives of this cruise are to address the following points:

- directly determine the nature of the reversal boundary with depth in the upper oceanic crust.
- determine the source of sea surface magnetic anomalies by defining the upper contributions, but also in doing so, putting constraints on the contribution from the lower crust.
- directly relate the measured magnetic structure of the crust to the overlying magnetic anomalies measured near the sea floor and at the sea surface.
- define the distribution and timing of the crustal processes responsible for emplacement, accretion, tectonic disruption, and alteration of oceanic crust. These observations can then be related to the observations at the current axis of spreading.

This appendix contains 5 figures. Copies of these figures can be obtained from the UNOLS Office.

APPENDIX VIII

A NEAR-BOTTOM GEOPHYSICAL STUDY OF A NEW ERUPTION SITE ON THE JUAN DE FUCA RIDGE

ALVIN/ATLANTIS II Expedition to the CoAxial Segment of the Juan de Fuca Ridge
26 August to 10 September, 1995
Astoria, Oregon to Astoria Oregon

Funded by the MG&G Program of the National Science Foundation

Chief Scientist: Paul Johnson
Scientific Personnel:

Paul Johnson	University of Washington
Maurice Tivey	WHOI
Bob Embley	NOAA/PMEL/Newport
Mark Holmes	University of Washington
Dawn Wright	Oregon State University
Randy Herr	Navoceano
Darcy Van Patten	University of Washington
Julia Getsiv	NOAA/PMEL/Newport
Andrew Daniel	University of Liverpool
Matt Pruis	University of Washington
Byron Ruppel	private consultant
Michael Hutnak	University of Washington
Gwen O'Donnell	Lehigh University

Specific Experiments - 13 dives in 1995

1. ALVIN magnetometer surveys. (basket-mounted)
2. Bell gravity meter surveys (in-hull deployment)
3. Mesotech high resolution bathymetry (hull-mount on ALVIN)
4. Deploy 5 sea floor magnetometers and tilt meters (year-long deploy, recover in '96)

5. Deploy a bare rock heat flow blanket
6. ABE near-bottom magnetometer survey
7. Recover rock samples; map HT activity, fissure density, geological observations of area overlying the feeder dike.

CoAxial-95 Cruise- GOALS

1. Determine the time-dependent changes in magnetization and density of the (zero-age) New Flow and surrounding crust.
2. Characterize the geophysical signature of the 'diking event' associated with the New Flow eruption.
3. Determine the details of the thermal budget of crustal formation process.

Part of continuing time-series of measurements of the CoAxial New Flow eruption.

Oct 1993 - ALVIN

Sept 1994 - TURTLE/ATV

Aug 1995 - ALVIN/ABE/All

Sept 1996 - Jason/Thompson

There are 7 figures/charts that are part of this appendix. These are available from the UNOLS Office.

APPENDIX IX

Alvin/A II 132-17
HYALOCLASTITES

Science:

- DEPOSITS ARE THIN (< 20 cm)
- NO GRADIENTS IN THICKNESS
- NO LOCALIZED VENTS
- GLASS SHARDS PRODUCED DURING ACTIVE SHEET FLOW ERUPTIONS
- CONTACT-SURFACE EXPLOSIVITY
- LAB EXPERIMENTS, MODELING

Technology:

- ALVIN SUBMERSIBLE
- HOLLOWAY-STAKES DRILL
- CAMERA

There are 4 charts/figures that are part of this appendix. Copies of these charts/figures can be obtained from the UNOLS Office.

APPENDIX X

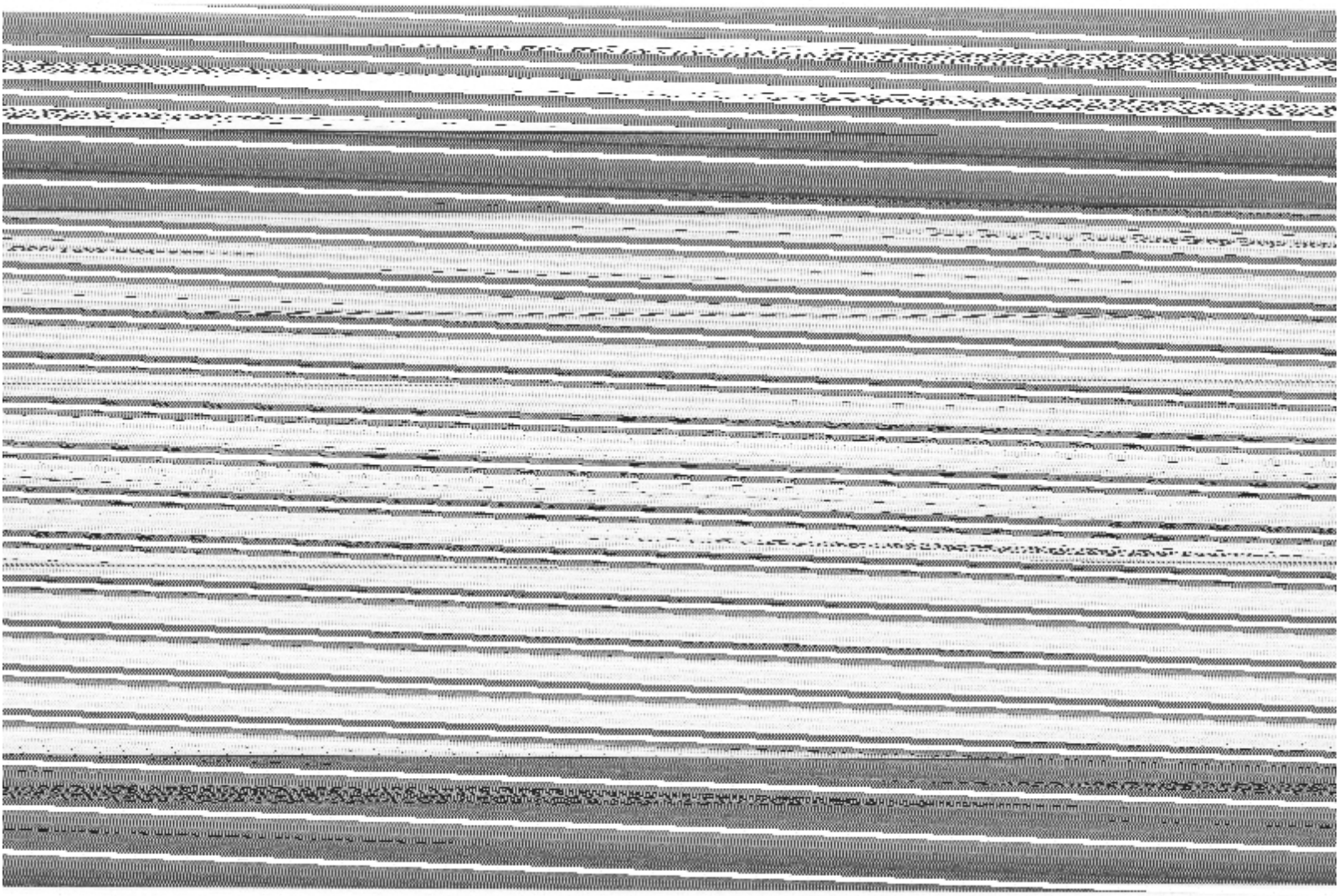
Gametogenic Ecology of a Hydrothermal Vent Community

- Spatial analysis of reproductive activity within field--tests whether reproduction vent species is continuous.
- If not continuous -- test whether synchrony is controlled by tidal cycles
- Second set of samples collected 1 month later permits a time-series approach.

Sea Cliff/ATV Operations

Highlights

- ATV Sampling of biota
- ATV Sampling of black smokers
- ATV temperature measurements
- ATV small package deployment and recovery
- Sea Beam survey on arrival
- 24 hour operations maximize bottom time
- Launch and recovery in sea state 4
- Professional, competent, courteous crew
- *(~24 members of combined Sea Cliff and ATV crew)*



APPENDIX XII

DSOG Unmanned Vehicle Status

Jason/Medea

- Control Van Rewire - completed
- Medea Replacement - completed
- Debug Telemetry Lockups - completed
- Documentation - underway
- Manipulator Testing - underway
- Revise design of lower payload skid - underway
- Improve self rescue capability - underway

Argo II

- Improved Obstacle Avoidance Forward Looking Sonar
- Determine Source of Video Camera Focus Problems
- Thrusters for Heading Control - underway
- Resolve Noise on LBL Transducer - underway
- Single Van Operations - completed
- Documentation - underway

DSL 120

- Replace Depressor - underway
- Refine Low Speed Tow Dynamics - underway
- Design and Install Weight Dropper - postponed
- Determine suitable Upgrade Path for Surface Processing proposal submitted
- Documentation - underway

DSOG Sonar Upgrade Proposal

- Standard Sparcstation and peripherals to replace unique embedded system developed in 1991.
- Digital Signal Processing card to decode sonar telemetry.
- Limited hardware development
- Engineering time for development by specialist non- DSOG personnel.
- Post processing enhancements by D. Scheirer of Brown.
- Primary goal: eliminate many potentially catastrophic reliability problems and streamline data pipeline from collection to map making and analysis by the scientist.

DSOG Acoustic Navigation Upgrade

Two Phase Implementation of DESSC Subcommittee Recommendations

Phase One:

- Purchase three copies of Pelagos Inc. Winphrog software
- Purchase two computers (PCs) to support Winphrog
- Install and test on Atlantis II for Alvin surface control
- Integrate into portable navigation and control
- Test Winphrog as in hull navigation processor and display
- Determine preferred technical approach for permanent in hull installation to be proposed in phase two
- Review DESSC subcommittee recommendations and incorporate in future upgrade proposals (ie. ACDP/USBL/DR)

Jason Manipulator Development Program

Objectives

- Improve reliability
- Test at maximum rated pressure
- Develop techniques for handling and triggering "double major" hydrothermal vent fluid samplers
- Design and test new elevator system
- Redesign gripper
- Improve spares and documentation
- Demonstrate ability to work with temperature probes and "bio. boxes"

APPENDIX XIII

New Equipment Used, Tried or Evaluated ALVIN - 1995

- ABE
- Rock Drill
- NAVOCEANO Gravimeter
- Pan/Tilt Mechanism
- HBOI 10mw micro lasers
- DSP&L Thallium Iodide light for HMI ballast
- TriTech sonar
- Imagenex sonar
- New Moog motor controllers
- Cameras
    - DSP&L small 1-chip color
    - DSP&L small ICCD
    - WHOI HiDef B/W
    - WHOI Macro
    - Benthos/Kodak ESC

Battery Power

- Bottom time comparisons
- ALVIN bottom time
- Bottom time variables
- Improvement efforts

A figure that shows the Cruise Averages of Bottom Time is available from the UNOLS Office.

Comparison of On-Bottom Times for Different Deep Diving Submersibles

ALVIN	(1500 dive average 1985-1995) (dives >1500 m,>2 hr)	4 hr 47 min
NAUTILE	(200 dive average 1994)	4 hr 8 min
CYANA	(200 dive average 1994)	5 hr
SHINKAI-2000	(at 2000m 1994)	4 hr

SHINKAI-6500	(at 6000m 1994)	4 hr
	(at 6500m 1994)	3 hr 30 min
	(at 3000m 1994)	5 hr

Comparison of Battery Characteristics & Cost Factors for Deep-Diving Submersibles

SPEC	**ALVIN**	**NAUTILE**	**SHINKAI 6500**
Type	Pb acid	Pb acid	AgZn
Capacity	37.4 kwh	38.4 kwh	86.4 kwh
	(80%)	(80%)	(80%?)
Cost/set	$7,800	$42,000	$2,630,000
Dives/set	200	200	75
$/dive	$39	$210	$35,000
$/kwh	$208	$1,141	$30,440
Maint. Int.	60 dives	50 dives	30 dives

Variables Affecting Alvin Power and Bottom-Time

Long-Term Variables

1. Power Characteristics of Battery Type
2. Charging Equipment and Procedures
3. Changing Configuration and Number of Power Consumptive Operational Equipment and Science Equipment

Short-Term Variables

1. Science Mission Objectives
2. Lead-Observer Experience and Organization of Science Tasks
3. Piloting Style (e.g. throttle usage, trim control, mission planning, manipulator skill, fatigue,
4. Dive Depth
5. Type of Terrain
6. Lights (observation and video photography)
7. Sampling/Hydraulics Demand
8. Battery Condition

9. Service - Maintenance Procedures

Improvement Efforts

- Continue Monitoring Battery Market
- Continue to Optimize Charge Cycle
- Continue to Optimize Battery Maintenance
- Continue Pilot Efficiency Training
- Continue Electronic Monitoring Development

Increased payload possibilities

- New motor controllers
- Reduce battery weight
- Variable ballast monitoring

Imaging Proposal Status

Complete:

- Macintosh computer monitor, laser printer
- Long baseline nav upgrade investigation
- EXACT system evaluation on ALVIN
- Additional shipboard recorders, monitors, editing station
- New HMI, quartz iodide lights
- Scaling lasers
- Spare relay can electronics

Pending:

- Additional 1-chip color camera
- 3-chip color camera
- Pan/tilt mechanism - selected, order Dec 95

Motor Controllers

- Housings complete
- Testing new endcaps and connectors

APPENDIX XIV

	LULU	ATLANTIS II	KNORR	ATLANTIS
LOA	105 ft	210 ft	279 ft	274 ft
Beam	48 ft	44 ft	46 ft	52.5 ft
Crew	9	22	22	22
Science	17	28	34	37
Generators (3)	150 kw	600 kw	1,780 kw	2.145 kw
Cruising Speed	6.5 kts	10.5 kts	12 kts	12 kts
Endurance	20 days	30 days	60 days	60 days
Range	2,000 mi	9,000 mi	12,000 mi	11,300 mi plus
				30 days on station
Labs	1 van	4 labs	6 labs	6 labs
		1.031 sq. ft.	1,981 sq. ft.	4,000 sq. ft.

AGOR 25/ATLANTIS II/ALVIN Schedule

APPENDIX XV

Deep Submergence Science Committee
New Deep Submergence Support Vessel Plans

Sunday, 10 December 1995
San Francisco, CA

Woods Hole Oceanographic Institution

	LULU	ATLANTIS II	KNORR	ATLANTIS
LOA	105 ft	210 ft	279 ft	274 ft
Beam	48 ft	44 ft	46 ft	52.5 ft
Displacement	480 Ltons	2,300 Ltons	2,685 Ltons	3,250 Ltons
Crew	9	22	22	22
Science				
DSV/Tech	9	9	13	13
Party	8	19	21	24
Generators (3)	150 kw	600 kw	1,780 kw	2,145 kw
Cruising Speed	6.5 kts	10.5 kts	12 kts	12 kts
Endurance	20 days	30 days	60 days	60 days
Range	2,000 mi	9,000 mi	12,000 mi	11,300 mi plus
				30 days on station
Labs	1 van	4 labs	6 labs	6 labs
		1,031 sq. ft	1,981 sq. ft.	3,890 sq. ft.

This appendix contains 9 drawings of ATLANTIS (AGOR 25) outboard profile (Starboard) and deck layouts. This are available from the UNOLS Office.

ATLANTIS (AGOR-25)

Schedule of Key Events

Atlantis II out of service	Sept '96

Alvin Overhaul	Sept '96 - Apr. '97
Atlantis (AGOR-25)	
Conversion Complete	Apr.'97
Arrive WHOI	5/6/1997
DSOG Demo/Trails	5/20/97 - 6/3/97
Available for Science	June -Dec '97
(Contigous to USA)	
Available for Science	>Feb '98
(unlimited)	

Two figures that show AGOR 25/ATLANTIS II/ALVIN Schedule

APPENDIX XVI

Date: Wed, 06 Dec 1995 11:38:57 -0500 (EST)
From: Hank Frey <HFrey@rdc.noaa.gov>
Subject: re: Final DESSC agenda for Saturday
To: perf@nervm.nerdc.ufl.edu
Cc: GeneSmith@rdc.noaa.gov

Mike,

I am very sorry that I had to cancel my trip to San Fransico and the DESSC meeting in order to respond quickly to issues related to NURP's sharply reduced appropriation of $12 million. If you wish, you may read the message below to the attendees:

"I am very sorry that I am unable to attend the DESSC meetings tonight and tomorrow. I had looked forward to doing so. Events are happening in rapid succession here in response to the outlook for FY 1996 funding, the short time we have to respond to such a deep cut, and intensive activity to award grants to the Centers. I need to be in Silver Spring to work closely with OAR and NOAA management on these issues. The situation as of Wednesday, December 6th was (1) the NURP appropriation of $12 million has been reported out of conference but not voted upon, (2) the President may veto the bill to which the NURP funding is attached because it would deny the administration the 100,000 police officers it sought in the Department of Justice appropriation (Commerce, State, and Justice are lumped together), and (3) the conference language requires NOAA to fund the Centers at $1,560K and to distribute the "excess" to the three Centers that suffered cuts during the FY 1995 rescission. The FY 1994 and FY 1995 appropriations were $18.1 and $18.0 million, respectively. A $3.5 million rescission occured in FY 1995, reducing NURP to $14.5 million. The FY 1996 appropriation is down by one-third from the FY 1994 and FY 1995 (pre-rescission) appropriation. Nevertheless, we will do everything possible to preserve funds to support ALVIN. We may, however, have to do so at a somewhat reduced level. I think that it will take weeks for decisions to be made and ratified. I will keep Mike Prefit, Don Heinrichs, and Dolly Dieter informed as decisions are made at NOAA on allocating the sharply reduced FY 1996 funds. Best regards from Gene Smith and me."

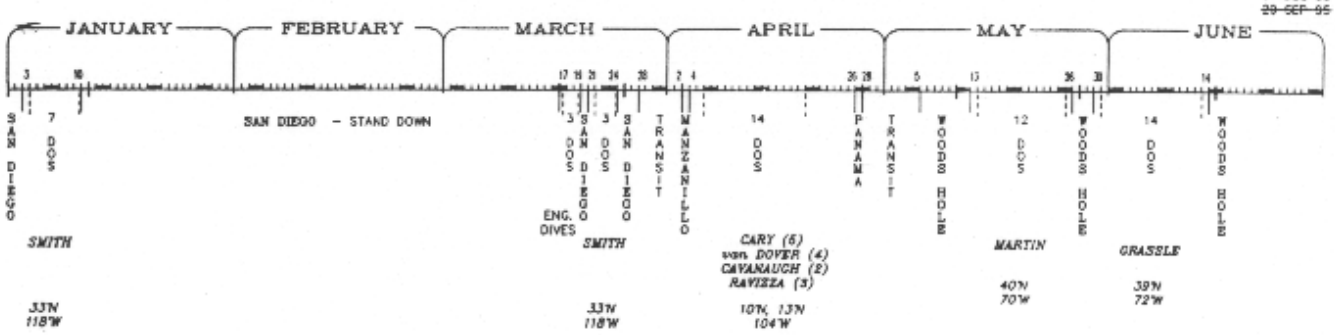
TENTATIVE *

R/V ATLANTIS II & ALVIN OPERATIONS

1996

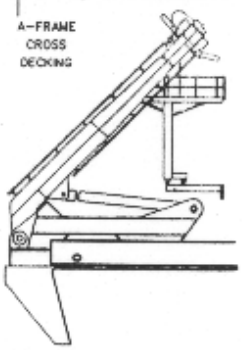
OPERATIONAL SCIENTIFIC SERVICES
WOODS HOLE OCEANOGRAPHIC INSTITUTION

07 DEC 95
~~29 SEP 95~~



TRANSIT TO GULF PORT
TBA

A-FRAME
CROSS DECKING



All DECOMMISIONED

A L V I N O V E R H A U L (July–December)

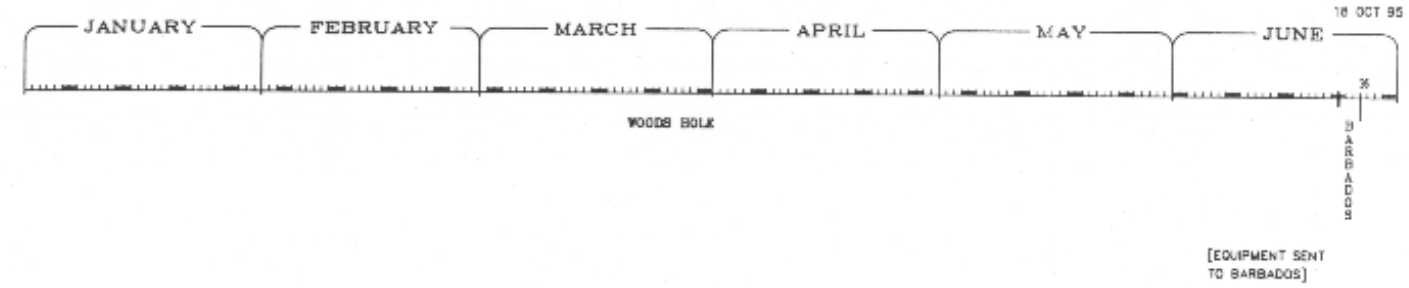
ALVIN Dives	
Science	50
Cert./Eng.	3
Total	53

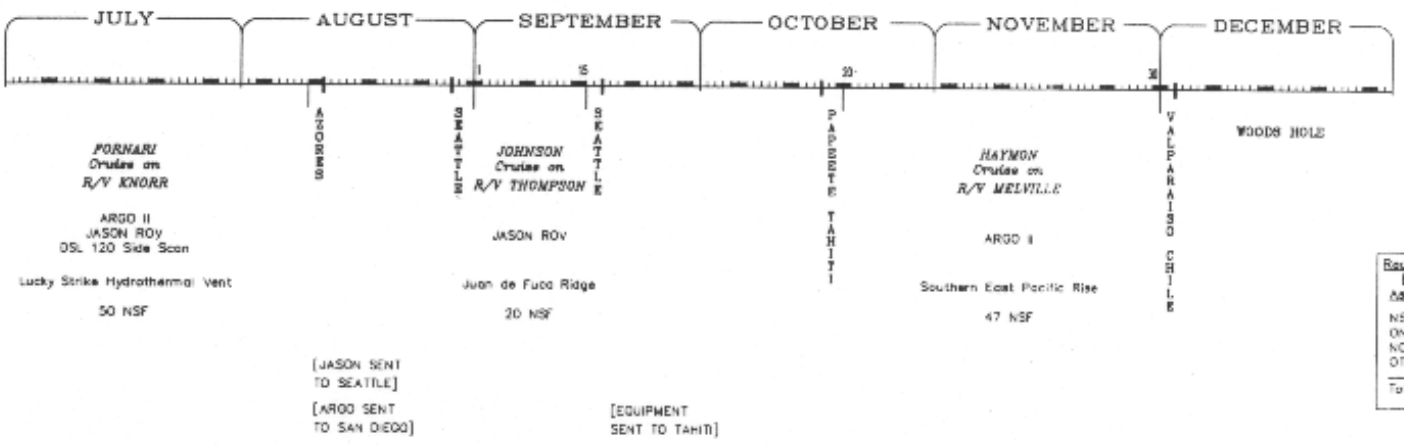
DOS = Dive Days On Station
* Based upon requests for ALVIN time received by the UNOLS ALVIN Review Committee and therefore subject to revisions resulting from supporting agency funding decisions

ROV OPERATIONS

1996

OPERATIONAL SCIENTIFIC SERVICES
WOODS HOLE OCEANOGRAPHIC INSTITUTION





Recommended ROV Day Assignments	
NSF	117
ONR	–
NOAA	–
OTHER	–
Total	117

APPENDIX XVIII

1995 Science Operations
Advanced Tethered Vehicle

DSV TURTLE
DSV SEA CLIFF

- 28 April to 14 May: Southern California
- 9 to 16 August: Southern California
- 23 August to 13 September: Juan de Fuca Ridge
- 15 to 26 September: Mendocino Ridge
- 1 to 11 October: Juan de Fuca Ridge
- 26 to 28 October: Southern California

Whale_Fall Communities
Catalina Basin

29 April - 8 May

- Dr. Craig Smith (University)
- Investgated significance of whale-fall communities as dispersal stepping stones for sulfide-dependent spicies
- Recovered 36 vertebrate segments, 41 core and scoop samples, 62 hours of video recordings, 550 still frames
    - ATV: 7 dives (69 hrs)
    - TURTLE: 3 dives (25 hrs)

Deep-Sea Brittlestar Fish
San Diego Trough:

8 May - 14 May

- Dr. Gordon Hendler (Natural History Museaum of Los Angles)
- Interpretion of Brittlestar behavior pattern
- Recovered over 100 specimens, 65 hours of video, 950 still frame
    - ATV: 5 dives (59 hrs)
    - TURTLE: 4 dives (23 hrs)

Submarine Canyon Studies

La Jolla Canyon

9 - 16 Aug
26 - 28 Oct

- Drs Paul Dayton and Eric Vetter (Scripps Institution of Oceanography)
- Study to Assess the Importanc eof Submarine Canyons as Hot-spots of Secondary Production
- Collected 92 tube and box core samples, 9 Niskin samples, 81 hours video, 1650 stills
    - ATV: 11 dives (76 hrs)
    - SEA CLIFF: 9 dives (35 hrs)

Hydrothermal Microhabitatas
Juan du Fuca Ridge:

23 Aug to 13 Sep
1 Oct to 10 Oct

- Dr Cindy Lee Van Dover (University of Alaska)
- A snap shot approach to sampling dominant invertibrate
- Collection of 3 Niskin samples, 22 recruitment arrays, 52 hours of video, 2700 still photes, 14 boxes of invertebrates
- - ATV: 6 dives (39 hrs)
- - SEA CLIFF: 7 dives (55 hrs)

Mendocino Ridge Studies
Mendicino Ridge:

14-26 Sep

- Dr Martin Fisk (Oregon State University)
- Ridge's Impact on the Surface Circulation of Pacific Ocean
- Conducted 120 hours of SEA BEAM, 92 rock samples, 22 biological samples, 1500 still frames, 52 hours of video
    - ATV: 4 dives (51 hrs)
    - SEA CLIFF: 4 dives (33hrs)

Summary of Operations

- Total days on station: 40 days (4 lost due to weather)
- Depth of opersations: 923 - 10,500 feet
- TURTLE dives: 7 dives/48 hours
- SEA CLIFF:dives: 20 dives /123 hours

- ATV dives: 33 dives/294 hours (longest: 37 hours)
- Total hours ofbottom time: 215 hours

Recent Military Operations

- Coast Guard mishap investigation
- Three high value R&D Recoveries
- F-14 and F-18 air Mishap Boards
- SEAL Delivery Vehicle (SDV) search in Hawaii
- Training Minefield Surveys
  ** Over $60 million of recovered hardware
  ** Over 500 hours of ROV bottom time

Science Related Initiatives
(including WHOI/MPL support)

- Lighting studies/upgrade for ATV and SCORPIO ROV's
- SEA BEAM post processing system
- Integrated data logging
- ATV tether and telemetry upgrades
- Tracking upgrades (WINPHROG/N-916)
- Video frame grabber
- MARSAT E-mail

APPENDIX XIX

ROPOS

- Remotely Operated Platform for Ocean Science

DFO

- Department of Fisheries and Oceans Canada

CSSF

- Canadian Scientific Submersible Facility
- Newly incorporated not-for-profit company
    - President: Steve Scott
    - Sec-Treas: Kim Juniper
    - Director: Larry Mayer

ROPOS System

- Fiber-optic tethered ROV
- 5000 m capability: 3000 m with present cable but 5200 m cable planned for 1996
- 2 manipulators, excellent dexterity
- variety of specialized sampling tools, e.g.:
    - ... titanium water samplers
    - ... temperature probe
    - ... chemical scanner (NOAA/PMEL)
    - ... suction sampler
    - ... tube worm stainer
    - ... sample tray
- EM experiments (Nigel Edwards)
- 2 video cameras: SIT for continuous logging and 3CCD color Betacam for detail
- 7 simultaneous RS232 connections
- Deep water system with cage (>350 m):
    - ... vehicle 2700 kg
    - ... cage 4000 kg
    - ... winch & 4000 m cable 24,500 kg
    - 6 pilot/engineers for 24 hr day
- Shallow water system without cage (<350 m):
    - ... vehicle 1600 kg

- ... winch & 500 m cable 2200 kg
- ... 3 pilot/engineers for 8 hr day

- Ship requirements
  - ... A-frame: 14 t SWL, 6 m high x 3.7 m wide
  - ... winch deck area 3 x 4 m
  - ... cage deck area 4.5 x 5 m
  - ... consoles floor area 2.5 x 3 m
  - ...Power for system: 460 VAC, 100 A, 60 Hz
  - ...Power for winch: 460 VAC, 200 A, 60 Hz
- Problems we are working on:
  - ... heave compensation
  - ... navigation (Oceano/MORS, Datasonics, EdgeTech)

ROPOS SYSTEM RATES

$CDN ($US)

STANDBY/TRANSIT/WEATHER RATES

- CHARGED FROM THE TIME THE SYSTEM LEAVES THE SHOP UNTIL IT RETURNS TO THE SHOP

PER DAY	$2740($2000)

OPERATIONAL RATES

- CHARGED ON ANY DAY (OR PART THEREOF) WHEN THE SYSTEM IS AT OPERATING DEPTH. CHARGED INSTEAD OF STANDBY RATE.

3500 metre system with cage

PER DAY	$5480 ($4000)

350 metre liveboating system (no cage)

PER DAY	$2740 ($2000)

****INSURANCE EXTRA****

3500 metre system insurance is estimated per day at $137 ($100)
350 metre system insurance is estimated per day at $89 ($65)

PERSONNEL

IOS PERSONNEL PER DAY AWAY FROM SHOP	$550 ($400)
$68.5 ($50) PER HOUR AFTER 12 HOURS	

SHOP RATES

- ENGINEERING SERVICES, PER PERSON, PER DAY

ELECTRICAL/ELECTRONIC DESIGN AND FABRICATION	$411 ($300)
MECHANICAL DESIGN AND FABRICATION	$411 ($300)
SYSTEM MOBILISATION	$411 ($300)

Standby rates are negotiable depending upon the term of the contract and the number of days involved.

All travel expenses to be covered by the client. Any additional costs to be borne by the client.

Rates are subject to change without notice.

APPENDIX XX

This Appendix consists of 10 pages. These pages show:

- ALVIN/ROV Letters of Imterest - Summary 1995-1997 (6 Pages)
- ALVIN Letters of Interest - Summary 1997 and Beyond (1 Page)
- Chart showing the geographical areas of ALVIN Interest - 1997 and Beyond (1 Page)
- ROV Letters of Interest - Summary 1997 and Beyond (1 Page)
- Chart showing the geographical areas of ROV Interest - 1997 and Beyond (1 Page)

This items are available from the UNOLS Office.

APPENDIX XXI

A PRE-PROPOSAL

To the National Science Foundation

OPPORTUNITIES ASSOCIATED WITH PRODUCTION OF AN IMAX DOCUMENTARY ON SUBMARINE HYDROTHERMAL VENTS

J. R. Delaney, School of Oceanography, University of Washington, Seattle, WA 98195-7940

R. A. Lutz, Inst. of Marine & Coastal Sciences, Rutgers University, New Brunswick, NJ 08903

S. E. Humphris, Woods Hole Oceanographic Institution, Woods Hole, MA 02543

Introduction

An opportunity is arising within the coming three to six months that can benefit the U.S. Deep-Submergence Community. Private funding sources have agreed to provide major funding for production of an film focused on submarine hydrothermal vents. Steven Low, producer of several widely-acclaimed documentaries, and Emory Kristof, a National Geographic photographer, will be using two Russian MIR submersibles as camera and lighting platforms to film scenes of vent fields on the East Pacific Rise between 9 and 10' North and on the Mid--Atlantic Ridge in the TAG area near 26' North. Low and associates will combine these images into a 45-minute documentary film slated for world-wide distribution. This situation offers a much-needed opportunity to bring to the attention of the viewing public the vivid imagery and basic processes associated with submarine volcano-hydrothermal systems along the global spreading center network.

Philosophy

Our preliminary discussions with Low and Kristof have emphasized two key elements that represent basic scientific messages to be conveyed in such a documentary. First is the element of discovery and excitement that has characterized ridge crest research over the past 2 decades. The distilled message being that the seafloor may represent the last major earthbound frontier. The second element involves highlighting the interplay among geological changes that trigger shifts in vent water chemistry resulting in dramatic adjustments of the associated animal communities. In short, the rhythms of life at ridge crests are tied to volcanic episodicity rather than solar input cycles as in most surface ecosystems. Volcanoes, in the presence of liquid water, can sustain life independently of the sun. This is true on earth and may well be true on other planets. We hope this documentary can explore processes involved in, and

consequences arising from, this powerful model of the role volcanoes may play in planetary evolution.

Issues of potential interest to the Deep Submergence Community

(1) At present the program does not involve ALVIN, despite the fact that it has been centrally involved in the both discovery and exploration of these fascinating systems for over one and a half decades. Low and Kristof are willing to have ALVIN involved as an integral part of the documentary if the submarine can be made available at the appropriate times and in the appropriate places. Owing to ship scheduling constraints for the MIR's, the optimal time-frame is in the February-June window of 1996; the location of the IMAX filming is presently planned for the hydrothermal vent fields at 9'N and for the TAG site. Currently, plans call for the R/V KELDYSH to pass from Atlantic to Pacific in that time frame and for the AII to pass from the Pacific to the Atlantic, so it may not be possible to have the two systems together at both sites in the time interval specified. A primary goal of this pre-proposal is to explore parallel scientific and educational rationales for making ALVIN available during one or more of the at-sea filming sessions.

The 9°N EPR site is a vent system that has been extensively studied since the April, 1991 eruptive event. NSF is presently funding a continuing series of studies at this site through the Biological Oceanography, MG&G and Marine Chemistry Divisions. There are distinct scientific advantages to revisiting the 9'N site in that time frame to continue time-series sampling and other documentation of biological, geological and geochemical changes in the rapidly evolving hydrothermal system. The TAG site has recently been the focus of an entire Ocean Drilling Program drilling leg and has been sampled before, during and after the drilling. Appropriate documentation of additional changes at this point in time would add significantly to the story evolving as a consequence of drilling into an active hydrothermal system. In short, viable scientific reasons exist to visit both sites.

(2) Kristof will be using recently developed lighting systems on the seafloor that are unparalleled in current research activities along ridge crest systems. He expects to be able to fully illuminate areas half the size of a football field for use in the IMAX filming. This situation opens unique scientific opportunities to obtain (at a cost to the scientific community well below the real expense) comprehensive high-level digital stereo, as well as and high-definition video (HDV) imagery of large tracts of seafloor in a fashion that has never before been attempted. In concert with quality navigation, these images could become extraordinarily high quality, high resolution maps. The opportunity to obtain well navigated high definition, stereo imagery of both sites could move the study of seafloor hydrothermal systems into a new era. Placing a state-of-the-art Electronic Still Camera onboard ALVIN would further insure that maximum scientific advantage is taken of the illuminated seafloor with appropriate spatial control.

(3) A third opportunity to emerge from the program may be availability to the science community of a spectrum of unprecedented images. Much of the work will include techniques that involve high-definition video and other approaches to studying the seafloor. Kristof points out that, as in many such programs, a good deal of the initial imagery is not ultimately included in the final product. He and Low

are offering access to these materials for a wide variety of research and educational purposes. With support from NSF, and advice from an NSF-appointed Advisory Committee, researchers and educators involved in the program could oversee a process by which a significant fraction of this "overflow" material (stereo imagery, HDV imagery, stills, etc.) is made available in a timely manner to potential users throughout the world. These issues may have to be explicitly negotiated based on the level of support provided by the scientific community.

(4) An unusual educational opportunity could consist of involving a separate film crew and several high school teachers and students aboard the ATLANTIS II during the entire program to provide on-site documentation and higher visibility of research conducted on the ALVIN-AII system. The goal would be twofold: to involve teachers directly in exciting research with the understanding that classroom material of value to all schools could be prepared from the experience. Also, showing involvement of students in the actual research process allows students across the country to identify with the spectrum of opportunities available in basic research. This activity could be separate from, but parallel to, the effort, or it may become a component of the documentary itself if it is done properly. The effect would be substantially enhanced if it were possible to publicize the approach before-hand. Participants could become central figures in follow-on workshops for teachers across the country. Significantly improved teaching materials could be provided for all workshop participants from "overflow products" of the entire program and high school curricula throughout the country could benefit substantially (see 3 above).

(5) An additional scientific possibility includes the strong interest that SAIC, Inc. has in developing a deep ocean-capable, laser line-scanning device for mapping the seafloor. The resolution of a bathymetric map produced from such a system would be measured in millimeters. A shallow water version has produced stunning images of brine pools at the seafloor in the Gulf of Mexico. The potential for digitally draping high-definition photographic images directly on the line-scanned bathymetry would allow full optical definition of large seafloor features such as the entire TAG mound, or major sections of the small axial valley ("axial summit caldera") at 9°N in all its volcanic, tectonic and hydrothermal complexity. In both cases, rock formations and associated fauna would be resolved with comparable high resolution. Again, the issue of quality navigation becomes important; without participation of scientists in the program there will be little reason for film makers to insist on precision navigation. SAIC, Inc. representatives seem anxious to have this system become part of the program and would consider an especially accelerated development program if the opportunity existed to use the instrument on ALVIN during the program.

Public Awareness of Deep Submergence Oceanographic Research

The U. S. Deep Submergence Community has rarely been as aggressive or as effective as the NASA community in capturing the public eye with the basic messages and the excitement of our research. Yet scientifically we have discovered earth systems and volcanic processes that easily rival and basically complement discoveries that NASA scientists and engineers have made in the solar system within the past two decades. This imbalance is in part because most of us are funded by specific grants from NSF. Rarely do we apply for (and, in general, NSF research sections do not provide) funds for public outreach

related to our individual research programs. But the situation also exists because we the community have rarely gotten behind an opportunity to publicize the activities in which we are so deeply involved. The potential exists in this situation. The issue is how to optimize the benefit to our community.

The Proposal

We propose that a combined scientific/pubic awareness cruise consisting of 12 dives at either the 9°N site or the TAG site take place sometime within February-June, 1996 window to be coordinated with the film scheduling. Cruise participants would consist of 12 scientists (selected on the basis of the key science to be conducted), 3 members of a video crew, and 4 additional participants selected from U.S. high schools. The scientific studies would involve continuing documentation of evolving biological, geological and geochemical changes taking place in either of the areas currently scheduled for IMAX filming. An additional focus would be to obtain unprecedented imagery of the active vent systems in their volcano-tectonic setting. While conducting scientific research, ALVIN would be a focal point of the documentary filming through close coordination with the IMAX crew. In parallel with the scientific effort, a high-profile educational program involving actual students and teachers could be conducted and recorded in a fashion targeted for high schools around the country. If done properly, such an educational program could substantially raise public interest levels in scientific and related careers involving planetary exploration and basic science.

Budgetary Issues

If ALVIN and NSF are indeed to be involved, it is necessary to proceed rapidly. Decisions must be made within a month as to whether the program should go forward. The estimated cost of the program overall is about $6 million. The industrial contacts involved have tendered $3 million. The primary costs borne by NSF would be in the facility support; twelve ALVIN dives would be required on site in order: 1) to allow a serious scientific program to be conducted, 2) to allow sufficient availability of the submarine for documentary efforts, and, 3) to insure quality navigational results. Additional costs would include the expenses of the scientists involved - salary, lab and sampling costs, analyses, etc. Other costs would involve travel for all participants and the costs of selecting both a film crew and the students and teachers to be involved. Actual costs of the film crew may be born privately with sufficient lead time for planning. These "scientific/educational" expenses are likely to be close to $300,000 not including institutional overhead.

Immediate Steps

If this letter is favorably received, we will assemble details and specifics related to the issues and opportunities sketched herein and produce a formal proposal. It is our understanding that a significant amount of additional funding from sources other than NSF must be raised in the near-term to insure that the entire program comes to full term. Some of the fund-raising will have to be conducted by the scientific institutions represented in the program. We plan a meeting early in December involving all potential participants including both members of the Low/Kristof team, representatives of supporting

agencies, selected members of the advisory committee, several educators, the principal investigators and additional scientists who may be involved. The goals of this early meeting would include at least the following items: definition of essential details of scheduling, participation of all scientists, all financial requirements and responsibilities, fund-raising timeliness materials and imagery ownership, responsibilities for the intellectual caliber of the product, and any royalty issues related to intellectual and/or artistic contributions. Following the meeting we will be able to submit a formal proposal to NSF by early January. With this pre-proposal we formally request that $25,000 be made available for advanced planning purposes. Planning will require coordination among all the parties mentioned above, and will involve significant travel for the P.I.'s and other scientists involved in the program. A present no salary money is requested.

Contact information

John R. Delaney - (206) 543-4830; jdelaney@u.washington.edu; FAX (206) 543-0275.

Richard A. Lutz (at sea 'til mid-December) - atlantis@atsvax.rsmas.miami.edu - subject: Scil.

Susan E. Humphris - (508) 457-2000 ext. 3451; susan@copper.whoi.edu; FAX (508) 457-2150.

DEep Submergence Science Committee

Carriage House, Woods Hole Oceanographic Institution
Woods Hole, MA

May 31 - June 2, 1995

AGENDA

8:30 a.m. - Wednesday May 31, 1995

I. Welcome, Introductions, and Meetings Goals
II. Accept Minutes of December, 1994 DESSC Meeting

STATUS REPORTS

III. Report on WHOI/DESSC Meetings with NOAA/NSF/ONR: (R. Pittenger, J. Fox, M. Perfit)
IV. National Deep Submergence Facility Operations at WHOI:
    A. 1995 Deep Submergence Field Program: Completed & Scheduled
        1. AII/ALVIN
        2. Tethered Systems
    B. Equipment/Instrumentation Upgrades and Improvements (B. Walden, D. Foster, A. Bowen)
        1. Navigation Proposal Status
        2. Video System: Pan and Tilt Camera; New 3-chip Video
        3. Electronic Still Camera for JASON, ARGO-II and ALVIN
        4. ARGO-II and 120 KHz Systems Status
        5. ROV - JASON Manipulator Program
    C. Plans/Options/Issues for 1996-1997 Operations (R. Pittenger)
        1. ALVIN Overhaul: Scope and Timing
        2. Support Ship: WHOI Perspective
        3. Timing Options for Deep Submergence Operations
V. UNOLS Report (Jack Bash, UNOLS for Ken Johnson)
VI. Agency Reports on Program Funding for 1996 and Beyond:
    A. NSF
    B. ONR (J. Andrews)
    C. NOAA
VII. NOAA and US Navy Deep Submergence Operations
    A. NOAA/HURL Program (A. Malahoff)
    B. US Navy/NOAA Programs (Cmdr. John Green)

DESSC ISSUES

VIII. Recommendations on 1996 Operations at the National Facility
- A. Assessment of Letters of Intent and Tally of Funded Programs (see Enclosure)
- B. Recommendation for a 1996 Schedule of Operations: ALVIN and Tethered Systems
- C. Implications for 1997 and Beyond
- D. Guidelines for the Community

IX. 3rd Party Tool Review
- A. Finalize Announcement for 3rd Party Tool Policy
- B. Status Stakes/Holloway Drill
- C. Other Systems: New NOAA Manifold Sampler, New Temperature Probes and Water Bottles, Fiber Optic Data Link
- D. DUMAND Request for ROV Assets

X. DESSC Discussion and Recommendations on Developmental Upgrades
- A. ALVIN Power
- B. Other

XI. DESSC Discussion and Recommendations on Calibration of Science Sensors

XII. Review of User Community Assessments of the National Facility

XIII. Other DESSC Issues
- A. DESSC and the Millennium

XIV. Recommendations for DESSC Membership

XV. Meeting Plans - Dec. 1995 Meeting

Adjourn

Return to Minutes

APPENDIX Ia

UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

An association of institutions for the coordination and support of university oceanographic facilities.

DATE: 9 February 1995

TO: Deep Submergence Community
WHOI, National Facility Operator
DESSC/FIC KNORR Conversion Subcommittee
DESSC
FIC

FROM: Karen Von Damm, Subcommittee Chair

SUBJECT: KNORR Conversion Subcommittee Meeting of January 31, 1995

This letter is a summary, including recommendations, from the meeting held on January 31, 1995 at Woods Hole Oceanographic Institution. In 1996 KNORR is to be converted to be the deep submergence support vessel for the US deep submergence science community, coinciding with the retirement of the ATLANTIS II. The purpose of the meeting was to review the present plans for KNORR conversion, and to provide the operators with community input and recommendations regarding the conversion. A list of attendees is attached. The recommendations of the earlier meeting of this committee (September 22, 1993) were also addressed.

The major recommendations follow:

The timing of the conversion was identified as a critical issue. We most strongly recommend that the conversion and ALVIN overhaul begin early enough in CY 1996 to permit the new KNORR/DSV/ROV system to be field tested in waters close to Woods Hole and to permit field work in the North Atlantic in fall 1996, prior to the KNORR transiting to the Pacific.

It is prudent that the work be completed by late summer so that field testing need not occur at a distant site. It is also important to note that if the deep submergence science community working in the Atlantic is not accommodated during fall 1996, they are likely to face an extremely long hiatus in the availability of deep submergence assets. This will have a negative impact on the community, and may cause them to took elsewhere for facilities to accomplish their science. It was also noted that the UK is interested in purchasing US deep submergence time during this period of time for work in the central North Atlantic.

We recommend that the proposed plan to have the DSV hangar located to port be adopted. An option discussed at the meeting, for which drawings are not yet available, incorporating the DSV shops into the modified hangar structure, appears to be an even better plan. This revision to the plan will result in no loss of deck space and a smaller loss of lab space compared to the present proposed arrangement on KNORR.

The offset deck hangar appears to be most cost effective and also be most effective at retaining deck space. To

preserve deck utility, at least some of the rails needed for DSV transport across the deck to the port mounted A-frame need to be removable. It is especially important that the rails closest to the stem be removable.

We recommend that the DYNACON winch be permanently installed below decks.

Without the presence of this winch, KNORR is not truly equipped to handle ROV's, and hence compromises the role of KNORR as the "deep submergence support vessel". If the winch were not permanently mounted in the hold, it would consume a large amount of deck space and would also lead to increased maintenance problems and costs. There are other traction winches in the UNOLS fleet, thus retaining the flyaway capability of the ROV system.

Due to added weight from the A-frame, additional ballast, and other proposed work, the draft of KNORR will increase by 0.5-0.8 feet. As the available models suggest, this will reduce stern slamming by 50%. We do not recommend that the rapid ballast system be installed at the present time.

If stem slamming remains a significant problem, the resulting ship shuddering may not only have a negative long term impact on KNORR, but also on the structural integrity of the DSV and ROV. If the proposed modifications do not sufficiently dampen stem slamming, the addition of the rapid ballast system may need to be considered at a future time.

KNORR will accommodate 21 science personnel once the DSV/ROV personnel are housed. As this is a real increase of 2 bunks over the ATLANTIS II, and the cost of the least expensive berthing addition is > $200K for 4 bunks, and this option will also result in the permanent loss of lab space, we do not recommend that more bunks be added at the present time.

While in the ideal case KNORR would carry »30 science personnel, the additional scientists will also require more lab space. If the lower lab is not converted to bunk space, KNORR retains almost twice the lab space of ATLANTIS II. The addition of 4 bunks would not obviate the need for a hotel ship for some science programs. An alternative plan provides for the addition of 12 bunks forward on the 01 level for »$900K. Based on funding constraints it is not reasonable to propose this modification at the present time. If science program demands are shown to require significant use of hotel ships over the next few years, it may be cost effective to add those bunks at a future time.

At present KNORR is operating with two storage vans for science stowage. This is likely to continue after the conversion. As installation of the rapid ballast system is not recommended at present, there is not the associated negative impact on storage space. KNORR is presently housing full science parties for legs of 50 days with adequate dry stores, so this no longer appears to be an issue. Most submersible cruises at present are under 30 days in duration. A multi-beam system (SEABEAM 2100) has now been installed on KNORR, this previous recommendation has already been met. We recommend that the needed wet and dry ends of a combined short and long baseline navigation system be installed on KNORR as is necessary for submersible and ROV operations, and that it be integrated into a single navigation system that utilizes the high quality dynamic positioning system on KNORR. Without good navigation the utility of the deep submergence tools will be severely compromised.

To enhance the "livability" of KNORR, we recommend a space be found to house exercise equipment. While other options should be explored first, a small amount of space in one of the upper labs may, if necessary, be used for this purpose. Small boat handling on KNORR is less than ideal. We recommend that any relatively costly resolution of this be deferred unless or until small boat handling becomes a significant limiting factor in DSV/ROV launch/recovery operations.

Several ROV handling issues such as survey cable routing and slack ensioning need to be addressed during the Phase H design specifications.

The net effects of the KNORR conversion are as follows:

small net increase in science berthing for deep submergence operations compared to ATLANTIS II

- large (almost double) the available lab space on ATLANTIS II
- an effective, and integrated, vessel for deep submergence operations involving a DSV and/or a ROV
- retention of all current deck space for general oceanographic applications
- minimal negative impact on existing lab space
- minimal negative impact on existing storage space.

The net impact on the general oceanographic capabilities of KNORR as a result of this conversion are therefore minor, permitting KNORR to continue to serve in this capacity as required. The deep submergence science community is firmly behind the retirement of ATLANTIS II and the conversion of KNORR to the support vessel. While ATLANTIS II has served the community well, its limited space for science, personnel, lab and hold space has been limiting. KNORR will be a significant enhancement over those capabilities. The conversion to KNORR will allow us to truly integrate submersible and ROV operations in ways that will certainly enhance opportunities for deep submergence science, both in terms of greater capabilities as well as reduced cost. The integration of the deep submergence operations of he National Facility aboard KNORR will open new investigative horizons for the deep submergence science community in the same way the move to ATLANTIS II from LULU proved to be a significant step function in the capability of our deep submergence operations. With KNORR serving as a platform for an integrated deep submergence science program, the user community will truly have a facility that can range globally to address the challenging problems of this planet's inner space. While the conversion of KNORR is not trivial, both structurally and financially, it will serve the community well throughout the next decade of deep submergence work.

ATTENDEES

Karen Von Damm, Sub Committee Chair
Jack Bash, UNOLS
Peter Betzer, FIC
Andy Bowen, WHOI
Bob Detrick, FIC
Bob Dinsmore, WHOI
Dan Fornari, WHOI
Dudley Foster, WHOI
Jeff Fox, DESSC Chair
Rich Lutz, Rutgers
Don Moller, WHOI
Theo Moniz, WHOI
Dick Pittenger, WHOI
Barrie Walden, "WHOI

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UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

An association of institutions for the coordination and support of university oceanographic facilities

Date: April 6, 1995

To: Deep Submergence Research Community

From: P.J. Fox, Chair

DEep Submergence Science Committee

Subject: Delay in Planned Conversion of R/V KNORR to Support

UNOLS Deep Submergence Vehicle Facilities

Request for Input on Areas of Interest for ALVIN diving in 1996

DESSC has been informed by NSF and ONR that the planned 1996 conversion f R/V KNORR to replace the R/V ATLANTIS II as the UNOLS deep submergence support vessel has been delayed approximately six months. KNORR was to have returned from the Indian Ocean in the Spring of 1996 to begin the conversion, and now it will likely not return to Woods Hole until early Fall, 1996. It will carry out science programs in the South and North Atlantic on its way home. This delay has come about because of ongoing deliberations amongst the agencies regarding the best course of action for the long-term health and effectiveness of the entire UNOLS fleet. DESSC and the deep submergence operator, Woods Hole Oceanographic Institution, are working closely with the agencies to ensure that a capable and long-term support vessel is available to support deep submergence science into the 21st century, and to construct a plan that minimizes disruption to the deep submergence facilities and their operations.

The present A-II/ALVIN schedule has the facility returning to Woods Hole in January of 1996. Then A-II was to leave the UNOLS fleet, and ALVIN was to commence a major overhaul of approximately six months duration. It is still too early to define a workable utilization strategy given all the unknowns, but DESSC would like to get community input on what may or may not be possible in terms of science operations. For example, although there is presently no ALVIN-related science proposed or scheduled for the first half of 1996, the A-II/ALVIN schedule could be extended into the first half of 1996 (e.g. work in the Eastern Pacific, Gulf of Mexico, MAR south of 29!N), and then return to Woods Hole. DESSC and the federal agencies realize that because of prior plans for the timing of KNORR conversion, many scientists did not request to use ALVIN in 1996. DESSC is soliciting input from the research community in the form of short letters of intent (1-2 pages maximum) stating the science programs that could be proposed and carried out in the 1996 time frame.

The lead time for preparing proposals to ONR, NOAA, and NSF is very short for new 1996 field work. Additional discussion with the agencies will be required to develop a schedule and process for consideration of potential projects. Prior to these discussions, we need to establish the scientific interests, geographical areas, potential sponsors and timeliness of requests.

In order to help us in the planning effort to respond to this change,investigators are requested to send brief letters of intent to the UNOLS office by April 21st, outlining their thoughts for ALVIN work in 1996 and proposed funding source. The issues of 1996 deep submergence field work and possible ALVIN/A-II programs past Jan. 1996 will be important agenda items for the UNOLS Council Meeting that will meet at the end of April. E-mail correspondence is encouraged for the letters of intent and the address is given below.

Any questions regarding this matter should be addressed to Mr. Jack Bash or Ms. Annette DeSilva at the UNOLS Office-URI

I thank you in advance for your collective efforts to assist us in ensuring that 1996remains a viable year for conduct of deep submergence science with ALVIN.

Contact Address for UNOLS Office:

E-mail: unols@gsosun1.gso.uri.edu
Telephone: 401-792-6825
Fax: 401-792-6486
Address: UNOLS Office, PO Box 392, Saunderstown, RI 02874

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DESSC Memorandum to the Funding Agencies

To: Dr. R. Corell,
NSF Dr. F. Saalfeld, ONR
Dr. N. Ostenso NOAA

CC: Dr. D. Heinrichs, NSF
Dr. M. Reeves, NSF
Dr. E. Deiter, NSF
Dr. S. Ramberg, ONR
Dr. J. Andrews, ONR
Dr. H. Frey, NOAA

From: The DEep Submergence Science Committee

Date: June 2, 1995

Subject: Deep Submergence Support Ship Conversion

Gentlemen:

Based on the deliberations at our meeting this week, the committee feels strongly that the unique qualities and effectiveness of the NationalDeep Submergence Facility, which includes ALVIN and the ROV /towed vehicles, at Woods Hole Oceanographic Institution (WHOI) must be preserved and nurtured so that the U.S. research community continues to have access to the abyss in a safe and efficient manner into the 21st century. The continued need for deep submergence facilities is underscored by the array of fundamental scientific questions that can only be addressed by deep ocean observation, monitoring and measurement, and the advent of a variety of sea floor observatories that will monitor critical geological, chemical and biological processes on and above the deep sea floor. The DESSC believes that conversion of the new ATLANTIS (AGOR-25) represents the greatest potential benefits to the long-term support of US deep submergence science. The positive aspects of following that conversion path include greater science berthing, laboratory space, deck area, operational range, and longer projected life-span. There are some minor potential negative technical considerations which include the dynamic positioning system, and greater size and hence motion

differences between the ship and submersible/ROV vehicles during launch and recovery operations. These issues are, however, being considered by several interested parties and the outlook for resolution is positive.

DESSC has reviewed the information provided by the Deep Submergence Facilities Operator (WHOI), and the reports of the Federal agencies that support deep submergence, in terms of the options that are available for providing the community with a first-class support ship that could provide service into the 21st century. The committee notes that there are two principal conversion paths. One option is that the R/V KNORR be converted. At the DESSC meeting WHOI presented a revised KNORR Conversion plan that meets the specifications of the original AGOR-25 proposal, and provides for a capable deep submergence support vessel at no cost to the Federal agencies. This proposal is well-constrained logistically and fiscally, and will result in a converted deep submergence support vessel that is ready for science operations by mid-1997.

The other conversion option includes the new ATLANTIS as indicated above. The committee favors that path, however we also note that there are important and potentially deleterious consequences to following this path depending on the schedule followed during the conversion (see Attachment Options). These consequences must be adequately addressed or the plan to use the ATLANTIS as the new support platform is unacceptable because the long-term health of the facility could be jeopardized. The most critical consequences that must be addressed with regards to converting the ATLANTIS are:

1. the uncertainties relating to the scheduling of the conversion and the impact that has on potential stand-downs of deep submergence operations and the consequent loss of technical/operational expertise,
2. interruption of ongoing time-series deep submergence science if the conversion process extends past mid-1997,
3. integrating and contracting for the conversion effort to support deep submergence with the ongoing construction of the new ATLANTIS,
4. the costs involved in the conversion,
5. the programmatics and delivery of any WHOI supplied items that are critical to the conversion (e.g. the A-frame), and
6. certification of launch systems by NAVSEA (SEA92Q).

One result of the recent changes in plans for providing a new support ship is that the community and funding agency program managers were caught short in terms of filling-out a 1996 science schedule. In order to ensure that 1996 provides a reasonable amount of deep submergence science and facility support the committee strongly recommends that PIs who submitted deep submergence based proposals for the NSF Feb. 15, 1995 target that were declined be allowed to resubmit for the NSF Aug. 15, 1995 target. If some of those proposals are funded it would be important to permit the programs to be fielded in late 1996 and early 1997. A response to this issue is requested as soon as possible as it will clearly impact how the science community responds in the near-term to writing ALVIN/A-II and ROV proposals that could potentially be funded and scheduled for the latter part of 1996.

The committee also notes that for both conversion options a window of opportunity exists for utilization of ROV and towed vehicles through 1996 and 1997. We would encourage the agencies to look critically at science proposals that seek to use those vehicles in order to continue the process of integrating the usage of those deep submergence vehicles

by the full spectrum of the deep ocean scientific community.

In order to facilitate planning with the least negative impact to the research community and the deep submergence facilities operator we request that the agencies consider the recommendations of DESSC on the

matter of the new support ship as detailed above, and arrive at a timely decision on which path is to be followed so that

the community and WHOI can react accordingly and continue to be productive.

If you have any questions concerning this matter please do not hesitate to contact Mike Perfit, the new DESSC Chair, and Dick Pittenger at WHOI if there are technical questions on the facilities.

Thank you for your attention and consideration of this matter and continued support for deep submergence science and facilities.

Best Regards,

P.J. Fox (outgoing DESSC Chair)

M. Perfit (new DESSC Chair)

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APPENDIX II

NAME	INSTITUTION/ ORGANIZATION	PHONE/FAX	E-MAIL
Jim Andrews	ONR	(703) 696-8699/(703) 696-2007	andrewj@onrhq.onr.navy.mil
Jack Bash	UNOLS	(401) 792-6825/(401) 792-6486	unols@gsosun1.gso.uri.edu
Jim Bellingham	MIT Sea Grant	(617) 253-7136/(617) 258-5730	belling@mit.edu
Andy Bowen	WHOI/DSOG	(508) 289-2643/(508) 457-2191	abowen@whoi.edu
Rick Chandler	WHOI	(508) 289-2272/(508) 457-2107	rchandler@whoi.edu
Annette DeSilva	UNOLS	(401) 792-6827/(401) 792-6486	desliva@gsosun1.gso.uri.edu
Dolly Dieter	NSF	(703) 306-1577/(703) 306-0290	edieter@nsf.gov
Dan Fornari	WHOI	(508) 289-2857/(508) 457-2187	fornari@tone.whoi.edu
Dudley Foster	WHOI/DSOG	(508) 289-2273/(508) 457-2107	dudley@whoi.edu
Jeff Fox	URI/GSO	(401) 792-6229/(401) 792-6811	jfox@gsosun1.gso.uri.edu
Hank Frey	NOAA/NURP	(301) 713-2427/(301) 713-0799	hfrey@rdc.noaa.gov
CDR John Green	COM SUB DEV GRUONE	(619) 553-0360/(619) 553-7131	jwgreen@tecnet1.jcte.jcs.mil
Hugh Milburn	NOAA/PMEL	(206) 526-6169/(206) 526-6744	milburn@pmel.noaa.gov
Don Moller	WHOI	(508) 289-2277/(508) 457-2185	dmoller@whoi.edu
Dan Orange	MBARI	(408) 633-7012/(408) 633-4581	dano@mbari.org
Mike Perfit	U of Florida	(904) 392-2128/(904) 392-9294	perf@nevm.nerdc.ufl.edu

Dick Pittenger	WHOI	(508) 289-2597/(508) 457-2185	rpittenger@whoi.edu
Lisa Rom	NSF	(703) 306-1578/(703) 306-0390	erom@nsf.gov
Gary Taghon	Rutgers U	(908) 932-6555x547/ (908) 932-8578	taghon@ahab.rutgers.edu
Karen Von Damm	U of New Hampshire	(603) 862-0142/(603) 862-2649	kvd@christa.unh.edu
Barrie Walden	WHOI	(508) 289-2407/(508) 457-2195	bwalden@cliff.whoi.edu
Carl Wirsen	WHOI	(508) 289-2307/(508) 457-2169	cwirsen@whoi.edu

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APPENDIX III

This appendix is a copy of the 1995 R/V ATLANTIS II & ALVIN Operations Schedule and the 1995 ALVIN Dive schedule.

If copies of these schedules are desired, contact the UNOLS Office.

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APPENDIX IV

DSOG Unmanned Vehicle Status

Jason/Medea

- Control Van Rewire
- Medea Replacement
- Debug Telemetry Lockups
- Documentation
- Manipulator Testing

Argo II

- Improved Obstacle Avoidance Forward Looking Sonar
- Determine Source of Video Camera Focus Problems
- Thrusters for Heading Control
- Resolve Noise on LBL Transducer
- Single Van Operations
- Documentation

DSL 120

- Replace Depressor
- Refine Low Speed Tow Dynamics
- Design and Install Weight Dropper
- Determine suitable Upgrade Path for Surface Processing
- Documentation

New 3-Chip DSOG Video Camera and Pan and Tilt

3-Chip

- Studied Present Market and Technology
- Studied Present 3-chip Performance and Specifications
- Studied MBARI 3-chip Development Effort
- Developed Specs and RFQ for Camera Compatible with Both Alvin and

Jason

- New Camera will be Installed During 1996 Overhaul Period

Pan and Tilt

- Surveyed Commercial Vendors
- Identified Remote Ocean Systems as Preferred Vendor
- Discussed Performance History of ROS units with Users
- Acquired Quote
- To Be Installed During 1996 Overhaul

Jason Manipulator Test Program

Completed as of 6/95:

- Demonstration of Fiber Optic Connector Mating/Unmating
- Operational Pressure Tests to 1 0,000 psi
- Redesign of Gripper for More Gripping Force
- Identification of Hydrothermal Fluid Sampler Trigger Mechanism
- Development of Mechanical and Electrical Documentation
- Identification of Dock Test Program
    1. Gas Tight Sampler
    2. Major Sampler Bottle
    3. High and Low Temperature Probes
    4. Rock/Glass Sampler
    5. Rock Sampling
    6. Transfer of Samplers/Samples to/from Elevators
    7. Biology Samples

To Be Accomplished Before 1/96:

- Installation and Testing of New Gripper
- Implementation of Polar Coordinate Control
- Dock Trials
- Vehicle/Manipulator Pressure Tests to 6,000 Meters
- Installation on Alvin for a Portion of November Science Program

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Electronic Still Camera Characteristics

Vital:

- Analog Display of Acquired Digital Data
- Time Stamp at Acquisition
- Simple Real-Time Control
- Real Time Enhancement
- Adaptable to Both Alvin and ROV Power and Telemetry
- "High" Dynamic Range and Resolution
- Minimize Custom Software and Hardware
- Standard Data Format

Desirable:

- Real-Time Control of Focus
- Real-Time Zoom
- Real-Time Viewfinding

Image Processing and Mosaicking

This appendix includes a three dimensional graph of "DSOG Ummanned Vehicle Proposals" number of proposals by year and funding agency and a "DGOS Unmanned vehicles 1995/96" schedule. If a copy of these items is desired, contact the UNOLS office at:

e-mail unols@gsosun1.gso.uri.edu

phone (401) 792-6825

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APPENDIX V

Navigation Upgrade

- Pelagos navigation software (modular, integrated)
- Mission replay capability provided for users...
- Custom software
- In-hull navigation
    - computer (Pentium)
    - flat panel displays
    - ALVIN data logging transferred to new CPU? (installation, timing of upgrade?)
- Nautronix 916 USBL/LBL system
    - provided on new vessels
    - Honeywell 906 acquired from Navy,, then upgraded
- Installation of surface system w data logging
- Intelligent transponders
- DVL for ALVIN

****

Constraints

1. upgrade should not disable present system until new system is functioning -

-> *yes, except in-hull interface upgrade*

2 operator must have source code for all navigation software

-> *yes, both code and development environment*

3 upgrade should not increase work-load of operator

-> *yes ...*

4 volume and power should stay within present system envelop in-hull

-> *only if requirement 1) relaxed*

5 use off-the-shelf hardware (and software)

-> *yes*

Concerns

large position jumps observed when switching between transponders

-> *calibration issue ...*

navigation software difficult to use

-> *integrated, documented package to be supplied*

in-hull displays not as versatile as desired

-> *solved, but requires remove of existing system*

array deployment responsibilities not well defined

-> *documentation issue... needs to be addressed*

post-processing requirements of scientists not well supported

-> *solved... demo package*

LBL Upgrade

Common hardware/software across Alvin surface and in-hull navigation & Argo/jason/Medea/AUV navigation (modular hardware/software components)

-> *Nautronix 916 surface hardware , Pentium based computers*

Software upgrade -> commercial vendor/WHOI cooperative effort (acquisition, logging, display, computation, outlier rejection, etc.)

-> *Pelagos software package*

Improved array calibration

Provide post-processing tool set for scientists in well supported environment

-> *free*

DOCUMENTATION

Transponderless Navigation

Ensure navigation software supports integration of new systems (DVL, etc.)

-> *modular software, support for multiple devices*

Provide well documented data files with raw values

-> *provided*

Provide post-processing tool set for scientists in well supported environment

-> *free demo package provides processing capability*

Merging of surface and in-hull data files

-> *not addressed*

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APPENDIX VI

ALVIN Overhauls & Inspections

Navy Requirements:

	Annual sustaining certification audit
	Overhaul at least every five years
	Hull inspection every five years (currently under review)
1989	February - Hull inspection
	August - Overhaul completed
	August - Sustaining certification audit
1990	March - Sustaining certification audit
1991	June - Sustaining certification audit
1992	August - Overhaul started
1993	February - Hull inspection (delayed until 1996)
	March - Overhaul completed
	March - Sustaining certification audit
1994	May - Sustaining certification audit
1995	May - Sustaining certification audit
1996	(Hull inspection)
	May - Sustaining certification audit)
1997	(May - Sustaining certification audit)
1998	(Overhaul)
	(Sustaining certification audit)

Major Overhaul Work Tasks:

- Hull inspection
- Frame inspection and repair
- Non-destructive testing of VB/HP air spheres
- Syntactic foam repair
- Fiberglass skin repair and painting
- Implodables pressure testing
- Cable inspectionl/replacement

- Battery replacement
- Control center refurbishment
- Primary systems inspections and refurbishment:
    - Hydraulic system
    - Variable ballast
    - Main ballast
    - Propulsion
    - Mercury trim
    - Compensation
    - Manipulators
- Electronic equipment refurbishment, alignment, repair

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APPENDIX VII

Deep Submergence Science Committee

31 May - 2 June 1995

Woods Hole Oceanographic Institution
@ Carriage House/Quissett Campus

Overview

WHOI prepared to go ahead with *Knorr* conversion as proposed in April 1991 (AGOR-25 proposal).

Features of Conversion

- A-frame center-line versus offset to port.
  - Less expensive, fewer structural changes
  - Uses more deck space
  - Uses less main lab space
- Traction winch on deck vice below decks (not in original proposal).
- Crane to be moved off main deck.

Weight storage, handling as on Atlantis II

Navigation - separate proposal per Bellingham's DESSC subcommittee

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R\V KNORR

COMPARISION OF LAB & DECK SPACES (Area in ft.2)

MODIFIED AGOR 25 PROPOSAL

	Total	Main	Anal.	Upper	Wet	Lower	Top	Main Dk.
Total Area	2851	1320	260	483	148	260	380	2619
Unusable	479	192	23	77	18	55	114	-
Alvin	288	288	0	0	0	0	0	1076
Seabeam	103	0	0	83	0	0	20	-
Science	2227	1086	237	323	130	205	246	1543

JUNE '94 CONCEPT

	Total	Main	Anal.	Upper	Wet	Lower	Top	Main Dk.
Total Area	2851	1320	260	483	148	260	380	3061
Unusable	479	192	23	77	18	55	114	-
Alvin	288	288	0	0	0	0	0	1341
Seabeam	103	0	0	83	0	0	20	-
Science	1981	840	237	323	130	205	246	1720

	LULU	ATLANTIS II	KNORR
LOA	105 ft.	210 ft.	279 ft.
Beam	48 ft.	44 ft.	46 ft.
Displacement	480 Ltons	2,300 Ltons	2,635 Ltons
Crew	9	22	22
Science:			
DSV/Tech	9	9	13
Party	8	19	21
Generators	150 kw	600 kw	1,780 kw
Cruising Speed	6.5 kts	10.5 kts	12 kts
Endurance	20 days	30 days	60 days
Range	2,000 mi.	9,000 mi.	12,000 mi
Labs	One Van	4 labs-1031 sq.ft.	6 labs-1,981 sq.ft.
Modified KNORR			2227 sq.ft.

Key Objectives for WHOI 1996-1998

Short-Term (during transition period)

- Science Support Continuity and Excellence
- Keep ALVIN and ROV's Viable (personnel, team skills perishable)
    - Overhaul ALVIN
- Minimize Impact on Marine Crews
    - Minimum overlap of ATLANTIS II, KNORR out of service
- Minimize Cost to Feds

Long-Term

Build to First Class National Facility

This appendix includes deck layouts for AGOR 25 as the ALVIN Handling vessel, and operating/ conversion schedules for AGOR 25 and KNORR. They can be obtainrd by contacting the UNOLS office at:

e-mail unols@gsosun1.gso.uri.edu

phone (401) 792 - 6825

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APPENDIX VIII

OCEAN SCIENCES DIVISION

		Estimated	
	FY 1993	FY 1994	FY 1995
Ocean Sciences Division	$177.7M	$188.9M	$193.4M
Ocean Sciences Research	92.5M	100.0M	102.9M
Ocean Drilling Program	36.0M	38.7M	39.9M
Oceanographic Facilities	49.2M	50.2 M	50.6M

OCEANOGRAPHIC FACILITIES DETAIL

Operations

Ship Operations	29.4 M*	32.7 M*	35.2 M*
ALVIN, Aircraft, etc.	1.4 M	2.2 M	2.4 M
MarineTechs	4.2 M	4.2 M	4.2 M
	$35.0 M	$39.1 M	$41.8 M

*Plus $1.6 M from ODP (1993 and 1994), $1.8 M (1995)

Infrastructure

Science Instruments	1.3 M	2.5 M	2.3 M
Shipboard Equipment	2.1 M	2.1 M	1.4 M
Ships, Upgrades	7.2 M	2.6 M	0.4 M
UNOLS Misc.	0.5 M	0.5 M	0.6 M
	$11.1 M	$7.7 M	$4.7 M

Centers and Reserves

AMS	1.0 M	1.2 M	1.4 M
Cross Directorate/Reserves	2.1 M	2.2 M	2.7 M
	$3.1 M	$3.4M	$4.2 M

(Apr. 1995)

NSF FY 1996 BUDGET REQUEST

OCEAN SCIENCES

Request is $205.6 Million

Increase of $12.2 Million or 6.3%

	FY 1994	FY 1995	FY 1996
OCEAN SCIENCES RESEARCH	$100.0M	$102.9M	$110.3M
OCEANOGRAPHIC CENTERS & FACILITIES	50.3M	50.6M	54.2M
OCEAN DRILLING PROGRAM	38.7M	39.9M	41.1M
	$189.0M	$193.4M	$205.6M

Major Research Initiatives

GLOBAL CHANGE PROGRAMS	$53.7M	$57.7M	$59.8M
BIOTECHNOLOGY	4.0M	3.6M	3.8M
HIGH PERFORMANCE COMPUTING	0.4M	0.8M	1.0M
ENVIRONMENTAL RESEARCH	7.3M	7.7M	8.3M
SMETE (EHR)	2.1M	2.1M	2.2M
	$67.5M	$71.9M	$75.1M
OTHER RESEARCH ACTIVITIES	$121.5M	$121.4M	$130.5M

(April 1995)

POSSIBLE UNOLS FLEET ALIGNMENT - 1997 - 2002

ATLANTIC/GULF REGION

- NORTHEAST

KNORR	GENERAL PURPOSE	GLOBAL	WOODS HOLE
ENDEAVOR	GENERAL PURPOSE	NORTH ATLANTIC	RHODE ISLAND
EWING	MCS/MGG/GP	GLOBAL	LAMONT
ATLANTIS	SUBMERSIBLE	GLOBAL	WOODS HOLE

- MID-ATLANTIC

CAPE HATTERAS	GENERAL PURPOSE	NORTH ATLANTIC	DUKE ET AL
CAPE HENLOPEN	GENERAL PURPOSE	CHESAPEAKE BAY	DELWARE

- BERMUDA

WEATHERBIRD II	GENERAL PURPOSE	BERMUDA	BERMUDA

- SOUTHEAST/GULF

SEWARD JOHNSON	GP/SUBMERSIBLE	N. ATLANTIC	HBOI/MIAMI
EDWIN LINK	SUBMERSIBLE	CARIBBEAN GULF	(BOTH SHIPS)

- LOCAL SHIPS

BLUE FIN	GENERAL PURPOSE	S.E. LOCAL WATERS	GEORGIA
SEADIVER	SUBMERSIBLE	FLORIDA WATERS	HBOI
CALANUS	GENERAL PURPOSE	FLORIDA LOCAL	MIAMI
PELICAN	GENERAL PURPOSE	LOUISIANA GULF	LUMCON
LONGHORN	GENERAL PURPOSE	TEXAS GULF	U.TEXAS

PACIFIC REGION

- ALASKA

OCEANUS	GENERAL PURPOSE	N.E PACIFIC, BEARING	ALASKA

- NORTHWEST

THOMPSON	GENERAL PURPOSE	GLOBAL	U. WASHINGTON
WECOMA	GENERAL PURPOSE	NORTHERN PACIFIC	OREGON

- CENTRAL CALIF.

PT. SUR	GENERAL PURPOSE	N.E. PACIFIC	MOSS LANDING

- HAWAII

MELVILLE	GENERAL PURPOSE	GLOBAL,WEST PAC.	HAWAII

- SOUTHERN CALIF

REVILLE	GENERAL PURPOSE	GLOBAL	SCRIPPS
NEW HORIZON	GENERAL PURPOSE	NORTH PACIFIC	SCRIPPS
SPROUL	GENERAL PURPOSE	N.E. PACIFIC	SCRIPPS

- LOCAL SHIPS

BARNES	GENERAL PURPOSE	PUGET SOUND	U. WASHINGTON

REQUIRED UNOLS FLEET CHANGES 1997-2002

A MODEST PROPOSAL

RETIRE	**MOVE**
ISELIN (1996)	OCEANUS
GYRE	MELVILLE
MOANA WAVE	
ALPHA HELIX	
ATLANTIS II (1996)	

FLEET PROFILE

ATLANTIC/GULF	**PACIFIC**
3 LARGE SHIPS	3 LARGE SHIPS
3 INTERMEDIATES	3 INTERMEDIATES
3 REGIONAL	2 REGIONAL
5 LOCAL	1 LOCAL

MAJOR PLAYERS

NSF

- OCEANUS, ALPHA HELIX, ATLANTIS II, ISELIN

ONR

- KNORR, ATLANTIS, MELVILLE, MOANA WAVE

INSTITUTIONS

- WHOI, SCRIPPS, HAWAII, ALASKA, MIAMI, TEXAS A&M

FLEET COSTS - 1997

- ESTIMATED AT $50.5 MILLION
- UNCHANGED UNOLS FLEET - $60.0 MILLION

1995 ESTIMATED FUNDING - $48.3 MILLION

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APPENDIX IX

A 5-year plan for undersea research in the region of the Central Pacific is being prepared.

Hawaii Undersea Research Laboratory -Project Unity Narrative

Following the rectification review of June 1994, the Hawaii Undersea Research Laboratory changed its basic direction to concentrate on the completion and full Integrated operation of its ship, submersible and, ROV. This has been labeled as project Unity. This change in focus was one of the central recommendations of the rectification committee.

Project Unity began in full swing in the fall of I994. The goal of Project Unity is to effectively integrate the Ka'lmikai-o-Kanaloa ROV and Pices V submersible into a smoothly operational 2000m diving system. Initial work began on the ship. This involved overhaul of the ship's motors and installation of an inertial navigation system. This was followed by a drydock period. During the drydook the rudders were overhauled and repacked, the below hull Seabeam array was installed, the hull was cleaned and painted and zinc anodes were replaced. Following drydocking a CTD winch and boom were installed as well as a ship wide video monitoring and clear com system.

The second part of project unity is the submersible. Work on the submersible began by totally dismantling the present vehicle. This was followed by now calculations on sub stability to make adjustments for the new hook which arrived from Scotland. A series of strengthening measures were taken on the strongback to allow for lift by the telearm. The hook has been installed. All submersible components have been on overhauled. ABS has certified the frame and spheres. Reassembly is now taking place. The submersible with the now anti-pendulation tele-arm and A-frame lift system will be ready for ocean testing in the summer of 1996.

Following overhaul, the ship conducted three short test cruises. The Seabeam took accurate swath bathymetric data over rough terrain at 11 knots. The CTD system and rosette water sampling system deployed by the innovative CTD boom worked flawlessly. All of the other ship systems also functioned well making the ship the first completed part of project unity.

A detailed study of our ROV system came to the conclusion that the purchase of a new ROV rather than an upgrade of the current ROV is most cost effective. Specifications have been completed and a new ROV will be ordered. Specifications have also been completed for a motion compensating crane to launch the ROV.

Project unity plans for tests of the integrated system in the spring of 1996 followed by a full science program in the summer of 1996. Project Unity is well on the way to providing the nation an effective deep ocean research diving capability .

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APPENDIX X

ALVIN Letters of Interest

Summary 1995 - 1997

	1996 Prop.	1996 Funded	1997 Prop.	1997 Funded
ATLANTIC				
1 Calder	2			
2 Duncan		12		
4 Martin	12			
5 Ravizza	2			
6 Schmitt/Williams	7			
7 MacDonald	15			
8 Rona	10			
9 Klinkhammer	20			
11 Grassle/Petrecca	12			
42 Casey	22			
47 NERC	3			
Total	**105**	**12**		
GUAYMUS BASIN				
12 Jannasch*	10		10	
OFF CALIFORNIA				
14 Smith/DeMaster	10			
EQUATORIAL PACIFIC				
13 Karson	20			
43 Schneider	12			
Total	**32**		**10**	
JUAN DE FUCA				
15 Goldfinger/Kulm	16			
16 Johnson**	12			

17 Johnson	15		
18 Tivey			5
19 Kelly et. al.	15		
20 Embley	15		
22 Zierenberg et. al.	33		
23 Becker	6		
24 I Kadko	7		
25 Mottl **	22		22
26 Kadko	3		
Total	**144**		**27**

NORTHERN EAST PACIFIC RISE

Chave/VonDover		4	
Langmuir	?		
Cary 5			
VanDover/Jonnasch			17
Haymon/MacDona	18		
Lutz			
Total	**23**	**4**	**17**

SOUTHERN EAST PACIFIC RISE

34 Naar	28		
35 Mullineaux/France	8		
36 Edmond	30		
37 Lilley	27		
38 Lupton***			25
39 Lutz/Vrijenhoek		15	
45 Kent			20
Total	**93**	**15**	**45**

WESTERN PACIFIC

41 McMurtry	8		
46 Perfit		20	

Total	**8**	**20**

SUMMARY	**1996 Prop.**	**1996 Funded**	**1997 Prop.**	**1997 Funded**
	425	**31**	**119**	**0**

NOTES:

* ALVIN or JASON can be used

** Proposal requests JASON, But ALVIN preferred

*** Work can be moved to 1996 if ALVIN is in area

ROV Letters of Interest

Summary 1995 - 1997

	1996 Prop.	**1996 Funded**	**1997 Prop.**	**1997 Funded**
ATLANTIC				
3 Fornari	30			
9 Klinkhammer	20			
10 Sempere	35			
Total	**185**	**0**		
GUAYMUS BASIN				
12 Jannasch*	10			
OFF CALIFORNIA				
44 Stephen	16			
JUAN DE FUCA				
16 Johnson**	12			
21 Humphris	25			
25 Moftl **	22		22	
Total	**59**		**22**	

SOUTHERN EAST PACIFIC RISE				
33 Fornari	30			
48 Haymon				21
Total	**30**			**21**

HAWAII				
40 Chave			8	
Total			**8**	

SUMMARY	**1996 Prop.**	**1996 Funded**	**1997 Prop.**	**1997 Funded**
	200	**0**	**30**	**21**

NOTES:

* ALVIN or JASON can be used

** Proposal requests JASON, But ALVIN preferred

*** Work can be moved to 1996 if ALVIN is in area

This appendix includes a series of charts that provide greater detail about each proposal. World maps indicating the locations and number of proposed and funded dives for both ALVIN and ROVs are also included. Copies of these charts and maps are available from the UNOLS Office.

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APPENDIX XI

1995 SOUTHERN CALIFORNIA SCIENCE OPERATIONS ADVANCED TETHERED VEHICLE (ATV) AND DSV-3 TURTLE

29 APRIL - 14 MAY

WHALE - FALL COMMUNITIES

CATALINA BASIN: 29 APRIL - 8 MAY

- Principal Investigator: Dr. Craig Smith (University of Hawaii)
- Support of NURP's global change research initiative and man's influence on natural ecosystems and endangered species
- Investigated the significance of whale-fall communities as dispersal stepping stones for sulfide-dependent species
- Recovered 36 vertebrate segments, 41 core and scoop samples, 62 hours of video recordings, 550 still frames
- ATV:7 dives (69.3 hrs) TURTLE: 3 dives (24.7 hrs)

DEEP-SEA BRITTLESTAR FISH

SAN DIEGO TROUGH: 8 MAY - 14 MAY

- Principal Investigator: Dr. Gordon Hendler (Natural History Museum of Los Angeles
- Support of NURP ocean shelf and slope ecology initiative
- Provided first accurate interpretation of brittlestar behavior pattern; characteristic pattern of deep-sea animal life
- Recovered over 100 specimens, 65 hours of video recordings, 950 still frames
- ATV: 5 dives (58.6 hrs) TURTLE: 4 dives (23.4 hrs)

RECENT MILITARY OPERATIONS

OCTOBER 1994 - MARCH 1995

- R & D Recovery in Southern California
- R & D Recovery on Pacific Missile Range
- Vil Vana Mishap Investigation
- F-14 and F-18 Air Mishap Boards
- Over 200 hours of ROV bottom time .
- Over $50 million of recovered hardware

FUTURE OPERATIONS

ATV AND SEA CLIFF:

AUGUST - SEPTEMBER 1995

- Dr. Paul Dayton and Dr. Eric Vetter investigating submarine canyons off the southern California coast
- Dr. Cindy Lee Van Dover investigating hydrothermal vent invertebrates at the Main Endeavour Field
- Dr. Martin Fisk investigating geology of the Mendocino Ridge

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RECENT IMPROVEMENTS PROJECTS AND UPGRADES

- 3- Chip CCD Camers for both DSVs and UMVs (currently in use with great reviews)
- Lighting Upgrade for ATV and TUVWs (Dr. Joules Jaffe of Scripps)
- Micro-laser scaling system (initial use for Dr. Gordon Hendler)
- Navigation Upgrade (Winphrog and N-916)
    - Sea Beam post processing improvements
    - Sun Sparc 5 Stations w/ 17" real-time color monitor
    - HP 650C color-fill plotter
    - Archiving system
- Marsat E-mail
- SCORPIO depth upgrade

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APPENDIX XII

1996 - ALVIN Dives/Cruises - 1996

(No Name Exercise)

Calendar Days Associated with a Program

Area	Dives	Transit	Port	Total
Transit to W.H.	-	9	-	9
WNA: Martin	12	2	-	14
WNA: No name	12	2	-	14
Transit Pan-WH	-	9	-	9
EPR: Chave etal.	4	9	2	-
No name vents	2	-	-	17
Guaymas Basin	10	9	3	22
California	10	2	3	15
Totals	50	42	8	100 days

This appendix includes includes a tenative 1996 ATLANTIS II & ALVIN operating schedule.

Copies of this schedule are available from the UNOLS Office.

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APPENDIX XIII

April 19, 1995

Dr. Donald F. Heinrichs
Oceanographic Centers and Facilities
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

Ms. Lisa Rom
Oceanographic Instrumentation and Shipboard Technology
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

Dear Don and Lisa

We have made progress on formulating policy and guidelines for third party tool development and use on ALVIN and the ROV/towed systems operated by the WHOI-DSOG in response to your letter of February 15, 1994. By this effort we hope to encourage innovation in the use of the assets of the National Facility, resulting in improved capabilities and enhancing the science that can be addressed. Additionally, this effort will establish guidelines to aid the reviewers and the agencies in the evaluation of the benefits and projected costs beyond the proposed work.

Third party tools are defined for this memo as devices developed outside of the National Facility with agency funds, and the emphasis is on those tools that may be useful for the larger deep submergence research community. New tools are required for the increasingly complex and multi-disciplinary nature of deep submergence research in mid-water, hard-rock and soft-sediment environments, as well as the advent of deep ocean seafloor observatories and time series studies. Advances in sensor technology, materials, and engineering must be incorporated in a manner to effectively support the science and enhance the US deep submergence capability. The Stakes/Holloway rock drill development is an example of a tool that meets this criteria. It was designed for the work of the developers, it has been interfaced and tested on ALVIN, and has sparked the interest of other investigators. This type of asset should be developed with open communication with the DSF operator and the DESSC, and future operating, maintenance, and mobilization costs should be addressed in the original proposal where applicable.

We envision a procedure that involves scientific and technical review by the DESSC and operational assessment and recommendations by the WHOI-DSOG with respect to proposed 3rd party tool

development. This must be done without unnecessarily burdening the investigator, but in a way that will enhance the review process and provide the agencies with information that is otherwise not available. The scientific merit of the proposed tool development, its operational viability, and its general applicability to a wide spectrum of deep submergence facility users, must be carefully reviewed to ensure that all disciplinary objectives and requirements are considered.

A straw-plan was presented to the DESSC at the December meeting and comments were gathered in the ensuing weeks to help in formulating the policy outlined in the Third Party Tool Policy draft that follows.

Additionally, we propose a Technology Subcommittee be formed from the DESSC membership as necessary to address third party tool issues and to provide input to the Operator on technology issues.

Sincerely,

(signed)

Barry Walden

(signed)

Jeff Fox

THIRD PARTY TOOL POLICY

1 . Investigators considering submitting a proposal for developing a tool with intended applicability beyond the initially proposed science program are encouraged to submit a "letter of intent to propose" to the DESSC - Technology Subcommittee for initial comment and review. The letter of intent should include preliminary estimates of those items mentioned in paragraph #2. The Subcommittee and the Operator would evaluate the information provided and respond with a letter to the investigator with comments and suggestions in a timely fashion. Based on the feedback, the proposer could submit a formal proposal to the funding agency. Tools that could be utilized on a variety of deep submergence assets available to U.S. investigators would obviously have greater potential of use. In addition, the interfacing of new tools with various types of vehicles should be encouraged. Attaching the letter will show reviewers the contact with the DESSC and Operator had been made. Omission of this step, or lack of endorsement by the DESSC, could jeopardize the chances of success for the proposal.

2. Proposals for third party tools should include operation and maintenance cost estimates. Investigators should be prepared to support the continued maintenance of the tool via the funding received for the tool development and implementation, or include a long-term maintenance plan in the proposal that

addresses the user costs for support services, repair and logistics.

3. Proposals submitted to the funding agencies for development of scientific instruments or tools will be reviewed under the applicable agency peer review system. The agency is encouraged to incorporate a DESSC Sub-committee member as a reviewer, who in turn will contact the Operator for dialog relevant to the review. The agency panel could be assured that there has been coordination in the proposal/review process and an assessment of the priority of a specific proposal relative to other requested instrumentation will be provided.

4. The responsibilities of the vehicle operator should not go beyond providing detailed interface specifications, installing equipment, evaluating safety and operational requirements, and cooperating on testing of new equipment. At sea repair, maintenance and spare parts for third party equipment shall be provided by the user or designated technician funded by the PI.

5. **If**, based on community demand, review by the DESSC Technology Subcommittee and with concurrence of the operator, equipment developed by a third party is to become a permanent addition to a vehicle system, the assets should be transferred to the vehicle operator for operation and maintenance. The appropriate support costs should be added to the annual operating budget of the vehicle operator.

6. The DESSC will report the status of third party tools to the community at the annual general meeting, including a review of tools under development and scheduled testing. In addition, a summary of tools available to the community, including the primary contact, will be maintained by DESSC and available with DSOG vehicle information.

We noted comments in your letter relating to the importance of the DSOG participation in the planning and implementation process for science tools that fall into the third party category. DESSC and WHOI-DSOG agree that this is a critical component of the process and it will play an important role in the eventual success of any tool development and utilization program. The 1995 DSOG Operations Proposal has included, within the scope of work for both ALVIN and the ROV/towed vehicles, the efforts that must be undertaken to provide and disseminate the vehicle systems criteria to interested parties in the deep submergence community, and the eventual work required to interface with those scientists and engineers.

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APPENDIX XIV

To: fornari@whoi.edu
Subject: stuff
Date: Tue May 30 22:50:44 1995

Here is a brief status report of the continuing development of themultiple barrel drilling and plans for the October deployment onto theAlvin.

The dedicated valve pack is installed and has operated successfully on two deployments. Some initial problems have been solved by adding check valves. We also divided the valves between a high pressure side which powers the main drive motor and a low pressure side for everything else. This division isolates the seals for most of the small actuators from the full pressure of the hydraulic system. This modification should enable the system to be operated on a broad range of hydraulic pressures without the component failure we observed last year. An apparent added bonus is that the division into high and low pressures shunts more flow into the main motor to obtain higher rpms.

Sensors have been installed to monitor rpm, weight on bit, and torque (pressure drop). only the rpm has been calibrated. The new systems delivers about 50% higher rpms. We also think that there is higher torque as we have sheared two driveshafts, but we have no previous value for comparison. We are building a new driveshaft and will be experimenting with a different coupling that can tolerate the higher torques. Otherwise things are progressing well with regard to the drill.

The only major change that would impact the ALVIN program is the multiple changes in components and component composition. Where possible we have moved from aluminum to titanium with a slight increase in weight. The result should be a more robust system. There was a major weight savings early in the year with the addition of a titanium custom hydraulic cylinder to replace the original steel cylinder. I have requested that Ops determine the air and water weight of the entire system once the design is stable. For the purpose of the Batiza cruise, the goal should be to maximize the allowable weight on the basket to provide the maximum weight on bit.

Extensive discussions have been held about mob and de mob for the Batiza cruise. Holloway will likely come to MBARI, assemble and test

the system, then drive it to San Diego. The drill will be installed on ALVIN and tested in port. Holloway will also accompany Batiza on the cruise. we have not resolved the safest strategy for the return of the drill to MBARI. Holloway has put together a spares list. we intend to have backups for every hydraulic component in addition to a generous supply of expendables. After the next round of dives at the end of June, I will notify you whether the ALVIN group should still provide their manifold as a back up. We

are working on a daily check sheet for the system.

The one major concern that I have is the issue of insurance. Batiza was not successful in obtaining insurance coverage. The situation with a third party tool is that if it is lost, all you are guaranteed is an apology. Given the substantial investment we have made in improving this system, it would be appropriate for some additional assurance. our insurance underwriter may provide coverage since I am a collaborator and will be physically on the ship. For some project that does not include me, WHOI should look into providing coverage at some fee. Failing this, perhaps NSF can self-insure unique tools to be used on ALVIN.

That's about it for now. Please ask questions if there is more information that you would like.

Debra

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APPENDIX XV

DUMAND-Deep Underwater Muon and Neutrino Detection

Hawaii DUMAND Center
University of Hawaii
2505 Correa Rd.
Honolulu, HI 96822
808-056-7391

To- DESSC

From- John Learned
Department of Physics and Astronomy
For The DUMAND Collaboration

Date- May 24, 1995

Subject- Cooperative use of JASON for DUMAND installation and service

This memo contains a description of the DUMAND Neutrino Astronomy Project in brief terms, summarizes the status of already installed deep ocean facilities, and outlines our needs for deep submergence vehicles to install and maintain the laboratory which is located 25 km west of the Island of Hawaii at a depth of 4800 meters.

We respectfully request that DESSC consider the following-

1) DESSC endorsement of the cross disciplinary use of the JASON/MEDEA system for the DUMAND deep ocean operations is requested. The DUMAND System will need to be serviced by the ROV at a frequency of approximately once per year for order of one week, beyond a first year effort of several weeks for initial installation. We have already discussed minor modifications to JASON vehicle with the Deep Submergence Operations Group at Woods Hole Oceanographic (Mr. Andy Bowen - of the unmanned vehicles group has been the prime point of contact), in order to accomplish the tasks. These tasks are similar to those needed for almost any deep ocean terminal/laboratory. Funds required for any vehicle modifications or special components needed to carry out the DUMAND work would be provided by the DUMAND Project.

2) We ask the advice of DESSC on the best means for us to proceed to acquire needed facilities support, given that the DUMAND project is an approved and multiply reviewed project which is funded by the Dept. of Energy, which does not have deep submergence facilities like the Ocean Sciences Branch of

NSF. The use of the JASON ROV for the DUMAND deployment and servicing is currently caught between agency and disciplinary forces, in kind of a Catch -22 situation. One line of argument in favor of shared, interagency use of facilities such as the deep submergence vehicles supported by NSF/ONR and NOAA is that DOE provides 'free' accelerator beam time to NSF-Physics researchers, so that in all fairness the DUMAND group (the only high energy physics project conducting experiments in the oceans), should have similar access to consideration for ship time and ROV allocations; from the NSF shared-use oceanographic facilities. To date, NSF-OCE facilities personnel have stated that DUMAND was not eligible for consideration for such ship time unless DOE paid the bill, or unless we had NSF funded collaborators (which we had in the past and did receive ship time for testing in previous years but our NSF collaborator has retired). (In passing I might mention that I have been unable to obtain a written policy which defines the rules.)

3) We have a deep ocean multiple use terminal already in place at depth, with high data rate capability, and it has capacity beyond our physics needs (due to built-in spare channels). We have considered the route of soliciting ocean researchers to co-propose other ocean science activities which might be cost-effectively carried out with this unique asset (25 km West of the Big Island of Hawaii, and at 4.76 km depth in a subsidence basin).We would welcome shared-use of this potential deep ocean monitoring system for other oceanographic research and stand ready to collaborate with marine scientists in providing access to the DUMAND facility for their work. However, because of the urgent need to deploy the system (we are ready to perform tests for which JASON is needed as soon as possible in 1995) we do not feel that it is viable to wait for other oceanographic work to be attached to DUMAND so that it fits the mold of currently acceptable NSF-OCE facilities use.

4) We might also depend upon facilities potentially available from the USN in the Submarine Development Group One from San Diego. There are several problems with this however. First, it is a Navy facility and always at the command of flag officers who properly put the military concerns first, but who often care little about scientific missions (which do not contribute to their career advancement). Second, due to the decreasing funding of the military generally, the substantial amount of training time formerly available at little or no cost, must now be supported partially, For us in Hawaii this means paying unacceptably large transit costs (of order $250K), if we are the only user. Third, there is the systemic USN problem due to rotation of officers every two years, which means that long term experience is not accumulated (and historical documentation is not very good either). Fourth, we hear continuing rumors about the possible demise of the entire SubDevGrp1 operation. Thus, while we have had good relations with the SubDevGrp1 people, and there are some excellent people there now who have a really supportive attitude about science (particularly our liaison, Cmdr John Green), their use in the long run seems not a viable option.

We respectfully request that this memo be distributed to the DESSC membership and agency representatives; at the meeting and that the issue be discussed. If you require further information please do not hesitate to contact me by email or telephone at the addresses listed below. Thank you in advance for your consideration of this matter.

Sincerely,

(signed)

John G. Learned

DUMAND Project Spokesman and Director
email- jgl@uhhepg.phys.hawaii.edu
office: 808-956-2964 / fax: 808-956-2930

The DUMAND Project - Scientific Overview and Planning

Since the discovery of neutrinos in the 1950s, people have dreamed of viewing the universe in the 'light' of these particles, which must stream to us in vast numbers from astrophysical objects. Neutrinos are produced in essentially any place of high activity, from such nearby objects as galactic black holes and neutron stars, to the distant centers of the most luminous objects in the universe, the quasars. The neutrinos do not interact much with ordinary matter, and thus can flow freely from even the most dense objects, and will travel in straight lines to us (unlike charged cosmic rays which wander about due to the magnetic fields in the galaxy). Photons, the stuff of all astronomy until now, whether radio, light, or x-rays and gamma rays, do not escape from densely shrouded sources. The higher energy gamma rays are absorbed just in traversing the distance to quasars. But, while neutrinos will allow insight into the enigmatic engines of the universe, these neutrinos are exceedingly hard to catch, mostly going right on through the earth without a trace.

Occasionally a neutrino (one in a million or so for the energies in question) will snatch a charge from a quark in the earth near a detector and become a charged particle. The electric charge then disturbs atoms along the path and radiates a wake of light, (called Cherenkov Radiation) as it travels at greater than the local speed of light (which in water is 3/4 of the speed in vacuum). Large photomultipliers can then provide signals to trace the trajectory of such a particle, which travels kilometer distances and reveals the initial neutrino source direction to a degree or less. One can imagine a neutrino observatory such as we are building as a rotating all-sky (fish-eye lens) camera observing a faint image which will take months or years to develop.

There are many spinoffs to the neutrino detection program, including searches for the missing dark matter of the universe, study of the interactions of these particles at energies not assessable at human made accelerators, and even a plan to do earth tomography with neutrinos. Acoustic detection of neutrino induced particle cascades, which may be possible at the highest energies, will also be pursued in DUMAND.

The idea of carrying out neutrino astronomy from the depths of the ocean was conceived many years ago, owing to the unique nature of the benthic region.- phenomenal optical clarity, shielding, placidity,

sparsely of biological activity (including human!), ready access from mid-ocean volcanic islands, and of course cost of material. Ocean is our shielding, target material, and detection medium. It took dearly a decade of activity, however, to;. examine the environment (it was found to be better than anticipated optically); study the backgrounds (bioluminescence having been a worry); develop the technology needed (in optical detectors, fiber optics, electronics, and overcoming a frustrating series of connector difficulties); and for physicists to gain the requisite operating and engineering experience in the deep ocean to design the reliable high technology equipment needed for an ocean laboratory for long term deployment.

The array under construction was approved in 1990, and will consist of eight moorings 450 m tall, placed in a 106 m diameter octagonal pattern, with one further instrument string in the center. Each instrument string consists of 24 optical detectors, each encased in a standard 17 inch glass instrument housing, plus 2 laser calibration devices, 5 hydrophones, a programmable pinger, environmental sensors, and a central electronics unit. Power at 350 VDC is delivered to a 12 port junction box, along with 12 single-rnode optical fibers, via a 30km armored cable to shore.

Near Future DUMAND Operations

This junction box has already been installed on a flat, barren bottom in the Kaho'olawe Deep (West of the Big Island of Hawaii), and successfully connected to a shore laboratory at Keahole Point, Hawaii. One instrument String was installed at the time of table laying, but this string failed soon due to a leak, and was recovered via acoustic release. The umbilical cable remaining from this initial string is now shorted (it was designed for a guillotined release) and must be removed prior to activation of the junction box; at present we are hoping that the ATV will be able to carry out this task (requiring about one half day of dive time) on the newly organized expedition of the Laney Chouest to Hawaii during June 1995.

We have developed a plan in concert with WHOI personnel, to employ the JASON cable and winch for sea trials of the reliability of the three moorings, prior to commitment to the deployment operations. These tests can employ a locally available ship, not needing DP capability. The DUMAND Project would provide the funding to cover the expenses for the winch costs including mobilization/ demobilization and personnel for this work,

The first three moorings are ready for installation, though of course under continuous testing and improvement in our laboratory at UH while awaiting a ship for deployment and an ROV or DSV for connection. Deployment involves the use of a DP ship for placement of the mooring with several meter precision (an acoustic network is also in place) In the second step, an electro-optic connector must be dragged from the string base some 50 m to the junction box and plugged in. The connection operation was demonstrated to be workable (about 12 times) at the DUMAND site in 10/92 using the US Navy ATV with a mockup junction box and connector. JASON has practiced the connector removal operation in shallow water at WHOI in early 1995. JASON is the only available academic/civilian ROV in the US that is capable of carrying out these operations.

Summary of DUMAND's needs for joint operations with JASON,

1) Mooring tests from junction box as early as Summer/Fall, 1995.

2) Deployment and connection operations for three moorings during 1996.

3) Further activities for the deployment and connection of six more moorings in approximately 1997, plus ongoing maintenance at a frequency of order of once per year or less, for a period of less than five years.

Note that long range plans by a world consortium to build an array fifty times larger than DUMAND (a full cubic kilometer in size) are in formation at present for construction around the turn of the century. If carried out in Hawaii, this project would probably involve requiring an ROV and platform to be locally available for a significant fraction of time over some years, and certainly with direct funding of associated costs. Several options for that are under study, but we hope that the project can be carried out with oceanographic community involvement to our mutual benefit. Whatever we do would hopefully be carried out with significant involvement by WHOI and working within the scope of the DEESC.

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APPENDIX XVI

Comparison of On-Bottom Times for Different Deep Diving Submersibles

ALVIN	1500 dive average 1985-1995	4 hr 47 min
	dives >1500 m,	>2 hr
NAUTILE	200 dive average 1994	4 hr 8 min
CYANA	200 dive average 1994	5 hr
SHINKAI-2000	at 2000m 1994	4 hr
SHINKAI-6500	at 6000m 1994	4 hr
	at 6500m 1994	3 hr 30 min
	at 3000m 1994	5 hr

Comparison of Battery Characteristics & Cost Factors for Deep-Diving Submersibles

SPEC	ALVIN	NAUTILE	SHINKAI 6500
Type	Pb acid	Pb acid	AgZn
Capacity	37.4 kwh (80%)	38.4 kwh (80%)	86.4 kwh (80%?)
Cost/set	$7,800	$42,000	$2,630,000
Dives/set	200	200	75
$/dive	$39	$210	$35,000
$/kwh	$208	$1,141	$30,440
Maint. Int.	60 dives	50 dives	30 dives

Variables Affecting *Alvin* Power and Bottom-Time

Long-Term Variables

1. Power Characteristics of Battery Type
2. Charging Equipment and Procedures
3. Changing Configuration and Number of Power Consumptive Operational Equipment and Science Equipment

Short-Term Variables

1. Science Mission Objectives
2. Lead-Observer Experience and Organization of Science Tasks
3. Piloting Style (e.g. throttle usage, trim control, mission planning, manipulator skill, fatigue, attitude)
4. Dive Depth
5. Type of Terrain
6. Lights (observation and video photography)
7. Sampling/Hydraulics Demand
8. Battery Condition
9. Service - Maintenance Procedures

This appendix contains two graphs depicting ALVIN bottom times. Copies of these graphs are available from the UNOLS Office.

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APPENDIX XVII

Woods Hole Oceanographic Institution
Woods Hole, MA 02543
Phone: (508) 548-1400
Telex: 951679

May 10, 1995

TO: Prof. P. Jeff Fox, Chair - DEep Submergence Science Committee

FROM: Dudley Foster and Barrie Walden - WHOI

SUBJECT: ALVIN Batteries and Hydraulic system

Dear Jeff:

In response to questions raised at the December 1994 DESSC meeting concerning ALVIN batteries, charging cycles and bottom time we have provided the following information for evaluation by the committee. We feel that it is important to demonstrate to the committee and the community that we are tracking the submersible power issue. Realistically, however, there exists no panacea to this problem, and given the current fiscal climate it is extremely difficult for us to do more than what we have within the scope of our limited operational budget.

One question that was raised by the committee and various scientists at the meeting was how does the ALVIN group justify its battery voltage limits. The recommended low-voltage limits and capacity of Pb-acid batteries is available from most major manufacturers of this type of battery. We have tracked this issue carefully over the years and have stayed abreast of the most current recommendations as they relate to the batteries we purchase to build our battery packs. Several months of research on various Pb-acid cell types (flat and tubular plates), and their care and treatment, was re-done by our engineers about six years ago. This has been done several times in our 30 year history due to ALVIN battery configuration changes. The results of those studies have determined our present voltage cut-off limits.

There have been no significant developments in Pb-acid battery manufacturing that have provided any type of technological breakthrough which would be worth spending the time and money to redo those studies in an effort to gain power for ALVIN. The information does not show that any appreciable power-gain, over what we currently have, is possible with today's Pb-acid technology. At such a time that either Pb-acid technology breakthroughs arrive, or should the current testing of Ag-Zn or Fe-Ni batteries by other submersible operators show that these battery technologies could provide a reliable, cost-effective, and sustainable increase in available operational and science power, we would be the first

to argue for funding to investigate the applicability of those power sources for ALVIN. As mentioned above, given the present funding climate we do not feel that we can make a strong case at this time for requesting additional funding to further research the submersible power issue, despite its clear importance and implications for the conduct of science while on the bottom. The ALVIN group will continue to monitor the Pb-acid technology and dialog with the other submersible operators to learn about their experiences with other power sources, and we will keep DESSC abreast of our findings at upcoming meetings.

As further background to the voltage cut-off limit we have recently been doing some testing of Pb-acid cells here at WHOI and have concluded that the at-sea operations group is running the batteries to about 70% discharge when they leave the bottom. The general guidelines throughout the Pb-acid battery industry is to not discharge below 80% of capacity for regularly used batteries, such as fork trucks, which is less severe service than we use for ALVIN. The net result is that ALVIN leaves the bottom with only 10% of the "usable" battery left to get to the surface, maneuver if required, and get secured in the hanger until external power is connected. Our experience and data show a significant imbalance in cell capacity with usage, and running below 80% capacity risks permanent damage to the weakest cells.

The initial battery problem on the last Karson cruise (January - February 1995) is a good example of what can happen if a single cell in a battery is overly discharged. When the low-capacity ALVIN battery was removed in Barbados after that cruise, some of the individual cells showed "reverse polarity" damage on the initial test discharge, even though the overall battery voltage was satisfactory. These cells were likely the weakest ones in the battery pack. This type of problem can only be solved by throwing away the cell. Pressing the low voltage limit increases the risk of this kind of cell damage, resulting in permanent loss of the entire ALVIN battery capacity. The result is lost bottom time for future legs until the battery pack can be replaced.

In an effort to get the most power for the longest period of time from our batteries, we continually try to improve the way ALVIN battery packs are maintained, and we are currently testing electronic monitoring devices that will help us track battery performance. Part of this effort requires occasional changes to procedures, support hardware, and associated evaluation of results. The initial poor battery performance on the Karson cruise was due in part to changes in the battery charging hardware, internal component grounds, and a battery with some less-than-optimum cells. The time involved in recognition and evaluation of the results caused limited power on several dives. Because of the small incremental improvements we are trying to achieve, any changes realistically require 50 or more battery cycles (dives) to correctly evaluate the results. Because these "experiments" can only be evaluated in our operational environment the expected results will not be 100%. Unfortunately, a few users may, at times, be shorted on performance in the interest of long-term improvements for all ALVIN users.

We intend to present some historical data that we have compiled on bottom times for dives from 1985 to the present at the upcoming DESSC meeting and discuss the many variables involved with the issue of submersible power and bottom time with the committee.

Please let us know if you need further information on this topic or if there are questions on the issues we discuss above.

Sincerely,

(signed)

Barrie B. Walden

(signed)

Dudley B. Foster

cc: R. Pittenger WHOI - DSAC

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APPENDIX XVIII

To: DESSC
From: J. G. Bellingham and D. L. Orange
Re: Increasing Bottom Time of ALVIN

Date: June 26, 1995

At the DESSC meeting in Woods Hole June 1, 1995, we discussed the potential increases in ALVIN bottom time attainable through improved hydrodynamics or changes in available power. We felt that it would be instructive to assess these two approaches via the following analysis:

Start with the following equation for power consumption: **Eo =2(P/n)(D/ro)+P to**

- P = power consumed on bottom
- P/n = power consumed on descent/ascent (i.e. n is reduction in power used relative to power consumed on bottom)
- Eo = total energy available (present ALVIN configuration)
- ro = rate of descent/ascent (present ALVIN configuration)
- to = bottom time (present ALVIN configuration)

Write the power consumption for a modified ALVIN as: **E1 = 2(P/n)(D/r1)+P t1 = f Eo**

- f = increase in battery capacity
- r1 = modified rate of descent/ascent
- t1 = bottom time of changed ALVIN configuration

Solving for tl we get: **t1=(2Df/nro) - (2D/nr1)+ fto**

Consider two cases, both with D = 2800 m and to = 240 minutes.

(1) ro = rl = 25 m/s, f = 1.5 (i.e. descent/ascent rate stays the same, battery capacity increased 50%).

(2) rl = 2ro = 50 m/s, f = 1.0 (i.e. descent/ascent rate doubled, no change in batteries).

Discussion:

If the power used on ascent and descent is minor compared to the power used on the bottom, n becomes a large number. In this case, any increase in ascent/descent rate has a negligible effect on bottom time. Thus a 50% increase in battery capacity increases the bottom time -50% (in the limit). At the DESSC

meeting Dudley commented that the power consumed during ascent/descent was very low compared to power usage on the bottom. Therefore, any increase in battery power directly increases the bottom - science - time, whereas increasing the ascent/descent rate has less of an effect on bottom time. Increased hydrodynamics could benefit the deepest dives, which may be currently limited by the length of the operational day. We feel that the largest benefit to science, though, would come from increasing the available battery power.

We sympathize with the engineering challenge presented by increasing the available battery power, and with the up-front cost inherent to a change in battery technology. However, when viewed in light of the high day rate attached to deep submergence science, the significant increase in bottom time achievable with increase battery power is worth striving for.

This appendix contains two curves based upon the formulas above.

Copies of this schedule are available from the UNOLS Office at:

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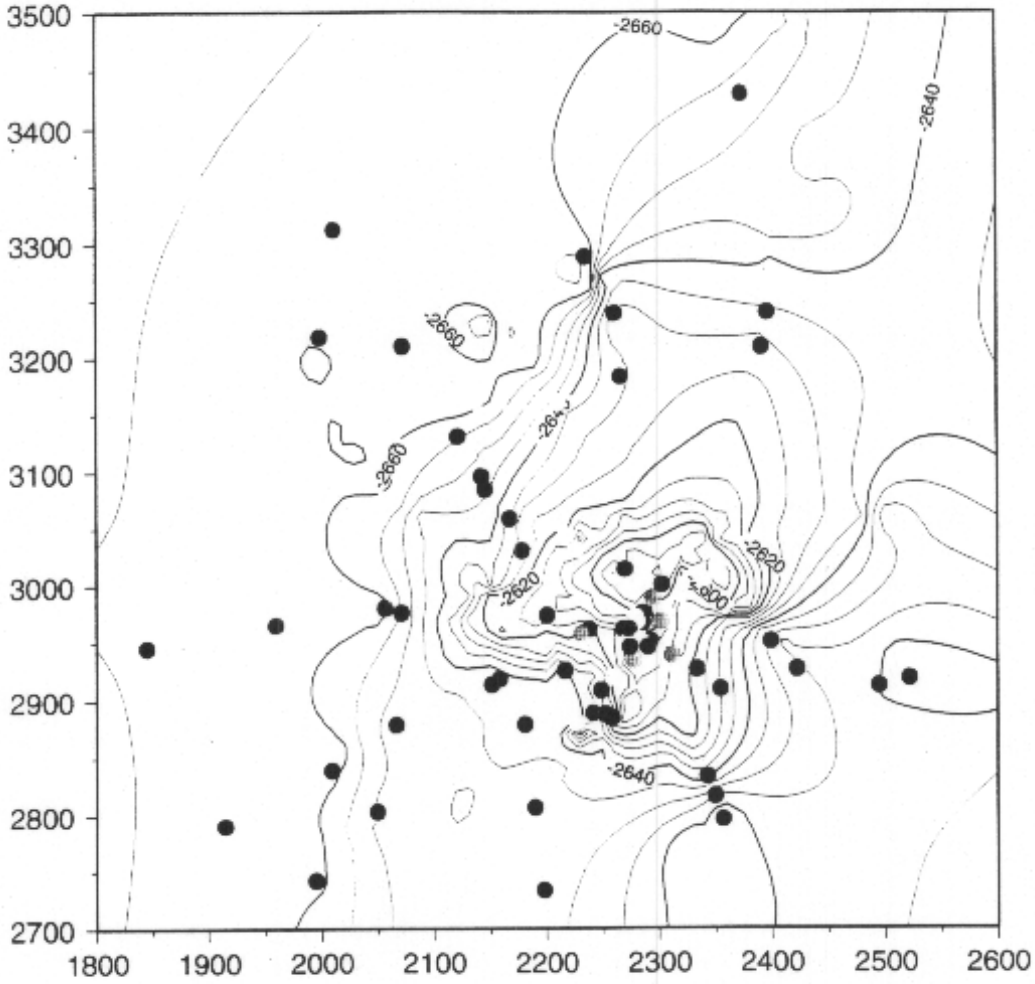
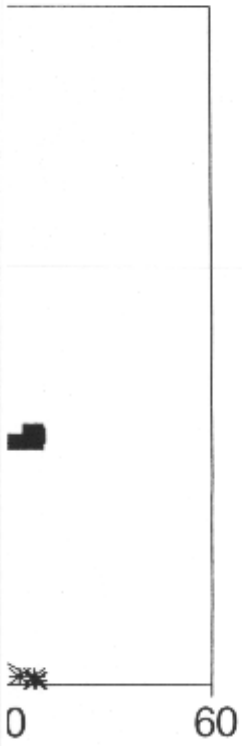
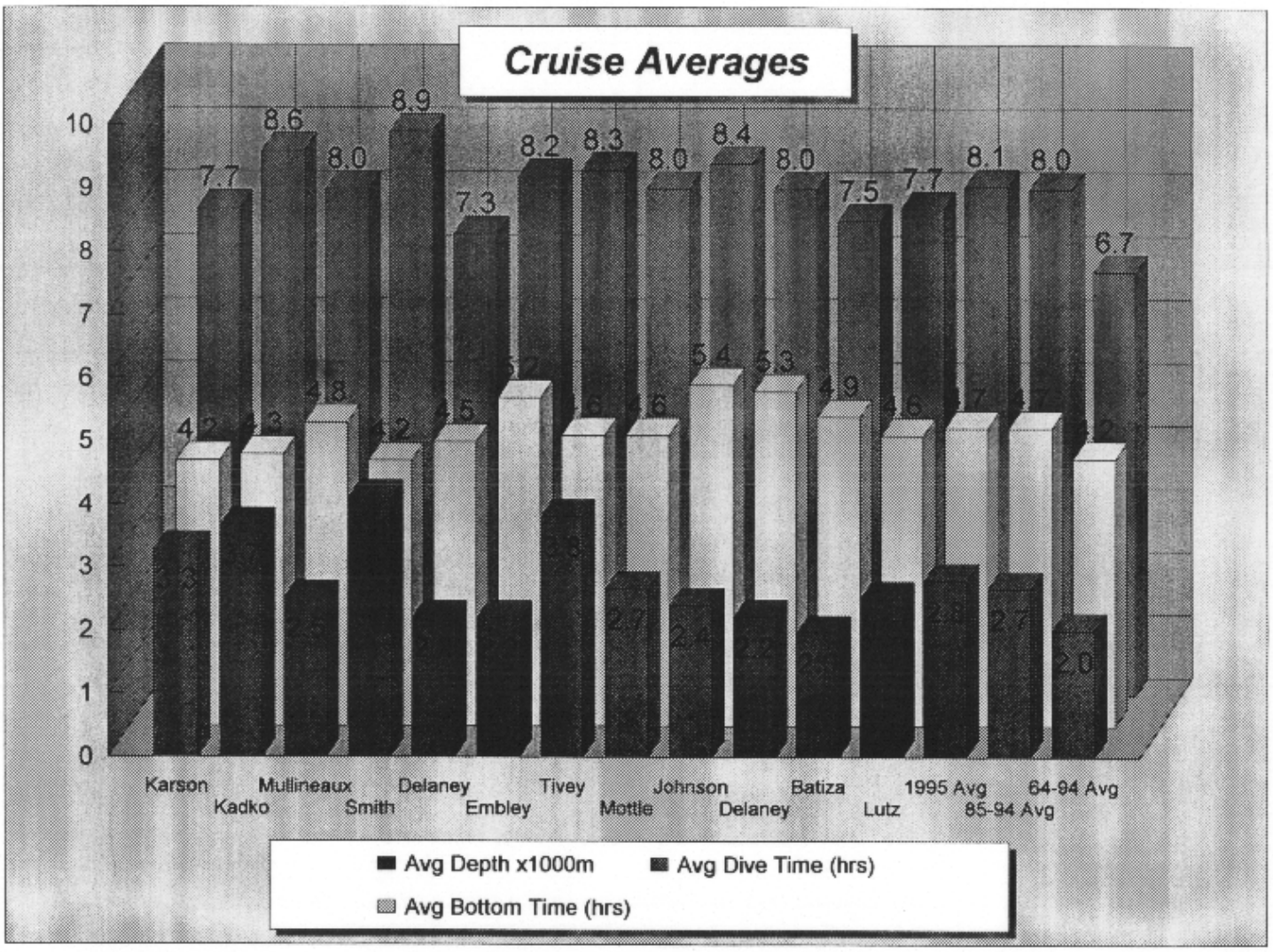
Baby Bare upward fluid velocity data from *DSV Alvin* cores
units are cm/y






Cruise Averages
10
9
8
7
6
5
4
3
2
1
0
7.7
8.6
8.0
8.9
7.3
8.2
8.3
8.0
8.4
8.0
7.5
7.7
8.1
8.0
6.7
4.8
5.4
5.3
4.9
2.7
2.4
2.8
2.7
2.0
Karson
Kadko
Mullineaux
Smith
Delaney
Embley
Tivey
Mottle
Johnson
Delaney
Batiza
Lutz
1995 Avg
85-94 Avg
64-94 Avg
Avg Depth x1000m
Avg Dive Time (hrs)
Avg Bottom Time (hrs)