UNIVERSITY - NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

ALVIN REVIEW COMMITTEE

June 9-11, 1992

Carriage House
Woods Hole Oceanographic Institution
Woods Hole, MA

CONTENTS

ALVIN REVIEW COMMITTEE

Minutes of Meeting
Carriage House
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APPENDICES

WELCOME AND INTRODUCTION

Fennan Jennings, ALVIN Review Committee (ARC) Chair, called the meeting to order at 8:30 a.m. on June 9, 1992. Modifications to the agenda, Appendix I, were announced. These minutes reflect the order in which agenda items were reported. Attendance at all or part of the meeting included:

ALVIN Review Committee
Feenan D. Jennings, Chair; TAMU
Jeff Fox, GSO/URI
Doug Nelson, UC Davis
Gary Taghon, Rutgers
Geoffrey Thompson, WHOI (substitute ARC reviewer)
Karen Von Damm, UNH
Dick Pittenger, WHOI ex-officio member

Agency Representatives
David Duane, NOAA
Don Heinrichs, NSF
Keith Kaulum, ONR
Mike Reeve, NSF/OSRS

Participants
Garry Brass, UNOLS Chair
Jack Bash, UNOLS
Annette DeSilva, UNOLS

WHOI
Craig Dorman, Director
Lane J. Abrams
Robert Ballard
Andy Bowen
Rick Chandler
Joe Coburn
Dudley Foster
Susan Humphris, RIDGE
Donald Moller
Barrie Walden

The ALVIN Review Committee Roster is Appendix II.

The minutes of the ALVIN Planning Meeting, December 8, 1991, were accepted as written.

ALVIN/ATLANTIS II WELCOME HOME! The ALVIN Review Committee meeting was highlighted by the return home of ATLANTIS II and ALVIN. **Craig Dorman, WHOI Director,** extended a greeting to the ARC and invited all to attend the welcome home party. The homecoming took place on 10 June at the Iselin Marine Facility. ATLANTIS II had been at sea for 575 days and away from Woods Hole for a record total of 894 (Appendix III). The ship and ALVIN looked great! A tour was offered to the public.

ALVIN/ATLANTIS II OPERATIONS 1992, 1993

ALVIN/AII Operations Report - Barrie Walden provided a report on ALVIN/AII operations from June 1991 to present, Appendix IV. On 1 July, ALVIN recovered the Navy's CURV III off the coast of Southern California. Following the recovery, ALVIN/AII headed north for operations on the Juan de Fuca Ridge. Work along the ridge included sampling, data collection and maintenance of a previously instrumented ODP bore hole. The Stakes drill was used successfully in demonstrating its coring capabilities of consolidated materials.

In 1992 no proposals for ALVIN use were funded except for those which were carryovers from 1991. As a result of its light schedule, ALVIN will be brought back to Woods Hole in August of this year and begin its overhaul in September. Barrie indicated that it would be extremely undesirable to lay off the ALVIN team during these lean times. Hopefully a new Memorandum of Agreement between the three funding agencies (NOAA, NSF and ONR) and a more aggressive marketing of the submersible could resolve this problem.

In 1991, 152 of the 156 planned ALVIN dives were completed. All lost dives were due to weather. The ALVIN on-shore operations group has been scaled down to one part-time electrical and one part-time mechanical engineer. Any additional reductions in personnel would increase the risk of unsafe operation to an unacceptable level. Technical improvements for the year included replacing 50 percent of the motor controllers and installing video enhancements.

ALVIN Engineering Cruise Highlights - Dudley Foster provided a report of the February 1992 ALVIN engineering cruise highlights. This included ALVIN and AII crew training, camera/video testing and evaluation, ALVIN performance data gathering, and evaluation of bottom marking systems for AUV tracking and photo/video transects. Extensive testing and evaluation of the hydraulic system resulted in corrective measures to bring the Stakes drill performance up to advertised capabilities. The full list of highlights is included in Appendix V.

A request to increase ALVIN's depth capability to 15,000 feet was submitted 15 months ago. To allow the 15,000 foot depth capability would require only a paper waiver; the pressure housings are adequate. The increased depth capability would decrease the present factor of safety from 1.5 to 1.25, which is the safety factor SEA CLIFF now operates under.

ALVIN Archives - Lane Abrams, WHOI Electrical Engineer, reported on the status of the ALVIN Archives. The archives include an enormous amount of footage including 150,000 feet of 35 mm film, approximately 1.2 million images. The archiving process requires addressing problems relating to preservation methods, access to data, search techniques and the quality loss associated with duplication techniques. The technology is continuously changing. Improved methods for preservation are being developed to reduce the degradation effects of duplication.

Techniques WHOI has currently reviewed or pursued to provide a means for preserving and accessing film includes: Optical disk-based image database and search for high density storage capability, digitized imaging for high resolution, generalization of the initial database (this would require a great deal of time and effort for interpretation of images), and use of digital cameras. WHOI is also considering the possibility of a joint venture with USGS to store ALVIN data on CD-ROM.

Lane indicated that the ALVIN Archivist are getting close to selecting an appropriate means for preservation of ALVIN footage.

ALVIN Overhaul and Inspection - At the start of the overhaul ALVIN will automatically lose its certification. Since only one cruise is scheduled between now and overhaul, Barrie reported that an extension to the ALVIN certification audit scheduled for June has been requested. An audit is performed annually between certifications to physically inspect the submersible and its paperwork to assure that it is operating in accordance with standards. The extension was granted based on WHOI performing an internal audit. Rumors have it that the NAVSEA certification will be very difficult to pass, because major changes in the rules have been incorporated regarding toxic material. WHOI will request a pre-survey prior to the certification.

ALVIN will begin post-overhaul diving trials in March 1993. Science diving should resume in April 1993.

ROV PROGRAM AT WHOI

Deep Submergence Lab - Bob Ballard reported on the Deep Submergence Lab (DSL) facility and the JASON Remotely Operated Vehicle System, see Appendix VI. The lab was established at WHOI ten years ago to develop the first deep water teleoperated exploration vehicle system. A long-term objective of the program is to allow large groups of scientists to participate in deep-sea operations from shore-based telecommunication centers, including control of the vehicles from shore.

The design objective of the JASON development effort was to bridge the gap between acoustic and visual imaging systems. Scientists have experienced difficulties in cross-correlating acoustic and visual data sets. To remedy this problem, JASON combines the use of high-frequency acoustic sensors and low-light level large-area visual sensors as well as using high-resolution visual-imaging devises and remote manipulation. Jason employs a navigation system with precision to within centimeters.

Bob provided detailed descriptions of JASON and its Towed Camera Sled, MEDEA (figures of each are provided in Appendix VI). MEDEA is dynamically positioned by the surface ship and watches JASON from a distance of 15 to 20 meters. MEDEA also serves to decouple surface motions from JASON. Other components of the system include: workshop and supply vans, overboard handling system, fiber-optic winch system, control van, data processing center, and remote displays. The operational team consists of a navigator, JASON pilot, manipulator operator, sonar operator, MEDEA flyer and JASON engineer. ALVIN had a positive influence on the JASON development process by reducing the learning curve. All pilots are also ALVIN pilots.

In July and August of 1991, the JASON vehicle system was used in its first major comprehensive science program on the rift valley of the Juan de Fuca Ridge. Conductivity, temperature, and Mn sensors were mounted on the front of JASON. In all JASON spent more than 190 hours on the bottom, collected nearly 700 hours of video, obtained more than 18,000 still images, made approximately 40 EXACT navigated runs in the hydrothermal plumes, and digitized the bottom terrain with its various sonar systems.

In early 1993, a major expedition is planned for the Guaymas Basin. This expedition is both a scientific expedition and the fourth year of the JASON Project. It will be funded by Navy (OP-23) and the JASON Foundation. Elements of the expedition include the support ship R/V LANEY CHOUEST, the deep submersible TURTLE, the MEDEA/JASON system, 25 interactive downlink sites and 2 remote science sites. TURTLE and MEDEA/JASON will operate in the water simultaneously.

Deep Submergence Support Organization - Andy Bowen of WHOI/DSL operations, provided organizational charts of the existing deep submergence support activities at WHOI, post-transition deep submergence support activities at WHOI, and the JASON/MEDEA Transition Working Group, Appendix VII. The JASON/MEDEA Transition Working Group was formed to begin integrating the operations of ALVIN and unmanned vehicles. In the post-transition organizational structure, ALVIN operations and unmanned vehicle operations are merged. Both groups will fall under the direction of Barrie Walden. The field operations group in the new structure will be made up of twelve people, four of which will be designated as JASON specialists. The remaining eight individuals will be shared between ROV and ALVIN operations.

WHOI is committed to the merging of manned and unmanned operations at their institution. Two programs are planned for this summer in which personnel will be shared between manned and unmanned operations. A manned submersible will be deployed simultaneously with JASON.

A schedule of DSL operations, advanced subsystem development and vehicle/equipment status was provided, Appendix VII.

ALVIN PROGRAM MANAGEMENT:

Dick Pittenger reported on ALVIN program management issues, Appendix VIII. In 1992, the ALVIN Program was faced with an oppressive funding challenge. The low number of funded dives caused the cost per dive to escalate. As a result, it became difficult if not impossible to sell dive time with such high day rates. This in effect kicks-off a "Death Spiral". For years in which funding is lean, there is no means for WHOI to sell off the excess time at a reasonable rate. Outside users would rather wait until a healthier funding year when the ALVIN daily rate is low. The present tri-partite Memorandum of Agreement (MOA) is inadequate in addressing this problem. ALVIN improvement initiatives were precluded or curtailed as a result of the funding situation.

Dick reported on the status of WHOI's response to the recommendations of the ALVIN Management Review Committee report. WHOI has addressed the recommendations to increase pilot training, enhancement of both internal and external communications, enhancement of technology and decrease pilot turnover. Potential fixes along with the status of each of these issues is detailed in the Appendix VIII charts.

Three other key activities at WHOI include: (1) The merger of the ALVIN Group with the ARGO-JASON Group, (2) Formation of a science advisory group within WHOI to provide oversight and guidance for deep submergence activities, and (3) Discussions with Harbor Branch Oceanographic Institution (HBOI) for a larger operations structure.

Lastly, a brief list of accomplishments for ALVIN/AII on its Voyage #125 was provided. "Firsts" included the first female ALVIN pilot, the first all female dive, the first all female officers on AII and the first successful use of the rock drill. An impressive 96 percent of ALVIN's dives were successfully completed. Bottom time totalled 2809 hours.

RIDGE PROJECT

Susan Humphris of WHOI gave a talk on the RIDGE Project. The goal of the RIDGE Project is to understand the geophysical, geochemical, and global causes and consequences of energy fluxes. They begin by taking a global look, then focus down to the vent area.

Program elements are broken down to five research areas: (1) Global structure and fluxes - Characterization of the architecture, geochemical, biological and energy fluxes on a global scale; (2) Crustal accretion variables - Investigation and characterization of the key variables that affect crustal accretion (spreading rate, magma supply, tectonic history); (3) Mantle flow and melt generation; (4) Event detection - Development of an effective method of identifying and responding to events and (5) Temporal variation - Establishment of one or more long-term seafloor observatories to measure temporal variation of physical, chemical, geological and biologic process at ridge crusts. Both manned and unmanned vehicles are required for this research.

Review of Dive Requests For 1993

Dive requests for investigations in 1993 are listed by region in Appendix IX and summarized in Appendix X. Dive requests had been submitted in response to UNOLS announcement *Opportunities for Oceanographic Research During 1992 using DSV ALVIN*, Appendix XI. Twenty-six requests for a total of 373 dives were received by the committee, of these 322 dives were requested for 1993. Six of these requests had been submitted to the committee, but had not yet been submitted to the funding agencies. In such incidences, the committee attempted to review their proposal if enough information had been provided. Reviews were conducted in accordance with the ARC rules, Appendix XII.

The ARC recommended twenty-five of the requests for scheduling, for a total of 297 dives in 1993. It was realized that 297 dives far exceeds the number of dives which could be accomplished in a nine month operating period. However, in light of last year's funding situation, it would be optimistic to predict that the majority of pending proposals would be funded. Further, some of the dives requested (and recommended) were distant from any other ALVIN work, or had time constraints that would be difficult to schedule. ARC left the scheduling of the recommended proposals to the WHOI schedulers.

It was noted that the UNOLS Office had received correspondences from Lisa Levin and Lauren Mullineaux requesting ALVIN time in 1993. They could not submit proposals at this time, but wanted the ARC to be aware of their interests.

A correspondence (Appendix XIII) was received from Jan J. Kohlmeyer of the University of North Carolina, requesting the collection of deep-sea fungi by ALVIN in connection with other dives on or near the sediment surface. His request was passed along to Barrie Walden for consideration during the 1993 dive series. The UNOLS Office will write a letter to Kohlmeyer in regard to this action.

ALVIN Program Funding

NSF - Mike Reeve, NSF/OSRS, reported that an increase in funds for 1993 is not expected. ARC voiced their concern on the chances of there being a repeat of last year's lack of for ALVIN projects. NSF is exercising oversight by sending both Don Heinrich and Mike to this review meeting. They will keep abreast of the situation, but feel that a trend away from funding ALVIN science is in the future.

Mike indicated that possible reasons for the lack of funded proposals last year could have resulted from a lack of organization on the FARA project. Also, in 1991 the PI's were coming off long cruises and did not have a chance to digest their collected information before having to submit proposals for 1992.

It was suggested that perhaps the ALVIN proposal submittal and review dates be moved forward to allow for greater lead time. Mike indicated that NSF is willing to work with ARC in modifying the ALVIN scheduling process. Changing review dates should not be a difficult process.

ONR - Keith Kaulum said that there is no change in ONR funding expected for next year. DOD is cutting back in procurement, but not in the Research and Development area. ONR is pleased to see WHOI's strong commitment to integrating operations of ROVs and ALVIN. ONR is planning to support operations of ARGO/JASON this year. They would like to see this integration of ROVs with manned submersibles included in the renewal of the tri-partite Memorandum of Agreement for support of the national research facility.

FALL WORKSHOP

Plans to put on a workshop in the fall to focus on ALVIN technology issues and to coordinate efforts for a global expedition were discussed. A subcommittee would be needed to identify the workshop structure, establish an agenda, set a timetable and advertise the meeting. Jeff Fox and Karen Von Damm will put together the subcommittee.

To accomplish the goals of the workshop, it was felt that two and half to three days would be needed. Funding agency representatives would be invited to attend and encouraged to provide funding forecasts in regard to both technology and global expeditions. Washington, DC was recommended as a meeting location because it would most likely allow the greatest participation from the funding agencies. Methods of funding the workshop were discussed and it was the general opinion that the participants should be offered partial travel reimbursement for their travel costs. Participants could submit applications for travel reimbursements and at the same time indicate what they would be willing to contribute to the workshop. Full support could be provided to those participants designated as topic or expedition leaders. Other participants would be reimbursed based on time zone. NOAA, NSF and ONR were all receptive to the idea of funding such a workshop at an approximate total cost of $35,000.

A strawman agenda was put together. Day one would be devoted to ALVIN technology, equipment and instrumentation. It would focus on near and immediate term issues. The scientific community would be brought together to establish one prioritized list of improvements. Day two would be devoted to coordinating efforts for ALVIN global expeditions. Geographic centers of interest would be identified. The UNOLS Office has received a number of correspondences in response to notices on the OMNET OCEANS bulletin board and the EOS article regarding an ALVIN global expedition, Appendix XIV. At the workshop, investigators to champion research expeditions to the various centers would be identified along with strategies for carrying out such expeditions. Expeditions would be prioritized based on the maturity of the science proposed. Day three if needed could be used for each expedition center to review their coordinated efforts and proposed schedules. It should be noted that this is a strawman agenda and that the subcommittee will assess the needs of the community in preparing the workshop objectives and agenda.

Dates for the fall workshop were tentatively set as October 14 - 16, 1992. Advertising for the workshop could be through EOS, the OMNET OCEANS bulletin board and UNOLS mailings. The UNOLS Office will submit a supplement to the funding agencies to cover costs associated with the workshop.

SCHEDULE RECOMMENDATIONS FOR 1993

WHOI schedulers established two tentative schedule options for 1993 ALVIN/AII operations based on the ratings given during the ARC review, dive times requested and locations of dives, Appendix XV. Version A assumes a light mid-Atlantic ridge schedule in which case AII can transit to the Juan de Fuca Ridge area for dives within the weather window. Depending on the outcome of the global expedition initiatives, this schedule may allow the mid-Atlantic ridge dives to be performed on the way to the Mediterranean or Red Seas in 1994. A total of 186 ALVIN day assignments are recommended, leaving 114 days unassigned.

In Version B, AII/ALVIN would perform most requested mid-Atlantic ridge work, but would be unable to reach the Juan de Fuca ridge within the workable weather window. Diving would continue in the second half of the year in the East Pacific Rise region. The schedule recommends 225 ALVIN day assignments, leaving 75 days unassigned.

As a special note, it was brought to the WHOI scheduler's attention following this review meeting that a proposal for work in the mid-Atlantic Ridge had been funded. WHOI schedulers have provided a third proposed schedule, Version C, with this work included (Appendix XV). Version C includes ALVIN operations on the mid-Atlantic Ridge, Juan de Fuca and East Pacific Rise regions. A total of 249 ALVIN day assignments are recommended, leaving 85 operational days unassigned.

All options offer full schedules with little transit time.

ASSESSMENT OF ALVIN COMMENTS

The Speiss Report identified the lack of useful feedback from the ALVIN user community as a problem. A recommendation to improve this situation would be to have an ARC member personally phone PI's who have recently returned from ALVIN/AII cruises. Key questions could be asked to obtain an accurate, fair assessment of the cruise. The calls would be kept confidential.

Annette and Rick Chandler will provide Jeff a list of names, telephone numbers and addresses of PI's who have used ALVIN from late 1991 to present. Jeff will then distribute phone assignments to the various ARC members.

AII/KNORR CONVERSION

In preparation for the conversion of ATLANTIS II to KNORR as a support ship for ALVIN, the UNOLS Council has recommended that ARC and FIC work together as an oversight sub-committee during this process. FIC has expressed their willingness to participate in this effort.

WHOI indicated that the conversion will take a lot of time and engineering. Joe Coburn will develop a strawman plan of how this process should proceed. The strawman will be presented to FIC at their October meeting and ARC after their new membership is in place.

After discussion it was the consensus that the best window of opportunity to perform the support ship conversion would be in the 1995-1996 timeframe. At that time both ALVIN and AII would be due for overhaul. Also, by beginning the conversion in 1995 there would be no impact on plans for a global expedition.

ALVIN ARCHIVING

The ALVIN Archiving problem had been discussed in detail earlier in the meeting. The two primary issues are preservation and archiving of on-going data. WHOI is responsible for preparing a proposal recommending an archiving method. Barrie feels that they are very close to coming up with a method for preserving which will not harm the film.

SEA CLIFF PROPOSAL

Garry Brass reported that on May 18-19 the first SEA CLIFF panel review meeting was held in Washington, D.C. The panel, which included three ARC members, reviewed proposals for academic research using SEA CLIFF. Mail reviews appeared to be very useful in the review process. Each proposal was carefully considered in regard to whether or not SEA CLIFF and/or an ROV was the appropriate tool for the research.

David Duane noted that from the eighteen proposals submitted, 41 dive days were scheduled. There would be six or seven legs of six to seven days in length. The dives would take place between mid September and early November, 1992.

PLANNING FOR 1994 AND BEYOND

The fall ARC meeting held in San Francisco in conjunction with the AGU meeting is traditionally used to solicit intents of interest for ALVIN use in future years. In light of recent developments, suggestions were made to use this year's fall meeting to preview and recommend the results of the global expedition workshop. The meeting could also include technology presentations.

ALVIN EQUIPMENT AND INSTRUMENTATION

ALVIN equipment and instrumentation issues will be addressed by the ALVIN Fall Workshop.

Garry Brass inquired as to the process in which equipment/tools could be cross-shipped. Barrie indicated that cross-shipping is being done as well as it can be done at this time. Frequently tools/equipment such as magnetometers and CTDs are loaned out. Other equipment is more difficult to transfer because it was uniquely designed for a specific operation.

MEMORANDUM OF AGREEMENT (MOA)

The ARC subcommittee of Jeff Fox, Dick Pittenger, Barrie Walden and Jack Bash provided ARC with a draft package of MOA recommendations, Appendix XVI. The package includes a philosophy paper on deep submergence support for the next decade and rationale and recommended elements for the MOA. Basically, the recommendations propose to implement a safety net for ALVIN and its support ship in lean years. A level of funding must be maintained to insure the safe operation of ALVIN. Modifications to the current scheduling process are suggested to make excess unused time of the support ship more sellable.

ARC recommended that the package be forwarded to the UNOLS Council for endorsement. Once endorsed, the recommendations would be officially sent to NOAA, NSF and ONR.

TERMS OF REFERENCE

The ARC reviewed the draft Terms of Reference which had been provided in the agenda package. In light of this meeting's suggestions for developing a new scheduling process for ALVIN time, it will be necessary to modify the terms.

An extensive discussion took place on ways in which the scheduling process could be modified to allow the support ship to actively participate in the UNOLS ship scheduling process. Presently, NSF proposals to use ALVIN in the following year are submitted 1 May and are reviewed in late spring/early summer by the NSF peer review. During this same time frame ARC performs their review of all ALVIN proposals for the following year. WHOI often is not notified of which proposals will be funded until just prior to the operating calendar year. As a result, WHOI does not have the opportunity to schedule any unused AII time in the UNOLS ship scheduling process. This in turn causes the costs for use of AII and ALVIN to escalate to a point in which the excess time cannot be sold (the "death spiral"). If the AII group was informed by April of all funded ALVIN projects, they could participate in the spring ship scheduling meeting.

Don Heinrichs suggested making the deadline for submittal of ALVIN proposals 1 November, fourteen months prior to the operating year and all proposals from the various funding agencies would be reviewed together. The proposals would only be subject to peer review. The present peer review panels are chartered by NSF, and as such NSF chooses the panelists. Panelists are selected after the proposals are submitted and they have the benefit of mail reviews. Additionally, program managers are present at the review. The other funding agencies, ONR and NOAA, did not indicate that their agencies could accommodate this suggestion.

Doug Nelson strongly recommended that ARC have participation in the peer review. Funding agencies were also encouraged to request technical and scheduling advice from the operating institution during the review process. The ALVIN Review meetings would no longer be held. PI's would only need to submit one proposal. The ALVIN proposal now submitted to the UNOLS Office would be replaced by a form for diving logistics and scheduling purposes. This form could be included as part of the ALVIN brochure. Barrie Walden will draft the new ALVIN Request form.

Don Heinrichs indicated that changing the proposal submittal and review dates should not be difficult for NSF. He will suggest a scheduling/review strategy to UNOLS by 1 July. For the first year, a proposal submittal date of 1 February would probably be considered. This should allow adequate time for the user community to adjust to the new scheduling process and also allow time for planning of a global expedition.

The revised Terms of Reference will be much broader. ARC would continue to do long term planning and act as a sounding board and oversight committee for the community. They will encourage technological advances in deep submergence research. The ARC will provide recommendations for use of other submersibles and unmanned deep submergence systems when suitable; such as those offered by HBOI, MBARI and other countries. ARC will give up its role as the ALVIN review committee. The UNOLS Office will redraft the Terms of Reference to reflect these changes and circulate it to the committee.

RECOMMENDATIONS FOR NOMINATIONS TO ARC

The ARC membership terms for Feenan Jennings, Doug Nelson, and Gary Taghon are expiring. Gary is eligible for re-appointment to a second term. Additionally, a resignation from Dave Cacchione was received.

Garry Brass, in his authority as UNOLS Chair, appointed Jeff Fox as the new chair of ARC. Recommendations to fill the remaining positions were made with consideration being given to assure a well balanced disciplinary committee. One existing position would be filled with an individual having a background in deep submergence technology. The total number of committee members would not be increased at this time, but would be considered after the new terms of reference are adopted.

Recommendations for membership included the following individuals:

Gary Taghon	-	Benthic Biology
Dan Fornari	-	Geology
Carl Wirsen	-	Micro Biology
Hugh Milburn	-	Deep Submergence Technology

David Duane will look into whether or not Hugh will be available to serve on the committee. Jeff Fox will contact the others to determine their willingness to serve.

On behalf of the UNOLS Council and the ALVIN Review Committee, Garry Brass extended thanks to Feenan Jennings and Doug Nelson for their years of service on ARC. David Duane also extended the appreciation of the funding agencies to Feenan and Doug for their dedication.

The meeting was adjourned at 12:00 noon on June 11, 1992.

AGENDA
ALVIN REVIEW COMMITTEE

8:30 a.m. June 9-11, 1992
Carriage House, Woods Hole Oceanographic Institution
Woods Hole, MA

8:30 a.m.- Tuesday, June 9, 1992 - Carriage House

Welcome and Introduction: Feenan Jennings, ALVIN Review Committee Chair, will welcome attendees, describe meeting goals and set the agenda.

Accept Minutes of December, 1991 ALVIN Planning Meeting.

Report on 1991 ALVIN/ATLANTIS II Season, Status of 1992 Season and Preview of Factors for 1993. Barrie Walden and WHOI operators/managers will provide a report on 1991 operations and on operations from Jan 1, 1992 to present. Review of schedule for 1992-93 ALVIN overhaul and inspection, with other factors pertinent to 1993 operations.

ROV Program Status at WHOI. Andy Bowen will discuss the program status of ROVs at WHOI in regard to capabilities and availability.

ALVIN Program Management. Dick Pittenger will report on ALVIN program management issues.

Review Dive Requests for 1993. NSF, ONR and NOAA representatives will provide best-available funding information for all dive requests. ARC rules and procedures for reviewing requests will be provided with the proposal package. ARC review and discussion of all new requests for 1993 and beyond.

Comments on ALVIN Program Funding, 1993 and beyond, by Agency Representatives. Keith Kaulum, ONR; Eugene Smith, NOAA; Don Heinrichs, NSF.

7:00 p.m. - Tuesday, June 9, 1992

Memorandum of Agreement (MOA). The ARC Subcommittee for review of the MOA (Jeff Fox, Dick Pittenger, Barrie Walden and Jack Bash) will meet with Federal Agency Representatives to discuss the status of the MOA renewal.

8:30 a.m. - Wednesday, June 10, 1992 - Iselin Marine Facility

ATLANTIS II Welcome Home Party. All are invited to attend a Welcome Home Party for ATLANTIS II at the Iselin Marine Facility, Woods Hole, Wednesday, June 10, 8:30 a.m. Jazz Band & Refreshments.

11:00 a.m. - Wednesday, June 10, 1992 - Carriage House

Schedule Recommendations for 1993. (1)ARC will develop 1993 schedule recommendations based on review of Dive Requests and operational/logistical information from WHOI. (2)WHOI will develop candidate schedule for ARC review based on those recommendations. (3)ARC review and final schedule recommendations will be balanced against NSF, ONR and NOAA program/budget structure to assure that each agency's critical needs are met.

MOA Update. Discussion on status of the NOAA-NSF-ONR tripartite MOA for support of ALVIN. Review draft recommendations prepared by ARC Subcommittee (enclosure 1).

ARC Terms of Reference. Review/Accept draft Terms of Reference (enclosure 2). Discuss strategies for implementing the new terms.

ALVIN Equipment and Instrumentation. Discuss method in which to facilitate dialog between ARC and user community on recommendations for ALVIN technology upgrades.

8:30 a.m. - Thursday, June 11, 1992 - Carriage House

Fall Workshop. A fall workshop is being planned to solicit thoughts from the community on equipment and instrumentation, global expedition strategy and related concerns.

Assessment of ALVIN Comments. Discuss method by which ARC can collect, review and assess comments from ALVIN users on a yearly basis and identify themes that warrant attention by the WHOI ALVIN group.

Global ALVIN Expedition. Jack Bash will provide an update on the status of efforts to generate interest in a Global Expedition. Discussion on this concept and review of correspondences (enclosure 3).

ATLANTIS II/KNORR Conversion. Form a sub-committee to work with FIC to evaluate the conversion of KNORR to a support ship for ALVIN.

ALVIN Archiving. Update on the status of WHOI's proposal for preserving ALVIN's scientific film footage.

SEA CLIFF Proposal Review. Garry Brass will report on the SEA CLIFF proposal review held in Washington, D.C. on 18-19 May.

Recommendations for New ARC Members. Terms for Feenan Jennings, Doug Nelson, and Gary Taghon expire. A resignation from the committee effective immediately has been received from Dave Cacchione. Gary Taghon will be eligible for re-appointment. The committee will also most likely need to expand to assume the additional responsibilities for undersea technology as defined by the terms of reference. New ARC recommendations/re-appointment of new members for their positions.

Planning for 1994 and beyond. A planning meeting in San Francisco (Sunday before AGU fall meeting?) Suggestions for agenda.

Adjourn at Noon on June 11, 1992.

UNOLS Review Committee for DSRV ALVIN

Rev. 6/92

(First Meeting 2/19/75)

1975

		Term Expires
A.F.	Richards, Chair, Lehigh	7/78
C.L.	Drake, Dartmouth	7/76
G.D.	Grice, WHOI	7/78
R.R.	Hessler, Scripps	7/77
G.H.	Keller, NOAA/AOML	7/77
S.	Murphy, U/Wash	7/76
C.	Rooth, RSMAS	7/76
K.K.	Turekian, Yale	7/78
T.J.	van Andel, Stanford	7/77
A.E.	Maxwell, WHOI, ex-officio	

1976

		Term Expires
A.F.	Richards, Chair, Lehigh	7/78
R.W.	Corell, UNH	7/79
M.C.	Gregg, U/Wash	7/79
G.D.	Grice, WHOI	7/78
D.E.	Hayes, L-DGO	7/79
R.R.	Hessler, Scripps	7/77
G.H.	Keller, OSU	7/77
K.K.	Turekian, Yale	7/78
T.J.	van Andel, Stanford	(resigned 9/76)
A.E.	Maxwell, WHOI, ex-officio	

1977

		Term
R.W.	Corell, Chair, UNH	7/76-6/79
J.B.	Corliss, OSU	7/77-6/80
M.C.	Gregg, U/Wash	7/76-6/79
G.D.	Grice, WHOI	2/75-6/78
D.E.	Hayes, L-DGO	7/76-6/79
A.F.	Richards, Lehigh	2/75-6/78
K.K.	Turekian, Yale	2/75-6/78
R.D.	Turner, Harvard	7/77-6/80
A.E.	Maxwell, WHOI, ex-officio	

1978

		Term
R.W.	Corell, Chair, UNH	7/76-6/79
J.B.	Corliss, OSU	7/77-6/80
J.M.	Edmond, MIT	7/78-6/81
M.C.	Gregg, U/Wash	7/76-6/79
D.E.	Hayes, L-DGO	7/76-6/79
K.C.	Macdonald, Scripps	7/78-6/81
D.C.	Rhoads, Yale	7/78-6/81
R.D.	Turner, Harvard	7/77-6/80
A.E.	Maxwell, WHOI, ex-officio	

1979

		Term
R.W.	Corell, Chair, UNH	7/76-6/82
R.N.	Anderson, L-DGO	7/79-6/82
J.B.	Corliss, OSU	7/77-6/80
J.M.	Edmond, MIT	7/78-6/81
K.C.	Macdonald, Scripps	7/78-6/81
D.C.	Rhoads, Yale	7/78-6/81
R.D.	Turner, Harvard	7/77-6/80
M.	Wimbush, URI	7/79-6/82
A.E.	Maxwell, WHOI, ex-officio	

1980

		Term
R.W.	Corell, Chair, UNH	7/76-6/82
R.N.	Anderson, L-DGO	7/79-6/82
J.M.	Edmond, MIT	7/78-6/81
D.E.	Karig, Cornell	7/80-6/83
K.C.	Macdonald, UCSB	7/78-6/81
D.C.	Rhoads, Yale	7/78-6/81
G.T.	Rowe, Brookhaven	7/80-6/83
M.	Wimbush, URI	7/79-6/82
A.E.	Maxwell, WHOI, ex-officio	

1981

		Term
R.W.	Corell, Chair, UNH	7/76-6/82
R.C.	Aller, U/Chicago	7/81-6/84
R.N.	Anderson, L-DGO	7/79-6/82
D.E.	Karig, Cornell	7/80-6/83
G.T.	Rowe, Brookhaven	7/80-6/83
F.L.	Sayles, WHOI	7/81-6/84
M.	Wimbush, URI	7/79-6/82
A.A.	Yayanos, Scripps	7/81-6/84
G.D.	Grice, WHOI, ex-officio	

1982

		Term
R.W.	Corell, Chair, UNH	7/82-6/85
R.C.	Aller, U/Chicago	7/81-6/84
J.K.	Weissel, L-DGO	7/82-6/85
D.E.	Karig, Cornell	7/80-6/83
G.T.	Rowe, Brookhaven	7/80-6/83
F.L.	Sayles, WHOI	7/81-6/84
M.	Wimbush, URI	7/82-6/85
A.A.	Yayanos, Scripps	7/81-6/84
G.D.	Grice, WHOI, ex-officio	

1983

		Term
R.W.	Corell, Chair, UNH	7/76-6/85
R.C.	Aller, U/Chicago	7/81-6/84
P.A.	Jumars, U/Wash	7/83-6/86
D.E.	Karig, Cornell	7/80-6/86
F.L.	Sayles, WHOI	7/81-6/84
J.K.	Weissel, L-DGO	7/82-6/85
M.	Wimbush, URI	7/79-6/85
A.A.	Yayanos, Scripps	7/81-6/84
G.D.	Grice, WHOI, ex-officio	

1984

		Term
R.W.	Corell, Chair, UNH	7/76-6/85
J.K.	Cochran, SUNY/Stony Brook	7/84-6/87
J.W.	Deming, Johns Hopkins	7/84-6/87
P.A.	Jumars, U/Wash	7/83-6/86
D.E.	Karig, Cornell	7/80-6/86
G.	Thompson, WHOI	7/84-6/87
J.K.	Weissel, L-DGO	7/82-6/85
M.	Wimbush, URI	7/79-6/85
G.D.	Grice, WHOI, ex-officio	

UNOLS Review Committee
for DSRV ALVIN

1985

		Term
R.W.	Corell, Chair, UNH	7/76-6/88
J.K.	Cochran, SUNY/Stony Brook	7/84-6/87
J.W.	Deming, Johns Hopkins	7/84-6/87
P.A.	Jumars, U/Wash.	7/83-6/86
D.E.	Karig, Cornell	7/80-6/86
W.	Ryan, L-DGO	7/85-6/88
G.	Thompson, WHOI	7/84-6/87
G.L.	Weatherly, FSU	7/85-6/88
G.D.	Grice, WHOI, ex-officio	

1986

		Term
R.W.	Corell, Chair, UNH	7/76-6/88
J.K.	Cochran, SUNY/Stony Brook	7/84-6/87
J.W.	Deming, Johns Hopkins	7/84-6/87
J.	Eckman, Skidaway	7/86-6/89
D.E.	Karig, Cornell	7/80-6/89
W.	Ryan, L-DGO	7/85-6/88
G.	Thompson, WHOI	7/84-6/87
G.L.	Weatherly, FSU	7/85-6/88
G.D.	Grice, WHOI, ex-officio	

1987

		Term
F.D.	Jennings, Chair, TAMU	7/87-6/90
J.K.	Cochran, SUNY/Stony Brook	7/84-6/87
J.W.	Deming, Johns Hopkins	7/84-6/87
J.	Eckman, Skidaway	7/86-6/89
D.E.	Karig, Cornell	7/80-6/89
W.	Ryan, L-DGO	7/85-6/88
G.	Thompson, WHOI	7/84-6/87
G.L.	Weatherly, FSU	7/85-6/88
G.D.	Grice, WHOI, ex-officio	

1988

		Term
F.D.	Jennings, Chair, TAMU	7/87-6/90
J.	Eckman, Skidaway	7/86-6/89
J.C.	Casey Moore, UCSC	7/87-6/90
D.C.	Nelson, UC/Davis	7/87-6/90
W.	Ryan, L-DGO	7/85-6/88
M.I.	Scranton, SUNY/Stony Brook	7/87-6/90
G.	Thompson, WHOI	7/84-6/90
G.L.	Weatherly, FSU	7/85-6/88
G.D.	Grice, WHOI, ex-officio	

1989

		Term
F.D.	Jennings, Chair, TAMU	7/87-6/90
D.A.	Cacchione, USGS	7/88-6/91
J.	Eckman, Skidaway	7/86-6/89
P.J.	Fox, URI	7/88-6/91
J.C.	Casey Moore, UCSC	7/87-6/90
D.C.	Nelson, UC/Davis	7/87-6/90
M.I.	Scranton, SUNY/Stony Brook	7/87-6/90
G.	Thompson, WHOI	7/84-6/90
G.D.	Grice, WHOI, ex-officio	

1990

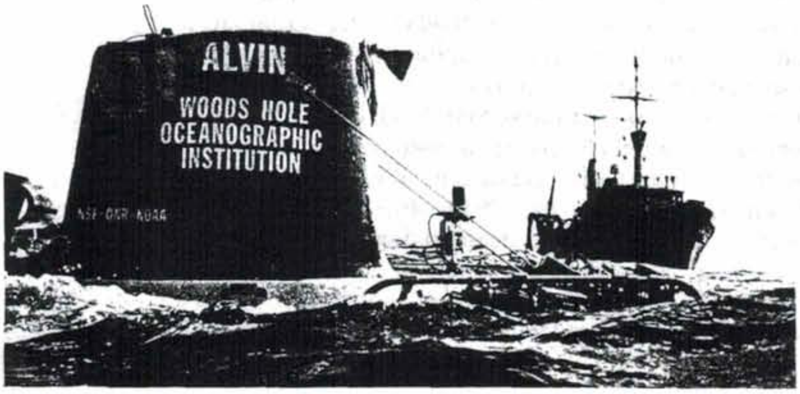
		Term
F.D.	Jennings, Chair, TAMU	7/87-6/90
D.A.	Cacchione, USGS	7/88-6/91
P.J.	Fox, URI	7/88-6/91
J.C.	Casey Moore, UCSC	7/87-6/90
D.C.	Nelson, UC/Davis	7/87-6/90
M.I.	Scranton, SUNY/Stony Brook	7/87-6/90
G.	Taghon, OSU	7/89-6/92
G.	Thompson, WHOI	7/84-6/90
G.D.	Grice, WHOI, ex-officio	

1991

		Term
F.D.	Jennings, Chair, TAMU	7/87-6/92
D.A.	Cacchione, USGS	7/88-6/91
P.J.	Fox, URI	7/88-6/91
J.C.	Casy Moore, UCSC	7/87-6/93
D.C.	Nelson, UC/Davis	7/87-6/92
M.I.	Scranton, SUNY/Stony Brook	7/87-6/93
G.	Taghon, OSU	7/89-6/92
K.L.	Von Damm, ORNL	7/90-6/93
R.	Pittinger, WHOI, ex-officio	

1992

		Term
F.D.	Jennings, Chair, TAMU	7/87-6/92
D.A.	Cacchione, USGS	7/88-6/94
P.J.	Fox, URI	7/88-6/94
J.C.	Casy Moore, UCSC	7/87-6/93
D.C.	Nelson, UC/Davis	7/87-6/92
M.I.	Scranton, SUNY/Stony Brook	7/87-6/93
G.	Taghon, OSU	7/89-6/92
K.L.	Von Damm, ORNL	7/90-6/93
R.	Pittinger, WHOI, ex-officio	



Welcome Home, *Atlantis II* and *Alvin*!

The Woods Hole Oceanographic Institution's Research Vessel *Atlantis II* and Deep Submergence Vehicle *Alvin* will return to Woods Hole June 10, 1992, completing one of the longest scientific voyages in Institution history.

A Homecoming Celebration is planned for the arrival of the ship and sub in Woods Hole June 10. A brief pierside program and Open House aboard *Atlantis II* for the WHOI community will follow their arrival. Due to limited parking in the village, shuttles will bring staff and guests from the Quissett Campus to Woods Hole. Please plan to arrive at the pier at least 45 minutes before the scheduled ship-arrival time to enjoy refreshments and special musical entertainment, a performance of Falmouth's award-winning Morse Pond School Hot Jazz Band.

Voyage #125 began December 29, 1989, when the vessels left the Institution pier to begin the first of 44 legs (37 scientific, 7 transit), most in the Pacific Ocean. During the voyage *Atlantis II* was away from Woods Hole a record 894 days and at sea 575 days. *Alvin* made 368 dives: 145 for geology, 120 for biology, 86 for geochemistry, 10 for engineering and 7 for search/recovery. Much of the ship's and sub's time was spent on hydrothermal vent research along the Mid-Ocean Ridge in the eastern Pacific. Fifty-one chief scientists and hundreds of scientific personnel from organizations throughout the U.S. and from other nations participated in the voyage.

Port calls (in alphabetical order) were made at Acapulco, Mexico; Astoria, Oregon; Ft. Lauderdale, Florida; Galveston, Texas; Guayaquil, Ecuador; Guaymas, Mexico; Jacksonville, Florida; Manzanillo, Mexico; Pensacola, Florida; Puntarenas, Costa Rica; San Diego, California; Seattle, Washington; and Tampa, Florida.

Highlights of the voyage include the first use of a rock drill from *Alvin*, the first female pilot, the 2,500th dive, recovery of the U.S. Navy's remotely operated vehicle CURV III, and a shore-to-ship-to *Alvin*, on-the-bottom telephone interview with National Public Radio. The crew can tell you about other highlights!

For latest information on arrival time, call ext. 2122 (outside WHOI call 508-457-2122).

Please join us June 10 in welcoming home *Atlantis II* and *Alvin*!

Research Vessel *Atlantis II*, named for the Woods Hole Oceanographic Institution's first research vessel, was designed by the Bethlehem Steel Company's Central Technical Department, Shipbuilding Division, in Quincy, Massachusetts. Design Associate was M. Rosenblatt and Son of New York City. The ship was built by the Maryland Shipbuilding Company of Baltimore, Maryland, in 1961 under a grant from the National Science Foundation and commissioned in 1963. *Atlantis II* has worked in all disciplines, traveling the world's oceans in all weather, from the fringe ice of both poles to the equatorial tropics. In 1979 the ship underwent a major mid-life refit and overhaul and was converted from steam to diesel power to reduce operating costs and increase its range and selection of ports. In 1983 *Atlantis II* was converted to handle the manned submersible *Alvin*. Conversion included the installation of a deck hangar and a large stern A-frame for *Alvin* launch and recovery.

Some Operating Characteristics:

Length overall:	210 feet	**Draft:**	17 feet
Displacement:	2,300 long tons	**Beam:**	44 feet
Maximum Speed:	12 knots	**Endurance:**	35 days
Cruising Speed:	10.5 knots	**Complement:**	28 officers and crew, 19 scientists, 9 *Alvin* crew
Cruising Range:	9,000 nautical miles		

The Deep Submergence Vehicle *Alvin* has served the American ocean research community since 1964. The sub has made more than 2,500 dives to depths over one mile in its early career and to more than two miles in recent years. Early proof of *Alvin*'s worth was provided in 1966 when a U.S. hydrogen bomb accidentally lost off the coast of Spain in an airplane collision was located by the submersible. Demand for submersible research followed, and *Alvin* now makes an average of 175 dives per year. Funds for the construction of *Alvin* were provided by the Office of Naval Research; the Bureau of Ships of the U.S. Navy assisted in the preparation of performance specifications for the sub's design and construction, and the Applied Sciences Division of Litton Industries (formerly the Electronics Division of General Mills, Inc.) designed and built the original vehicle.

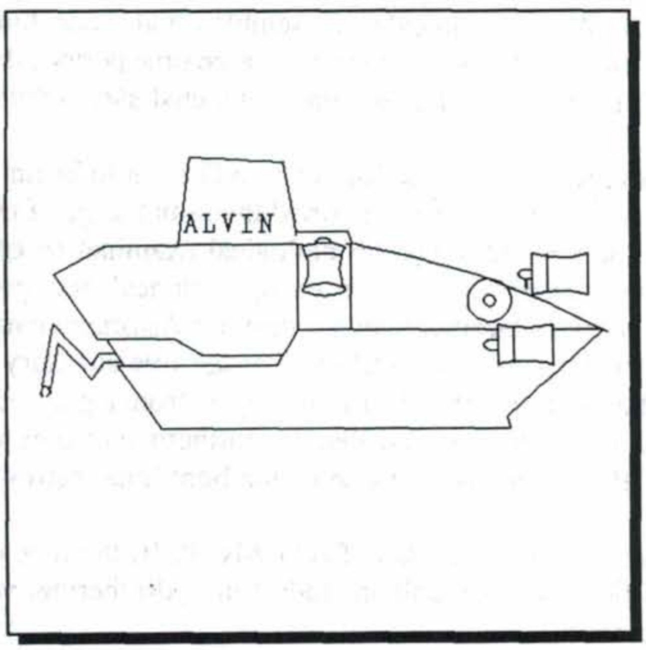
Alvin's original seven-foot-diameter pressure sphere of high-strength steel for operational depths to 6,000 feet was replaced in 1973 with a nearly two-inch-thick titanium alloy hull provided by the Naval Ship Systems Command. The titanium hull doubled the vehicle's capabilities without increasing its weight. The pressure sphere accommodates a pilot and two scientific observers as well as instrumentation and life support equipment for endurance up to 72 hours. In 1978 *Alvin*'s 23-foot aluminum frame was replaced with a titanium frame and a second manipulator installed. In 1983 *Alvin*'s frame was modified to allow for a single-point lift from the top for the new launch/recovery system aboard support vessel *Atlantis II*, and in 1986 six thrusters replaced the large stern and two small side propellers. DSV *Alvin* is considered the most active of the six deep-diving manned submersibles in existence worldwide.

Some Operating Characteristics

Length:	23 feet	**Displacement:**	18 tons
Beam:	8 feet	**Endurance:**	72 hours
Draft:	7 feet surfaced	**Normal Dive Duration:**	6-10 hours
Full Speed:	2 knots	**Depth Capacity:**	4,000 meters (13,124 feet)
Cruising Speed:	1 knot		

DSV ALVIN Statistics

1991-92



Submersible Engineering and Operations Laboratory
Woods Hole Oceanographic Institution

1991 began with a non-ALVIN geophysical cruise to the East Pacific Rise while the submersible remained in San Diego undergoing maintenance. The diving season opened in February in the Santa Catalina Basin where studies of whale bone biological communities were conducted. Following a transit to the Gulf of California, diving continued in the Guaymas Basin in support of hydrothermal vent system experiments. From there the ship and submersible returned to the East Pacific Rise for two lengthy studies of hydrothermal, volcanological and geochemical processes near ODP drill sites and the Siqueiros Transform. After transit back to San Diego in late May, ALVIN entered a maintenance period in which the main batteries were replaced and a Navy certification audit was successfully completed.

One week prior to the end of the scheduled maintenance period, the ALVIN Group was requested to assist the Navy in the recovery of its CURV III ROV work system, lost off the coast of southern California. ALVIN was quickly reassembled and made four search dives before finally recovering the vehicle on July 1st. During this same time period, the originally scheduled six science dives on the Fieberling Seamount were completed successfully.

Following the recovery, the ship headed north to Oregon to begin a season of operations on the Juan de Fuca Ridge. The first cruise supported the initial stage of interdisciplinary studies of hydrothermal flange evolution, followed by biological examination of mollusc populations. A NOAA Vents Program cruise followed, featuring chemical and geological work on the southern ridge. The second hydrothermal flange cruise left Astoria in early September for work on the northern segment of the ridge. During this voyage five auxiliary dives were conducted to support ONT experiments and to obtain data and samples from a previously instrumented ODP bore hole. The last Ridge leg of the year revisited the northern vent sites for isotope experiments and also revisited the ODP site for maintenance of the bore hole instrumentation.

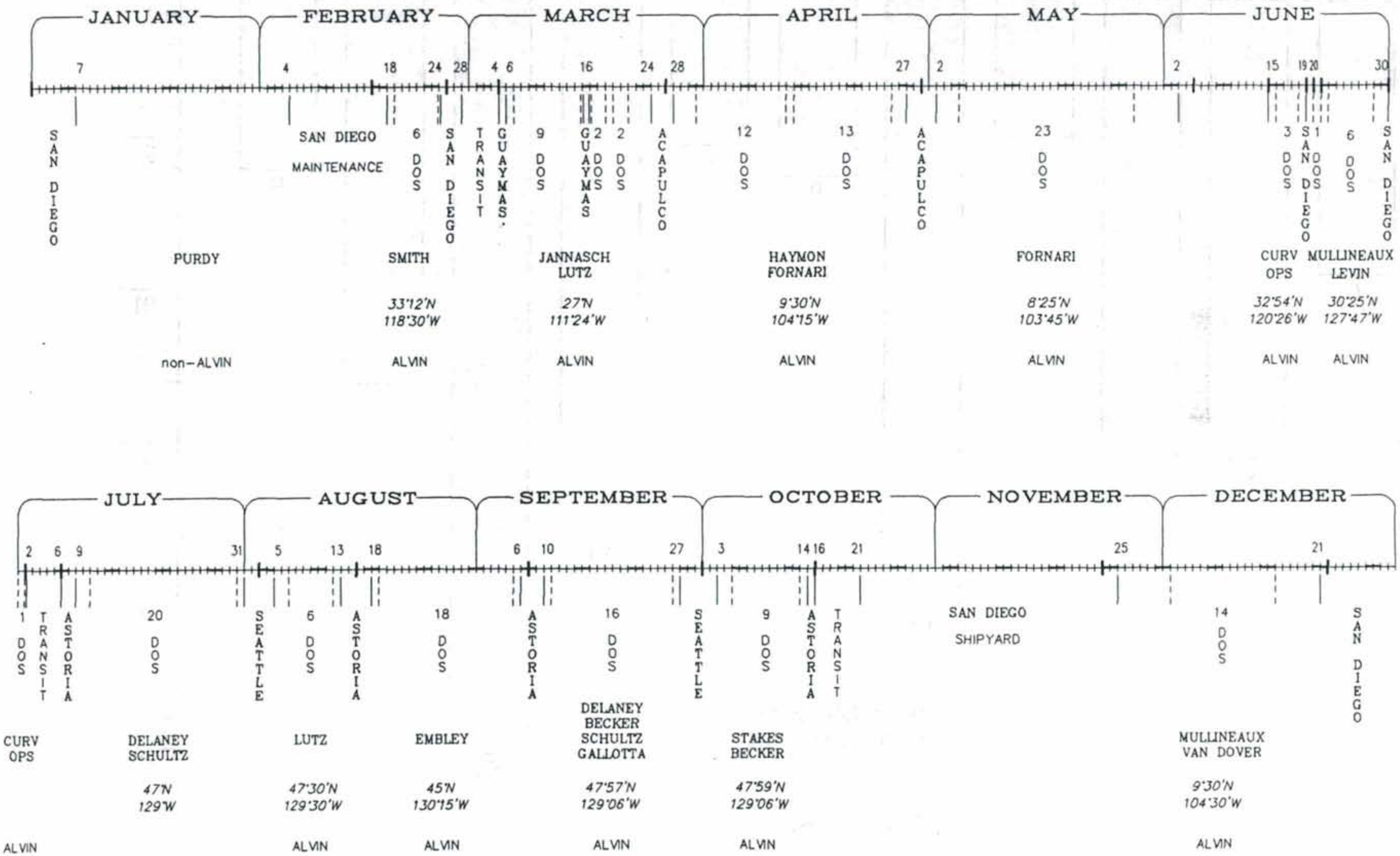
After a month-long shipyard overhaul of ATLANTIS II, the final cruise of the 1991 dive year visited the East Pacific Rise for plankton studies in hydrothermal vent plumes.

R/V ATLANTIS II & ALVIN OPERATIONS

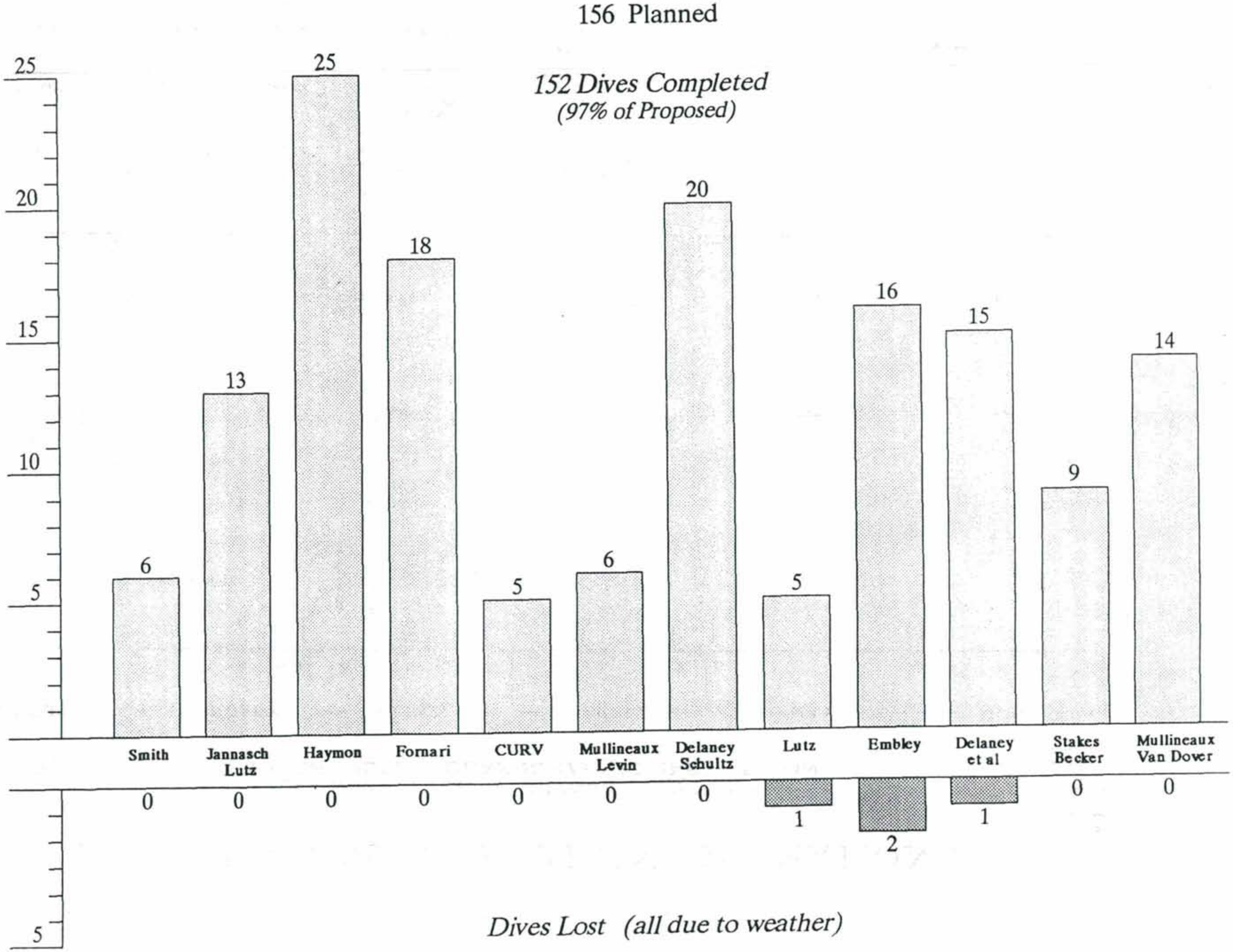
31 DEC 91
~~22 OCT 91~~
~~15 OCT 91~~
~~4 JUNE 91~~
~~26 FEB 91~~
~~8 FEB 91~~
~~3 OCT 90~~

1991

OPERATIONAL SCIENTIFIC SERVICES
WOODS HOLE OCEANOGRAPHIC INSTITUTION



1991 ALVIN DIVES



DSV ALVIN VOYAGE STATISTICS FOR 1991

ATLANTIS II VOYAGE NO.	ON STATION	AREA OF OPERATION NUMBER OF DIVES	DISCIPLINE	CHIEF SCIENTIST(S)	DAYS AT SEA	ALVIN DIVE NUMBERS
125–XX	19 Feb – 24 Feb	Santa Catalina Basin 6 dives	Biology	Craig Smith – UHawaii	7	2331–2336
125–XXI	29 Feb – 04 Mar	Transit to Guaymas			5	
125–XXII	07 Mar – 15 Mar	Guaymas Basin 8 dives	Biology	Holger Jannasch – WHOI	10	2337–2344
125–XXIII	16 Mar – 21 Mar	Guaymas Basin East Pacific Rise 5 dives	Biology	Holger Jannasch – WHOI Richard Lutz – Rutgers	10	2345–2349
125–XXIV	31 Mar – 25 Apr	East Pacific Rise 25 dives	Geochemistry	Rachel Haymon – UCSB Danial Fornari – LDGO	31	2350–2374
125–XXV	05 May – 27 May	East Pacific Rise 18 dives	Geology	Danial Fornari – LDGO	32	2375–2392
125–XXVI	16 Jun – 18 Jun	Channel Islands Basin 3 dives	CURV Search	NAVSEA	5	2393–2395
125–XXVII	21 Jun – 28 Jun	Channel Islands Basin 1 dive	CURV Search	NAVSEA	2	2396
		Fieberling Seamount 6 dives	Biology	Lauren Mullineaux – WHOI	9	2397–2402
125–XXVIII	01 Jul – 06 Jul	Channel Islands Basin 1 dive	CURV Recovery	Barrie Walden – WHOI	2	2403
		Transit to Astoria			5	
125–XXIX	11 Jul – 30 Jul	Juan de Fuca Ridge 20 dives	Geology	John Delaney – UW Adam Schultz – UW	23	2404–2423
125–XXX	07 Aug – 12 Aug	Juan de Fuca Ridge 5 dives	Biology	Richard Lutz – Rutgers	9	2424–2428
125–XXXI	19 Aug – 05 Sep	Juan de Fuca Ridge 16 dives	Geochemistry	Robert Embley – NOAA	20	2429–2444
125–XXXII	11 Sep – 26 Sep	Juan de Fuca Ridge 15 dives	Geology	John Delaney – UW Adam Schultz – UW Keir Becker – UMiami Richard Gallotta – ONT	18	2445–2459
125–XXXIII	05 Oct – 13 Oct	Juan de Fuca Ridge 9 dives	Geology	Debra Stakes – USCar Keir Becker – UMiami	12	2460–2468
125–XXXIV	16 Oct – 21 Oct	Transit to San Diego			6	
125–XXXV	02 Dec – 15 Dec	East Pacific Rise 14 dives	Biology	Lauren Mullineaux – WHOI Cindy Van Dover – WHOI	27	2469–2482

Total Days at Sea: 233 Dives: 152

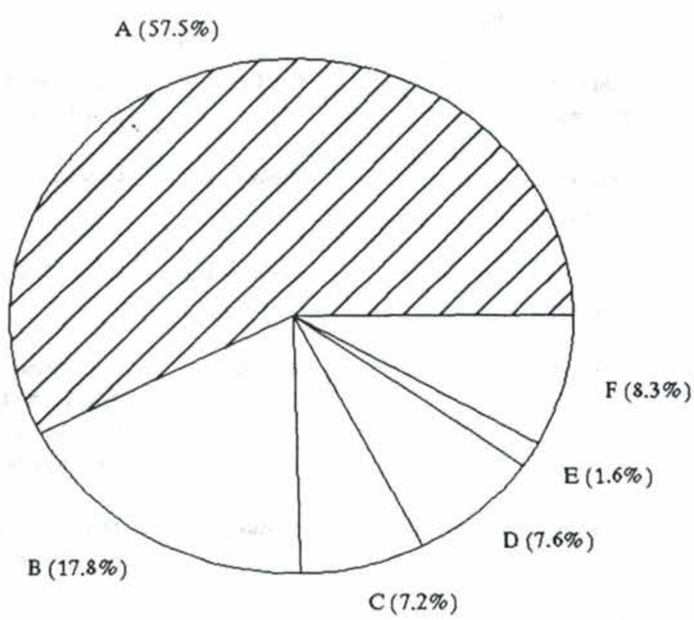
ALVIN Operations Proposal Summary

Year:	1991	**Number of Cruises:**	12
Day Rate:	$7,590	**Operational Days:**	
		Assigned	250
Operating Costs:	$1,836,780	***Days on Station***	162
Dives Proposed:	156		
Dives Accomplished:	152		

Proposal Breakdown

A) Salaries and Wages	1,056,243
B) Facilities/Insurance/Indirect	327,205
C) Direct Dive Costs	131,332
D) Line Items	140,385
E) Non−Specific Repairs/Replacements	30,000
F) Miscellaneous	151,615

Communications	10,000	Medical Exams	3,500
Publications	3,500	Film Processing	33,150
Shipping/Postage	15,545	ALNAV Support	22,500
Agent Fees	2,500		
Travel	60,920		



The first cruise of 1992 in early February gave the ALVIN Operations team a rare chance to conduct a series of engineering test dives off San Diego. Experts in the photographic, underwater video and acoustic fields were invited to participate in five shallow dives to recommend improvements in ALVIN's capabilities. Experiments included calibration of the still camera fields of view, evaluation of a new generation of video lighting and qualitative analysis of optimum light configurations, exposure tests for various cameras, application testing of a low-cost fathometer, and vehicle attitude/performance analysis. Extensive testing of the sub's hydraulic system resulted in corrective measures designed to bring performance up to advertised capability. Constructive external input from industry participants has already fostered interest in both real-time. 3-D graphical display of ALVIN's position in a navigated volume and the potential for "video inertial navigation" from computer processing of video images.

Scientific dives began on the East Pacific Rise in late February, where a multi-institutional team of investigators studied hydrothermal and geochemical processes in support of Ocean Drilling Program work. The rise area at 9°N had been found to be active during a late-1991 dive series, so experiments during this cruise provided an unusual temporal look at vent processes. Late in March, the Rise at 21°N was the site of geochemical sampling of hydrothermal fields, and in April scientists returned to the Rise at 10°N to complete experiments initiated with the French submersible NAUTILE in 1991.

Following a transit through the Panama Canal in early May, ALVIN and ATLANTIS II made a port call in Galveston before beginning studies of chemosynthetic ecosystems at two sites in the Gulf of Mexico. Two dives were made for specimen collection at the West Florida Escarpment cold seeps, and the final dive of Voyage 125 allowed a video transect of megafaunal habitats on the Continental Rise near Block Canyon. The ship and sub return to Woods Hole on June 10th after 575 days at sea, 367 dives and 894 days away from home port.

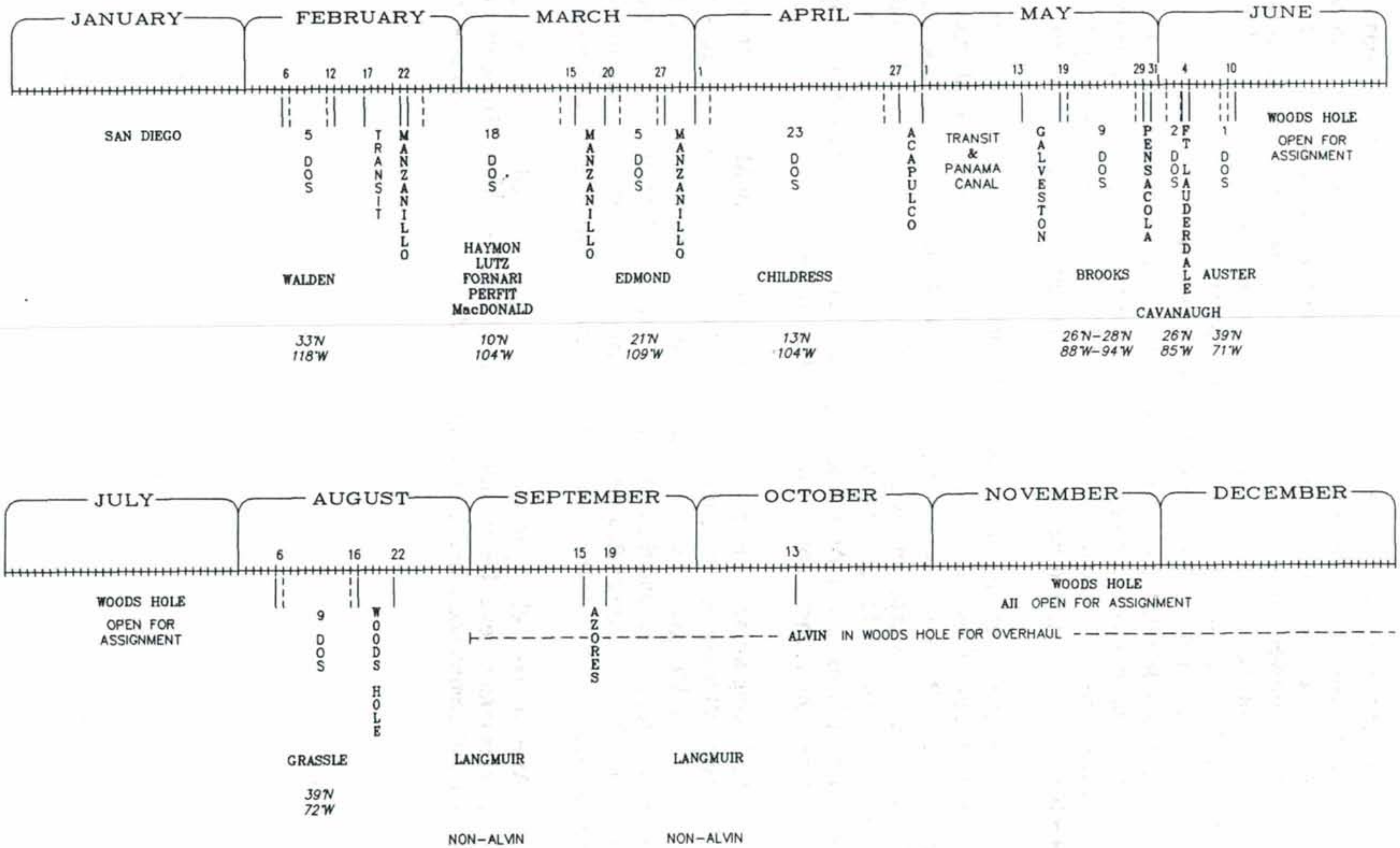
After a six-week layup the vessels will depart WHOI in early August for studies of biological communities at Deepwater Dumpsite 106 off New York. Upon return to Woods Hole, ALVIN will commence a major overhaul, with diving scheduled to resume in March, 1993.

R/V ATLANTIS II & ALVIN OPERATIONS

1992

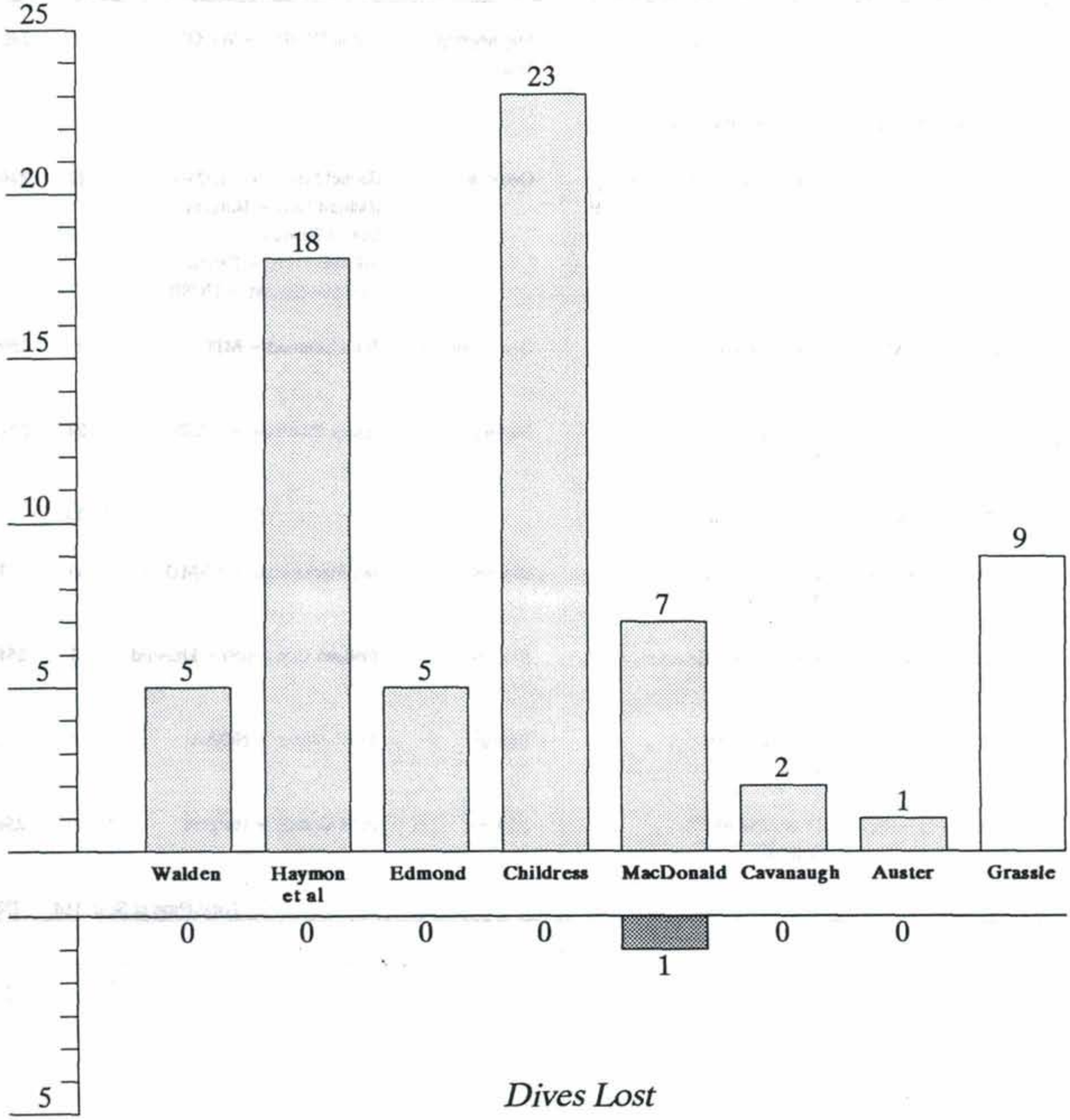
OPERATIONAL SCIENTIFIC SERVICES
WOODS HOLE OCEANOGRAPHIC INSTITUTION

14 MAY 92
~~27 FEB 92~~
~~28 JAN 92~~
~~9 JAN 92~~
~~4 DEC 91~~
~~16 OCT 91~~
~~25 SEP 91~~



1992 ALVIN DIVES

70 Planned



DSV ALVIN VOYAGE STATISTICS FOR 1992

ATLANTIS II VOYAGE NO.	ON STATION	AREA OF OPERATION NUMBER OF DIVES	DISCIPLINE	CHIEF SCIENTIST(S)	DAYS AT SEA	ALVIN DIVE NUMBERS
125–XXXVI	7 Feb – 11 Feb	San Pedro Channel 5 dives	Engineering Tests	Barrie Walden – WHOI	7	2483–2487
125–XXXVII	17 Feb – 21 Feb	Transit to Manzanillo			5	
125–XXXVIII	24 Feb – 13 Mar	East Pacific Rise – 10N 18 dives	Geology	Rachel Haymon – UCSB Richard Lutz – Rutgers Danial Fornari – LDGO Michael Perfit – Florida Ken MacDonald – UCSB	22	2488–2505
125–XXXIX	22 Mar – 26 Mar	East Pacific Rise – 21N 5 dives	Geochemistry	John Edmond – MIT	8	2506–2510
125–XL	3 Apr – 25 Apr	East Pacific Rise – 12N 23 dives	Biology	James Childress – UCSB	27	2511–2533
125–XLI	1 May – 13 May	Transit to Galveston			13	
125–XLII	20 May – 28 May	Gulf of Mexico 7 dives	Biology	Ian MacDonald – TAMU	11	2534–2540
125–XLIII	2 Jun – 3 Jun	West Florida Escarpment 2 dives	Biology	Colleen Cavanaugh – Harvard	5	2541–2542
125–XLIV	9 Jun	Block Canyon 1 dive	Biology	Peter Auster – NOAA	5	2543
126 (Planned)	7 Aug – 15 Aug	Dumpsite 106 9 dives	Biology	Fred Grassle – Rutgers	11	2544–2554
					Total Days at Sea: 114	Dives: 70

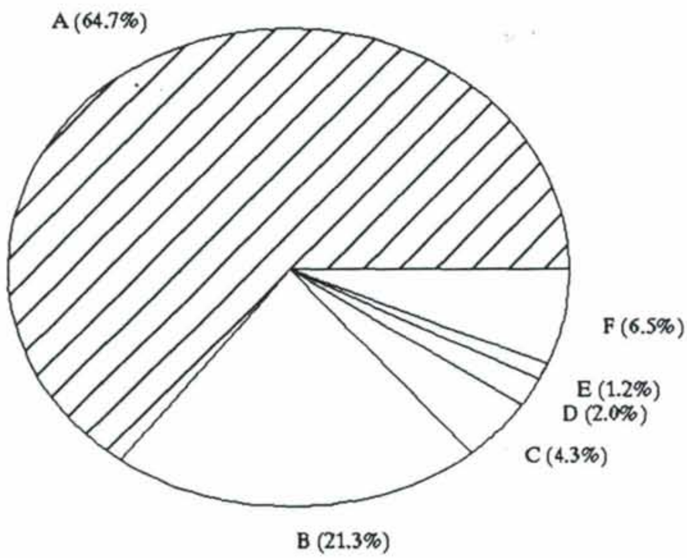
ALVIN Operations Proposal Summary

Year:	1992	**Number of Cruises:**	8
Day Rate:	$13,332	**Operational Days:**	
		Assigned	96
Operating Costs:	$1,439,856	***Days on Station***	71
Dives Proposed:	71		
Dives Accomplished:	61 (As of 6/9/92)		

Proposal Breakdown

A) Salaries and Wages	932,246
B) Facilities/Insurance/Indirect	307,005
C) Direct Dive Costs	61,881
D) Line Items	28,400
E) Non–Specific Repairs/Replacements	17,000
F) Miscellaneous	93,324

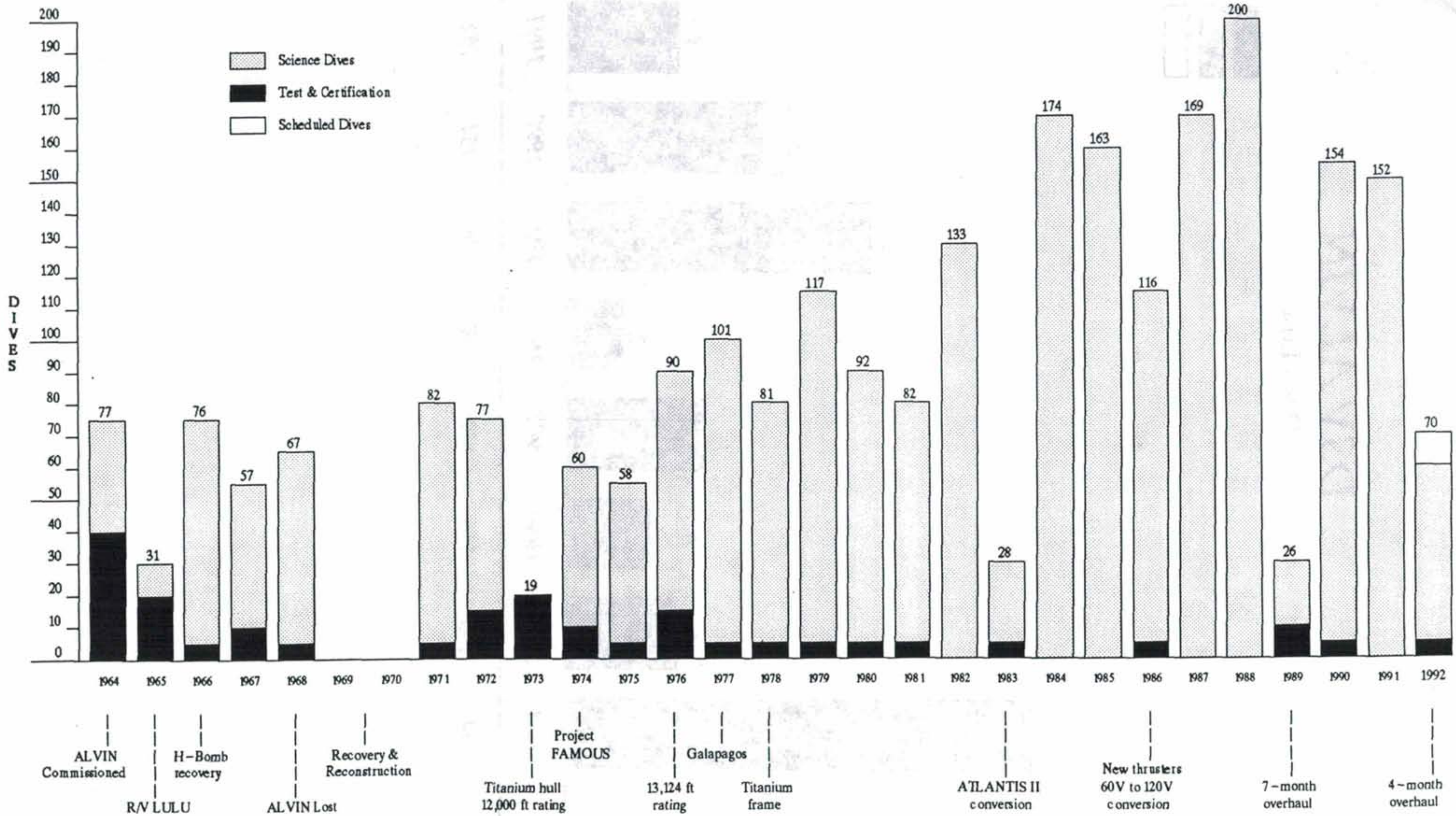
Communications	6,000	Medical Exams	1,500
Publications	3,000	Film Processing	34,960
Shipping/Postage	20,000	ALNAV Support	10,500
Agent Fees	2,500	Programming	500
Travel	14,364		



DSV-2 ALVIN DIVE STATISTICS

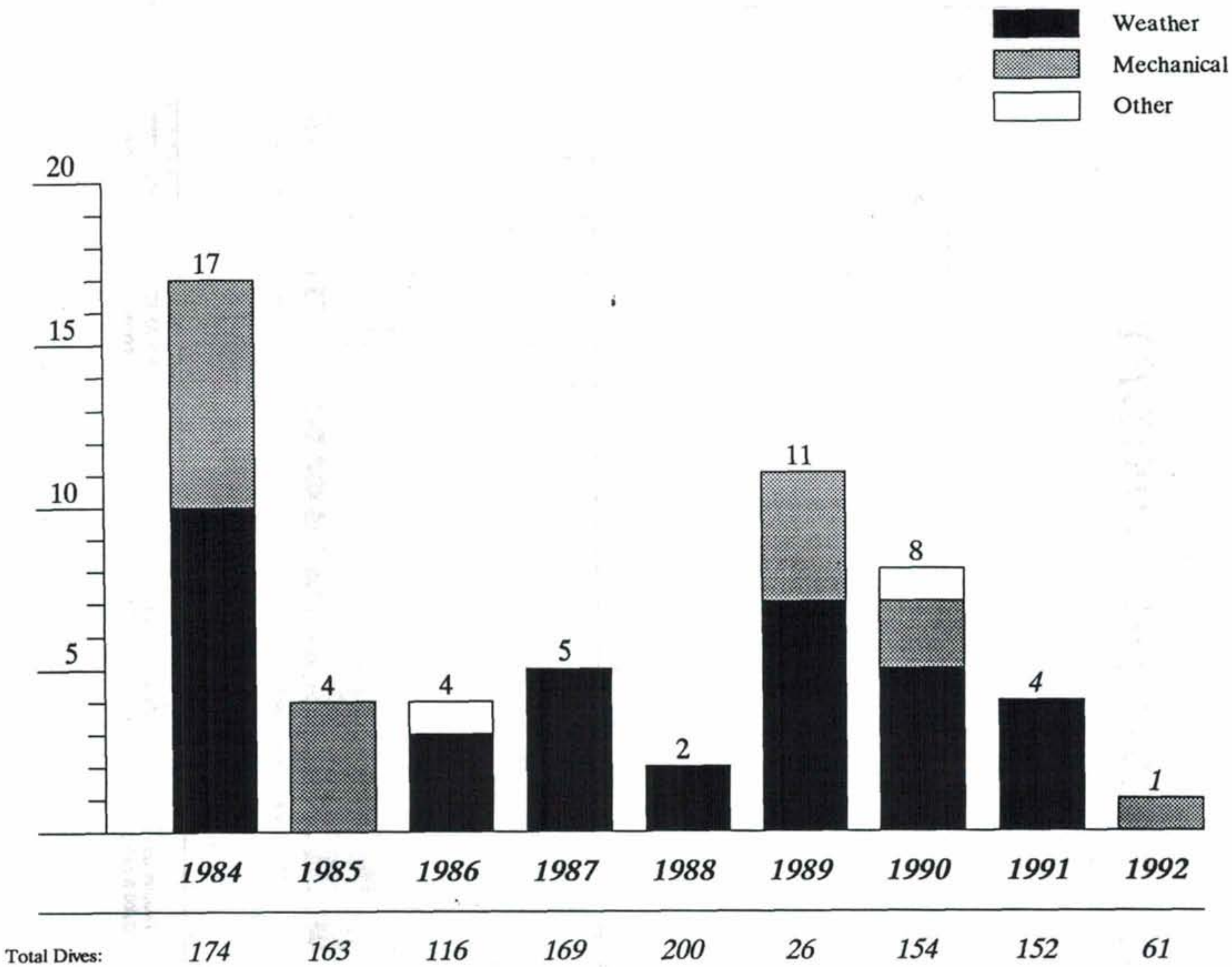
		1992 (6/4/92)	1964-92
Total Dives		58	2,540
Total Depth (meters)		137,963	4,872,707
Average Depth per Dive (meters)		2,379	1,918
Total Time Submerged (hours)		453	16,698
Average Time Submerged per Dive (hours)		7.81	6.57
Total Persons Carried		174	7,620
Dives for	*Geology/Geophysics*	18	1,021
	Biology	30	791
	Certification/INSURV	0	227
	Chemistry/Geochemistry	5	212
	Inspection/Search/Recovery	0	141
	Orientation	0	73
	Engineering and Equipment Tests	5	49
	Navy Test/Survey	0	26

DSV–2 ALVIN DIVE HISTORY



DSV ALVIN

Dives Lost



FEB '92 ALVIN ENGINEERING CRUISE HIGHLIGHTS

Crew Training
After a six week "stand down", the operational proficiency and safety awareness of the ALVIN and AII's crews were renewed. This resulted in a 100% functional team at the beginning of the first science program (an ambitious 18 dives at 9N)

Operation of ALVIN and the support systems
After an extended maintenance period, all ALVIN's systems and those of the support ship were tested and made fully operational, resulting in no lost time to the 9N science program.

Still camera grid calibration to improve photogrammetry
This information will be included in the Users Manual to allow users to scale their forward 35mm pictures.

Calibrate exposure settings for different camera elevations
This information will be used to change exposure and focus settings on the still cameras for different camera elevations. This will improve the picture results and increase user flexibility.

Extensive testing and evaluation of hydraulic system
This resulted in corrective measures to bring performance up to advertised capabilities.

Experimentation with down looking camera and lighting
This resulted in an outstanding altitude survey of 9N ASC, 12N EPR and photo mosaic of Alaminos Canyon dive area.

Evaluation of 1000 watt Metal Halide (HMI) lights
These are the same lights that were used on the MIR's for TITANIC IMAX filming. Loaned by cruise participants from Deep Sea Power and Light, the units provide a lot of light for special projects, but are unreliable in their present form. A 200 watt version is under development which may be more useful.

Miniature video camera evaluations
Prototype 1" diameter by 6" long color and B&W video cameras provided by DSP&L were tested. These have potential for application as rear view cameras and pilot/observer viewport area surveillance cameras.

Gather information for computer modeling of ALVIN lighting
This analysis by cruise participants from DSP&L may lead to better video lighting in the future.

Experimental evaluation of bottom marking systems for AUV tracking and photo/video transects
This information was used to determine the effectiveness of the "Bio-markers" to be deployed at 9N on the ASC.

Qualitative experiments for optimum video lighting configurations
Some of the improved quality of the video for the remainder of the 1992 dives was a direct the result of these tests.

Exposure tests with hand held cameras and comparative tests of high speed color print films
This information will be included in the Users Manual as a guide to correct exposure settings. This should increase the percentage of useable hand held pictures taken by the users.

Controlled transects and ascents/descents to gather ALVIN performance data

This information will be used to develop ALVIN performance characteristics. This information is important to evaluate the extent of possible bottom casualties such as flooded volumes or entanglement.

Evaluation of low cost consumer fathometer

Manufacturing and interfacing to ALVIN of a depth tolerant transducer, by cruise participant International Transducer, made this evaluation possible. Evaluation of these types of consumer products could lead to enhanced capabilities, lower costs, and higher reliability.

Evaluation of electrolytic tilt sensors

ALVIN attitude information in the data set is important to photogrammetry and computer generated 3-D graphics of the vehicle in space.

Evaluation of a freeze frame system

This was a prototype unit developed several years ago. Although the particular unit has relatively poor performance, the success of video photo-mosaic on the Brooks cruise was a direct result of these tests.

Comparative analysis of the new Osprey video camera with consumer Hi8 products

These tests established baseline information of performance and resulted in a decision to modify the video signal transmission into ALVIN for better quality video.

Gather data for evaluating 3-D graphics display of ALVIN

This information may lead to the capability to construct a computer/video model of a particular work volume. This work is the result of cruise participation by Silicon Graphics.

Gather data for evaluation of real time computer processing of video images

This capability could lead to real time photo-mosaics and a "video inertial navigation" system for continuous position information (unlike existing 15-30 second fixes). This work is the result of cruise participation by TAU Engineering, an engineering firm specializing in image processing.

6/8/92 DRAFT

THE JASON REMOTELY OPERATED VEHICLE SYSTEM

by Dr. Robert D. Ballard
Director, Center for Marine Exploration
Woods Hole Oceanographic Institution

INTRODUCTION

Prior to 1972, large-scale geophysical and geological investigations resulted in the emergence of a new global theory called Plate Tectonics which explained the structure and dynamics of the earth (ref. 1). Central to this theory is the Mid-Ocean Ridge (MOR); a 72,000-km (40,000-mile) long mountain range which is the largest feature on the earth (ref. 2). The MOR is of particular interest to earth scientists because it is along its axis that newly formed crustal material is being emplaced volcanically and subsequently rifted and transported laterally by tectonic forces associated with diverging crustal plates (ref. 3).

The geophysical measurement techniques used to define this global theory (i.e., gravity, heat flow, magnetics, seismology, and regional bathymetry) lacked the resolution necessary to delineate the detailed geological processes taking place along the rifted axis of the MOR.

Based on these large-scale investigations, however, it became clear in the mid-1970's that a better understanding of ridge axis processes required the application of traditional land-based field mapping techniques using manned submersibles (ref. 4).

The first major scientific program to investigate the MOR using manned submersibles was Project FAMOUS (French-American Mid-Ocean Undersea Study) and took place between 1972 and 1974 (ref. 5). The goal of this project was to use diving vehicles to address a number of important geological questions within the rift valley on a segment of the MOR called the Mid-Atlantic Ridge (MAR).

The three manned vehicles used during Project FAMOUS were the French bathyscaph ARCHIMEDE and the submersible CYANA as well as the American submersible ALVIN (ref. 6). In all, forty-two dives were made, which collected 1,360 kg (3,000 lbs.) of carefully selected rock samples and over 100,000 photographs along a network of precisely navigated geologic traverses across the rift valley and in the adjacent transform faults (ref. 6, 7). Project FAMOUS was a highly successful program that resulted in a number of important scientific articles and proved the value of manned submersible operations in the deep sea (ref. 7).

FAMOUS was followed in rapid succession by a series of equally important scientific expeditions using manned submersibles in the Cayman Trough (ref. 8), Galapagos Rift (ref. 9), and East Pacific Rise (EPR) (ref. 10) and on return trips to the MAR (ref. 11). These subsequent efforts resulted in major new discoveries in marine science including hydrothermal vent fields and their unique benthic communities in the Galapagos Rift (ref. 9) and polymetallic-sulfide deposits and "black smokers" on the EPR at 21° North (ref. 10).

This ten-year period from 1972 to 1981 was clearly the "decade of manned submersibles." But despite their many successes which continue to this day (ref. 12), manned submersibles have certain inherent technological characteristics that will always limit their ultimate efficiency.

An average dive on ALVIN, for example, results in three to four hours of actual bottom time (ref. 13). Manned presence also requires the submersible to be large and expensive for reasons of life support and safety and only one or two scientists can participate on each dive. A typical vehicle weighing twenty tons requires a large, expensive ship and sophisticated handling system. Space is also limited inside the pressure sphere which greatly reduces the supporting documentation a scientist can carry as well as instrumentation for data acquisition and analysis.

An average manned submersible expedition lasts 21 to 28 days, during which any one scientist in the science party may make 3 to 5 dives (ref. 13). In other words, three weeks to a month at sea will result, on average, in nine to fifteen hours on the bottom for each participating member.

Finally, it is important to point out that "manned" operations are not truly manned. Unlike the astronauts on the moon, a scientist cannot get out of the submersible and walk around on the bottom of the ocean using their hands freely to pick up samples or place instruments. An aquanaut is trapped inside the pressurized capsule, must look through a small window to see the outside world, and must use a mechanical arm to pick up samples or do desired manipulation. In other words, "manned" submersible operations are by definition partially "unmanned" at best.

Despite all these inherent limitations, the scientific community made the decision in the late 1970's and throughout the 1980's that taking a scientist to the bottom of the ocean was worth the expense given the unique contribution they could make in-situ. This decision proved wise and resulted in some of the most important discoveries ever made by marine scientists seeking to better understand the geology, geophysics, biology, and chemistry of the deep sea (ref. 7, 9, 10, 14).

By the early 1980's, however, new technological innovations made it possible to develop a new exploration vehicle system that would be neither manned nor unmanned but a hybrid of the two (i.e., a "teleoperated" system).

A teleoperated system permits an operator to control a vehicle from a distance by means of either a tether or acoustic link. A distributed control system permits the operator to change easily from full robotic control to manual control as well as a continous series of combinations between these two extremes (ref. 15).

Teleoperated systems are particularly useful in the deep sea since, as previously stated, the operator cannot leave the pressure sphere and work under ambient conditions. The basic question is, "Where is the person located when they are looking out the viewport or operating the manipulators?". Since manipulator commands can move back and forth between the operator and the end effectors at the speed of light, being situated in the pressure sphere or on the surface makes little difference. The correct question to ask is "Is the view the operator has of the environment they are working in superior from inside a manned submersible or can that view be replicated by a teleoperated vehicle system controlled from the surface?". Compared to the early unmanned vehicles like Deep-Tow and ANGUS used during Project FAMOUS (ref. 16,17), manned presence was clearly superior. Neither of these vehicles could be dynamically controlled to the precision necessary to carry out manipulation and the bandwidth of the data link of Deep-Tow would permit only a slow-scan black-and-white image to be transmitted to the surface.

By the early 1980's, however, the development of fiber-optic cables, digital low-light level imaging systems, and advances in robotics and control (ref. 18) made the development of an advanced teleoperated unmanned vehicle system possible.

JASON DEVELOPMENT PROGRAM

(Basic Design Constraints)

In 1982, the Deep Submergence Laboratory (DSL) was formed at the Woods Hole Oceanographic Institution (WHOI) to develop the first deep water teleoperated exploration vehicle system for the scientific community.

Funding for this integrated exploration vehicle came from three primary sources: the Office of Naval Research (ONR), the Office of Naval Technology (ONT), and the Deep Submergence Systems Division of the Deputy Chief of Naval Operations for Submarine Warfare (Op-23). Additional support came from the National Science Foundation (NSF) to partially fund the development of the fiber-optic cable technology and a shipboard dynamic positioning system.

Figure 1 illustrates the basic elements of the JASON system which includes a dynamically controlled surface ship, shipboard control center, fiber-optic wire and winch system, the MEDEA relay vehicle, the remotely operated vehicle JASON, a satellite link, and shore-based control and data processing center(s).

The short-term goal of this development program was to place the human operators in an advanced control center aboard ship connected by a high-bandwidth fiber-optic tether to the vehicles below. The long-term objective of the program, however, is to permit a larger network of scientists to have full participation in the at-

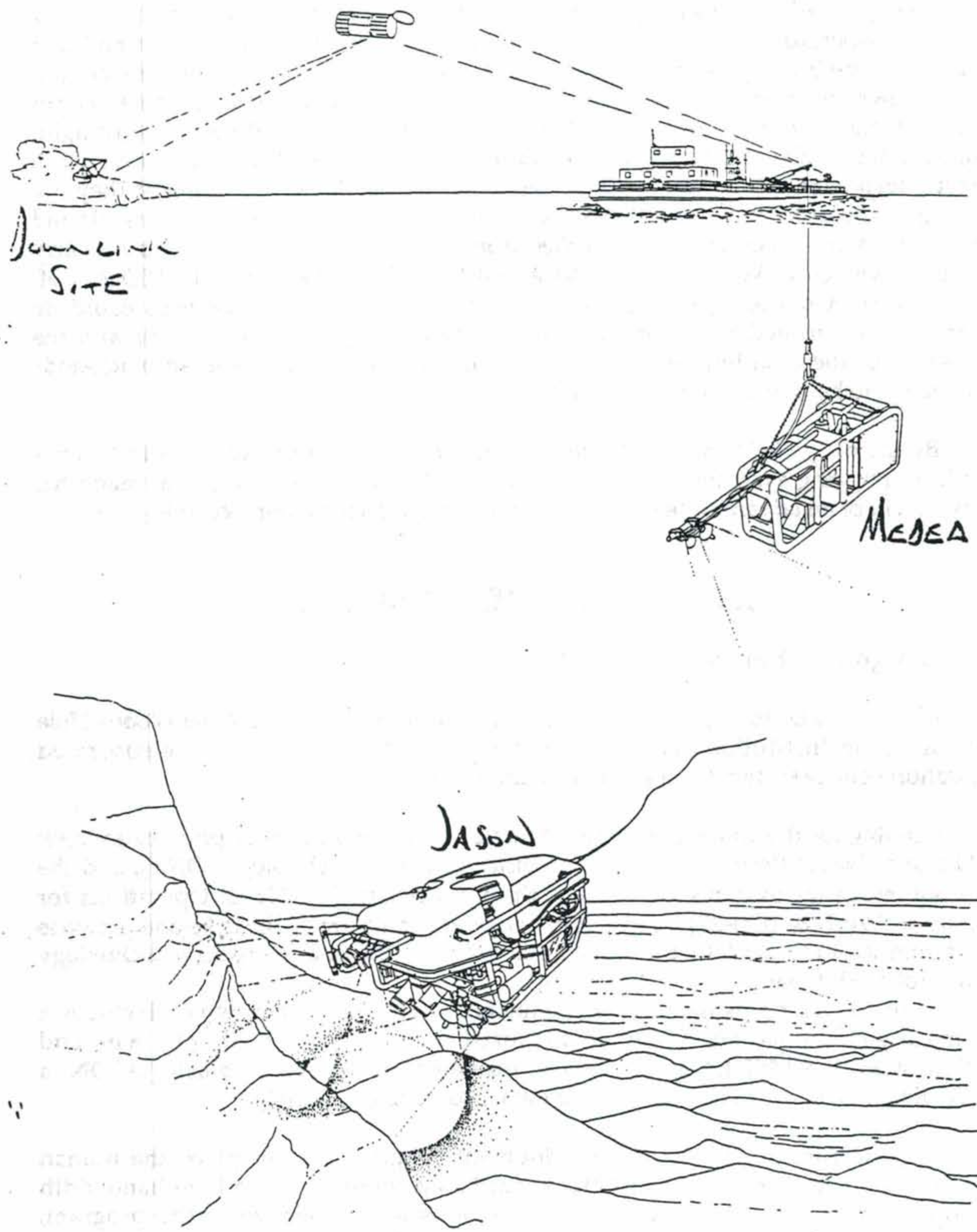


FIGURE 1

sea operations from shore-based satellite downlink sites, including full control of the vehicles from shore.

Although a teleoperated system like the JASON vehicle can perform a wide range of missions in the deep sea, the primary purpose for its development was an outgrowth of the earlier ALVIN geological mapping programs carried out on the Mid-Ocean Ridge.

Exploration and mapping in the MOR requires an overlapping family of vehicles and associated sensors that allow an investigator to look at a broad range of features varying in size from entire segments of the mountain range to individual lava flow forms. Figure 2 illustrates the spectrum of sensors used to span such a range of scales. It clearly demonstrates the classic trade-off in range versus resolution. Acoustic sensors like multi-narrow beam sonar systems and side-scan sonars are used to obtain a large-area view of the underwater terrain while visual systems like ANGUS and human observers inside a submersible can document small-scale features.

Historically, a gap existed between acoustic and visual imaging systems. Scientists found it difficult at times to cross-correlate acoustic and visual data sets. During Project FAMOUS, for example, scientists diving in ALVIN found the detailed multi-narrow beam sonar maps they carried with them to be a more generalized representation of the seafloor morphology than they initially expected. Depressions were found to be much deeper and adjacent volcanic peaks separated by narrow ravines were, at times, contoured as a single volcanic edifice, greatly complicating the mapping effort.

Given this traditional "gap" (shaded area in figure 2) in the mapping systems available to geologists at that time, the design objective of the JASON development effort as well as of the towed vehicles ARGO and the AMS-120 (ref. 19) was to bridge this gap with the combined use of high-frequency acoustic sensors and low-light level large-area visual sensors as well as by high-resolution visual-imaging devices and remote manipulation.

In short, the goal of the program was to make it easy for an investigator to move from one scale of geologic features to the next independent of whether one data set was collected with an acoustical sensor and the other with a visual imaging sensor. This approach to multisensor terrain modelling heavily influenced the development program (ref. 20, 21, 22).

In such a model, underwater features are viewed as a composite of three-dimensional spatial decompositions of cubical volume elements called voxels. A voxel is represented by a stochastic multisensor feature vector that characterizes the physical properties within each volume. Such modelling is an evolving process. As a new sensor is used in a previously mapped area, its data are merged with the previous data set using what has been termed a stochastic backprojection. Using this approach, information about the physical properties of the terrain occupying a particular voxel can

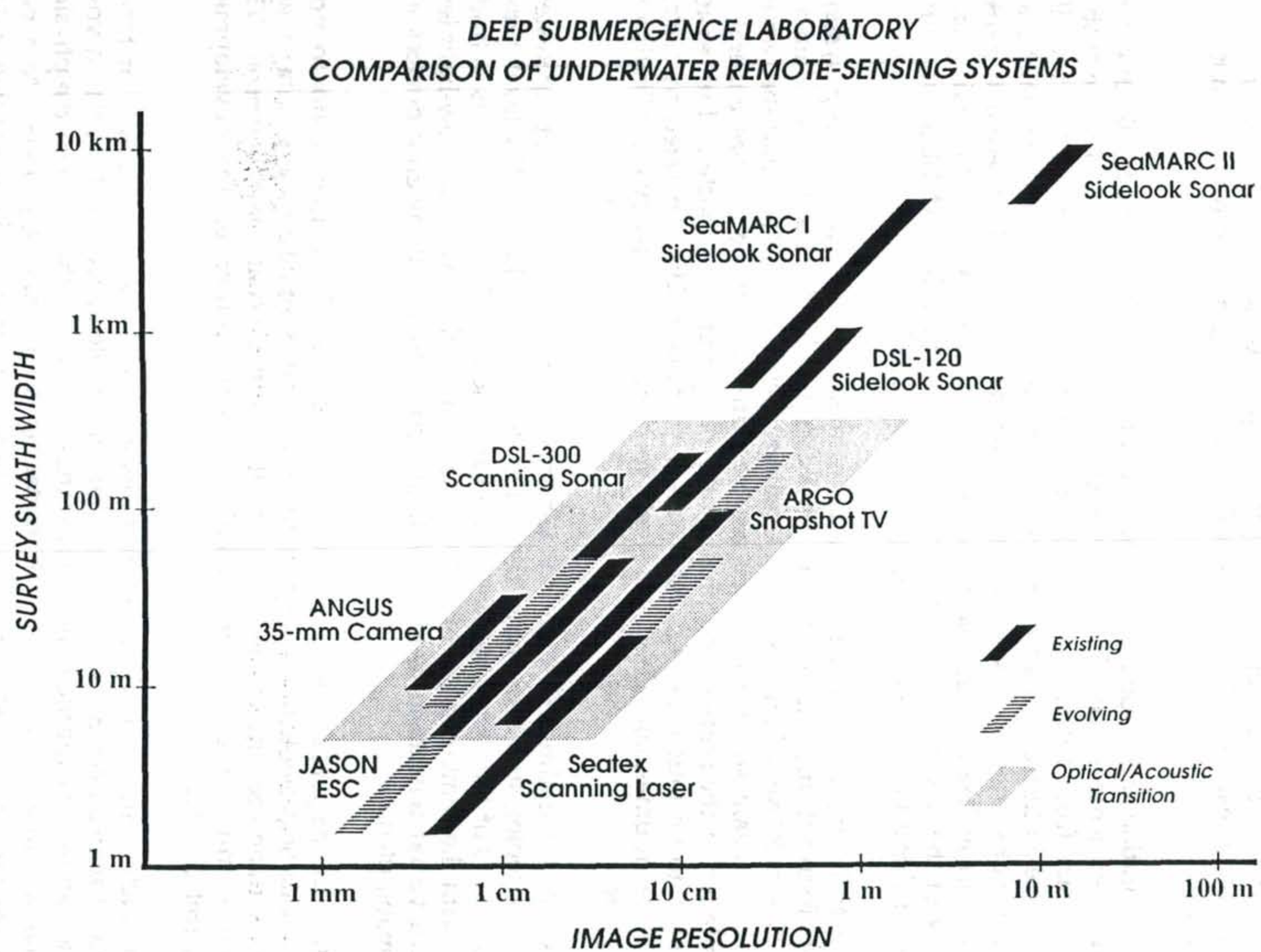

DEEP SUBMERGENCE LABORATORY
COMPARISON OF UNDERWATER REMOTE-SENSING SYSTEMS
SURVEY SWATH WIDTH
10 km
1 km
100 m
10 m
1 m
IMAGE RESOLUTION
1 mm
1 cm
10 cm
1 m
10 m
100 m
SeaMARC II Sidelook Sonar
SeaMARC I Sidelook Sonar
DSL-120 Sidelook Sonar
DSL-300 Scanning Sonar
ARGO Snapshot TV
ANGUS 35-mm Camera
JASON ESC
Seatex Scanning Laser
Existing
Evolving
Optical/Acoustic Transition

FIGURE 2

be combined with earlier data regardless of whether these different sets of information were obtained using a digital acoustical or visual sensor. One data set is no longer compared to a previous data set; it is combined to provide a better representation of the terrain under investigation.

But having the theoretical potential to develop multisensor modelling of various deep underwater terrains like the MOR is not the same as having the operational capability to produce high-quality data. To do that requires the development of vehicle system(s) equipped with high-resolution digital sensors operated at a level of precision and control not possible at the time the JASON development began in 1982. It was recognized early in the JASON development effort that hydrodynamic nonlinearities would dominate efforts to control the vehicle precisely enough to permit multisensor modelling and sophisticated manipulation (ref. 15).

At a number of levels, navigation is central to the precise vehicle control needed to accomplish the design goals of the JASON system. The first level of control needed was the development of a dynamic positioning system.

A number of dynamic positioning systems existed in the early 1980's, primarily within the offshore oil and gas industry, but their principal goal was to dynamically position a ship, not vehicles suspended at great depth beneath them.

To accomplish this task required a higher level of control dominated by the nonlinear behavior of the ship in varying wind and sea conditions, the behavior of the suspended fiber-optic cable connecting the teleoperated control center on the surface to the relay vehicle 7,000 meters (20,000 feet) below, and the hydrodynamics of the vehicle itself (ref. 23, 24, 25, 26).

To develop the software necessary to provide the desired level of dynamic control, an experiment was carried out in the Navy's AUTEC range, where the three-dimensional behavior of the cable under a variety of towed and stationary maneuvers could be carefully documented. A 0.68-inch tow cable similar to the JASON fiber-optic cable then under design was instrumented for high frequency motions, primarily those caused by vortex-induced vibrations, using self recording accelerometers. The highly accurate tracking system in the AUTEC range itself was used to measure low-frequency motions (ref. 27, 28, 29, 30). This experiment proved highly successful, confirmed the previous cable and vehicle dynamic modelling (ref. 23), and led to new insight into vortex-induced vibration for a deep-water ROV system.

Based upon these test results, an initial dynamic positioning test was carried out on the R/V KNORR in September of 1987. The tests were conducted in 2,700 meters of water under moderate sea conditions (sea state 2.5; winds of 8-15 knots) without a vehicle or cable. The station-keeping performance of the ship was excellent with a 25 meter root-mean-square (RMS) using an acoustic long-baseline system and 12 meters using a global satellite tracking system.

A final combined test of the ship-cable-vehicle system was conducted in August of 1988 with the R/V KNORR. Tests were carried out in water depths ranging from 700 to 3,000 meters using what would eventually become the MEDEA relay vehicle. The tests were successful and provided excellent results and further refinement to the modelling dynamics.

The next level of navigation and control dealt with the JASON vehicle itself. The dynamic positioning of the relay vehicle (MEDEA) within its 15-meter watch circle and the use of a neutrally buoyant tether connecting it to JASON, decoupled the surface motion propagated down the cable to the relay vehicle and did not transmit those motions to JASON. Therefore, JASON was free of surface action and capable of precise control.

Existing bottom-mounted acoustic-transponder tracking systems, however, lacked the precision necessary to control JASON for the highest level of multi-sensor modelling. To meet this requirement, two high-frequency navigation systems were developed. The first was called SHARPS and was developed with two initial applications in mind. Since the development of JASON would take over 5 years and involve a great deal of testing in a small test tank, a precision navigation system was needed which could operate in a small tank having numerous acoustic multipaths.

SHARPS filled this need. It is a 300-kHz broadband hardwired transponder navigation system that can operate inside a metal test tank. Angular resolution is about 1 degree, range resolution is better than 2 cm, and the maxium update rate is 10 samples/second. A three-transponder array can cover an area approximately 100 meters on a side. Since MEDEA is hardwired to JASON, the SHARPS system can also be used to precisely determine relative relationships between both vehicles while working in the deep sea.

The second system developed is called EXACT and has characteristics similar to the SHARPS system, only it is wireless and has a maximum update rate of 5 samples/second. This system is ideal for deep-water ROV operations where a hardwired system is impractical. The bottom transponder network is self-calibrating and can be used to navigate both MEDEA and JASON relative to the bottom or relative to a long-baseline transponder network fixed within geographical coordinates. Navigation relative to the bottom terrain using this system is better than 2 cm. With the EXACT system the desired navigational precision needed to control JASON for multisensor modelling can be achieved.

Good navigation, however, must be complemented by a good control design. In addition to a precise knowledge of the vehicle's x, y, and z positions, multi-sensor modelling requires a great deal of information about the vehicle's behavior, and special care must be given to its basic design. As a result, JASON's control sensors include instruments that measure acceleration and attitude. The vehicle's heading is determined by a flux-gate compass and a directional gyro. Acceleration is measured in three axes using servo accelerometers, and pitch and roll is measured using a two-axis inclinometer. Absolute depth and the vehicle's altitude off the bottom are also recorded.

(Early Operational Experience - JASON Design Phase-1982 to 1989)

Prior to the construction of the JASON vehicle, a variety of existing ROVs were tested in the Lab's tank and off the dock under dynamic closed-loop control using the SHARPS tracking system.

The dynamics of a vehicle in the deep sea are nonlinear, and care given during the design phase of a vehicle can greatly enhance its performance in the field. During these early tests, particular attention was given to eliminate open-loop coupling between translations and rotations by placement of the vehicle's thrusters relative to the vehicle's centers of mass and drag. An analysis was carried out of JASON's ducted thrusters, which are difficult actuators to control. This static and dynamic analysis of the thrusters, however, reduced the uncertainties associated with their thrust characteristics and improved their low-level control over the thrusters broad dynamic range (ref. 31).

During the JASON vehicle design a series of tests was conducted in the tank facility to determine how well an ROV could be controlled. These tests included automated track following and an interactive mode called "joystick auto." In the first case, the vehicle was commanded to follow prearranged tracklines. This could be a typical request from a scientist who wanted to make a detailed acoustic or visual survey of a small area like a hydrothermal vent field. Previous users of manned submersibles and other ROV systems have found that both classes of vehicles are very poor side-scan sonar platforms because they lack the ability to control their heading. The ROV used in the test, however, could control its heading to less than one degree and run automated tracks with RMS off-track errors of 0.36 meters (ref. 32).

Figure 3 illustrates the second trials conducted using an interactive automatic mode. During "joystick auto" the vehicle is in closed-loop control in all axes but the pilot can provide it with a continuous series of horizontal velocity commands that permit continuous involvement by the pilot during the survey runs but at a greatly reduced supervisory level of control. This greatly decreases the pilot's workload which is mandatory for JASON dive profiles that will last many days instead of a typical submersible dive lasting three hours on the bottom.

The first major vehicle development by DSL engineers was the ARGO search system (ref. 19). Since a new fiber-optic cable was still under design, the first vehicle effort was built around the then standard 0.68-inch co-axial cable used by the academic community.

ARGO was designed to operate to 7-km (20,000-feet), and included a suite of both acoustic and optical imaging sensors. The acoustic sensors are a standard 100-kHz

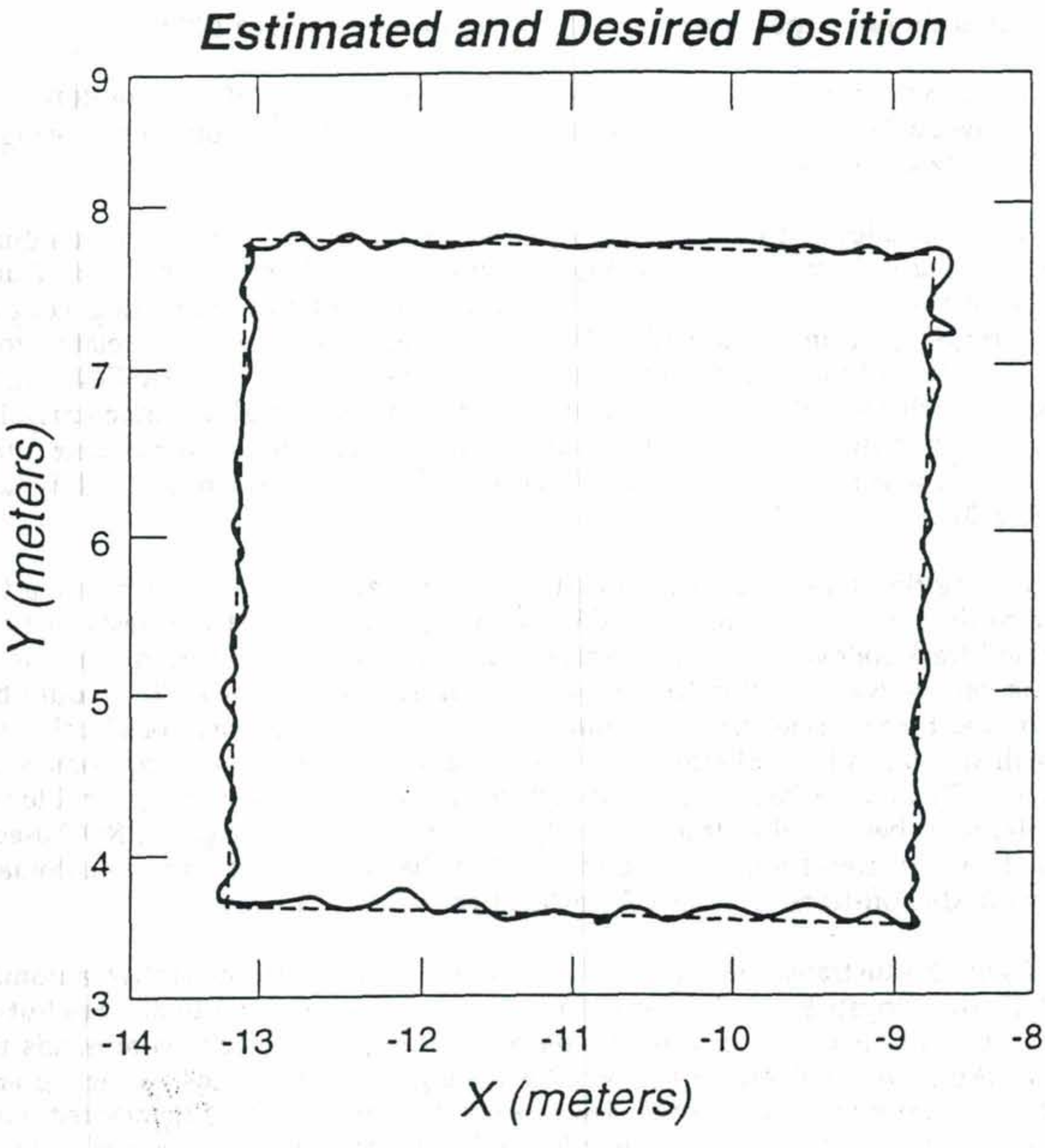

Estimated and Desired Position
Y (meters)
9
8
7
6
5
4
3
-14
-13
-12
-11
-10
-9
-8
X (meters)

FIGURE 3

side-scan sonar and a down-looking altimeter. ARGO, however, is designed to maintain constant visual contact with the bottom. As a result, major emphasis was placed on its visual imaging capability. During its initial design phase, a number of test cruises were conducted with the submersible ALVIN on which was mounted a low-light-level Silicon Intensified Target (SIT) black-and-white video camera. These experiments helped in the design of ARGO's lighting system, which permits useful imagery to an altitude of 15 meters.

Three SIT cameras are mounted on ARGO: a forward-looking wide-angle camera, a down-looking, wide-angle camera, and a down-looking zoom camera. Incandescent running lights mounted approximately 4 meters aft of the cameras provide illumination for real-time video imaging while strobe lights are used in conjunction with color cameras. Color photography, however, can only be accomplished when the vehicle is flown at a lower altitude of approximately 5-7 meters. Later, a cryogenically cooled high-resolution digital electronic still camera (ESC) was developed, that made it possible to obtain high quality images while flying the vehicle at its normal 15-meter operational altitude (ref. 33).

ARGO's first test cruise was conducted in the summer of 1984 for the Navy. Its second cruise in the summer of 1985 resulted in the successful location of the British luxury liner R.M.S. TITANIC (ref. 34, 35).

Since 1985, ARGO has been involved in a number of scientific and military programs including the location of the sunken German Battleship BISMARCK in the summer of 1989 (ref. 36) and two major investigations of the volcanic and tectonic processes occurring along the axis of the East Pacific Rise (ref. 37, 38).

In 1986, following the discovery of the TITANIC by the ARGO search vehicle, the first fiber-optic cable was under design but not yet built, and testing of the dynamic positioning system was still underway.

For these reasons, a decision was made to move forward with the development of a JASON prototype vehicle called JASON, Jr., or JJ, which could be deployed from the submersible ALVIN. This provided additional experience in ROV systems including the development of tether management and vehicle-control systems. JJ's first field deployment proved successful resulting in a detailed inspection of the TITANIC (ref. 39; figure 4).

In the summer of 1988, a cruise was conducted in the Mediterranean to test the new dynamic positioning system on the R/V KNORR as well as the system's first fiber-optic cable. Both tests proved successful and lead to the final JASON design followed by its construction.

Critical to JASON's ability to collect high bandwidth data is the fiber-optic telemetry system connecting JASON to the team of scientists and engineers working in shipboard control center.

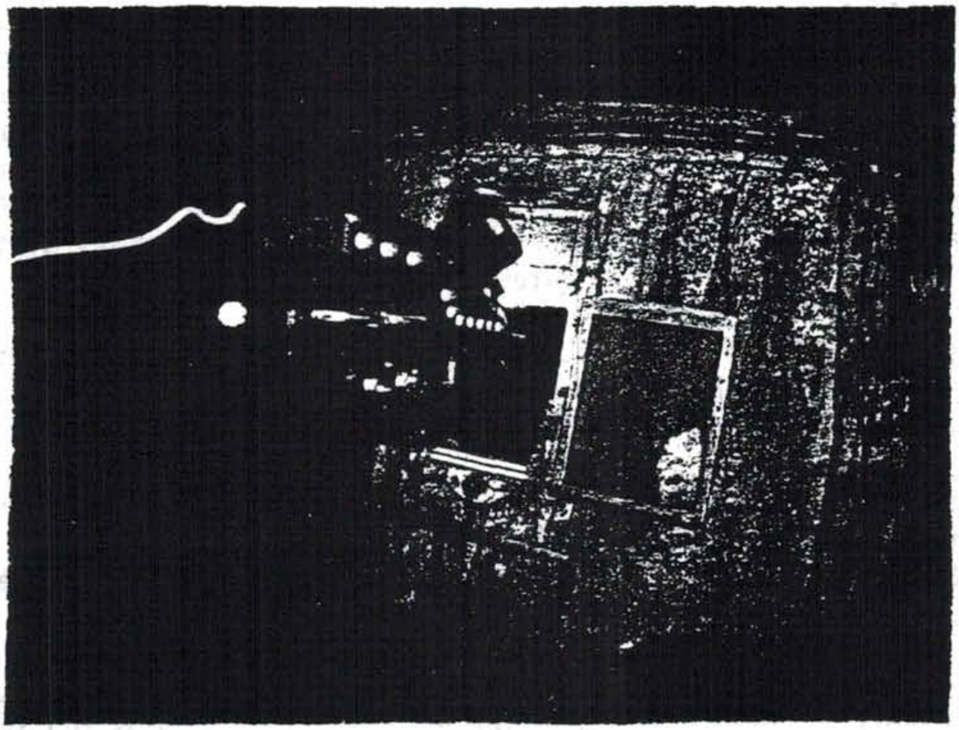


FIGURE 4

Since the original ARGO vehicle was not built for this function and it was designed to operate on a co-axial cable, a second and larger ARGO was built in 1989. It was called HUGO which stood for a Huge ARGO system.

Unfortunately, when this combined system was launched on its first deployment in May of 1989, it proved too light, and severe snap loading during a storm led to the failure of the fiber-optic cable termination and the loss of HUGO and JASON in 3,000 feet of water (ref. 40).

Fortunately, the combined system was recovered using a test sled and the ship's dynamic positioning. Given this experience, however, it was felt a two-body system should be deployed in the future to eliminate such snap loading and greatly reducing the size of the launch and recovery system.

This decision led to the development of the MEDEA relay vehicle as illustrated in figures 1 and 5. MEDEA weighs approximately 500 kg and its main steel tubular frame is about 1.8 meters in length. Its various sub-systems are shown in figure 5, most important of which are its black-and-white or color video cameras, navigational beacons, lights, and the junction box where the power lines and optical fibers in the armored cable coming down from the surface are connected to similar copper wires and fibers in the neutrally-buoyant cable leading to JASON. It is the MEDEA vehicle which is dynamically positioned by the surface ship and maintains a watch circle of 15-20 meters above JASON. MEDEA serves two primary roles: the first is to decouple surface motions from JASON and the second is to provide the scientists and engineers in the control van with a high-altitude view of JASON. Manned and unmanned operations carried out close to the bottom are easily blinded by small topographic features. It is easy not to see the big picture. MEDEA, which is generally 15 to 30 meters above the bottom can oversee JASON in its work setting and observe a much larger area.

Figure 6 is the most recent illustration of the JASON vehicle. Although its basic sub-systems change little from cruise to cruise, its array of sensors continues to evolve and change according to the mission. These major sensor systems are described in greater detail in the following pages.

(Top-Side System)

Figure 7 illustrates a standard seaboard layout for the JASON vehicle system. It consists of (1) workshop and supply vans, (2) in-water vehicles (JASON/MEDEA or AMS-120/depressor weight), (3) overboard handling system (crane, A-frame, and line tuggers), (4) fiber-optic winch system (traction unit, level winder, take-up drum, slip-ring assembly, and power supply), (5) control van, (6) data processing center, and (7) remote displays.

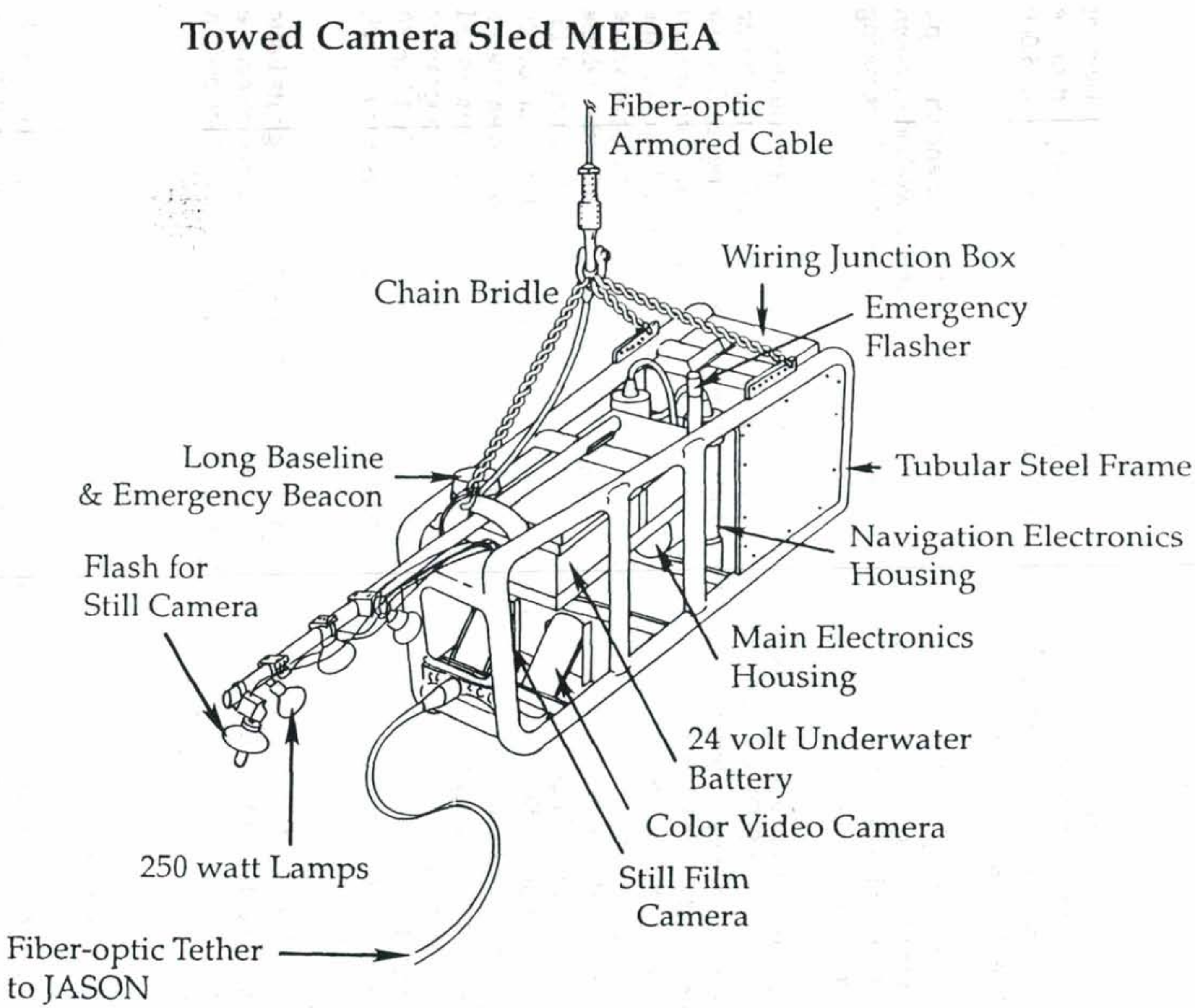

Towed Camera Sled MEDEA
Fiber-optic
Armored Cable
Wiring Junction Box
Chain Bridle
Emergency
Flasher
Long Baseline
& Emergency Beacon
Tubular Steel Frame
Navigation Electronics
Housing
Flash for
Still Camera
Main Electronics
Housing
24 volt Underwater
Battery
Color Video Camera
250 watt Lamps
Still Film
Camera
Fiber-optic Tether
to JASON

FIGURE 5

Remotely Operated Vehicle JASON

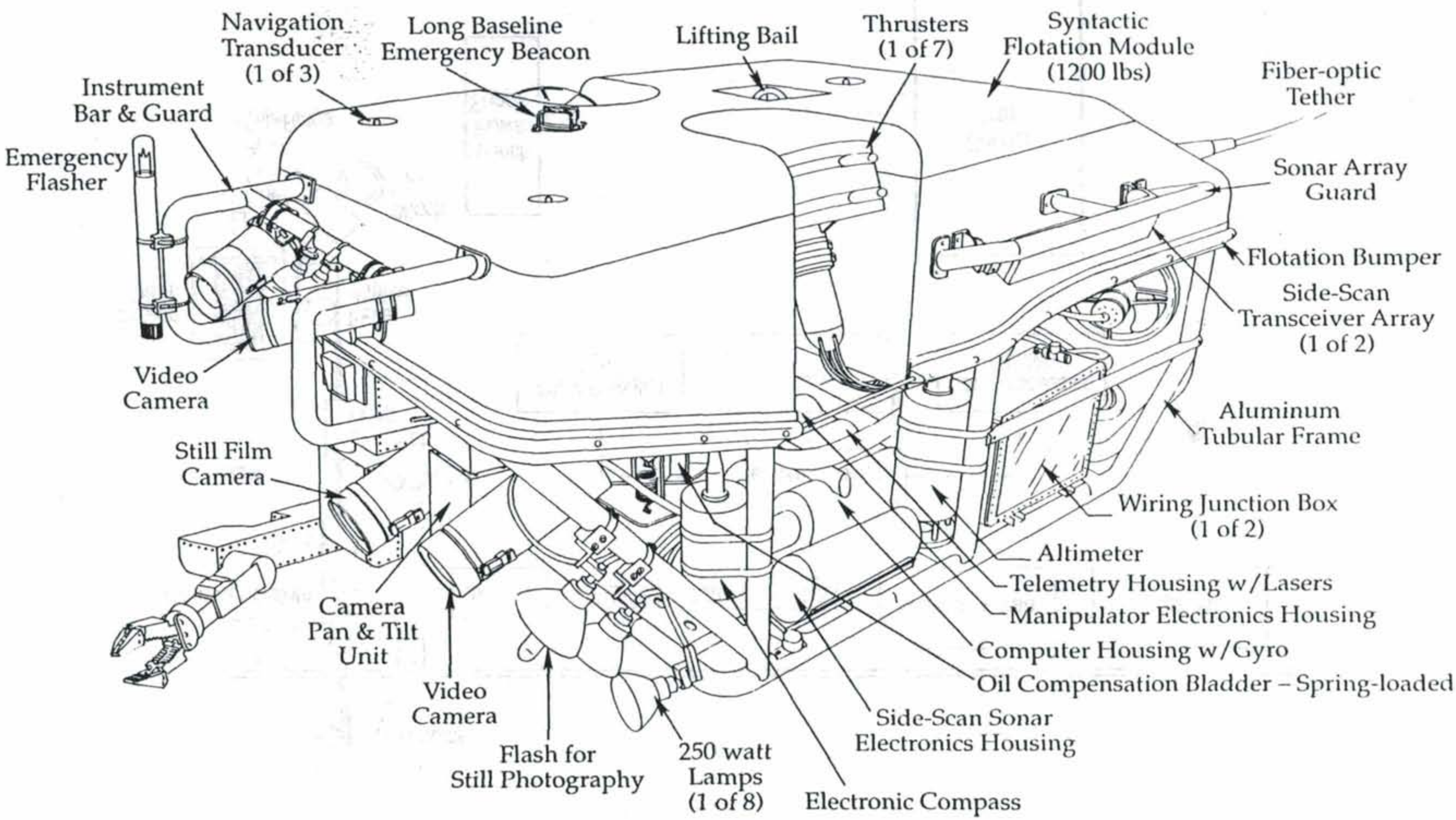


FIGURE 6

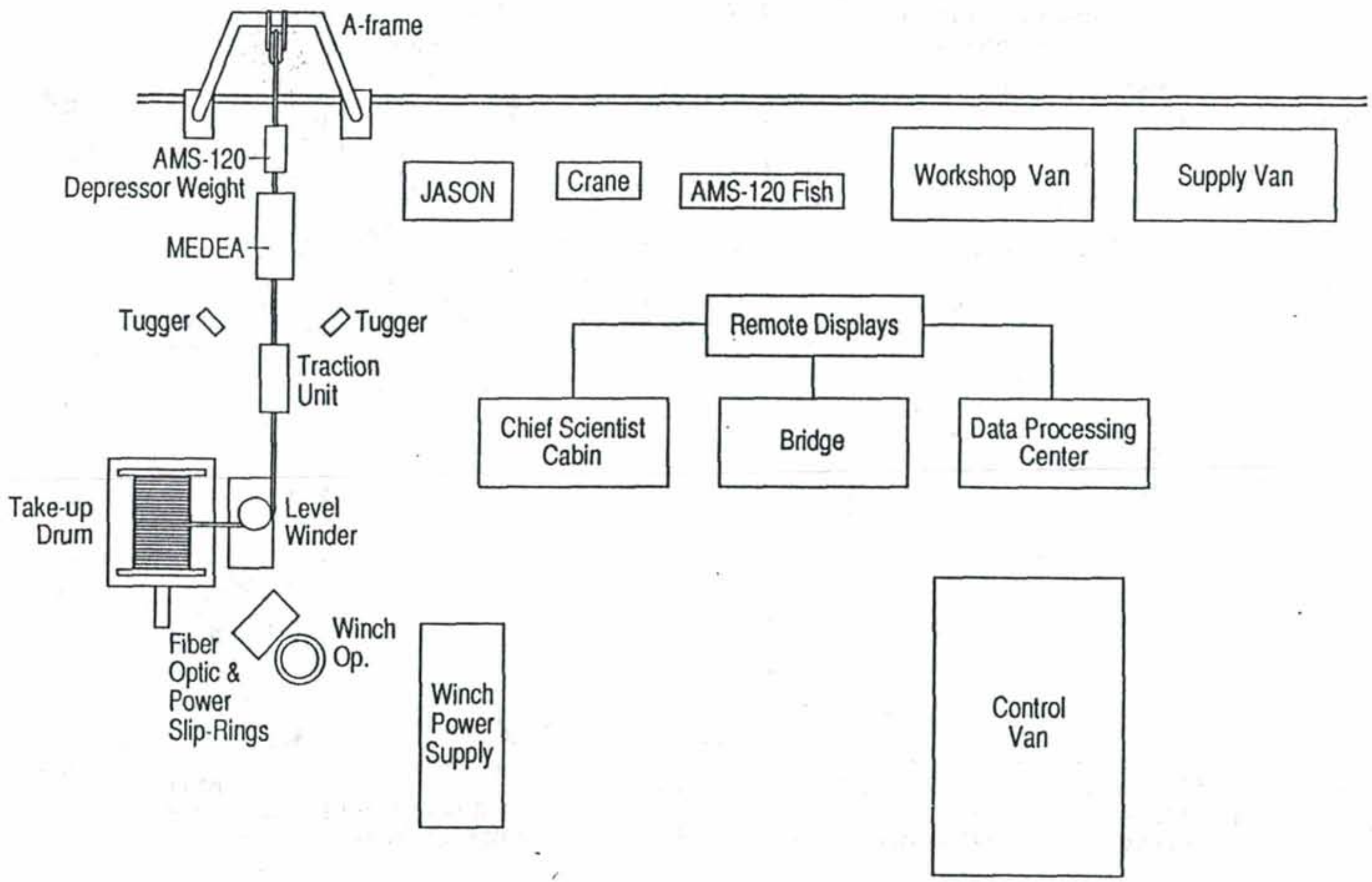

A-frame
AMS-120 Depressor Weight
MEDEA
Tugger
Tugger
Traction Unit
Take-up Drum
Level Winder
Fiber Optic & Power Slip-Rings
Winch Op.
Winch Power Supply
JASON
Crane
AMS-120 Fish
Workshop Van
Supply Van
Remote Displays
Chief Scientist Cabin
Bridge
Data Processing Center
Control Van

FIGURE 7

Once the vehicles are in the water, total control of all systems (winch, ship, and MEDEA/JASON or AMS-120) transfers to the control van complex (figure 8). This complex normally holds eleven to twelve people; five to six operational personnel and six from the science party.

The science party consists of a watch leader, data logger, and room for other observers if desired. The Chief Scientist has three watch leaders which implement the operational/science plan. The data logger works with the JASON engineer to keep track of all the images being recorded on three beta recorders. Normally that includes the electronic still images (which are also stored on disc), the 1-chip and 3-chip color video cameras on JASON but can include a variety of other images. The data logger provides a quick description of each electronic still image collected every 20 seconds and the JASON engineer can perform a limited amount of real-time image processing and enhancement on those images if requested. The data logger also maintains an electronic log book for the watch leader (i.e. loss of navigation, problems with JASON, what the JASON engineers has turned on and off aboard JASON, etc.). Other observers take their direction from the watch leader and commonly record their own observations.

The operational team consists of a navigator, JASON pilot, and manipulator operator postioned in front of the main display unit (figure 9); sonar operator and MEDEA flyer (figure 10); and JASON engineer (figure 11).

The navigator works with the ship's watch, the JASON pilot, and watch leader to coordinate the overall operation (figures 8 and 9). When the dynamic positioning (DP) system is engaged, control of the ship is transferred from the bridge to the navigator and a constant line of communications is maintained should the bridge need to suddenly assume control of the ship due to lose of D.P. or for ship safety. The navigator takes his orders from the watch leader and informs the pilot of his actions.

Figure 12 displays the basic navigational information about all three primary systems (ship, MEDEA or fish, and JASON or ROV). The last five positions for each, recorded at 20 second intervals, are shown. These lists include Greenwich Mean-Time (GMT), raw travel times in seconds from three transponders (A, B, and C) for the ship, MEDEA, and JASON (Ship, Fish, ROV); their x, y, and z positions in meters for all three (E, N, and Z); speed over the ground (SOG) for ship and MEDEA; ship's gyro; what transponder baseline is being used (i.e., AB); what side of the baseline the vehicle is on (i.e., CC or CW); the scant range in seconds from ship to MEDEA (S-Fish) and from ship to JASON (Ship-ROV); and heading of JASON (HDG). Also shown are the minimum ranges in seconds that have been applied to each travel time from each of the three transponders for the ship, MEDEA, and JASON as well as their slant ranges. This helps to eliminate earlier acoustic multi-paths. Velocity filters can also be applied to filter out bad position fixes. Deep or shallow tells the navigator whether JASON or MEDEA are operating shallower or deeper than the height of the transponder net. At the very bottom of the display, data logging information is given that includes what ancillary

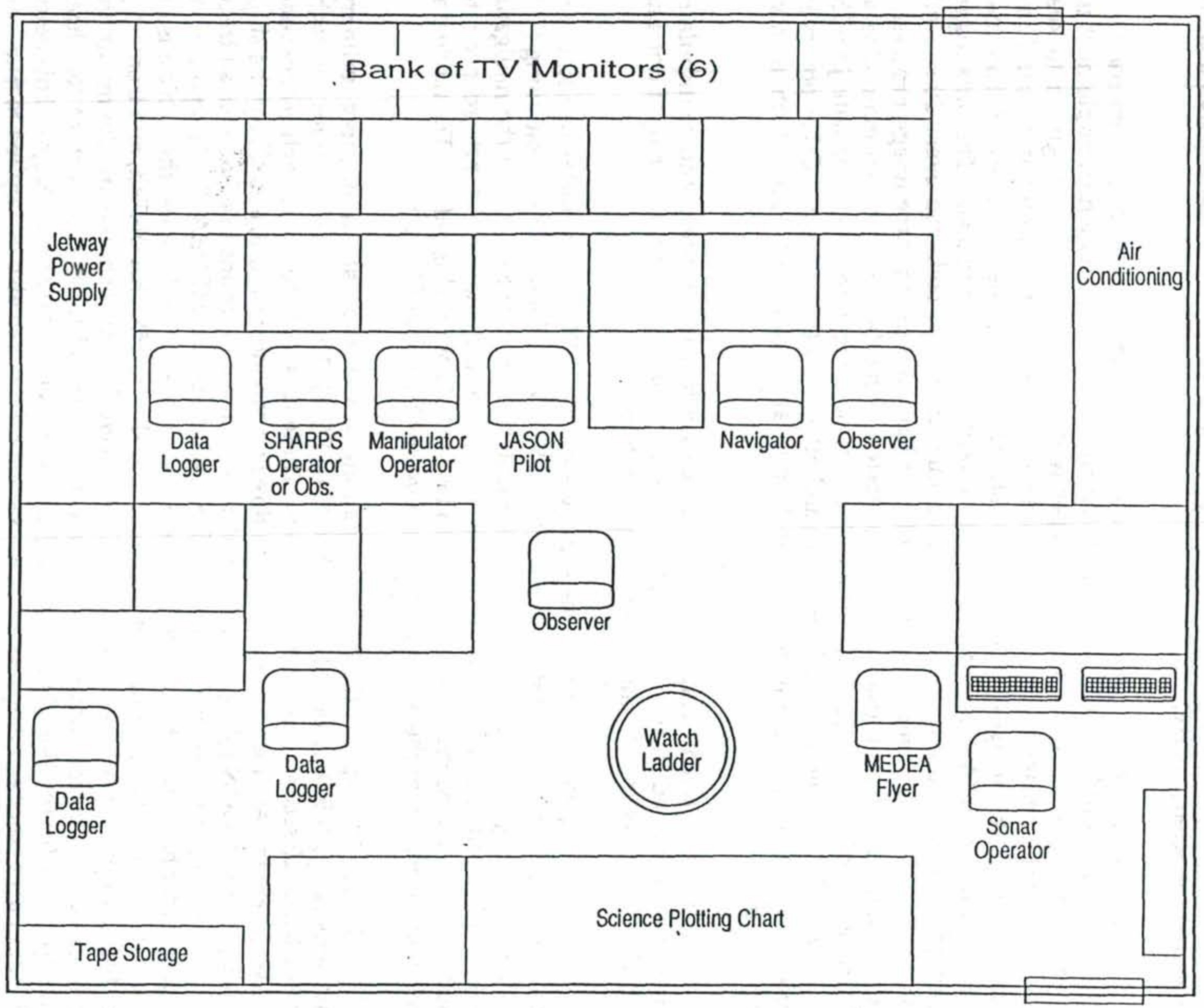

Bank of TV Monitors (6)
Jetway Power Supply
Air Conditioning
Data Logger
SHARPS Operator or Obs.
Manipulator Operator
JASON Pilot
Navigator
Observer
Observer
Data Logger
Data Logger
Watch Ladder
MEDEA Flyer
Sonar Operator
Tape Storage
Science Plotting Chart

FIGURE 8

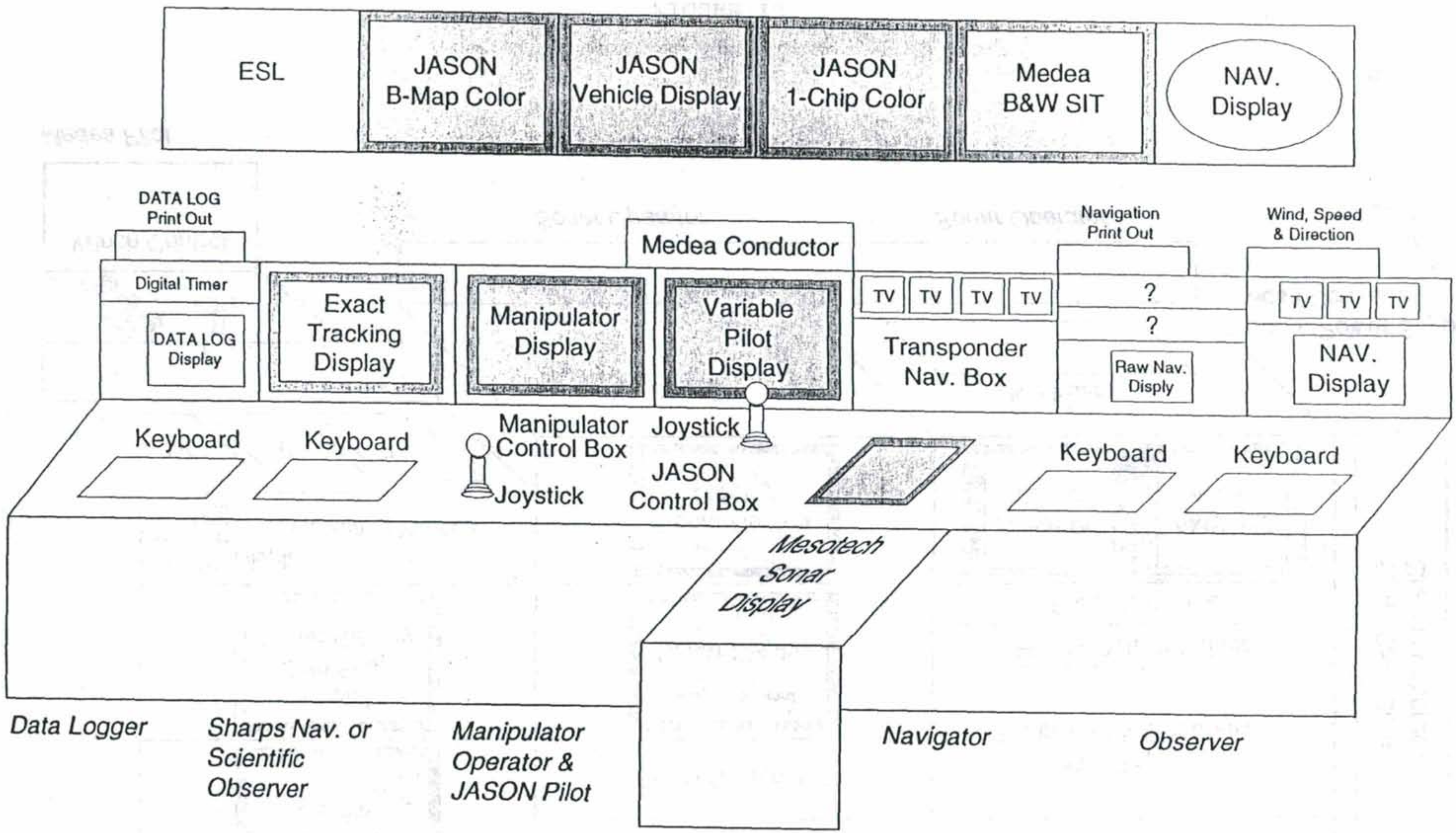

ESL
JASON B-Map Color
JASON Vehicle Display
JASON 1-Chip Color
Medea B&W SIT
NAV. Display
DATA LOG Print Out
Digital Timer
DATA LOG Display
Exact Tracking Display
Manipulator Display
Medea Conductor
Variable Pilot Display
TV
TV
TV
TV
Transponder Nav. Box
Navigation Print Out
?
?
Raw Nav. Disply
Wind, Speed & Direction
TV
TV
TV
NAV. Display
Keyboard
Keyboard
Manipulator Control Box
Joystick
Joystick
JASON Control Box
Keyboard
Keyboard
Mesotech Sonar Display
Data Logger
Sharps Nav. or Scientific Observer
Manipulator Operator & JASON Pilot
Navigator
Observer

FIGURE 9

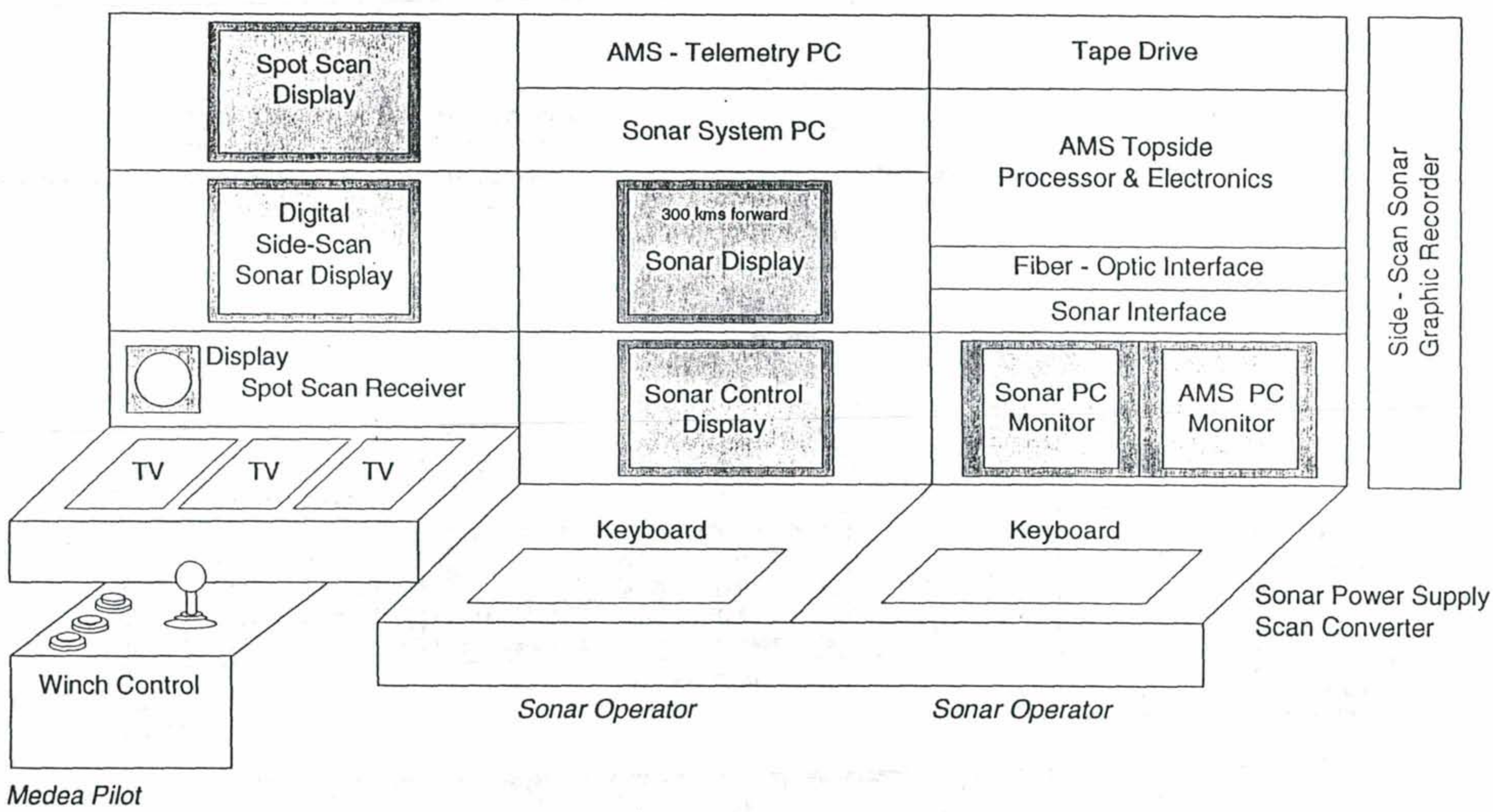

Spot Scan Display
Digital Side-Scan Sonar Display
Display
Spot Scan Receiver
TV
TV
TV
Winch Control
Medea Pilot
AMS - Telemetry PC
Sonar System PC
300 kms forward
Sonar Display
Sonar Control Display
Keyboard
Sonar Operator
Tape Drive
AMS Topside Processor & Electronics
Fiber - Optic Interface
Sonar Interface
Sonar PC Monitor
AMS PC Monitor
Keyboard
Sonar Operator
Side - Scan Sonar Graphic Recorder
Sonar Power Supply
Scan Converter

FIGURE 10

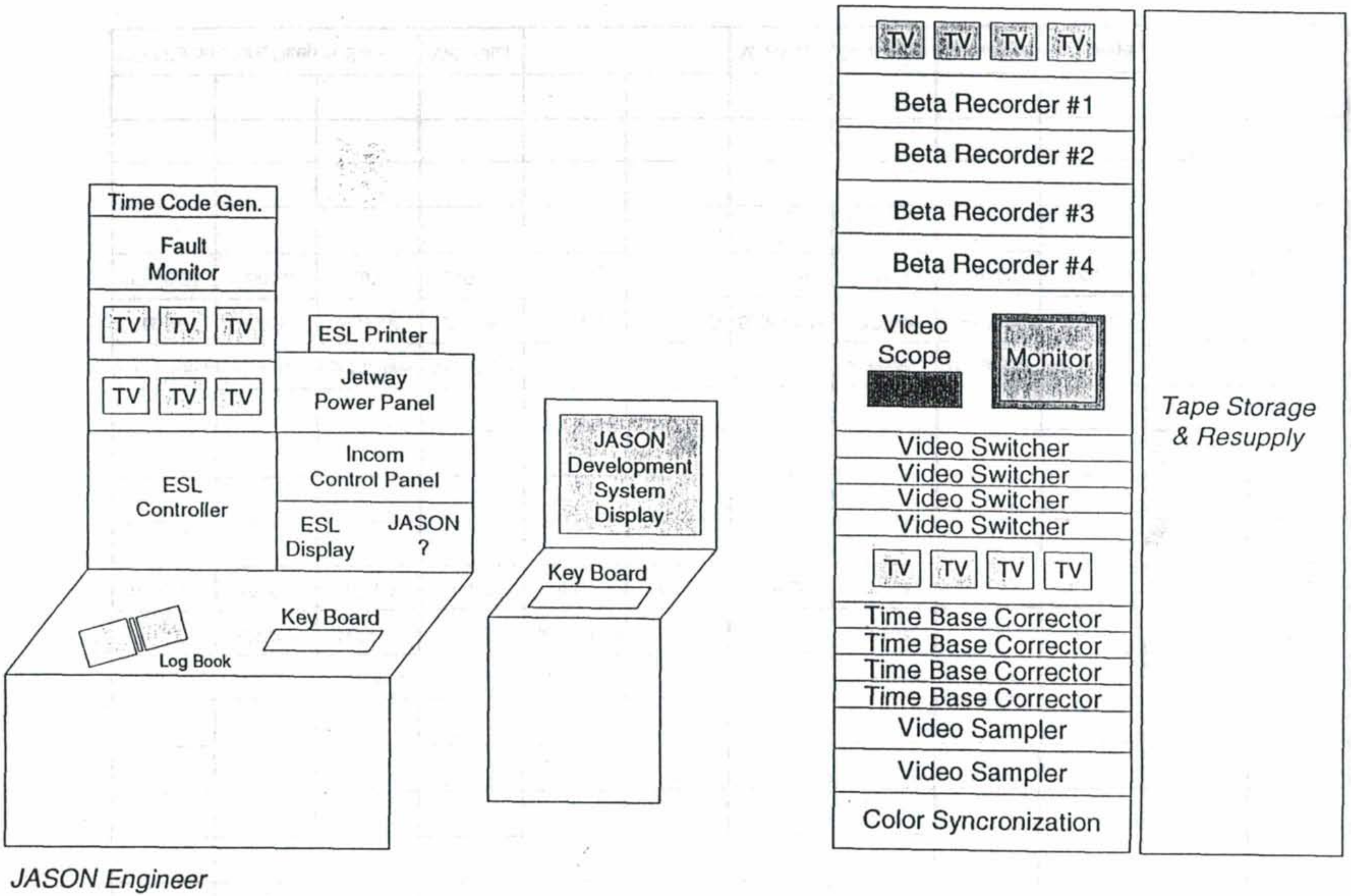

Time Code Gen.
Fault Monitor
TV TV TV
TV TV TV
ESL Controller
ESL Printer
Jetway Power Panel
Incom Control Panel
ESL Display
JASON ?
Key Board
Log Book
JASON Engineer
JASON Development System Display
Key Board
TV TV TV TV
Beta Recorder #1
Beta Recorder #2
Beta Recorder #3
Beta Recorder #4
Video Scope
Monitor
Video Switcher
Video Switcher
Video Switcher
Video Switcher
TV TV TV TV
Time Base Corrector
Time Base Corrector
Time Base Corrector
Time Base Corrector
Video Sampler
Video Sampler
Color Syncronization
Tape Storage & Resupply

FIGURE 11

GMT	E-SHIP	N-SHIP	Z-SHIP	Speed OG	Course OG	Ship Gyro	SHIP-A	SHIP-B	SHIP-C	BL	CD
18:46:31	5128.5	6224.7	4.0	0.51	221.4	267	3.1267	3.1154	3.2975	AB	CC
Ship Paramators		Deep or Shallow		Vel. Filter			M. Range	M. Range	M. Range		
GMT	E-ROV	N-ROV	Z-FISH	Speed OG	Course OG	S-FISH	FISH-A	FISH-B	FISH-C	BL	CD
18:46:31	5015.8	6274.0	270.2	0.53	218.5	1.4668	2.4095	2.5753	2.4631	AB	CC
FISH Paramators, Deep or Shallow			Vel. Filter				M. Range	M. Range	M. Range		
GMT	E-ROV	N-ROV	Z-ROV	Speed	Height OG	Ship-ROV	ROV-A	ROV-B	ROV-C	F-ROV	
18:46:31	4981.8	6262.1	2193.4	0.56	275.4	1.4778	2.4118	2.6060	2.4676	999.9	
ROV Paramators, Deep or Shallow			Vel. Filter			M. Range	M. Range	M. Range	M. Range		

FIGURE 12

units (i.e., plotter, disc recorder, printer, loran, or global positioning system) are on or off.

Figure 13 is the primary navigational monitor displayed throughout the control van and other locations on board ship. It's basic component is an x-y graphics display in long-baseline coordinates (east and north in meters from an arbitary origin which places all work in positive coordinates). On this display is shown a wide variety of information that includes (1) the desired tracklines for the survey being conducted, (2) obstacles on the bottom (1, 2, etc.) which may be transponders, bottom instruments, etc., (3) location of an elevator carrying instruments to the bottom or samples to the surface (closed diamond), (4) the locations of JASON and MEDEA (open diamond and cross), and (5) information about the ship. Ship information has three separate indicators. The inverted "t" represents the next desired goal for the ship's D.P. position, the open ellipse the present desired position of the ship, and "X" the present position of the ship based upon either GPS or long-baseline (LBL) navigation. In the upper right-hand corner is a compass display of the ship's gyro heading and the direction the ship is traveling based upon the previous two fixes. Beneath (but not shown in figure 13) is (1) the x and y position for the present (Goal) desired ship location, (2) the present x and y of the ship either based upon LBL or GPS navigation, (3) ship's speed, and (4) the x, y and z positions of JASON, MEDEA, and the elevator. In the lower left-hand corner is range and bearing information for the ship to its present desired location and JASON or MEDEA's range and bearing to a target on the bottom. Additional information is also displayed regarding the time that has elapsed since the last fix was given to the D.P. system and information about the D.P. system's ability to hold position as well as DISC logging information.

With all of this information at the navigator's disposition, he can manuever the ship so that MEDEA is placed in a location that permits JASON to either follow a desired survey trackline or work at a stationary point.

Seated next to the navigator is the JASON pilot (figures 8 and 9). He can observe the six main monitors controlled by the JASON engineer as well as select various displays on the monitors in front of him. Normally that includes (1) a MESOTECH sonar display (in five separate ingremental scales ranging from 10 to 200 meters) of the bottom beneath JASON and (2) the most important video view from JASON at any given moment (i.e. rear, high-resolution down, or pan and tilt camera). Situated at his console is the JASON control box (figure 14). On the left is a grip control for thrusting JASON up or down. Next to it is a push bottom for taking a color still image. To its right is the pan and tilt control with switches and dials to operate pan, tilt, speed of pan, and homing to pre-set position. In the center is a vertical series of switches which control vehicle power, motor power, auto heading, auto depth, and auto x,y. The horizontal series of switches control vertical bias on/off, amount of vertical bias, and the sensitivity of the joystick. On the right is the joystick which when twisted in a clockwise or counter-clockwise position rotates the vehicle in either direction. Pushing the joystick in any of 360 directions, commands JASON's seven thrusters to move the vehicle in that direction at a rate set by the joystick sensitivity dial.

NOT YET AVAILABLE

FIGURE 13

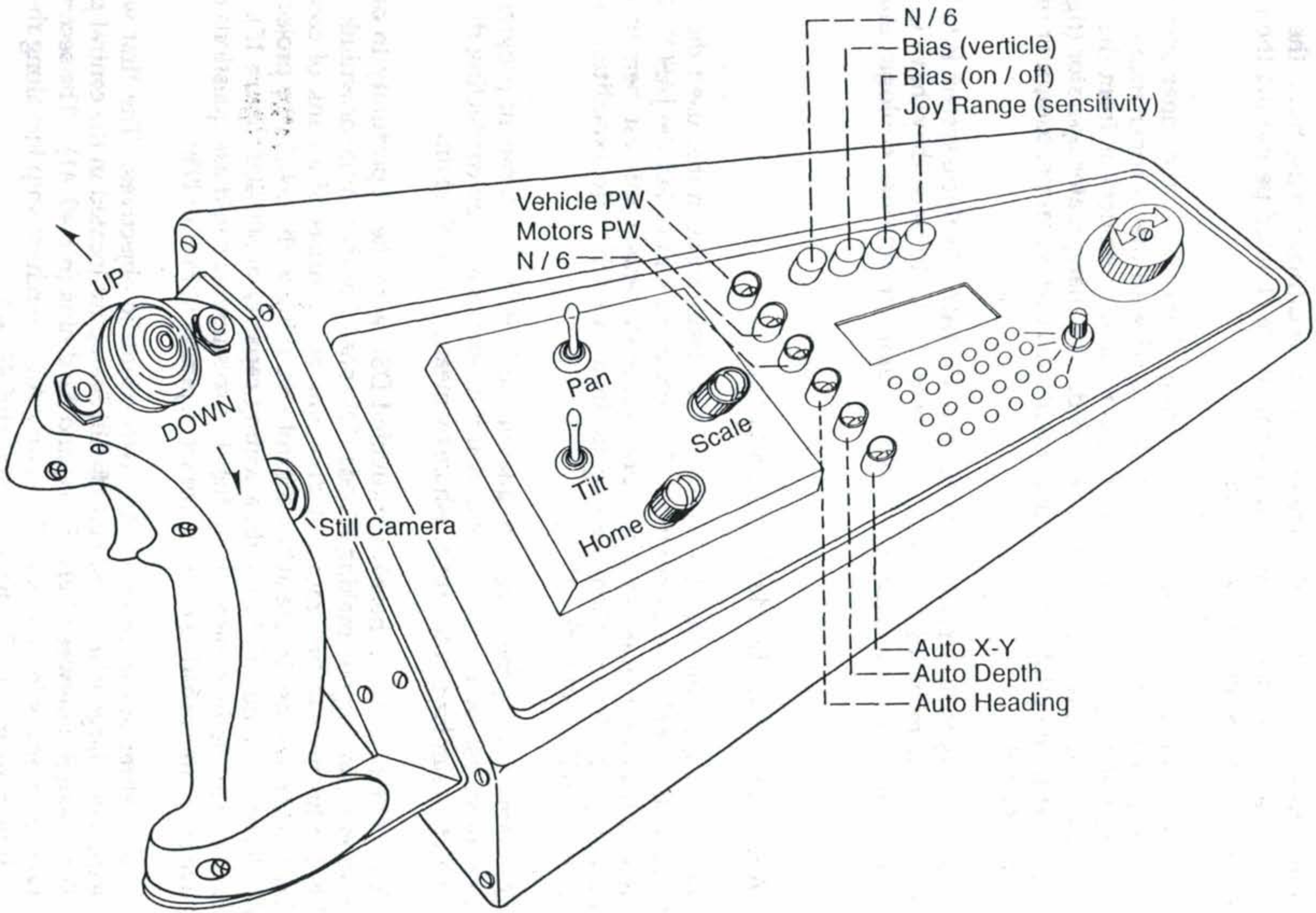

N / 6
Bias (verticle)
Bias (on / off)
Joy Range (sensitivity)
Vehicle PW
Motors PW
N / 6
UP
DOWN
Pan
Tilt
Scale
Home
Still Camera
Auto X-Y
Auto Depth
Auto Heading

FIGURE 14

If JASON is being tracked by the LBL navigation system, the slow up-date rate of navigational fixes commonly makes the auto controls difficult to use but if the EXACT system is in use, closed-loop control can commonly be attained permitting the EXACT navigator to assume control of the vehicle.

The sonar operator (figures 8 and 10) is in charge of all the sonar systems on JASON as well as the data management associated with their proper recording and display. The MEDEA flyer (figures 8 and 10) takes his instructions from the JASON pilot and raises and lowers MEDEA as required. The manipulator operator (figures 8 and 9) sits next to the pilot when needed and has his own separate, computer display, and joystick control.

The best way to illustrate the versitility of the JASON vehicle system is to briefly outline some of the missions on which it has been used. To date, they have involved both marine archeological efforts as well as more traditional geologic mapping programs.

(1989 JASON Project in the Mediterranean Sea)

In 1989, a program was carried out in the Mediterranean that used the JASON vehicle on its first major field operation. The program was called the JASON Project and was specifically designed for young pre-college students to interest them in science and technology by letting them participate in a live scientific expedition using a sophisticated satellite network (ref. 40).

As stated before, the long-term goal of the JASON development program is to permit scientists ashore to participate in real-time exploration by connecting the at-sea control van to a similar display room ashore by means of a satellite link.

The JASON Project, therefore, provided DSL with the opportunity to develop this addition technology by making Woods Hole one of twelve initial downlink sites in the 1989 Mediterranean program. A downlink site consists of a bank of computer consoles similar to those in the at-sea control van along with three large projector TV screens placed in an auditorium with a seating capacity of 300-400 (figure 15). There were two-way audio links between all the sites so students could ask questions during the 84 live programs broadcast over a two week period in May of 1989.

The Mediterranean program had two scientific objectives. The first was the investigation of a large volcano named Marsili Seamount located in the central portion of the Tyrranean Sea between Italy, Sicily, and Sardinina (ref. 40, 41). The second was the archeological investigation of a 4th century A.D. merchant ship lost along the trade route leading from ancient Carthage to Rome (ref. 40, 42).

NOT YET AVAILABLE

FIGURE 15

Both efforts were carried out in approximately 1,000 to 1,500 meters of water and involved the combined use of JASON and MEDEA. The primary instrument suite on JASON included a manipulator, sample basket, side-scan sonar, a high-resolution three-chip color television camera, a color still camera, a variety of color and black-and-white television cameras, and the standard instruments mentioned previously and shown in figures 1, 5 and 6.

The JASON vehicle was driven manually in conjunction with a long-baseline navigation system. The pilot could control the vehicle's heading and altitude automatically as well as use an auto-bias control to compensate for being either too heavy or too light. The transponder network was used to dynamically position the surface ship and the MEDEA relay vehicle.

The most challenging aspects of this program were the recovery of over 54 ancient artifacts from the shipwreck site using a manipulator system developed at DSL (ref. 43). Most commerically available manipulators are designed for highly structured tasks characterized by military and oil and gas requirements. Scientific missions, however, are highly unpredictable and commonly demand much finer control.

The design criteria for the JASON manipulator involved the ability to (1) control low forces and torques (2) work within the lift capability of the vehicle and (3) operate within the vehicle's field of view. The manipulator uses a series of joints having low-friction cables and pulleys that have a moderate ratio with zero-backlash. They are driven by high-performance brushless DC servomotors and each joint is oil filled to compensate for the pressure that exists at the vehicle's full operating depth of 7,000 meters (20,000 feet).

The recovery scheme involved both the manipulator and an elevator dropped from the surface (figure 16) and proved highly successful. The elevator free-fell to the bottom and was tracked on its way down by the long-baseline navigation system.

JASON's manipulator was modified to hold a large set of tongs that conformed to an object such as an ancient amphora, before applying any pressure (figure 17). Once grasped by the tongs, JASON thrusted up off the bottom and carried the amphora to the elevator. This was repeated 4 to 6 times before the elevator was acoustically commanded to release an ascent weight and rise back to the surface where it was emptied and sent back to the bottom. In all, 13 separate elevator round-trips were made without damage to any of the artifacts.

(1990 JASON Project in Lake Ontario)

The focus of the 1990 JASON Project in Lake Ontario was the archeological investigation of two warships, the HAMILTON and SCOURGE, lost in a storm in 300 feet of water during the War of 1812 (ref. 44). Both ships sit upright on the bottom in a high state of preservation..

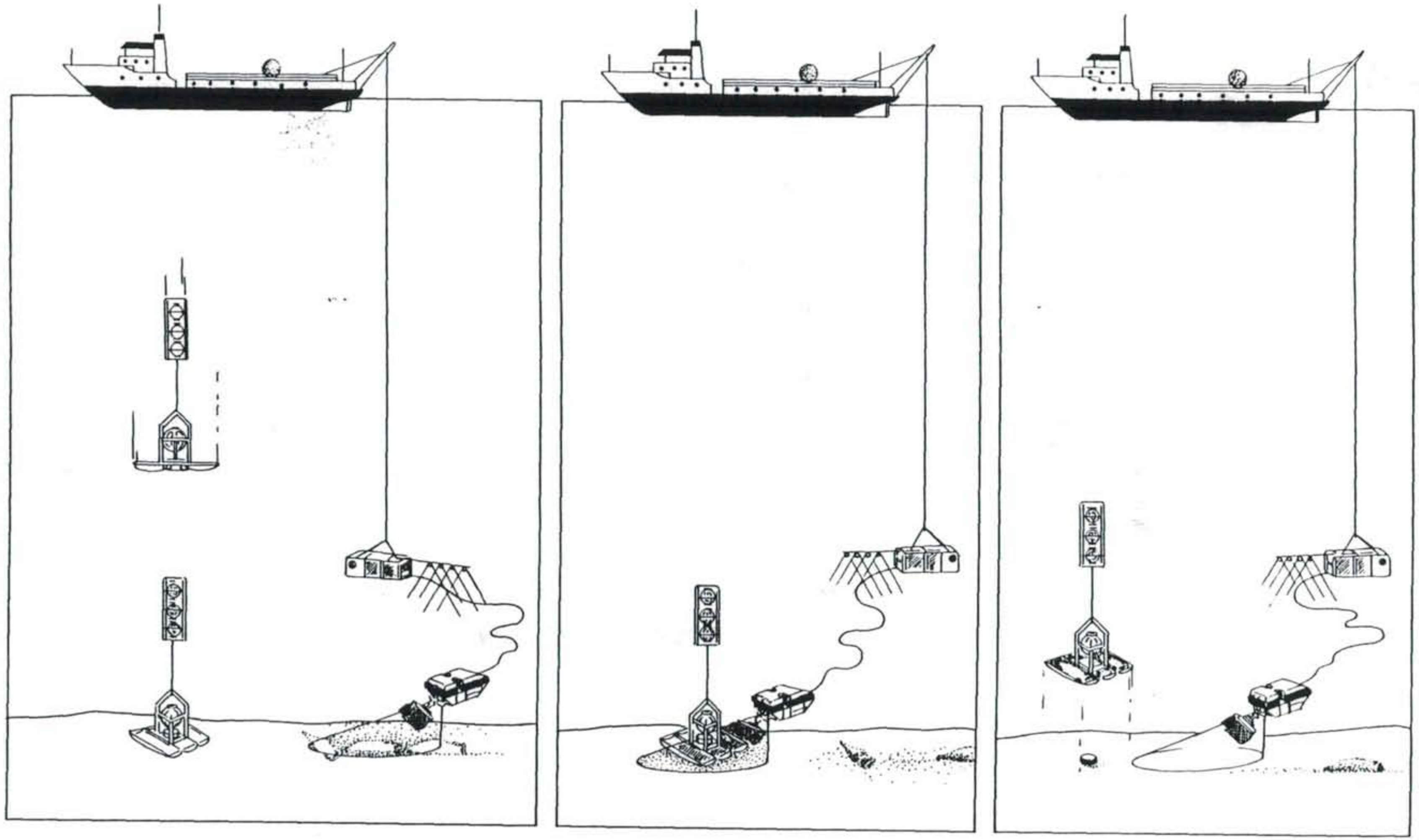


FIGURE 16

NOT YET AVAILABLE

FIGURE 17

A large barge carrying the control van was placed in a four-point mooring above the HAMILTON for one week and the SCOURGE for a second week. Three 300-kHz SHARPS transducers were attached to the barge and two lowered to the bottom. A 675-kHz pencil-beam MESOTECH 971 sonar was mounted on the front of JASON with the beam scanning in the vertical plane. JASON and MEDEA were lowered to the wreck site and JASON was placed in autoheading normal to the long axis of the ship and at a constant altitude just above bottom (figure 18a). The horizontal servo loops were activated, which held the vehicle in a dynamically controlled hovering position. The "joystick auto" mode was then engaged permitting the pilot to move the vehicle laterally along the sway axis of JASON. In this mode a deflection of the joystick to the right or left moved the vehicle precisely in that direction and the amount the joystick deflection was proportional to its lateral speed. This method of control greatly simplified the survey effort and reduced pilot fatigue. The resulting display, constructed using stochastic backprojection techniques (ref. 22), is a three-dimensional characterization of the ship, which in the case of figure 18 represents the warship SCOURGE.

A second sonar survey was carried out on both ships using a laser guided 1-Mhz Spotrange sonar having a narrow beam width of 1.5 degrees pointing down at 30 degrees from horizontal (ref. 45). In this particular application, the auto-control was used to hold the vehicle at a constant altitude along a line normal to the hull (figure 18b). The pilot then moved JASON back and forth along the trackline normal to the hull before moving to another line. Figure 18b illustrates one of the cross sections constructed during this survey. This same system was used through a ship's window to map a portion of its interior.

A third survey was conducted of each ship using a thermoelectricially cooled charged-coupled device (CCD) digital electronic black-and-white still camera (ref. 33). By cooling the CCD chip to -40 degrees C, its dynamic range and sensitivity is greatly increased. Mounted either in the vertical or horizontal mode, JASON made a series of closed-loop controlled photo runs along and over the ships using the "joystick auto" mode. After collecting the data set, each image underwent standard enhancement to remove particle backscatter characteristic of images collected in turbid water as well as adaptive histogram equalization to compensate for uneven lighting. Working at a PIXAR workstation, the processor was able to construct a mosaic of the HAMILTON while in the field. This at-sea processing effort included interactive dragging, rotating, blending, scaling, and tie-point warping.

An initial picture was selected upon which the mosaic was built. An adjacent processed image was then placed on the display and using a mouse, moved into position. Using several tie-points, the new image was panned, zoomed, and blended to fit the initial image. Flicking back and forth, the operator used a least squares algorithm to warp and fit the image into position. When satisfied with the fit, he combined the images building the mosaic until it was completed (figure 19).

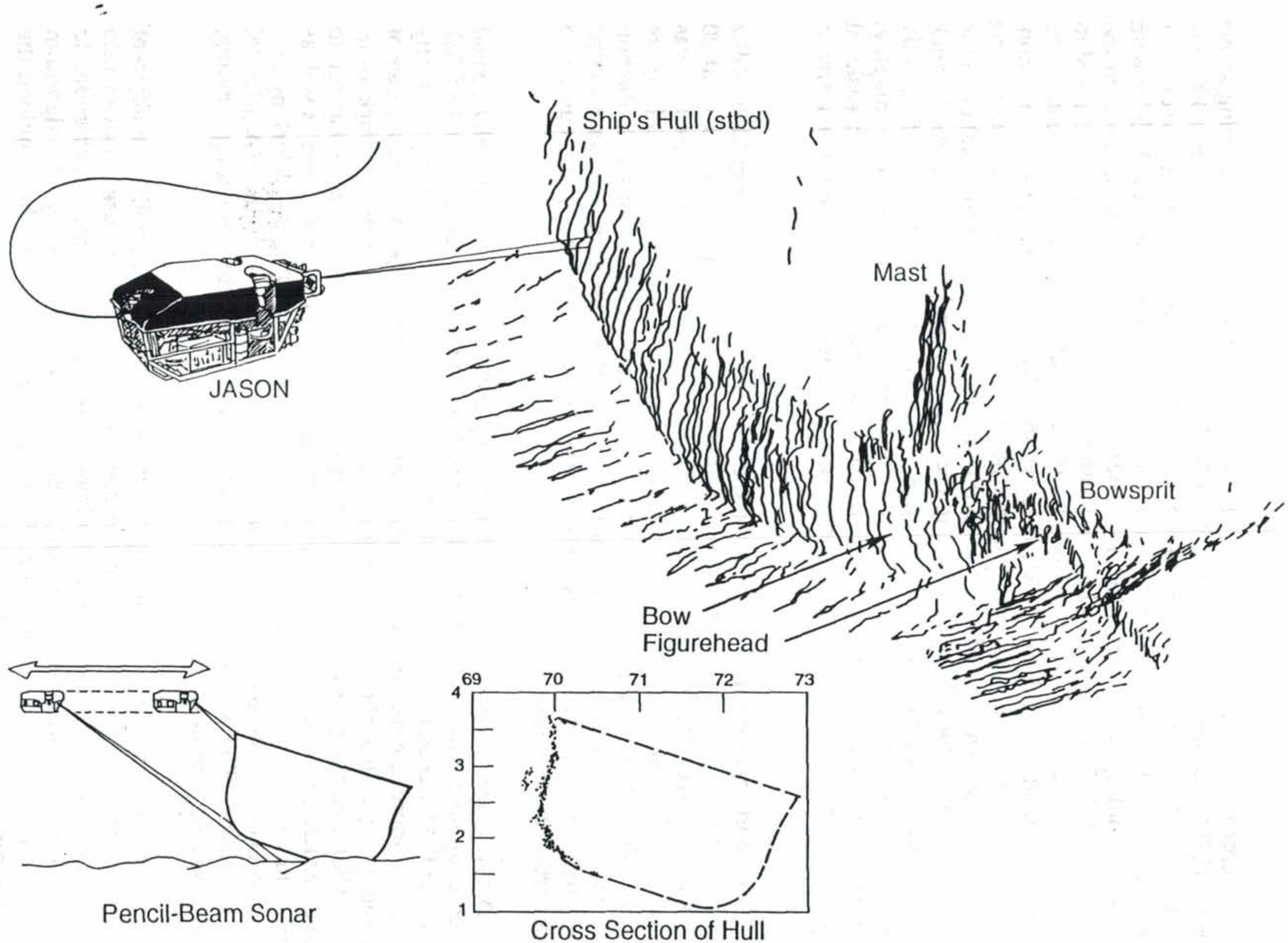


FIGURE 18a

FIGURE 18b

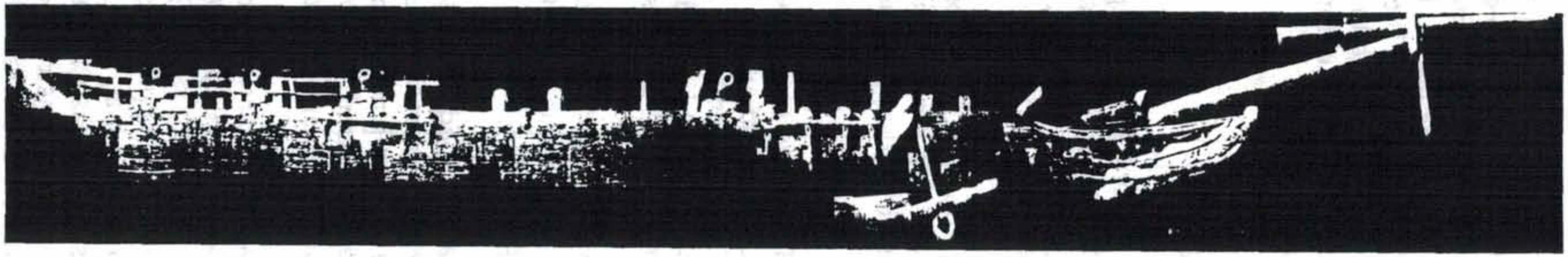


FIGURE 19

At the end of each of the 60 live broadcasts, a student was selected from the audience and brought to the control console situated at the downlink sites. There, a joystick control box and a computer-graphics display were connected to the JASON controls aboard ship by a digital satellite datalink. This link made it possible for the students to assume control of the JASON vehicle. The JASON pilot in the at-sea control van could transfer as much control of the vehicle to the student as he felt they could handle (figure 20). This experiment clearly demonstrated that remote piloting by scientists in on-shore downlink sites is possible.

(1991 Juan de Fuca-CREST Project)

In July and August of 1991, the first major comprehensive science program using the JASON vehicle system in the MOR (ref. 46) was carried out in the rift valley of the Juan de Fuca Ridge (Endeavour segment at 48° north, figure 21). This program was the first to utilize JASON's full deep-ocean capabilities.

JASON, as previously stated (figure 2), was designed to fill the traditional "gap" between acoustical and optical mapping systems. Prior to this cruise, the Juan de Fuca study area had undergone extensive investigation using a wide variety of mapping systems.

At the long-range low-resolution end of the spectrum, previous studies included the use of a SEABEAM swath-mapping sonar system (ref. 47, 48), SEAMARC I (ref. 49, 50), and SEAMARC II (ref. 51). The frequencies of these sonars range from 12 KHz (SEABEAM and SEAMARC I) to 27 and 30 KHz (SEAMARC II). In selected areas a limited amount of 100 KHz deep-towed side-scan sonar data was also collected (ref. 47).

At the opposite, short-range high-resolution end of the spectrum, were studies carried out using deep-towed still camera and video television systems (ref. 48, 52), and the manned submersible ALVIN (ref. 12, 53).

Although these studies have helped significantly to better understand the volcanic, hydrothermal, and tectonic processes occurring along the axis of the MOR, comparison or more importantly the merging of these data sets to provide a single coherent picture has not yet been attained. It was within this context that the July/August 1991 JASON expedition was planned and executed.

The first data set collected was a detailed systematic survey of the rift axis within a rectangle 18 km along axis by 4 km normal to axis (figure 21a) using DSL's AMS-120 side-scan sonar system (figure 22). This 120-KHz split-beam sonar was designed and developed by DSL in cooperation with the Applied Physics Lab. (APL) at the University of Washington and Acoustic Marine Systems, Inc. (ref. 20). The system's calibrated transducers permit accurate backscatter measurements and it's dual receivers provide phase information which can be used to construct high-resolution swath bathymetry. This data set resulted in a bathymetric map and side-scan sonar records that have a

NOT YET AVAILABLE

FIGURE 20

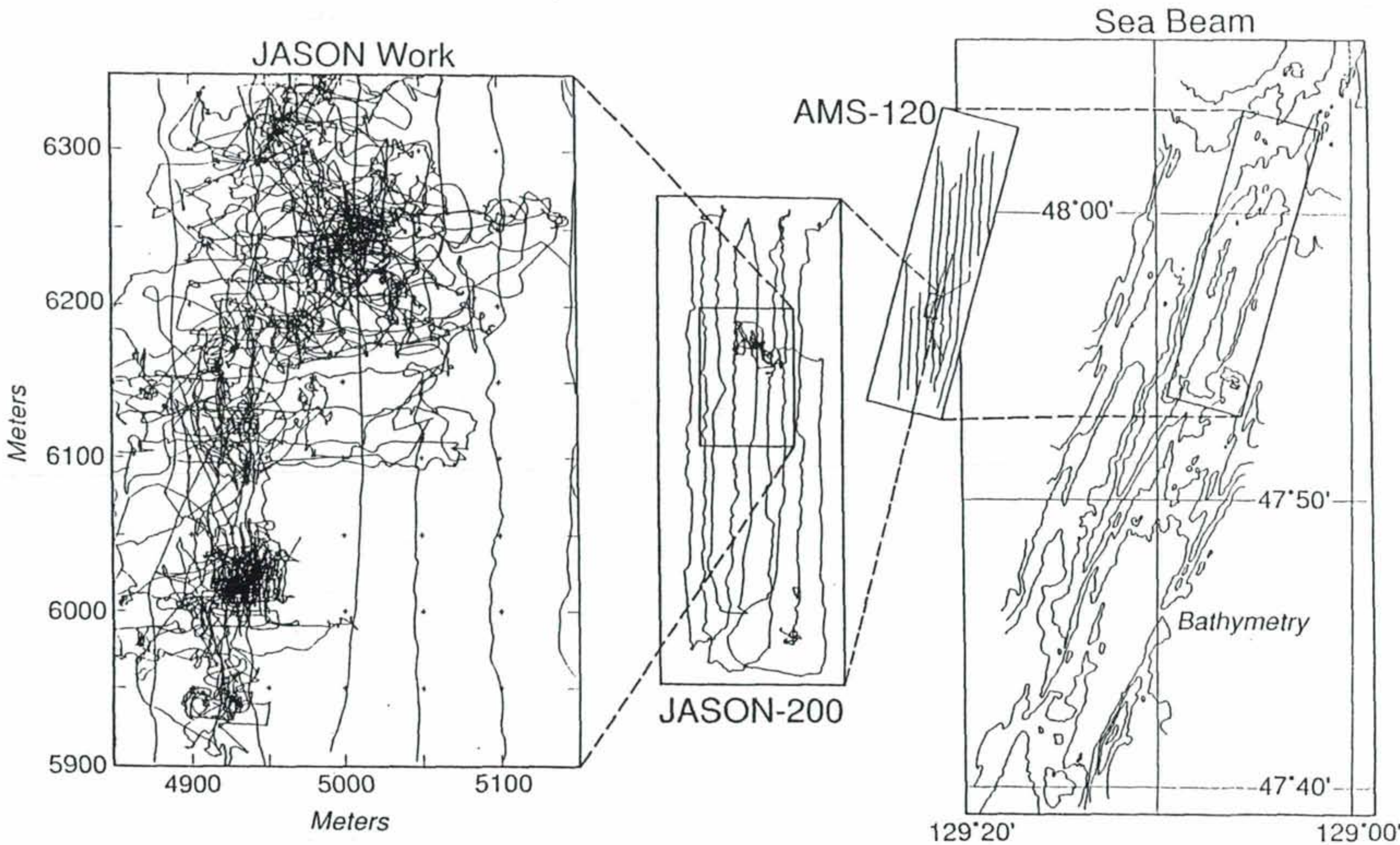


FIGURE 21a, b, c

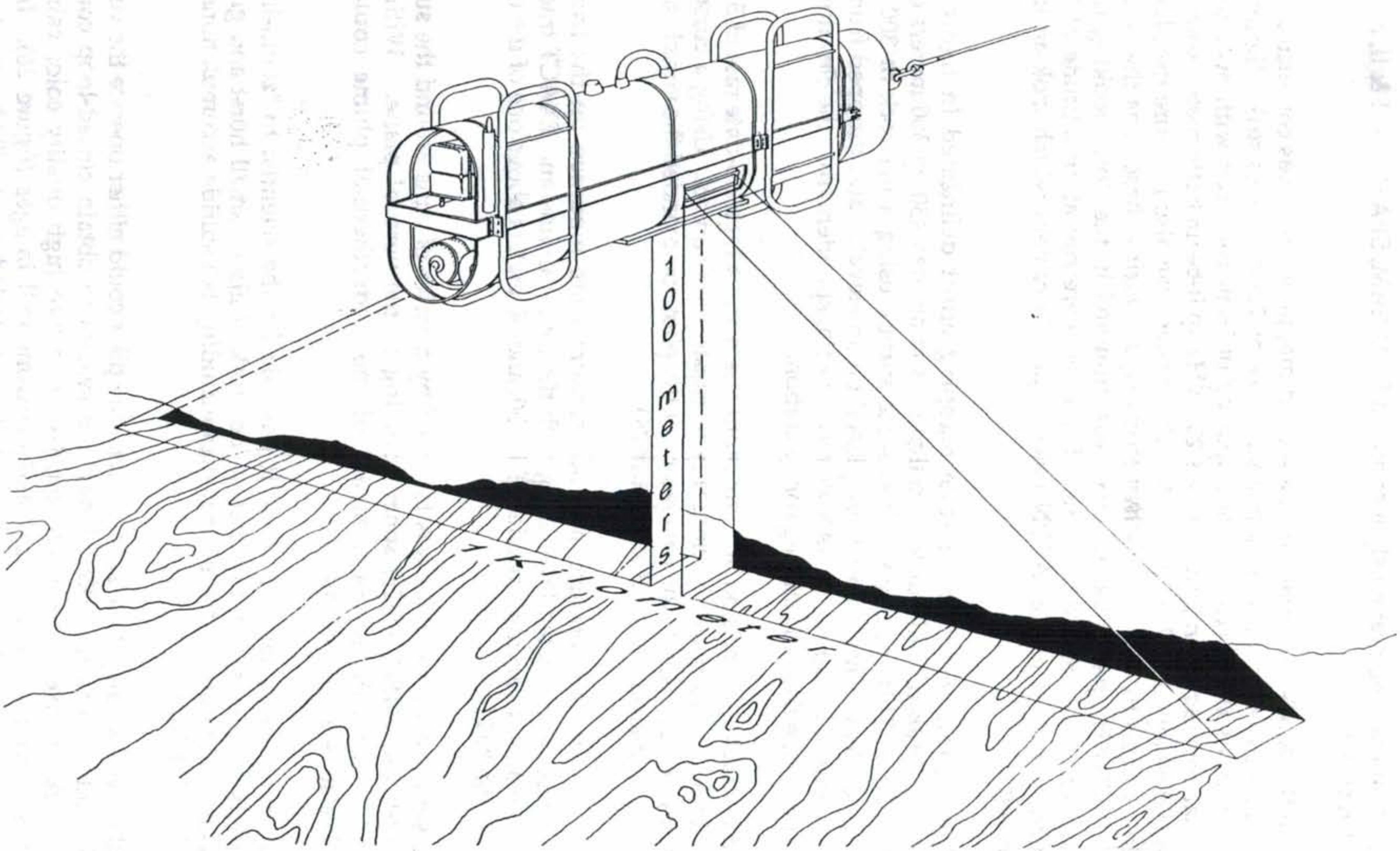


FIGURE 22

higher resolution than the previously mentioned SEABEAM, SEAMARC I & II, and 100 KHz side-scan surveys.

Within the AMS-120 survey area, a second mapping effort was conducted using JASON/MEDEA covering an area 7 km along strike by 2.5 km across strike (figures 21b and 23). A series of along axis lines at a spacing of 50 m were run with overlapping side-scan sonar coverage using the vehicle's 200-KHz split-beam bathymetric sonar that was similarly developed by DSL and APL. This system can also measure the phase of the returning signals to construct bathymetric maps. During these runs the vehicle's MESOTECH 675-KHz pencil-beam sonar was mounted in the down-looking mode, scanning perpendicular to the trackline. The lines were run at an altitude of 10-15 meters which permitted use of JASON's electronic still camera which took an image every 20 seconds.

Following this intermediate scale mapping effort delineated in figure 21b, JASON began a series of individual investigations in an area 450 by 300 meters on its sides (figure 21c). This included a finer scale survey using a network of 300-KHz EXACT transponders. These units were placed on an elevator and dropped from the surface in the area to be surveyed. JASON took the transponders from the elevator and deployed them in the desired tracking configuration.

With its tracking precision of a few centimeters and a high up-date rate of 5 fixes per second, JASON was placed periodically in closed-loop control. Using a cursor on the computer graphic display, the navigator not the pilot commanded the vehicle to run a series of closely spaced survey lines (figure 24).

Conductivity, temperature, and Mn sensors were mounted on the front of JASON. A series of navigated lines using both the long-baseline and EXACT tracking systems were made at varying altitudes of 10, 50, and 80 meters above one of the major vent systems (figure 25).

This series of survey lines was followed by a series of runs around the sulfide structure with the MESOTECH sonar scanning in the vertical plane. With this information, a three-dimensional model of the hydrothermal plume could be constructed relative to the vent structure.

This unique data set then made it possible for the scientist to "zoom-in" on specific targets of interest. In this case, a network of gjars, small horst and graben structures, and numerous hydrothermal sites including tall sulfide accumulations and "black smoking" chimneys.

While investigating these specific sites, the pilot could either operate the vehicle in manual mode or use the EXACT tracking system to obtain closed-loop control. During this final phase of investigation, JASON's two high quality color cameras obtained spectacular video coverage and electronc still images (figure 26). In all, JASON spent more than 190 hours on the bottom, collected nearly 700 hours of video

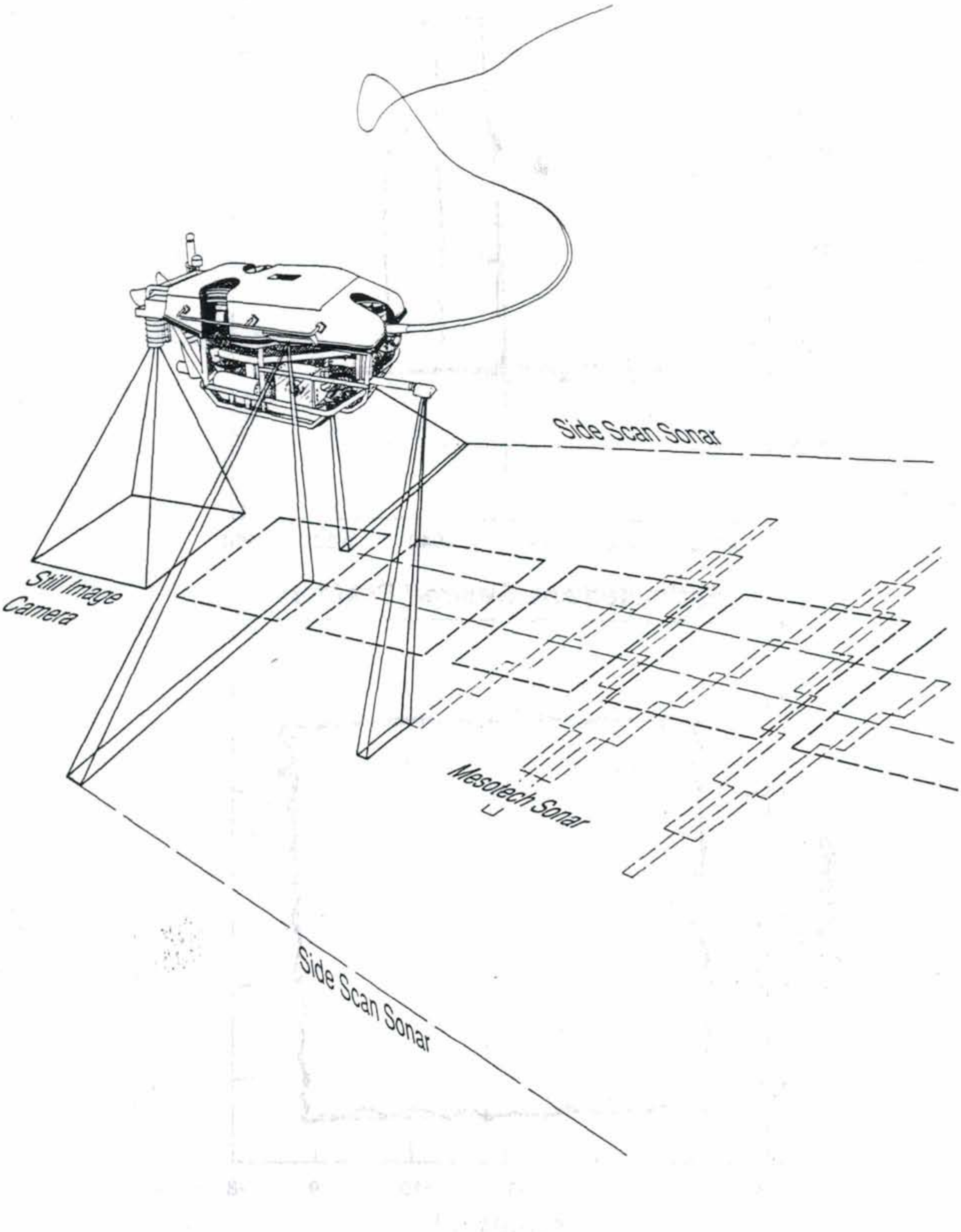

Side Scan Sonar
Still Image
Camera
Mesotech Sonar
Side Scan Sonar

FIGURE 23

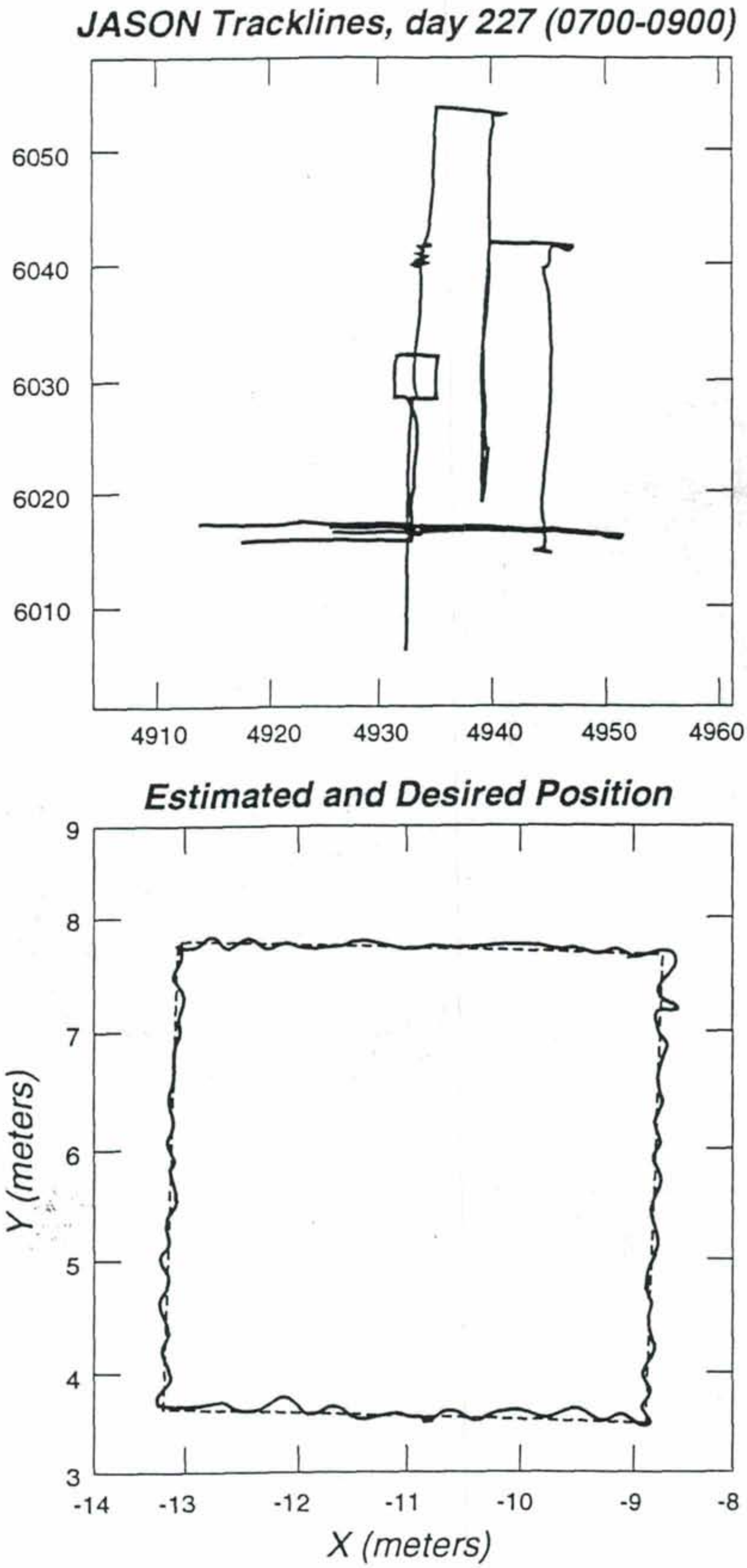

JASON Tracklines, day 227 (0700-0900)
6050
6040
6030
6020
6010
4910
4920
4930
4940
4950
4960
Estimated and Desired Position
9
8
7
6
5
4
3
Y (meters)
-14
-13
-12
-11
-10
-9
-8
X (meters)

FIGURE 24

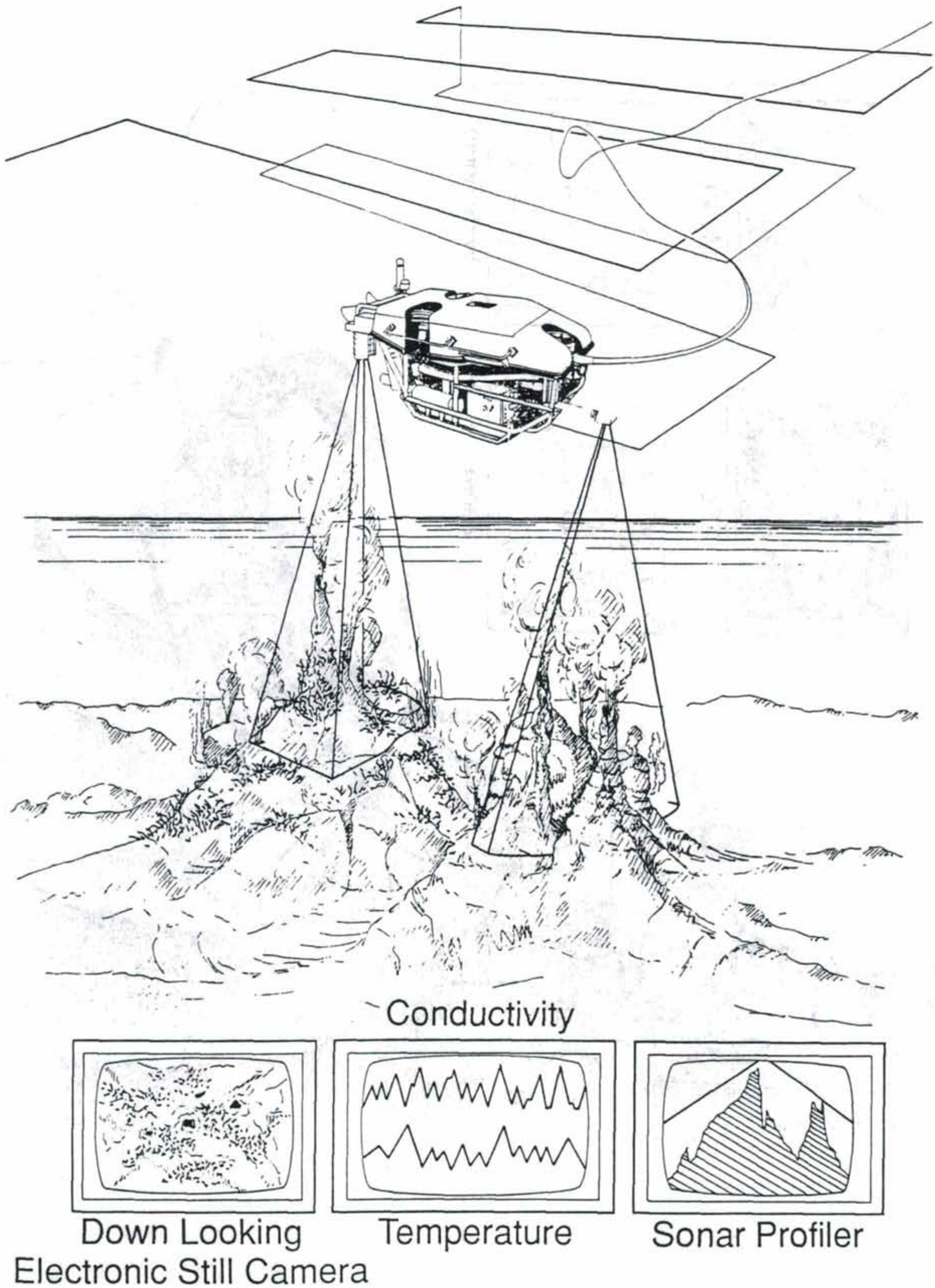

Conductivity
Down Looking
Electronic Still Camera
Temperature
Sonar Profiler

FIGURE 25

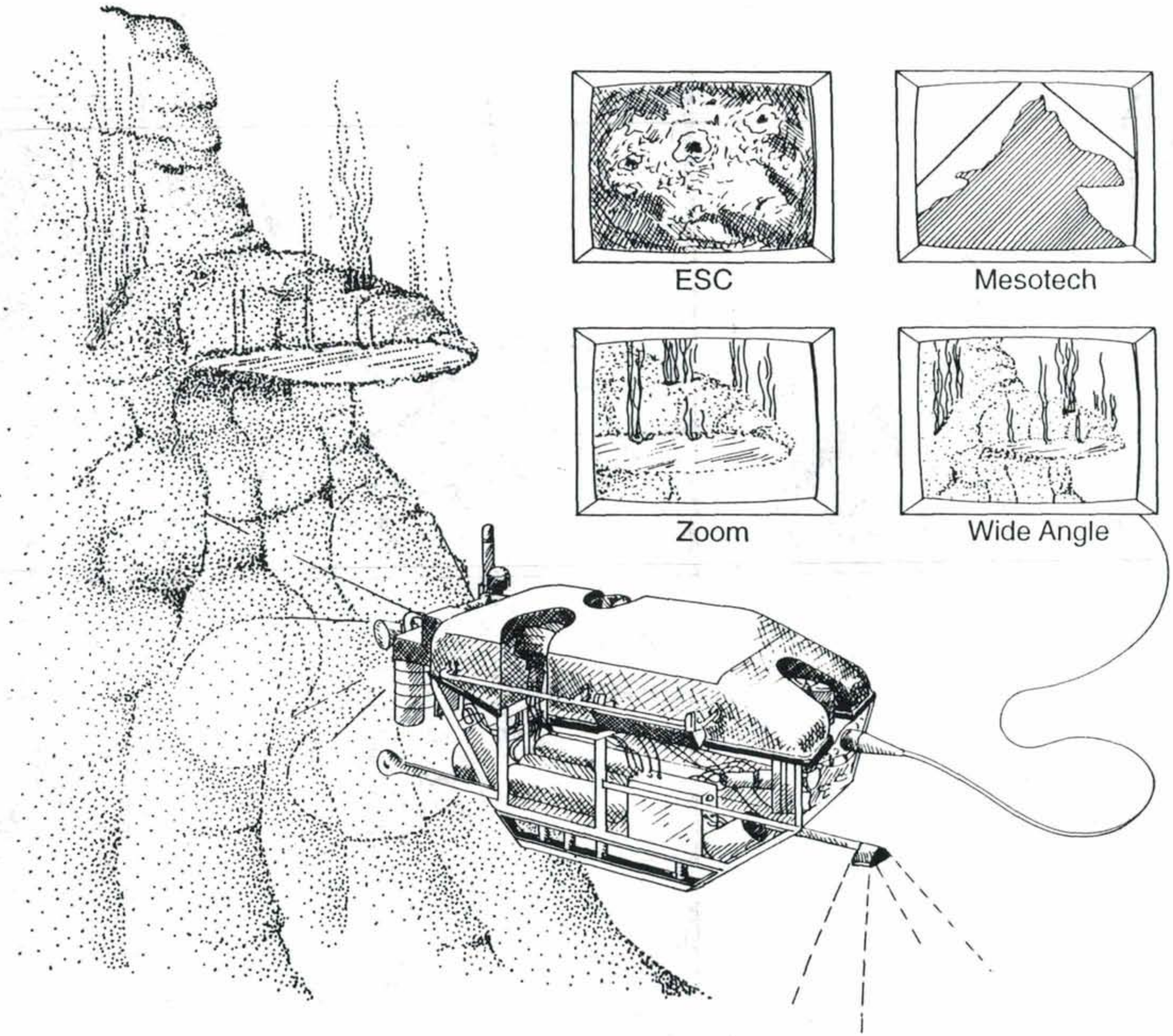


FIGURE 26

from its various cameras systems, obtained more than 18,000 electronic still images, made approximately 40 EXACT navigated runs in the hydrothermal plumes, and digitized the bottom terrain with its various sonar systems.

FUTURE DEVELOPMENT OBJECTIVES

Although the JASON vehicle system has proven its ability to carry out sophisticated missions in the complex terrain of the Mid-Ocean Ridge, much remains to be done before it becomes a highly routine operation. The most important issue to address is real-time processing of the massive amount of date this fiber-optic system can collect. Scientists accustomed to using a manned system have learned to quickly process their observations after three hours on the bottom each day. But a system working 24 hours a day with a tremendous number of acoustic and visual sensors can rapidly overwhelm even a team of experienced scientists.

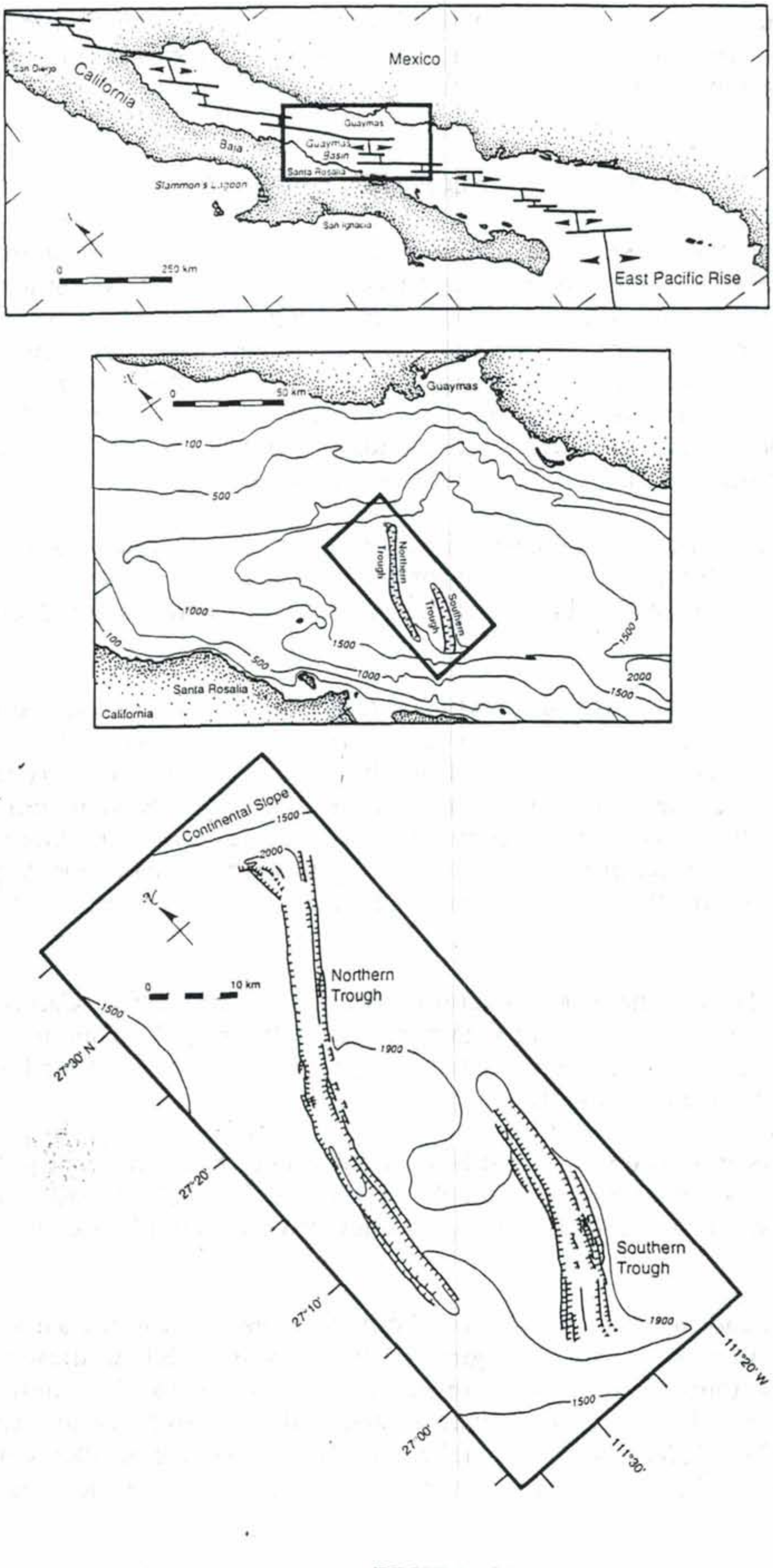
More can be done to process this information in real-time at sea but, clearly, expeditions of the future will require a completely different approach to mapping. A large number of scientists need to be involved to fully utilize the potential of the JASON system.

It is felt that this can best be done through a satellite link to shore. At the present time several marine institutions have joined the JASON Project network. They include the Woods Hole Oceanographic Institution, the Graduate School of Oceanography at the University of Rhode Island, Mote Marine Labs., the Harbor Branch Foundation, the Great Lake Studies Group at the University of Wisconsin, and the Orange County Marine Institute. Although these organizations joined the network for its pre-college educational program, the same system can be used to network scientists on future research expeditions.

In early 1993, a major expedition is planned in the Gulf of California in the northern and southern troughs of Guaymas Basin (figure 27). This area of intense hydrothermal activity will be investigated using a combination of manned, unmanned, and shore-based downlink sites (figure 28).

This expedition is both a scientific expedition and the fourth year of the JASON Project. The at-sea elements include the R/V LANEY CHOUEST, the deep submersible TURTLE, the MEDEA/JASON system, 25 interactive downlink sites and 2 remote science sites.

TURTLE and MEDEA/JASON will both be in the water at the same time. The science party will be split into three groups; those inside TURTLE, those in JASON's control van, and those at the various interactive downlink sites. Two basic downlink sites will be involved. Approximately 25-30 sites will be located in auditoriums in the United States, Canada, France and Great Britian. These sites will be filled with students and teachers as well as scientists monitoring the program. Two sites, one at Woods



Mexico
San Diego
California
Baja
Guaymas
Guaymas Basin
Santa Rosalia
San Ignacio
0
250 km
East Pacific Rise
0
50 km
Guaymas
100
500
1000
1500
2000
Northern Trough
Southern Trough
Santa Rosalia
California
Continental Slope
1500
2000
0
10 km
Northern Trough
1900
27°30' N
27°20'
27°10'
27°00'
Southern Trough
111°20' W
111°30'

FIGURE 27

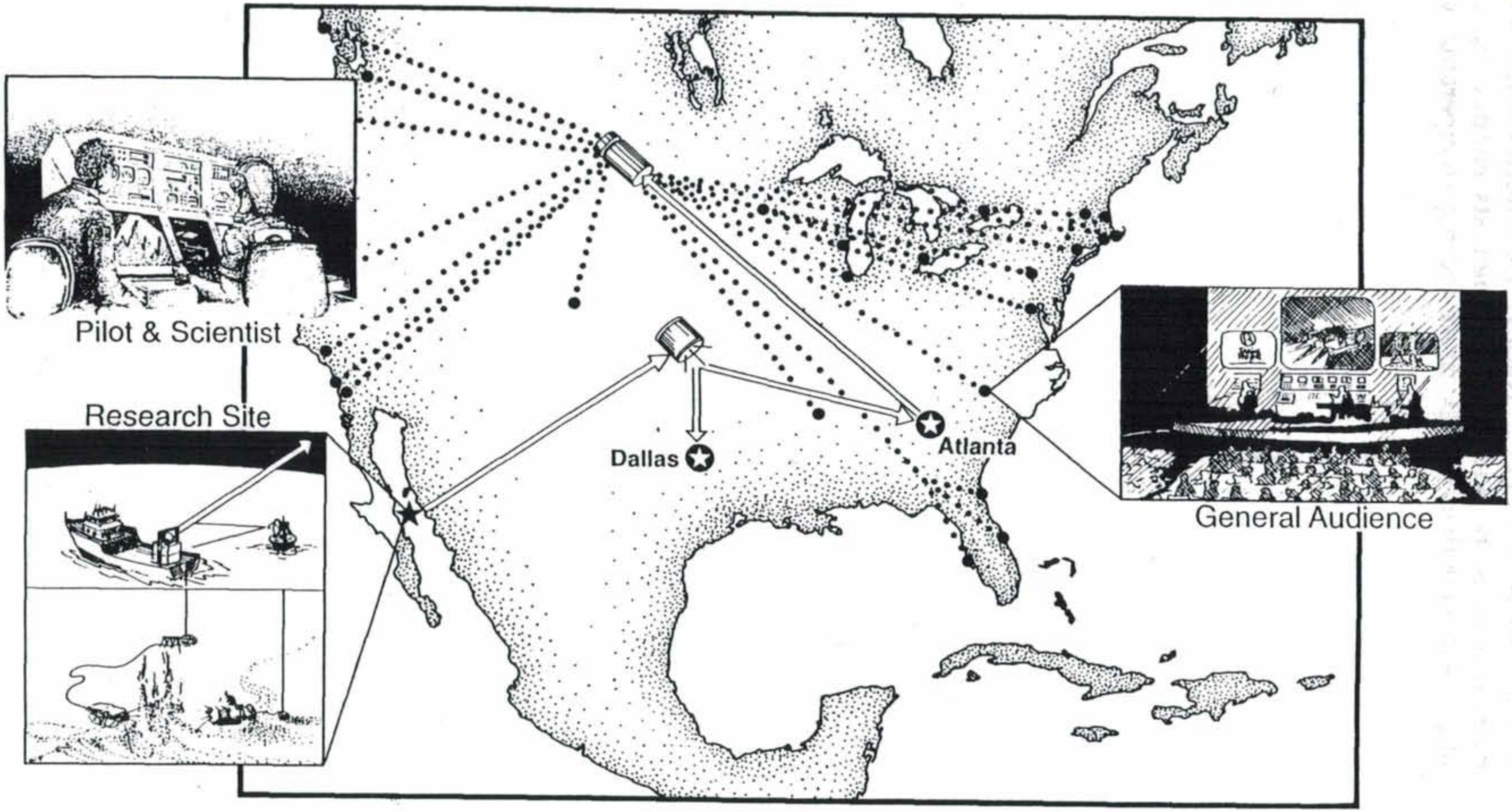

Pilot & Scientist
Research Site
Dallas
Atlanta
General Audience

FIGURE 28

Hole and the other in California will be in research laboratories where a JASON pilot and JASON engineer will work with various scientists conducting a variety of experiments using JASON in both low-temperature and high-temperature vent fields in Guaymas Basin.

FIGURE CAPTIONS:

Figure 1: Schematic of MEDEA/JASON remotely operated vehicle system deployed from dynamically positioned surface support ship. Real-time signals transmitted up the fiber-optic cable are relayed to shore-based station by way of a satellite link.

Figure 2: Comparison of various underwater mapping systems based upon their survey swath width versus their image resolution. The ARGO/JASON development program concentrated on shaded area where transition occurs between optical and acoustic sensors.

Figure 3: Test tank results of ROV under closed-looped control using SHARPS tracking system. Dashed lines are desired tracklines while the solid line is the actual track the vehicle followed.

Figure 4: Photograph taken from submersible ALVIN of JASON, Jr. (a proto-type of JASON) inspecting the upper starboard boatdeck of the R.M.S. TITANIC.

Figure 5: MEDEA vehicle used in conjunction with the JASON ROV. MEDEA acts as a relay vehicle between JASON and surface ship. It damps out surface motions and acts as an "eye in the sky," observing JASON's movements in the terrain below.

Figure 6: JASON ROV system and its various components. The actual configuration of these components varies as a function the ROV's particular mission requirements.

Figure 7: Typical shipboard layout used to support MEDEA/JASON/AMS-120 vehicles.

Figure 8: Surface control van used to operate various vehicle systems. It consists of two sea-going containers shipped as separate units and assembled aboard ship to create a single operations center.

Figure 9: Main control console at which sits the navigator, data logger, JASON pilot, and other engineers and scientists which varies during the course of any given mission.

Figure 10: Console used to support the MEDEA pilot and sonar operators.

Figure 11: Console used by JASON engineer.

Figure 12: Raw navigation data display used by navigator to monitor the reliability of various tracking information dealing with the location of the ship, MEDEA, and JASON.

Figure 13: Primary navigational display used at different locations aboard ship to monitor the locations of the various systems being used at any one time.

Figure 14: JASON control box used by JASON pilot.

Figure 15: One of 25 downlink sites used by the JASON Foundation for Education to conduct annual "live" interactive expeditions to various locations around the world.

Figure 16: Elevator system used to transport equipment or instruments to the bottom or to recover samples collected by JASON. Elevator free-falls to the bottom and it's location is monitored by the tracking system during descent. JASON/MEDEA are then vectored to its location using the ship's dynamic positioning system where they either pick up or place various items. The elevator is then acoustically commanded to drop a weight and rise back to the surface where it is then recovered and prepared for a subsequent lowering.

Figure 17: Image of JASON taken from MEDEA as it recovers an amphora using specially designed tongs. Once the object is securely held, JASON will carry it over to a nearby elevator.

Figure 18(a): JASON in closed-loop control using SHARPS tracking system with the vehicle operating in "joystick auto" mode. This mode automatically places the long-axis of JASON perpendicular to the long-axis of the warship SCOURGE at a given stand-off distance and vehicle altitude. Using the MESOTECH sonar in a vertical scanning mode, a vertical line of digital information is collected representing the distance between the scanner and the bottom/ship. The pilot then moves JASON laterally to a new position and the scan is repeated. The result is a three-dimensional characterization of that portion of the ship "visible" to the scanner.

Figure 18(b): JASON still in close-looped control operating at a constant altitude, positioned with its long-axis perpendicular to the long-axis of the ship. But instead of moving laterally along the strike of the ship, the pilot moves JASON back and forth from the ship. During these traverses a laser guided narrow beam Spotrange sonar scans the ship. The result is a series of cross-sections of that side of the ship "visible" to this sensor.

Figure 19: A partial mosaic of the warship HAMILTON constructed using approximately 109 individual electronic still camera images.

Figure 20: A young student controlling JASON from a downlink site while the vehicle is working near the warship HAMILTON. Certain vehicle functions are computer controlled depending upon the ability of the individual student. Over 120 students have carried out this operation during Projects JASON II (1990) and JASON III (1991).

Figure 21(a): Simplified large-scale bathymetric map of Endeavour segment of the Juan de Fuca Ridge where the Crest Project was carried in the summer of 1991. Rectangle delineates area where the AMS-120 (figure 22) was used to make a series of parallel tracklines. This split-beam bathymetric side-scan sonar measures both the intensity and the phase of the returning signals to generate both shadow-graph and bathymetric maps.

Figure 21(b): Intermediate scale study area showing the location of the primary work area as well as a series of tracklines carried out by JASON.

Figure 21(c): Tracklines of the JASON vehicle in primary work area. X and Y coordinates relative to an arbitrary point of origin.

Figure 22: Generalized schematic of AMS-120 sonar vehicle being flown at an altitude of 100 meters during its survey of overall study area (figure 21a).

Figure 23: Schematic showing the approximate "footprint" of each acoustic and visual sensor on JASON used during the intermediate scale survey (figure 21b) of the study area.

Figure 24: A portion of the trackline coverage carried out by JASON above a high-temperature "Black smoker" in the JASON work area (figure 21c). JASON is under close-looped control using the EXACT tracking system having a tracking precision of better than 2 cm.

Figure 25: Diagram of JASON working above high-temperature "Black smoker" (figure 24). Tracklines at various altitudes are shown as well as the "foot-print" of the electronic still camera and Mesotech scanning sonar. Also shown are the graphic displays of the conductivity and temperature sensors on JASON.

Figure 26: JASON working along the side of a sulfide chimney ("Black smoker") in the area of a flange (pool of high-temperature fluid). Inserts show sensors being used at that moment (electronic still camera in down-looking mode, scanning sonar in down-looking mode, 1-chip (wide angle) color television image, and 3-chip high-resolution (zoom) color television image. Both TV cameras are looking forward.

Figure 27: Proposed study are for JASON IV to be carried out in early 1993 in the northern and southern troughs of Guaymas Basin in the Gulf of California (Sea of Cortez).

Figure 28: Telecommunications network to be used during JASON IV. It consists of the at-sea operating assets (R/V LANEY CHOUEST, submersible TURTLE, and ROV JASON/MEDEA); production site in Atlanta, Georgia; mission control in Dallas, Texas; various general audience downlink sites (JASON PINS sites) in Canada and the UnitedStates (downlink sites in Britian and France not shown); international and domestic satellites to transmit live audio and visual signals, and two science downlinks in California and Woods Hole. Also not shown is JASON worksite in San Ignacio lagoon on the west side of Baja California.

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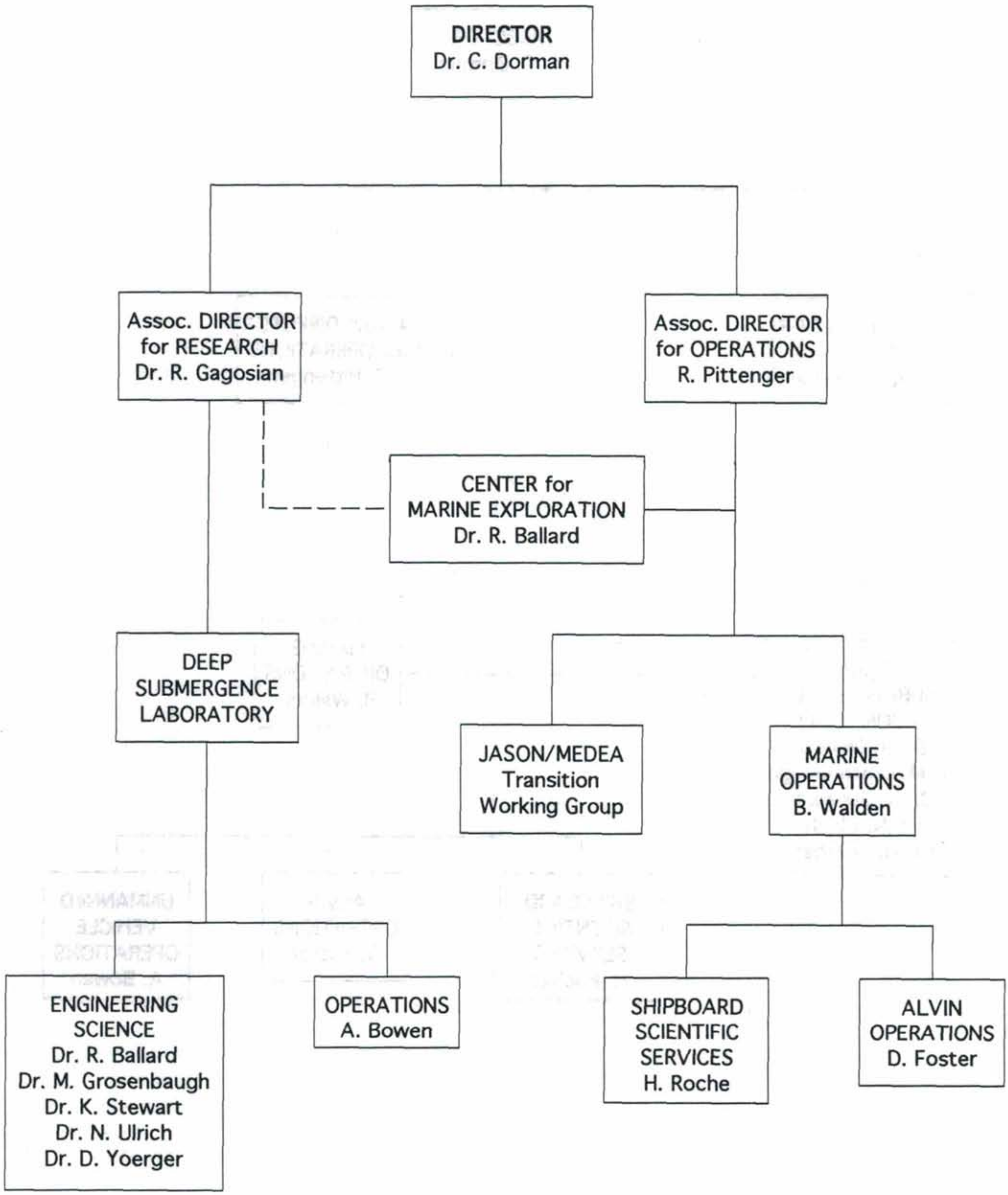
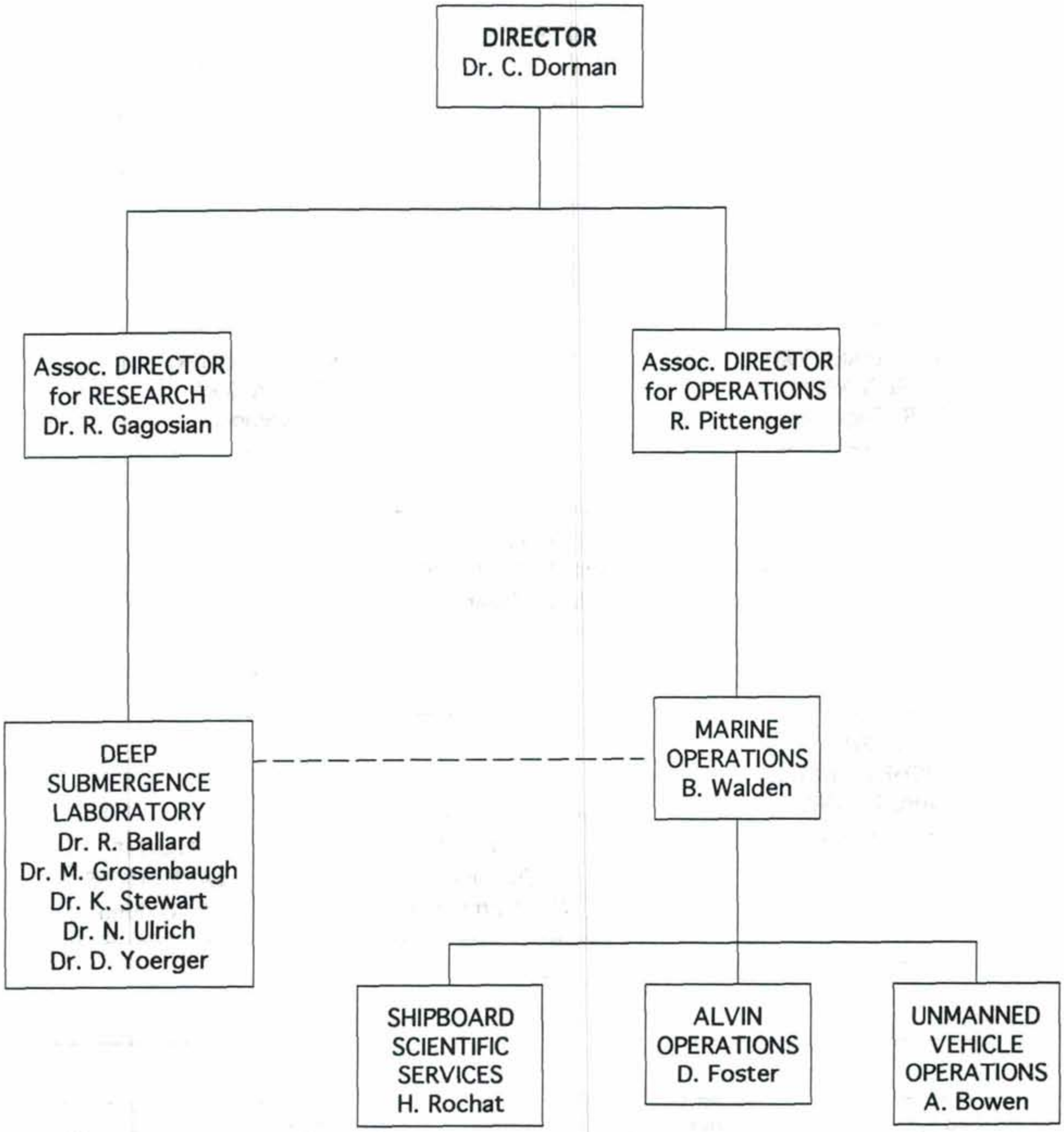
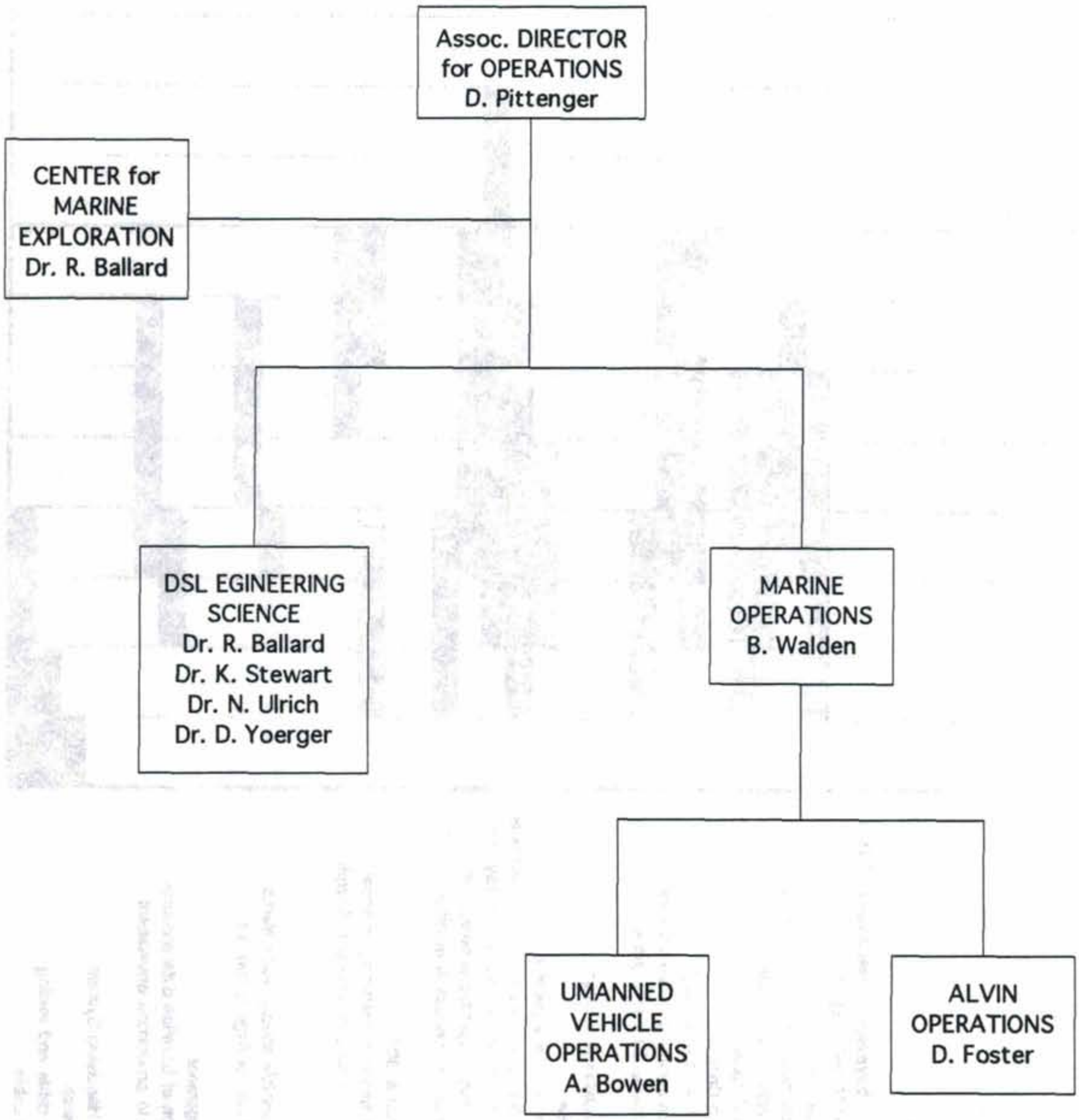
EXSISTING DEEP SUBMERGENCE SUPPORT ACTIVITIES AT WHOI

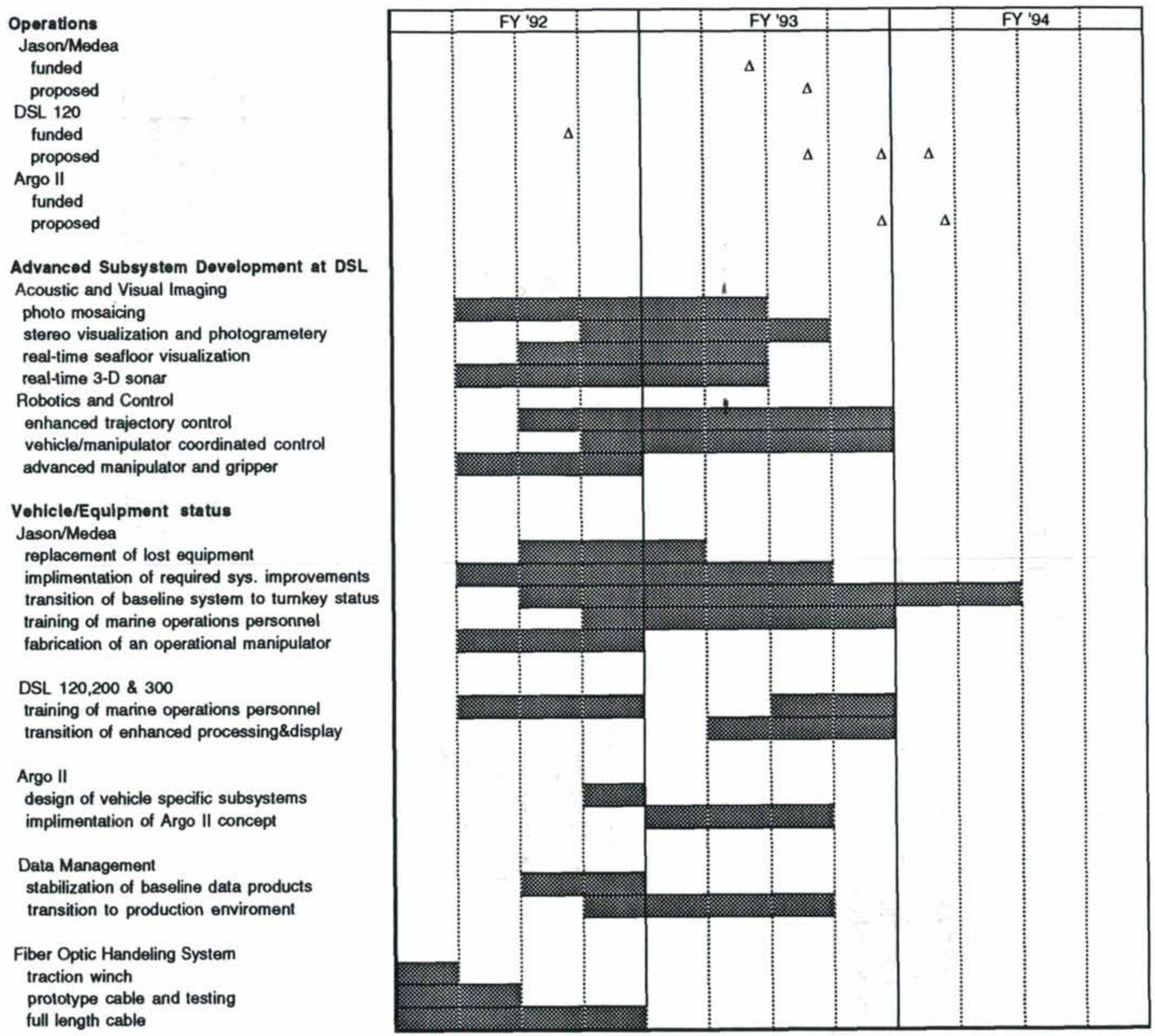


POST-TRANSITION DEEP SUBMERGENCE SUPPORT ACTIVITIES AT WHOI



JASON/MEDEA TRANSITION WORKING GROUP




FY '92
FY '93
FY '94
Operations
Jason/Medea
funded
proposed
DSL 120
funded
proposed
Argo II
funded
proposed
Advanced Subsystem Development at DSL
Acoustic and Visual Imaging
photo mosaicing
stereo visualization and photogrametery
real-time seafloor visualization
real-time 3-D sonar
Robotics and Control
enhanced trajectory control
vehicle/manipulator coordinated control
advanced manipulator and gripper
Vehicle/Equipment status
Jason/Medea
replacement of lost equipment
implimentation of required sys. improvements
transition of baseline system to turnkey status
training of marine operations personnel
fabrication of an operational manipulator
DSL 120,200 & 300
training of marine operations personnel
transition of enhanced processing&display
Argo II
design of vehicle specific subsystems
implimentation of Argo II concept
Data Management
stabilization of baseline data products
transition to production enviroment
Fiber Optic Handeling System
traction winch
prototype cable and testing
full length cable

ALVIN Program Management

- **1992 Funding Challenge**
- **Initiatives**
  - **Status**
  - **Other Activities**

1992 Funding Challenge

- Daily Rate - "Death Spiral"
- MOA - Inadequate
- Precluded or curtailed some initiatives

ALVIN MANAGEMENT REVIEW COMMITTEE REPORT

PERSONNEL

Visiting Comm. Recommendation	Potential Fix	Detailed Action	Discussion	Status (June '92)
Increase pilot training	▸ Develop training and qualification requirements to and beyond pilot certification	Provide a more formalized training structure with identifiable milestones	+ Improves consistency of training + Provides progress feedback + Develops better training methods – Subjective requirements difficult to codify	High priority for Chief Pilot during overhaul $
		Develop a position ladder with defined requirements	+ Insures continued training beyond pilot certification + Encourages additional proficiency	High priority for Chief Pilot during overhaul $
		Incorporate training and education in other areas of deep submergence operations (i.e. ROVs and AUVs)	+ Broadens knowledge base + Increases personnel pool + Provides job alternatives/variety – Reduces specialized skills – Reduces maintenance awareness	Working
		Provide avenues for continued professional development	+ More knowledgeable employee + Qualified for more diverse jobs – Conflict with work at sea – Fosters false expectations for advancement – Ensuring course quality difficult	Done/in progress

ALVIN MANAGEMENT REVIEW COMMITTEE REPORT

COMMUNICATIONS				
Visiting Comm. Recommendation	Potential Fix	Detailed Action	Discussion	Status (June '92)
Enhance internal communications	▸ Encourage interpersonal involvement	Deeper involvement of shore–based personnel in at–sea operations	+ Increased operational awareness + Fosters better understanding of grp concerns – Dilution of shore engineering effort – Added constraint on candidate pool	Partial, $
		Interjection of Dudley Foster with shoreside responsibility for daily operational activities and associated communications	+ Provides operational viewpoint ashore and and management viewpoint at sea – Alienation by operations personnel	Done
		Increased upper management interest and involvement	+ Demonstrates awareness and committment – Micromanagement with insufficient detailed information	Done
Enhance external communications	▸ Provide mechanisms for effective assimilation and dissemination of program information	Extend utilization of ARC (i.e. cruise assessment reviews)	+ Unbiased program evaluation + Identifies broad technological requirements – ARC member time committment increased – Possible management problems	Part of new ARC charter
		Annual ALVIN user conference	+ Provides forum for information exchange – Difficult to schedule	Pending, $
		Interjection of Dudley to provide users with timely operational advice	+ Provides easier access to operational expertise + Single point of contact + Helps to identify problems early in planning + Helps ensure timely information exchange	Done
		Frequent ALVIN User Manual and ATLANTIS II Cruise Planning Manual updates	+ Accurate hard copy of information – Requires considerable engineering staff effort	Done/continuing
		Shipboard pre–cruise planning meeting scheduling when requested	+ Guarantees Ops Group information exchange + Provides first–hand look at ALVIN – Disrupts port period activities	$

ALVIN MANAGEMENT REVIEW COMMITTEE REPORT

TECHNOLOGY

Visiting Comm. Recommendation	Potential Fix	Detailed Action	Discussion	Status (June '92)
Enhance technology	▸ Augment existing technology development efforts	Continue performance and reliability improvements; decrease required maintenance	+ Allows continued dependable operations	Done
		Schedule engineering dives	+ Allows testing of new technology without impacting scientific investigations + Focusses effort on new technology + Allows continued evaluation/calibration of systems + Operational training opportunities with new equipment − Possible science scheduling conflicts	Done, $
		Improve submersible science capability by involving WHOI engineering PIs and supporting their proposals	+ Promotes technology exchange among similar organizations	To be done
		Support science community development of special tools and equipment	+ Helps ensure submersible compatability + Makes available ALVIN Group expertise where appropriate	Done

ALVIN MANAGEMENT REVIEW COMMITTEE REPORT

PERSONNEL

Visiting Comm. Recommendation	Potential Fix	Detailed Action	Discussion	Status (June '92)
Decrease pilot turnover Possible causes: – long at–sea periods – long working hours – repetitive tasks – lack of appreciation – limited career ladder and/or advancement opportunities – boredom	▸ Reduce time at sea	Provide training and education required to open more shore–based jobs for rotational assignment	+ More versatile and skilled individuals + Larger personnel resource pool + Multiple evaluation opportunities – Must work and live in Woods Hole – Suitable alternate position location – Increase in Ops Group overall size – Additional/alternate funding required – Cost of living adjustment – Possible scheduling conflicts – Reduced pilot proficiency – Reduced systems status awareness – safety	In progress
	▸ Reduce workload	Increase number of persons qualified for ALVIN Operations team, including shore–based engineers and technicians, thus facilitating the availability of more personnel per cruise	+ More chance for daily learning + More work task variety + Increased opportunity for in–port R&R – Budgetary constraints – Berthing constraints – Fewer dives means less proficiency	Backwards, $
	▸ Provide advancment ladder	Provide training and education necessary to qualify operational personnel for advancement within the ALVIN Group and/ or a larger operations structure	+ Increases job satisfaction + Clarifies group structure/positions – Fair structure hard to implement – Rapid advancement of outstanding individuals hindered – Decreases assignment flexibility – Important subjective requirements difficult to codify	Working with HBOI, $

Other Activities

- **ALVIN Group//ARGO-JASON Group Merger**
- **WHOI Science Advisory Group - To be formed**
- **Discussions with Harbor Branch Oceanographic Institution**

Statistics

- Days gone - 894
- Days at sea - 575 (64%)
- Dives - 367 of 380 96%
- Bottom Time ~ 2809 hours
- Weights dropped - 180 Tons ~360,000 lbs.
- First female pilot
- First all female dive
- All female officers on AII
- First successful use of rock drill
- CURV III Recovery
- Bottom to shore - phone patch

ALVIN DIVE REQUESTS FOR 1993
BY REGIONN & DISCIPLINE

June, 1992

PACIFIC

		dives	
JUAN DE FUCA RIDGE			
3. Van Dover	Biol	3	
6. Mottle	Multi	16	*2
VANCOUVER			
12. Carson	G&G	4	
OREGON			
1. Lutz & Vrijenhoek	Biol.	4	
4. Orange & Moore	G&G	9	
12. Carson	G&G	16	
BLANCO FRACTURE ZONE			
16. Embly & Koski	G&G	14	
GORDA RIDGE			
1. Lutz & Vrijenhoek	Biol.	4	
17. Collier	G&G	8	
25. Shanks, VonDamm	Chem	10	
	TOTAL	88	
HAWAII			
5. Sansone	Chem	13	
	TOTAL	13	
GUAMAS BASIN			
1. Lutz & Vrijenhoek	Biol.	6	
	TOTAL	6	
CALIFORNIA BASINS			
9. C. R. Smith	Biol	10	
14. K. L. Smith	Biol	30	*3
	TOTAL	40	
EASTERN TROPICAL PACIFIC			
2. Wishner	Biol	44	*1
EAST PACIFIC RISE (EPR)			
7. Lutz	Biol	12	
8. Nelson	Biol	5	
9. C. R. Smith	Biol	3	
15. Jannasch	Biol	7	*3
18. Von Damm	Multi	4	*4
19. Von Damm	Multi	25	* 5
23. Fox & Mac Donald	G&G	17	
	TOTAL	117	
SOUTHERN EPR			
1. Lutz & Vrijenhoek	Biol.	12	
24. Edmond	Chem	15	
	TOTAL	27	
TOTAL PACIFIC		291	
TOTAL PACIFIC 1993		240	

ATLANTIC

MID-ATLANTIC RIDGE			
1. Lutz & Vrijenhoek	Biol.	6	
11. Chamberlain	Biol	7	
13. Van Dover	Ecol	8	
14. Jonnasch	Biol	5	
20. Von Herzon	G&G	16	
** Rona	Multi	20	*2
	TOTAL	62	
BERMUDA			
22. Calder	Biol	1	
WESTERN ATLANTIC			
21. Barth	Corr.	5	
10. Grassle	Biol	14	
	TOTAL	20	
TOTAL ATLANTIC		82	

Notes:

*1 14 of these Dives are in 1994
*2 Multi = Chem, Geol, and Biol.
*3 All Dives are for 1994
*4 Multi = Biol & Chem
*5 Multi = Chem & Geol

TOTAL DIVES FOR 1993

TOTAL:	322
BIOL	146
CHEM	103
ECOL	8
G&G	145
OTHER	5

#	Investigator	Associates	Area	Purpose/ Special Equipment Requirments	Sponsor	Date	Alternate	Dives	Remarks
93-01	Richard Lutz, Robert C. Vrijenhoek, Rutgers	Postdoctoral Research Assoc.; Research Spec.; . . .	1) Oregon Subductive Zone, 2)Gorda Ridge, 3)Guaymas Basin, 4) Mid-Atlantic Ridge, 5)17-22 dg S along EPR	Gene Flow, Dispersal and Systematic Relationships of Molluscs Associated with Deep-Sea Hydrothermal Vents. (Analyses of genetic variation will be conducted on a wide variety of molluscs collected using ALVIN at various deep-sea hydrothermal vent sites)	Funded: NSF	mid - 1993	late - 1993	1) 4 2) 4 3) 6 4) 6 5) 12 tot = 3	Recommended
93-02	Karen Wishner, URI	J. Deming, M. Gowing A. Hansen/ D. Kester, L. Levin L. Mullineaux C. Turley	Volcano 7: 13 deg 23'N 102deg27'W	OMZI: Oxygen Minimum Zone Interaction Study. Component I. Effects of the OMZ on the fate of organic matter, II. Processes Affecting Community Structure at the Lower OMZ Boundary. III. Spatial and Temporal Variability of Dissolved Oxygen and Related Redox Parameters in the OMZ of the Eastern Trop. Pacific.	Proposal Submitted to: NSF	Sep. 93, Mar. 94	Oct 1993, Apr. 94	Leg 1 - 30, Leg 2 - 14	Recommended (3 month separation needed between legs)
93-03	Cindy Lee Van Dover, WHOI	A. J. Williams, H. G. Truper J. F. Imhoff	Endeavour Segment, Juan de Fuca Ridge 47 57N; 129 06'W; 2200m	Light and Phototrophic Bacteria at Hydrothermal Vents - - Spectral characterization of vent "glow" at Endeavour vents and a search for phototrophic bacteria.	Proposal Submitted to:ONR/ NASA	1993: Sept.	1994: June	3 per year	Recommended
93-04	Dan Orange Casey Moore, UC Santa Cruz		44 40 dg N, 125 W	Geomorphology of Headless Submarine Canyons: Prediction of Slope Failure, Sediment Strength, Pore Pressure Gradient and the Regular Spacing of Canyons.	Proposal Submitted to: ONR	July, Aug 1993	May-Sep 1993	9	Recommended
93-05	Francis J. Sansone, Univ. of Hawaii	C. I. Measures, C. G. Wheat J. Lupton	18 dg 55'N, 155 dg 15'W	Hydrothermal vent and plume chemistry at Loihi Seamount, Hawaii (Submersible-based sampling of vent fluids and proximal plumes from mid-plate volcanism at Loihi)	Proposal Submitted to: NSF	Sept. - Nov	Aug, Dec	13	Recommended
93-06	Michael J. Mottle, Univ. of Hawaii	C. G. Wheat, M. D. Lilley, J. Lupton, R. Zierenberg, J. Franklin, K. Juniper	Middle Valley, Juan de Fuca Ridge: 48 dg 28'N, 128 dg 42'W	Chemical, Thermal, Geologic, and Biological Studies Using a Manned Submersible at the Middle Valley Vent Fields, Juan de Fuca Ridge	Proposal Submitted to: NSF	July - Aug	June, Sept.	16	Recommended
93-07	Richard Lutz, Rutgers	R.R. Hessler, R. M. Haymon, D. J. Fornari, D. Desbruyeres P. A. Tyler	9 deg 45'N to 9 deg 52' N along EPR	Temporal Changes in Biological Community Structure and Associated Geological Features at Newly Formed Hydrothermal Vents on the EPR Crest.	Proposal Submitted to NSF	mid - 1993	late - 1993	12	Recommended
93-08	Douglas C. Nelson, UC Davis	R. Lutz, K. Von Damm	9 dg 45' - 9 dg 52'N East Pacific Rise	Free Living Bacteria at Newly Formed Hydrothermal Vents - Temporal Changes, trophic Interactions and Productivity	Proposal Submitted to NSF	1993	other times	5	Recommended -earliest possible 1993

#	Investigator	Associates	Area	Purpose/ Special Equipment Requirments	Sponsor	Date	Alternate	Dives	Remarks
93-09	Craig R. Smith, University of Hawaii	9 dg N: L. Mullineaux, R. Lutz, R. Vrijenhock California: J. Deming, S. Macko	3 dives EPR at 9dg 50'N, 104 dg 17'W. 10 dives split (5 & 5) btwn 33 dg 12'N, 48 dg 30'W & 32 dg 26'N, 118 dg 9'W	Chemosynthetic communities on deep-sea whale falls: development, persistence and vent species colonization	Proposal Submitted To: NSF	Fall 1993	Winter - Summer 1994	3 and 10	Recommended
93-10	Frederick Grassle, Rutgers	M. Bothner, B. Brownawell, R. Colwell, B. Hecker, R. Hill, R. Petrecca, J. Robb, F. Sayles, P. Snelgrove W. Straube, C. Van Dover, R. Whitlatch	Deep-water dumpsite-106 bounded by 39 dg N, 38 dg 40'S, 72 dg E, & 72 dg 5'W & areas 50-60 NM E and SW of this dumpsite.	Processes Governing the Fate and Effects of Material Flux on Deep-Sea Communities at a Long-Term Ecosystem Observatory (LEO-2500) on the Continental Slope off the Coast of New Jersey.	Proposal will be Submitted To: NOAA-NURP & NSF	July	August	14	Tabled, but WHOI will work into schedule if feasible
93-11	Steven Chamberlain Syracuse	B. Battelle, L. Kass, G. Renninger, C. L. Van Dover	TAG Hydrothermal Field on mid-Atlantic Ridge, 26 deg N 45 deg W	Studies of the visual system of the deep sea shrimp R.exoculata. We propose a study involving anatomy, biochemistry, and physiology to examine the role of this animal's novel eye, the daily cycling of photosensitive membrane & composition relative to the high-sulfur content of the environment.	Funded: NSF	5/93 - 8/93	1/93 - 12/93	at least 7	Recommended
93-12	Bobb Carson, Lehigh	G. Lennon	1) Oregon: 44 deg 38.6'N 125 deg 19.6'W 2) Vancouvr: 48 deg 41.8'N 126 deg 52.3'W	Investigation of Fluid Sources and Movement at the Cascadia Margin: A study of Subduction-Induced Pore Water Expulsion from the Accretionary Prism off Oregon and Vancouver Island.	Funded: NSF	June-Aug 1993	May - October 1993	20	Recommended
93-13	Cindy Lee Van Dover, WHOI	C. Cavanaugh, G. Eglinton, D. White	TAG & Snake-Pit, Mid-Atlant Ridge: 26 dg 8'N 44 dg 49'W, 23dg 22' N 44 dg 57' W 3600 m	Ecology of Mid-Atlantic Ridge Hydrothermal Vents: Food Web Analysis Using Multiple Molecular and Isotpic Techniques - Microscale sampling for subsequent lab analysis.	Proposal Submitted To: NSF	June 1993	July 1993	8	Recommended
93-14	K. L. Smith, SIO	A. F. Carlucci, C. C. Reimers, P. M. Williams, E. R. M. Druffel	34 dg 50'N, 123 dg W	Temporal variation in deep-sea benthic boundary layer communities: long time-series measurements.	Proposal Submitted To: NSF	1994: Sep, Nov. 1995: Feb.	1994: July-Sept.	30	Recommended

#	Investigator	Associates	Area	Purpose/ Special Equipment Requirments	Sponsor	Date	Alternate	Dives	Remarks
93-15	Holger W. Jannasch, WHOI	C. Van Dover, C. Cavanaugh, R. Lutz, K. Stetter	1993: mid-Atlant. Ridge (23-26dg); 1994: EPR (9-10 dg N); Cruises of opport.	Microbial Transformations at Deep-Sea Hydrothermal Vents.	Renewal to NSF	1993: sum 1994: May-June	1994: July-Sept.	5 and 7	Recommended
93-16	Robert W. Embley, NOAA Randy Koski, USGS	R. Dziak, R. Bohannon, A. Davis	Blanco Fracture Zone, 3 sites: 43-44 deg N 127-128 deg W	Submersible Studies of Extensional and Strike-Slip Segments of the Blanco Fracture Zone: A Window into Seawater/Crustal-Seawater/Mantle(?) Interchange along an Oceanic Transform Fault System.	Proposal Submitted to NOAA?	July-Sept 1993	June 1993	14	Recommended
93-17	R. W. Collier, OSU	G. P. Klinkhammer, M. D. Lilley, K. Von Damm	160 n miles from Newport, OR: 42 dg 45.3'N, 126 dg 42.47'W	Studies of Off-Axis Hydrothermal Venting on the Northern Gorda Ridge. Purpose: Sample Hydrothermal Fluids From the Sea Cliff Hydrothermal Field.	Proposal Submitted To: NSF	Jun 1 to Sep 1, 1993	weather limited	8	Recommended
93-18	K. L. Von DAmm, UNH	M. D. Lilley	9 dg 45'N to 9 dg 52'N, ~ 104 dg 17'W, EPR	"Coupled Temporal Changes in Biological Community Structure and Water Chemistry at Newly-Formed Hydrothermal Vents on the EPR Crest." Four dives are requested to determine the coupling between vent community evolution and changes in fluid chemistry.	Will be Submitted: NSF	mid 1993	late 1993	4	Recommended
93-19	K. L. Von DAmm, UNH	M. D. Lilley, R. M. Haymon, D. J. Fornari, M. R. Perfit, K. MacDonald, W. C. Shanks	9 dg 16'N - 10dg 5'N at 104 dg W (EPR)	Temporal Evolution of Hydrothermal, Volcanic, and Geologic Propoerties of the EPR 9-10 dg N Following the 1991 Eruption.	Will be submitted t NSF	mid 1993	late 1993	25	Tabled (avoid Jul-Oct, hurricane season. Mar-Jun best)
93-20	R. P. Von Herzon, WHOI	K. Becker, P. Rona, N. Edwards, R. Evans	Mid-Atlantic Ridge, TAG: 26N,45W	Geothermal and Geoelectrical Investigations of the TAG Hydrothermal Site using ALVIN.	Proposal Submitted to: NSF	Apr - Nov 1993	All year OK	16	Recommended
93-21	Clyde H. Barth, General Electric	D. Marx, J. Parrington	Western N. Atlantic: (1) 18N 64W, (2) 38 dg 25'N 72 dg 6'W, (3) 38 dg 18'N 69 dg 35'W	Recovery of Deep Sea Corrosion Experiments. Retrieve test specimins deployed by ALVIN and/or TRIESTE in 1977, 1979, 1980, 1982, 1983, and 1986 to support long term corrosion research program.	Funded: DOE	Sum. 1993	Summer 1994, 1995	5	Recommended
93-22	Dale R. Calder, Royal Ontario Museum		Bermuda. Area S of Castle Roads, transect from 100 m to ca. 3500 m and running through 32 15'N, 64 40'W	DEEP-SEA HYDROIDS: SYSTEMATICS, LIFE CYCLES, BATHYMETRIC DISTRIBUTION, AND BIOGEOGRAPHY. Collection and study of hydroids down the slope of the Bermuda Pedestal, from depths of 100m to3500 m.	To be submitted: Nat. Sci. & Eng. Res. Cncl- Oct 9	late March - early April 1993		1	Recommended

#	Investigator	Associates	Area	Purpose/ Special Equipment Requirments	Sponsor	Date	Alternate	Dives	Remarks
93-23	P. J. Fox, URI & K. C. MacDonald, UCSB	Pockalny, Carbotte, Karson, Smith, Gente	Flanks of EPR - 8 deg 30'N - 10deg N; 103 deg W - 106 deg W	The origin of abyssal hills.	Proposal submitted ONR	Fall 1993 (mid-Sept or)	Spring 1993 (before June)	17	Recommended
93-24	John M. Edmond, MI	W. Shanks, J. Lupton, M. Lilley	26-30 S, 110 W	Chemical sampling of hydrothermal fluids on the superfast segments of the EPR in the region of Easter Island.	To be submitted to NSF	southrn sum.		15	Recommended
93-25	Wayne C. Shanks III, USGS Karen Von Damm, UNH Douglas Crowe Univ Ga.	J. Morton, R. Koski, R. Zierenberg	Gorda Ridge - 41 N 127 dg 30'W	Fluid Circulation, Hydrothermal alteration, and Sulfide Formation at a sedimented ridge, Escanada Trough, Gorda Ridge	To be submitted to NSF	Aug 15-30, 1993	Summer 1993	10	Recommended
****	Peter Rona, NOAA	H. Dick, G. Thompson	Mid-Atlantic Ridge 26 dg N (TAG) & 15 dg N (15 20 Fracture Zone)	FARA Program collaborative investigation of hydrothermal processes to include water chemistry, heat transfer, hydrothermal precipitates, mafic and ultramafic rocks, geologic setting, and biology.	Resubmit-ted to NOA & NSF	1993		20	This proposal was reviewed last year and recommended. (avoid hurricane season)

The University-National Oceanographic Laboratory System

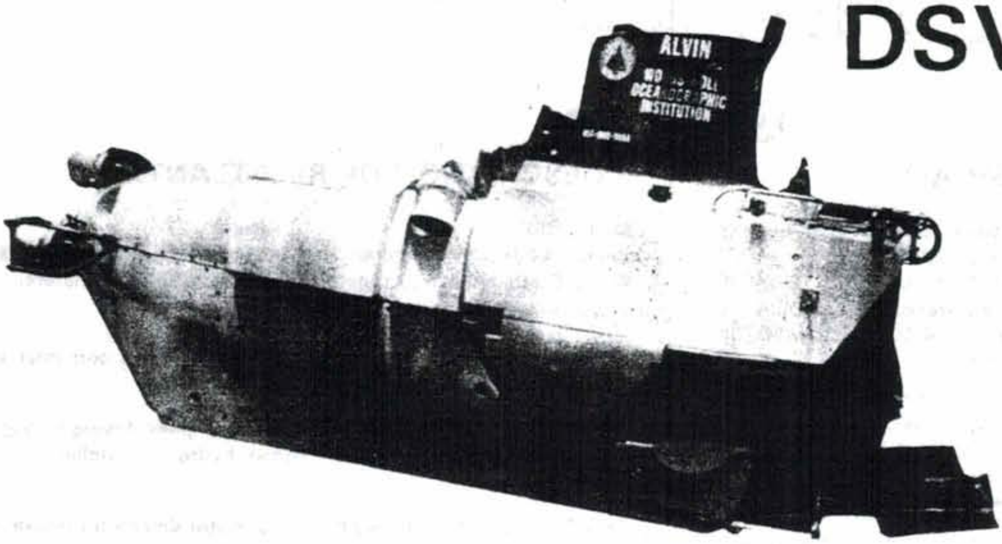
ALVIN Review Committee announces

OPPORTUNITIES FOR OCEANOGRAPHIC RESEARCH DURING

1993

using

DSV ALVIN



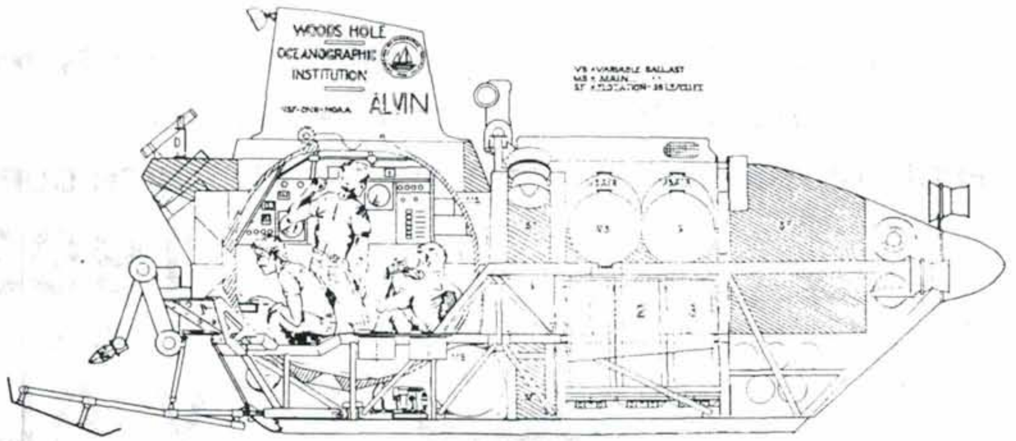
If you have an oceanographic research project that requires a manned research submersible operating to depths as great as 4000 meters, request dives on ALVIN - you will get the best facility and operational support in the world.

1993 Operations. ALVIN/ATLANTIS II will leave Woods Hole, Massachusetts in early 1993 after completion of ALVIN's overhaul. User interest for 1993 indicates large focuses of work along the **Mid-Atlantic Ridge and in the Pacific along the East Pacific Rise and the Juan de Fuca Ridge.** Additionally, the ALVIN user community has continued to express some interest in ALVIN supported research in more remote areas, such as, the mid Pacific, western Pacific, Southern Ocean Areas and the Mediterranean. Since ALVIN will not require another overhaul for three years after leaving Woods Hole, this may be the opportune time to propose research in far off regions. ALVIN/ATLANTIS II's itinerary and operations will most likely be centered on work on the Mid-Atlantic Ridge and nearby areas in the early part of 1993. Operations will follow in the eastern Pacific. Research expeditions to remote regions will be given serious condition.

ALVIN Time Requests. The ALVIN Review Committee solicits ALVIN Time Requests for research to be done during 1993. These Time Requests should be submitted to the Chair, ALVIN Review Committee by May 1, 1992, for review by the Committee during June, 1992.

Funding for research to be supported by ALVIN/ATLANTIS II should be requested through traditional channels. Research proposals requiring facilities support for operations in 1993 must be submitted to the National Science Foundation to meet either the November 1, 1991 or May 1, 1992 target dates. Research proposals to the Office of Naval Research or to the National Oceanic and Atmospheric Administration must have at least preliminary approval by June, 1992.

The Deep Submergence Vehicle Alvin is owned by the U.S. Navy under the purview of the Office of Naval Research. It is operated by the Woods Hole Oceanographic Institution under a Memorandum of Understanding among the National Science Foundation, the National Oceanic and Atmospheric Administration and the Office of Naval Research. ALVIN is designated a UNOLS National Oceanographic Facility.



DSV ALVIN

DESCRIPTION OF DSV ALVIN

Length: 7.6 meters (25 feet)
Beam: 2.4 meters (8 feet)
Draft: 2.1 meters (7 feet)
Full Speed: 2 knots
Cruising Speed: 1 knot
Cruising Range: 5 miles submerged
Displacement: 18 tons
Endurance: 72 hours
Normal Dive Duration: 6-10 hours
Depth Capacity: 4,000 m (13,120 ft)
Complement: 1 pilot, 2 scientific observers

Ownership: The submersible ALVIN is a Navy-owned national oceanographic facility operated by the Woods Hole Oceanographic Institution and jointly supported by the National Science Foundation, the Office of Naval Research and the National Oceanic and Atmospheric Administration.

Communications: Sonar telephone, voice or code (submerged); marine band UHF radio (surface).

Navigation: Gyro compass; magnetic compass; forward-looking horizontal scanning sonar system (CTFM); echo sounder; indicators for depth and altitude; long baseline acoustic positioning system (by request).

Electrical Power: Three banks of lead-acid batteries configured for 120 VDC (450 Amp. hours) and 30 VDC (450 Amp hours). A limited amount of 115 volt 60 cycle AC power is also available.

Hydraulic Power: The science basket is supplied with 1 GPM of 1500 PSI hydraulic oil for science applications.

Data Logging: Most of the information obtained from the permanently-installed instrumentation is logged on 3-1/2" computer disks. Also, selected data is superimposed on the video camera images and recorded on 1/2" VHS tape. Contact the ALVIN group for more information.

Additional Capabilities: The submersible is designed to be versatile with respect to payload, space and power available to meet the differing needs of scientists using the vehicle. Scientific equipment which remains on board most of the time includes two remotely controlled mechanical arms, two 35 mm. cameras and a closed circuit video system with recorder. Additionally, specialized equipment such as hot-water samplers, precision temperature sensors, a magnetometer and increased navigation capability is available but requires advance notice and may require additional funding for installation and operation. Contact the ALVIN group for further information.

To obtain further information regarding the ALVIN system capabilities or specialized equipment, contact:

Barrie B. Walden, Submersible Program Manager
Woods Hole Oceanographic Institution
Woods Hole, MA 02543
Telephone: (508) 548-1400 Ext: 2407

DESCRIPTION OF RV ATLANTIS II

Built: 1963
Beam: 44 feet (13 meters)
Gross Tonnage: 1,529 tons
Displacement: 2,300 L tons
Crew: 27
Length: 210 feet LOA (64 m)
Draft: 16 feet (5 meters)

Scientific Personnel: 9 ALVIN support team plus 1 corpsman plus 19 scientists.

Main Engines: Two GM 12-567E diesel engines driving through reduction gears with variable speed, hydraulic clutches. 2,000 shp.

Bow Thruster: 800 hp trainable. DC motor driving from main gear PTO.

Ship Service Generators: Two 480/120 volt AC 300-KW generators driven by CAT 353 diesel engines.

Propellers: Twin screw: 3 fixed blade; bronze.

Ownership: Built under grant from NSF. Conditional title rests with W.H.O.I.

Speed:		
	Cruising:	11.0 knots
	Full:	1.5 knots
	Minimum:	Dead Slow

Endurance: 45 days

Fuel Capacity: 90,000 gallons

Range: 9,000 miles

Laboratories: wet - 400 square feet
dry (4) - 3,500 sq ft plus 28' by 13' ALVIN hanger

Sewage System: Two type III holding tanks; five to ten days endurance.

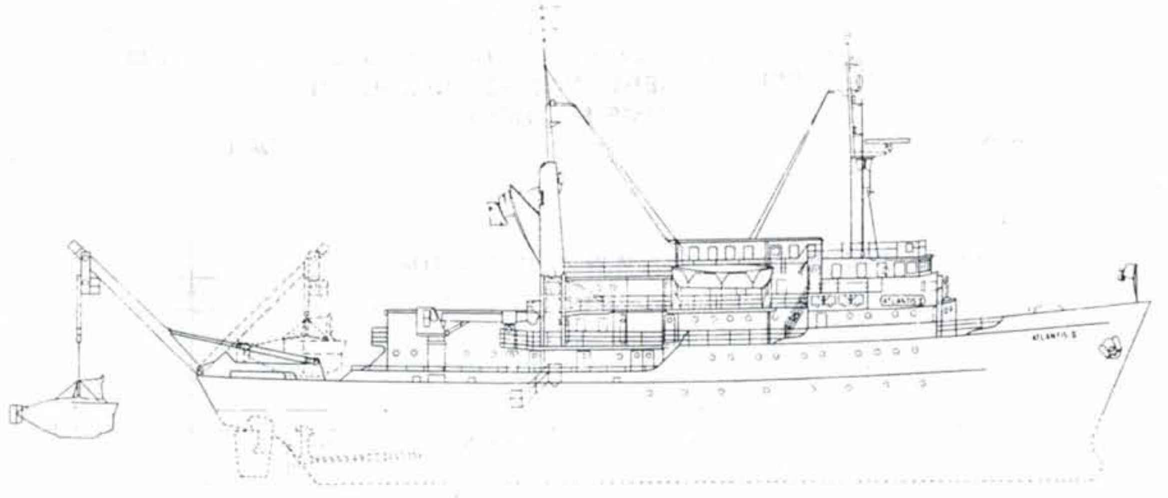
Ship Equipment: For full range of oceanographic observations and work. One trawl winch: 30,000 feet 1/2" cable. One CTD winch: 27,000 feet 0.303" cable; or, 30,000 feet 3/16" wire.

One Marine Crane: 20-ton capacity

One Hydraulic Powered A-frame: 18-ton capacity for launch and recovery of ALVIN.

To obtain further information regarding ATLANTIS II system capabilities or specialized equipment, contact:

Donald A. Moller, Marine Operations Coordinator
Woods Hole Oceanographic Institution
Woods Hole: MA 02543
Telephone: (508) 543-1400 Ext: 2277



RV ATLANTIS II

SUBMISSION OF ALVIN TIME REQUESTS

Requests for the use of DSV ALVIN should be initiated by sending a completed Time Request form (copy overleaf) to: Chairman, ALVIN Review Committee, c/o UNOLS Office, P.O. Box 392, Saunderstown, RI 02874. Requests may by made by scientists and engineers at any university or research institution in the United States, and should be supported by an exposition of the proposed research which specifically addresses each of the following:

1. **The nature and significance of the proposed research.**
2. **The scientific questions being asked and the approaches that would be used toward their resolution;** how ALVIN will be employed is critical to the Committee's evaluation.
3. **Justifications of the need for ALVIN to do this work.**
4. **The research site(s) and its justification.**
5. **Number of dives required, justification for the number of dives and any seasonal consideration;** it is especially important to include a dive plan or other description of how each dive will be used, and why each is needed. Provide sufficient detail to allow the Committee to make a quantitative evaluation.
6. **Likely requirements for future ALVIN dives** (not requested here) for completion of the research.
7. **Proposed number of scientists and engineers in the party.**
8. **Curricula vitae** of principal participants.
9. **Potential of current support for the proposed research effort;** in virtually all cases, science proposals should already have been submitted to the funding agency by the date of the Committee's review. If research proposals have not been submitted prior to the ARC review, the Committee may not review the Dive Request.
10. **List of publications resulting from any previous ALVIN work.**
11. **Any special engineering required for dive operations.**

NOTE:

1) Experience has been that ALVIN Time Requests covering items 1-7 in not more than 12 pages are most appropriate. Very long Requests bog down the review process. If science proposals are submitted, they should be appended to an appropriately concise Time Request. Items 8, 10 and 11 should also be appendices to the Request.

2) If operations are to be carried out in foreign waters, the required clearances should be requested as early as possible. Collaboration with foreign scientists is encouraged.

3) The ALVIN Review Committee will submit scheduling recommendations for consideration by the research sponsor. Final scheduling depends on approval of the pertinent research proposal by the funding agency.

ALVIN Review Committee

UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM
DEEP SUBMERGENCE VEHICLE ALVIN
TIME REQUEST

To: Chairman ALVIN Review Committee
c/o UNOLS Office
P. O. Box 392
Saunderstown, RI 02874

DATE: ______________________

USE OF THE ALVIN SUBMERSIBLE RESEARCH SYSTEM IS REQUESTED FOR ______________ FOLLOWS:
YEAR

PURPOSE: (Project, Title and brief outline of program)	
PRINCIPAL INVESTIGATOR: (Name, Title, Address, Telephone Number)	OTHER INVESTIGATORS INVOLVED:
PROPOSED CHIEF SCIENTIST:	TOTAL NUMBER OF SHIPBOARD PERSONNEL:

PROJECT REQUIREMENTS

# OF DIVES REQUSTED:	PREFERRED DATES:	ALTERNATE DATES:
AREA OF OPERATIONS: LATTITUDE AND LONGITUDE (Attach page-size chart showing location of dives and bathymetry)		
NAME OF NEAREST PORT:	DISTANCE, IN NAUT. MILES:	
LIST SPECIAL EQUIPMENT REQUIREMENTS: (e.g., sensing, sampling and navigation requirements; attach brief description of proposed escort/surface support ship if one is required)		
COUNTRIES FOR WHICH RESEARCH CLEARANCE WILL BE REQUIRED:		

FUNDING STATUS

PLEASE INCLUDE THE GRANT NUMBER FOR PROJECTS ALREADY FUNDED, THE PROPOSAL NUMBER FOR PROPOSALS SUBMITTED

NOTE: NSF research proposal requiring the use of facilities (e.g., ALVIN) must include a completed NSF-UNOLS Ship Time Request Form 831 (R-9/91).

FUNDED			NOT FUNDED		
FUNDING AGENCY:			PROPOSAL SUBMITTED: _______		WILL BE SUBMITTED: _______
			TO: ______________		
GRANT NUMBER:			DATE: ______________		
			AMOUNT REQUESTED: ______________		
AMOUNT OR ANNUAL RATE:	BEGIN DATE:	DURATION:	NEW PROPOSAL NUMBER:	OR	RENEWAL OF GRANT NUMBER:

IMPORTANT: ATTACH MATERIAL ADDRESSING POINTS LISTED ON OVERLEAF

SUBMITTED BY: ______________________
SIGNATURE

APPROVED: ______________________
DEPARTMENT CHAIR or LABORATORY DIRECTOR

NAME, TITLE, ADDRESS & TELEPHONE NUMBER IF DIFFERENT FROM PRINCIPAL INVESTIGATOR:

TELEPHONE: (   )

April 15, 1987

Rules for Review of ALVIN Dive Requests
ALVIN Review Committee

1. Requests for ALVIN dives, having been solicited by the ALVIN Flyer will be reviewed annually, and principally at the ARC meeting held for that purpose in about May.

2. Extraordinary requests (e.g., those for which a later submission is warranted, or those for which ARC recommendations and funding decisions do not agree) will be reviewed at ad hoc meetings either by telephone or opportunistic assembly. The Committee discourages late submissions.

3. There is potential for conflict of interest on any dive request originating at a Committee member's institution or if any investigator listed on the request is from a member's institution.

4. The Chair will raise the questions of conflict of interest at the beginning of consideration on each request for dives. Notes for the meeting will reflect these queries and actions of the member(s) involved.

5. If a Committee member is listed on a request (or is, in fact, actively involved) that member will be excused from the room for all discussion, consideration and voting on that request.

6. For requests originating at Committee member(s)' institutions, or with investigators from their institutions, those Committee members so connected will be excused from the room for all discussion, consideration and voting on that request except that at the invitation of the balance of the Committee (and with that member's concurrence) members connected only by institutional affiliation may comment on requests. However, in no case will those members vote on the request in question.

7. If there remains a question concerning conflict of interest concerning any member(s) for an individual request for dives, it will be decided by vote of the balance of the Review Committee.

8. Voting Committee members will vote to rank individual requests for dives as:

    1, outstanding
    2, excellent
    3, fair
    4, poorest ranking
    5, tabled--not ranked.

THE UNIVERSITY OF NORTH CAROLINA
AT
CHAPEL HILL

Institute of Marine Sciences
919/726-6841
FAX: 919-726-2426

The University of North Carolina at Chapel Hill
3431 Arendell Street
Morehead City, North Carolina 28557

18 May 1992

Dr. F. Jennings, Chairman
ALVIN Review Committee
c/o UNOLS Office
P. O. Box 392
Saunderstown, RI 02874

Dear Dr. Jennings:

This is to inquire about the possibility to obtain deep-sea fungi in connection with the 1993 operation of DSV ALVIN. I am interested in continuing research on filamentous wood-inhabiting deep-sea fungi, a group that is very little known. Collections of these organisms can be made in connection with other projects on or near the sediment surface. Since this project is actually a "piggy-back" operation, I don't need to request time for the use of ALVIN. For your information I enclose a copy of a proposal I wrote in 1987 for participation in NOAA's National Undersea Research Program in cooperation with the University of North Carolina at Wilmington.

Please let me know if a cooperation with your program will be possible.

With my thanks for your attention in the above,

Sincerely,

Jan Kohlmeyer

Jan J. Kohlmeyer
Professor of Marine Sciences

JJK:bbb

Enclosure

RECEIVED
MAY 21 1992
UNOLS OFFICE

Objective and Justification

The objective of this project is to obtain material of autochthonous deep-sea fungi, a group that is almost unknown. Whereas woodboring mollusks of the deep sea have been studied in detail for many years (Turner, 1973), lignicolous and other fungi from this habitat have been rarely available for investigation by marine mycologists. Therefore, only five species of deep-sea fungi have been described thus far (Kohlmeyer 1968, 1970, 1977). Besides marine bacteria, the fungi are important decomposers in the marine environment (Kohlmeyer & Kohlmeyer 1979). Without their action, organic material washed into the ocean and sinking into the abyss would remain intact forever. The few studies on the activities of deep-sea fungi show that they decompose cellulose, in the form of wood and cellophane, and also chitin (Kohlmeyer 1969, 1980, 1972). Growth of marine fungi in the deep sea is slow, probably due to low temperatures. It is hoped that the study of deep-sea fungi will clarify the question whether these organisms are an indigenous group adapted to high pressure, as was suspected (Kohlmeyer and Kohlmeyer 1979), or whether there are also fungi that are able to live in both, shallow and deep water. From a practical standpoint it is important to know what the role of fungi is in the deep sea, e.g. in the decomposition of dumped garbage.

Proposed Approach

It is proposed to collect wood that has accumulated on the ocean floor with the help of the submersible's manipulator arms. Such collections can be carried out in connection with other projects on or near the sediment surface. Wood is common in the deep sea, although irregularly distributed (Turner 1973), and accumulates in depressions on the ocean floor. After collection, the wood should be placed in plastic bags (without water or preservatives) and stored on board of the support vessel in a low temperature refrigerator or freezer. We will examine the material in our laboratory and try to culture the fungi. So far only preserved specimens have been available for study and no cultures of deep-sea fungi are extant.

Invertebrates, especially wood borers present in wood recovered from the deep sea will be forwarded to Dr. R. Turner for further investigation.

Results and Deliverables

Any results obtained from this research will be incorporated in our ongoing studies on the geographical and vertical distribution of marine fungi. Any fungi grown in pure culture will be used in a testing program for bioactive substances. Results will be published in a refereed journal.

Results from Previous Cruise

During a cruise conducted from August 7-13, 1987 a submerged wood panel was retrieved from the ocean floor at 947 feet. This wood was covered by limpets and was heavily riddled by borers. Fruiting bodies of marine fungi were found embedded in the surface, but identification was not possible because they did not contain any spores. The invertebrates were sent to Dr. Ruth Turner for examination and identification.

Literature Cited

Kohlmeyer, J. 1968. The first ascomycete from the deep sea. J. Elisha Mitchell Sci. Soc. 84: 239-241.

Kohlmeyer, J. 1969. Deterioration of wood by marine fungi in the deep sea. In: "Materials Performance and the Deep Sea". Amer. Soc. Testing and Materials. Spec. Tech. Publ. 445, Phil. Penn. pp. 20-29.

Kohlmeyer, J. 1970. Ein neuer Ascomycet auf Hydrozoen im Südatlantik. Ber. Deutsch. Bot. Ges. 83: 505-509.

Kohlmeyer, J. 1972. Marine fungi deteriorating chitin of hydrozoa and Keratin-like annelid tubes. Mar. Biol. 12: 277-284.

Kohlmeyer, J. 1977. New agenera and species of higher fungi from the deep sea (1615-5315 m). Rev. Mycol. 41: 189-206.

Kohlmeyer, J. and E. Kohlmeyer. 1979. Marine Mycology. The Higher Fungi. Academic Press, New York and London, 690 pp.

Turner, R. D. 1973. Wood-boring bivalves, opportunistic species in the dee sea. Science 180: 1377-1379.

D. Area of operations (attach page-size chart), include latitude and longitude of dive areas: ____________________

E. Nearest port(s) and distance(s) : ____________________

F. Maximum expected operating depth (m) any depths reached

G. Special equipment (other than standard sub/ROV gear) ____________________

3. FUNDING AND PERSONNEL

A. Research Funding Status:

1. Co-funding: granted___, submitted___, not funded ___,

2. Funding Agency ____________________

3. Authorizing Funding Official ____________________

4. Grant # ____________________, Amount ____________________,

Beginning Date ____________________, Duration ____________________

B. Principal Participants (Name, Title, Address, Phone Number)

Jan J. Kohlmeyer (Professor of Biology) and
Brigitte M. Kohlmeyer (Research Associate
University of North Carolina at Chapel Hill
Institute of Marine Sciences, Morehead City, NC 28557
Phone (919)726-6841

Ruth D. Turner (Professor of Zoology)
Museum of Comparative Zoology, Harvard University
Cambridge, MA 02138 Phone (617)495-2466

ALVIN

1993 and Beyond

- - NOTICE OF INTENT FOR GLOBAL EXPEDITION - -

ALVIN will undergo an overhaul in late 1992 when Atlantis II returns to Woods Hole. This major overhaul will permit the submersible to operate for three years before needing another overhaul, opening a window of opportunity for extended cruises to remote locations.

The ALVIN Review Committee has received a considerable number of letters of intent for ALVIN use for 1993 and beyond, several of which are in remote areas. The preponderance of requests however are in the more traditional areas of operation on the swing of the yo-yo from the Mid-Atlantic Ridge to the East Pacific Rise to the Juan de Fuca Ridge. These proposals appear to have a higher funding potential and therefore attract more interest. Efficient and prudent scheduling would suggest that ALVIN will return to this now familiar route satisfying the largest number of successful proposals.

During the San Francisco ARC meeting, discussion centered on whether or not we need to break out of the mold by seeking work in remote or non traditional ALVIN areas. To make a credible case for funding it would be necessary to develop a critical mass of ALVIN work at these various locations. The letters of intent presently held by the ARC do not do this. Here is a question for the community: Is it time to rally support for two or three remote areas and develop an expedition offering the critical mass of proposals that could stimulate the funding agencies to fund such science? If the answer is yes, do we have volunteers to act as rally points and champion specific locations? Please send any comments to UNOLS.OFFICE as soon as possible so that we can assist in this effort.

Comments can be mailed to: UNOLS Office
P. O. Box 392
Saunderstown, RI 02874

OMNET TELEMAIL: UNOLS.OFFICE

This TELEMAIL message came through to the UNOLS Office regarding ALVIN - Global Expedition:

Posted: Wed, Feb 26, 1992 10:10 AM PST Msg: NGJC-5135-7572
From: MIT.OCEAN.CHEM
To: unols.office
CC: g.brass

UNOLS Office: Global Expeditions by ALVIN

Thanks for the initiative on the flier!

I think that realistically we have only one option in the short-term. In every three year period between overhauls we devote one to one and a half years to the yo-yo and the remainder to "new" operating areas. This both preserves the "bread and butter" aspects of the yo-yo and and generates broader excitement and utilization. The most conservative plan would be to devote the first triennium to the East: WHOI-MAR-MED and on to the Black and Red Seas (maybe N. Indian Ocean) and back to the MAR and then the yo-yo. The more adventurous would be WHOI-MAR-Canal-Southern EPR-equatorial EPR and then the rest of the yo-yo. The complete yo-yo takes about 20 legs leaving about 15 for new areas. If this approach works then more ambitious plans could be contemplated that relegated the yo-yo to every other triennium and a major expedition mounted that consumed a complete triennium e.g. WHOI-MAR-Canal-EPR-Western Pacific Back Arcs-HONO-Canal-WHOI with only small bits of the yo-yo done.

If this approach to reinvigorating the ALVIN program is going to work several things have to happen. Since time is short for funding the next triennium we need SOONEST to have letters of intent for both the MED and SEPR options. An ad in EOS would do the trick. We may have to persuade ARCS to schedule a special panel in late spring to review them and decide on the option to follow and then a special NSF schedule to accommodate funding implementation. Planning for the second triennium would be much more orderly. Yo-yo proposals would go in as usual since they would be accommodated in this next triennium. The second thing is that the agencies need to be willing to escrow funded proposals. If a fundable proposal loses out either in the yo-yo or the "new" then it should be easily reactivated in the next triennium with a few page update to be adjudicated by the Panel rather than new mail reviews. The system has to have a memory. We should also make every effort to get the Europeans involved in ship-swaps. The Brits and the Germans are interested.

As an advocate of this new approach I would be prepared to honcho the Southern EPR option. However I feel that the MED option is the more conservative one for the first triennium and the one most liable to broaden the user community in the short term.

Associated Scientists at Woods Hole, Inc.
P.O. Box 721 Woods Hole, MA 02543 USA
(508) 540-5050 (508) 540-6902 fax (c/o MBL)

May 20, 1992

Dr Feenan Jennings
ALVIN Review Committee
Texas A & M University
College Station, TX 77843

Dear Dr. Jennings.

With this letter, I am resubmitting my original letter and completed form "Notice of Interest to use ALVIN" describing the use of ALVIN for fieldwork and a sampling program at Thera (Santorini), southern Aegean Sea, Greece. As you will remember, the original copies of this proposal-letter and form were lost within your office a year ago, rather than rewriting all this, I am submitting a copy of the version that was misplaced.

The concern and apology from your office regarding the lost version are appreciated. Recent shifts in funding priorities and evaluations certainly point to the urgency of considering additional areas for ALVIN use, and there is a group interested in seeing the submersible used in the Mediterranean. My concern now is in getting proposals written and submitted (and resubmitted, and resubmitted) in time to correspond to when ALVIN may be available because of these funding vagarities.

This letter is being sent as I depart for eight weeks of fieldwork above water on Thera. Please use the Woods Hole address above for contacting me until latest August when I shall be teaching at the University of Hawaii (Windward College, Kaneohe, HI 96744). I shall look forward to comments from the committee.

Sincerely,

Floyd W. McCoy

Associated Scientists at Woods Hole, Inc.

P. O. Box 721 • Woods Hole, Mass. 02543 U.S.A. • (508) 540-5050

fax: c/o MBL 540-6902

December 10, 1990

Dr. Feenan Jennings, Chairman
ALVIN Review Committee
Texas A. & M. University
College Station, TX 77843

Dear Dr. Jennings:

A preliminary request is submitted, via this letter, for use of ALVIN/ ATLANTIS II in support of an international program to conduct fieldwork and sampling at Thira (Santorini) volcano, Greece.

Research goals involving the use of ALVIN are:
(1) Detailed observations and measurements of the stratigraphic section exposed in underwater cliffs or slopes of both the caldera and the insular margin outside the caldera; this work to involve careful observation of the rock types in exposure (primarily lava flows, tephra falls and flows, and paleosols), of flow or depositional structures, bedding thickness, bedding contacts, etc.;
(2) Transects across the caldera floor to map talus deposits, displaced blocks, topographic irregularities suggestive of structural displacements, volcaniclastic sediment, and possible hydrothermal vent structures with biota;
(3) Sampling and retrieval of volcanic rocks and volcaniclastics from underwater cliffs, the caldera floor, and on the insular margin;
(4) Photographic/video documentation of stratigraphic sections, sampling sites, and other geological features.

This research program is the extension of a decade of fieldwork on the volcano of Thira (Santorini) by an international group of scientists concerned with better understanding the timing and volcanology of major explosive eruptions. Such eruptions are classified as Plinian and are a major volcanic hazard, as well-demonstrated by the eruption of Thira in 1628 B.C. when the course of western civilization was changed from Minoan domination (the palaces on Crete, the long period of Late Bronze Age peace and commerce) to Mycenean domination (Agammenon, Troy, etc.). This eruption was one of the four largest eruptions known in historic time, significantly larger than eruptions such as Krakatau or Mt. St. Helens.

Field mapping on land has identified major Plinian eruptions with a periodicity of about 20,000 years, but based upon only a few poorly-dated events. The Thira volcanic field has produced huge eruptions of tephra from predominantly southern-placed vents, and thick lava flows from predominantly northern-placed vents. Active hydrothermal venting occurs today from the central portion of the caldera at the site of historic eruptions of lava flows and pyroclastic debris.

Two areas are proposed as suitable for submersible fieldwork. The first area is within the caldera, where the best outcrops are vertical cliff-faces, left by the Late Bronze Age Plinian eruption, that continue over 400 m below sealevel; in addition, selected transects across the caldera floor are suggested. The second area is outside of the caldera, along portions of the insular apron; one such area would be to the northeast on Colombo Bank, a submarine vent that erupted in the last century.

Careful sampling of hard rocks (lavas, pyroclastic flows), less-indurated rocks (volcaniclastics, vent precipitates, paleosols), as well as venting fluids, requires careful observations at outcrops of bed attitudes, flow structures, bedding contacts, internal flow or ballistic structures, sample positions, etc. Good photographic or video documentation of exposed rocks thus is essential, particularly for paleomagnetic and petrographic studies.

The objectives of this proposed fieldwork are, first, from observations and sampling within the caldera, to describe the geological history of this volcanic field, especially to better understand: (1) periodicity of eruptions, (2) frequency of types of eruptions, (3) petrogenesis, and (4) number and duration of hiatus' between eruptive episodes. Inferences could then be made to the tectonic history of the southern Aegean arc, to paleoseismicity, to volcanic hazard predictions, and to eruption styles and their progression through time in this tectonic setting. Secondary objectives are to observe and sample the insular margin outside of the caldera, to map: (1) submarine pyroclastic flow phenomena, such as flow distance offshore, flow characteristics expressed by surface morphology and volcaniclastic components, water-flow interaction and hydromagmatic activity, reworking of tephra by slumping and bottom currents; (2) structural features; (3) volcanicity and petrogenesis of volcanic fields and hydrothermal vents peripheral to the volcanic edifice, such as Colombo Bank to the northeast.

Cooperative and interactive research on Thira has involved participants, who, with students, likely would be part of this proposed ALVIN fieldwork: Grant Heiken (Los Alamos), Steve Sparks (Univ. of Bristol), Tim Druitt (Univ. of Liverpool), Elizabeth McClelland (Oxford Univ.), Joep Huijsmans (Utrecht), and Floyd McCoy (Associated Scientists at Woods Hole and Lamont-Doherty Geological Observatory), in addition to various colleagues in Greece.

As yet, a specific number of dives remains to be determined. Considering the shallow dive-depths, only on the order of 400 meters within the caldera and not much more than than outside the caldera on the insular apron, transit times to and between study sites will be short. No funding requests have been written or submitted for this project. In view of the effort needed to refine specific research goals and to organize personel associated with these goals, a funded cruise program prior to 1993 would seem difficult.

However, if this proposed project is considered feasible, and the ALVIN/ATLANTIS II might be available for Mediterranean work, planning for the scientific and technical aspects of the research program outlined here would begin promptly. Attached is the UNOLS form indicating an interest in using ALVIN; a copy of the form and this letter were sent to the UNOLS office in Seattle. Your comments and advice are looked forward to.

Please use the address on the letterhead only up to January 13, 1991. For the spring semester, I will be teaching at the University of Hawaii at this address:

Windward College
University of Hawaii
Kaneohe, Hawaii 96744
telephone: (808) 235-0077
fax: c/o Ralph Moberly, Hawaii Institute of Geophysics
(808) 956-2538

Sincerely,

Dr. Floyd W. McCoy
Research Scientist

cc.: Dr. Kim Kastens (LDGO)
Dr. Bill Ullman (Delaware)
UNOLS Office (Washington)
potential participants noted above

attachment: Notice of Interest to Use ALVIN

DEC 10 '90 08:57 L-DGO OCE-

RECEIVED

MAY 26 1992

UNOLS OFFICE

NOTICE OF INTEREST TO USE ALVIN

Submit to:
OMNET Bulletin Boa
ALVIN.PLANNING
or
UNOLS Office, WB-1
University of Washin
Seattle, WA 98195

TITLE AND DESCRIPTION OF INVESTIGATION:

Stratigraphy + Structure of Thira Volcano, Greece

PRINCIPAL INVESTIGATOR (Name, Institution, address, telephone, telephone):

Dr. Floyd W. McCoy
Associated Scientists
P.O. Box 721
Woods Hole, MA 02543
(508) 540-5050

COLLABORATING INVESTIGATORS:

see attached letter

ADDITIONAL RESEARCHERS DESIRED (Additional research needed to fill out the investigation):

to be determined

TIME PROPOSED (include alternates):

none yet proposed

LOCATION OF INVESTIGATION (Geographic position and placement):

Aegean Sea,
eastern Mediterranean Sea

NUMBER OF DIVES:

to be determined

SIZE SCIENTIFIC PARTY:

to be determined

LOGISTICS FACTORS (Ports, transits, clearances required, weather constraints, etc.):

clearance required from Greece
weather not a serious constraint, tourism + accompanying ship traffic is thus June - Aug. should be avoided!

PROPOSED FUNDING SOURCE (Agency, proposal submission date):

N.S.F., no proposal submitted yet

ADDITIONAL INFORMATION (As necessary or desired):

none

SUBMITTED BY (Name, address, telephone, telemail):

Dr. Floyd W. McCoy
address noted above

THE OHIO STATE UNIVERSITY

Byrd Polar Research Center

103 Mendenhall Laboratory
125 South Oval Mall
Columbus, OH 43210-1308

Phone 614-292-6531
FAX 614-292-4697
Telex 4945696
OSUPOLAR

22 May 1992

Dr. Jack Bash
UNOLS Office
P.O Box 392
Saunderstown, Rhode Island
02874

Dear Jack,

I am very interested in the using the Alvin and Jason-Argo systems in the Southern Ocean and would be willing to assist Dr. John Edmond with the development of a strong research rationale. From 1984 to 1988, I used submersibles and remotely operated vehicles for my research in the Gulf of Maine. I also have spent four seasons in Antarctica, including one winter, and have made nearly 200 SCUBA dives in the Southern Ocean (a few of which were under the McMurdo Ice Shelf at White Island).

As identified by the International Geosphere Biosphere Program, the Southern Ocean is a "critical area" in the study of global climate change. As impromptu suggestions, the Alvin and Jason-Argo systems could be used for conducting *in situ* experiments to evaluate:

1) marine ice sheet marginal processes that may be associated with sea level changes;

2) rifting and the development of vent communities along the Scotia Arc that may reflect the progressive isolation of Antarctica during the Cenozoic;

3) benthic community dynamics that may reflect interdecadal variability adjacent to the Ross Ice Shelf.

4) ecological phenomena at the ice edge that may enhance interpretations of the sedimentary record in the Southern Ocean.

I look forward to participating in the development of a Southern Ocean Alvin - Jason/Argo program.

With best regards,

Pal

Paul Arthur Berkman
Assistant Professor

USF
Department of Marine Science
St. Petersburg Campus
University of South Florida
140 Seventh Avenue South
St. Petersburg, Florida 33701-5016
(813) 893-9130

1 June 1992

ALVIN Review Committee
UNOLS OFFICE
P.O. Box 392
Saunderstown, RI 02874

Dear UNOLS Personnel and ALVIN Review Committee:

I read with interest the UNOLS note published in EOS May 12, requesting input on ALVIN programming for 1993 and beyond. If I may, I would like to offer some feedback.

I have submitted a proposal to NSF (Chemical Oceanography/Neil Andersen) entitled:

CArbon Retention In A Colored Ocean (CARIACO): Physical and Biological Processes of Nutrient Import and Carbon Removal in the Cariaco Basin

This is a multi-institutional proposal which includes strong international collaboration ties with our colleagues in Venezuela. CARIACO is strongly driven by science, and one of the intended benefits is to establish a platform, logistical base, and data base for broad scope process studies which in the past have been sporadic (i.e. we would like to attract new science). I have included a copy of the CARIACO proposal abstract at the end of this message for your information.

I have been planning submitting a proposal to NSF/UNOLS to request a series of dives in the Cariaco basin to complement the activities of CARIACO. I have held preliminary dicussions with Drs. Kent Fanning (USF), Jose Torres (USF), Kendall Carder (USF), and Paula G. Coble (UW), to define a set of observations driving a program of ALVIN dives in the Cariaco Basin. We intend to submit a request for dive time for the May 1st, 1993, deadline, unless you suggest otherwise.

If you are interested in our scientific ideas in support of an ALVIN dive program in Cariaco, please let me know. We are very much interested in inviting other scientists in participating in such a series of dives. Our initial goal is to develop a program of seasonal dives in collaboration with the local and international scientific community to address questions on the biology, chemistry, physics and geology of the oxic/anoxic interface, and the bottom water column/sediment chemistry and geology.

Thank you very much for your attention,

Frank Muller-Karger
University of South Florida
(813) 893-9186

CARIACO ABSTRACT: (proposal submitted to NSFin Feb. 1992)

We propose to study the relation of near surface biogeochemical processes to the downward flux of particulate materials along a continental margin where down-slope lateral losses are minimal. Specifically, we propose to implement a low-cost ocean margin time series station in the Cariaco Basin, a depression located on the continental margin of the southern Caribbean Sea. Starting in September 1993, we will conduct monthly hydrographic casts and assess weekly sediment flux at 1,000 m depth using an automated moored trap. We refer to this program as CARIACO (CArbon Retention In A Colored Ocean).

Within the processes of upwelling, seasonal repopulation of the euphotic zone with phytoplankton, and sinking of particles, we are interested in a budget which assesses the total CO_2 upwelled with deep, nutrient-rich water with respect to annual export of organic carbon from surface waters. The Cariaco Trench is an ideal location to examine the vertical flux of biogenic particulate matter, because it forms a natural sediment trap in an area of restricted advection.

The approach combines a NASA-funded study of synoptic satellite observations (ocean color: CZCS, SeaWIFS, and temperature: AVHRR), with in situ observations of phytoplankton pigments and productivity, wind, sea level, hydrography, chemistry, particle flux, and numerical modeling. The program will be carried out in collaboration with the CONICIT (Consejo Nacional de Investigaciones Cientificas y Tecnologicas) of Venezuela through the Instituto Oceanografico of the Universidad de Oriente (IO/UDO; Cumana) and the Estacion de Investigaciones Marinas (EDIMAR) of the Fundacion La Salle (Margarita Island). The CARIACO program provides an interface for process studies focusing on anoxic basins.

Because it is not simply a study in ocean color, CARIACO will help fulfill the objective of the International JGOFS by studying an area of active vertical nutrient and carbon exchange along continental boundaries. Coordination with the Bermuda-Atlantic Time Series (BATS) will lead to consistency in long-term deep-ocean and margins series data for the JGOFS.

This study will provide information for:

1) understanding the effect of physical forcing factors, in particular winds and geostrophic flows, on vertical nutrient exchanges, biologically-mediated cycling near the surface, vertical flux of biogenic materials, and potential burial along the continental margin;

2) understanding the origin of sedimentary varves, and calibration and interpretation of annual- to decadal-scale climate change using varved sediments;

3) calibration and validation of historical (CZCS) and concurrent (Sea-WIFS) satellite-based ocean color in Case II waters and infrared (AVHRR) observations; these

measurements are essential for proper interpretation of global ocean color satellite observations; and

4) input to synoptic models of carbon cycles. To our knowledge, this would be the only time series of CO_2 exchange in pelagic waters.

The program will be carried out in three distinct phases:

1) Background research of the Cariaco Basin and preparation for deployment (August 1992 - August 1993). This phase includes literature searches and compilation of a regional data base with help of local scientists. Also, preparation of the US component for field work will take place in close cordination with local scientists for efficient use of resources. CARIACO is adopting the BATS sampling and data analysis/archive protocols.

During this phase we begin development of a two-dimensional model of sufficient biological richness to accurately depict population responses and chemical degradation along the most important ecological gradient in the sea, that of depth. We will also seek augmentation of the scope of the station by inviting scientists from various disciplines to take advantage of the hydrographic and sediment trap series.

2) Implementation of the time series, including initial field program and synthesis of background data (September 1993). Baseline hydrographic and biogeochemical data will be collected during this phase to lead to the maintenance of the series for an initial period of 3 years. Table 1 shows the distribution of responsibilities among participants. The bulk of the measurements will be conducted in a dedicated laboratory set up at EDIMAR, which also serves as training site for regional marine biogeochemists through the NSF-funded Caribbean Coastal Ocean Marine Productivity (CARICOMP) educational program. F. Muller-Karger and R. Varela will coordinate CARIACO scientists and ensure data quality control.

The time series will consist of monthly visits to 10°35'N, 64°40'W to conduct:
1 Shallow cast for CTD, O_2, and fluorescence profile.
1 Shallow cast for discrete samples at 8 depths.
1 Deep cast for samples within anoxic waters.

An additional station will be occupied routinely at 11°40'N, 64°40'W, north of the Cariaco Basin sill. This station will provide essential information on biochemical and physical properties of waters that may affect Cariaco during upwelling and other circulation processes that may induce ventilation. This station will be occupied during prescheduled cruises to Blanquilla Island by EDIMAR personnel.

Casts will be made with an existing Sea-Bird Seacat 19 CTD profiler, equipped with O_2 and chlorophyll fluorescence probe. Samples will be collected using 12 liter Niskin bottles. Measurements of incident and upwelling light will be collected with existing optical equipment from aboard the ship and daily from the shore station.

Samples will be analyzed for:

Pigment concentration by fluorometry and HPLC

Phytoplankton productivity

Phytoplankton taxonomy

Dissolved Organic Carbon (DOC) concentration, absorption spectra, and fluorescence

Nutrient concentration

CO_2 system: alkalinity and total CO_2

A sediment trap with 21 collection cups will be deployed at 1000 m to determine the weekly composition of sinking particulate material and total sediment flux.

Basic time records of wind speed, atmospheric visibility, precipitation, river discharge, relative humidity, and sea level will be assembled from local meteorological and sea level stations in the region.

3) Starting the second year of the project, data synthesis begins (September 1994). We will seek augmentation of the scope of the series to establish a long-term climate analysis station. High-resolution, synoptic Sea-WIFS and AVHRR imagery will be collected with local antennas (funded by Venezuela) during this phase.

Thank you very much for your attention,

Frank Muller-Karger
University of South Florida
(813) 893-9186

Posted: Tue, Jun 2, 1992 4:25 AM PDT Msg: KGJC-5257-5631
From: J.ECKMAN
To: unols.office
CC: d.thistle
Subj: ALVIN Ops

TO: ALVIN REVIEW COMMITTEE (via Feenan Jennings)
(cc: UNOLS office)
FROM: JIM ECKMAN & DAVID THISTLE
DATE: 1 June 1992
SUBJ: ALVIN USE IN 1994

Dear Feenan:

Please forgive us for sending this message so close to dates of the upcoming ARC meeting, but as we ARE NOT requesting ALVIN time during 1993 we hope that the lateness of this message will not significantly impact the committee's workload and deliberations. We would appreciate it if this message is distributed to ARC members, and perhaps mentioned at the upcoming meeting.

We wish to comment briefly on recent encouragements by the ALVIN Review Committee and by the UNOLS Office (e.g., see May 12, 1992 issue of EOS, p.215) for use of ALVIN in more remote locations of the world's oceans during the next 3 years. We recognize that the 3-year window during 1993-1995 between major overhauls presents an ideal opportunity for extensive, multi-project, collaborative missions using ALVIN in far-away locales. In fact, we share your hope that such missions can be funded and executed. However, we want to remind the ARC and UNOLS Office that there remains a high probability that quality research projects will be funded for research using ALVIN during this 3-year interval within the more traditional western Atlantic-eastern Pacifc "yo-yo" (Mid-Atlantic Ridge to Juan de Fuca Ridge with many points in between).

We will be submitting a proposal to NSF this November that will request three series of dives during 1994 to conduct manipulative experiments on the seafloor of San Diego Trough (1050 m depth, approximately 30 miles from San Diego). A formal request for ALVIN time will be made during next year's ARC meeting, and a funding decision by NSF should be made by then. We will be requesting 12 dives in San Diego Trough during January (or early) 1994, 9 dives approximately six months later (June, 1994), and a final 9 dives approximately six months after that (December, 1994).

Given the reduced demand for ALVIN in the past few years, we trust that our study, and others, within the "yo-yo" can be scheduled in addition to one or more time-consuming remote studies that we hope also will be realized. Nevertheless, we wish to alert the ARC and UNOLS Office that ALVIN studies that would be located near the continental U.S. during 1994 are already being planned.

Best wishes,

Jim Eckman (J.ECKMAN/OMNET)
Dave Thistle (D.THISTLE/OMNET)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
ENVIRONMENTAL RESEARCH LABORATORIES
Pacific Marine Environmental Laboratory
Marine Resources Research Division
Hatfield Marine Science Center
Newport, Oregon 97365

June 4, 1992 R/E/PM

ALVIN Review Committee
UNOLS Office
P.O. Box 392
Saunderstown, RI 02874

Dear ALVIN Review Committee Members:

We are writing to express a strong interest in using ALVIN to study the southern East Pacific Rise axis roughly in the region from the Garret Transform at latitude 13.5^{O}S down to 20^{O}S. As you may know, the EPR south of the Garret has been identified by the RIDGE Initiative as a region of primary interest for future studies. In addition, the huge helium plume emanating from the 15^{O}S region of the EPR indicates that this region of the ridge is host to very intense hydrothermal activity. We are interested in using ALVIN to study the hydrothermal systems along this section of the EPR, including collecting vent fluids and photographic reconnaissance of the surrounding area.

This ALVIN work would be a natural follow-on to a water-column study which is now being considered for funding by NSF under the RIDGE Initiative. This water-column study (R. Collier, G. Klinkhammer, and M. Lilley, NSF PIs, and J. Lupton, E. Baker, and R. Feely, NOAA/PMEL PIs) would be conducted from a surface ship and would map the distribution of hydrothermal sources along the EPR axis from the Garret Transform down to 21^{O}S. Taking the optimistic view that this water-column study will be funded and successfully completed, it would identify the regions of intense hydrothermal activity, thereby providing us with specific dive targets for the subsequent ALVIN study.

Because of the need to clearly identify dive targets via a water- column survey before beginning more detailed sampling and reconnaissance work with ALVIN, we would be most interested in using ALVIN on the southern EPR in the 1994-95 time frame. The PIs for this ALVIN project would likely include J. Lupton, D. Butterfield, R. Embley, E. Baker, G. Massoth, and R. Feely (all at NOAA/PMEL), R. Collier and G. Klinkhammer at Oregon State University, and M. Lilley at the University of Washington. As mentioned above, the major thrust of the work would be vent fluid sampling and other direct investigations of the hydrothermal system, as well as some geologic mapping of the ridge axis in the target areas. Due to the mix of NOAA and university-based PIs, we would likely seek support for this southern EPR ALVIN project from both NOAA and NSF.

We should also mention that it is likely that the NOAA VENTS Program will propose an ALVIN dive program in the northeast Pacific in the 1994-95 time frame as part of its ongoing program there and in support of the upcoming joint NOAA-NSF coordinated seafloor observatory experiments at the North Cleft site on the Juan de Fuca Ridge.

Sincerely,

John Lupton
Oceanographer

Dave Butterfield
Research Fellow

cc: Steve Hammond
Robert Collier
Gary Klinkhammer
Ed Baker
Gary Massoth
Richard Feely
Marv Lilley
John Edmond
P.J. Fox

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Cambridge, Massachusetts 02139-4307
DEPARTMENT OF EARTH, ATMOSPHERIC, AND PLANETARY SCIENCES
Telex: 92 1473

8 June 1992

To: ALVIN Review Committee
Re: Dive Requests
From: John M. Edmond

Enclosed are requests for ALVIN dives on the superfast spreading segment of the EPR in the region of Easter Island and in the hydrothermal deeps of the Red Sea.

An NSF proposal for the Easter Island work was deemed "fundable" in 1989 but lapsed in the absence of a suitable submersible (ALVIN). I wish this request to be reactivated.

The request for dives in the Red Sea is in collaboration with W. Shanks and W. Zierenberg of USGS.

Proposals will be submitted to NSF once the long-term ALVIN schedule is known.

93-24

UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM
DEEP SUBMERGENCE VEHICLE ALVIN
TIME REQUEST

To: Chairman ALVIN Review Committee
c/o UNOLS Office
P. O. Box 392
Saunderstown, RI 02874

DATE: 8 June 1992

USE OF THE ALVIN SUBMERSIBLE RESEARCH SYSTEM IS REQUESTED FOR 1993/4 (YEAR) FOLLOWS:

PURPOSE: (Project, Title and brief outline of program)
Chemical sampling of hydrothermal fluids on the superfast segments of the EPR in the region of Easter Island.

PRINCIPAL INVESTIGATOR: (Name, Title, Address, Telephone Number)	OTHER INVESTIGATORS INVOLVED:
John M. Edmond E34-201, MIT, Cambridge, MA, 02139 617 253 5739	W. Shanks, USGS J. Lupton, PMEL M. Lilley UW
PROPOSED CHIEF SCIENTIST: John M. Edmond	TOTAL NUMBER OF SHIPBOARD PERSONNEL: 15

PROJECT REQUIREMENTS

# OF DIVES REQUSTED:	PREFERRED DATES:	ALTERNATE DATES:
15	southern summer	

AREA OF OPERATIONS: LATTITUDE AND LONGITUDE (Attach page-size chart showing location of dives and bathymetry)
26-30 S, 110 W, water depths around 2,000 meters

NAME OF NEAREST PORT: Easter Island | DISTANCE, IN NAUT. MILES: 300

LIST SPECIAL EQUIPMENT REQUIREMENTS: (e.g., sensing, sampling and navigation requirements; attach brief description of proposed escort/surface support ship if one is required)
Transponder navigation, Ti-samplers

COUNTRIES FOR WHICH RESEARCH CLEARANCE WILL BE REQUIRED: Chile

FUNDING STATUS

PLEASE INCLUDE THE GRANT NUMBER FOR PROJECTS ALREADY FUNDED, THE PROPOSAL NUMBER FOR PROPOSALS SUBMITTED

NOTE: NSF research proposal requiring the use of facilities (e.g., ALVIN) must include a completed NSF-UNOLS Ship Time Request Form 831 (R-9/81).

FUNDED			NOT FUNDED		
FUNDING AGENCY:			PROPOSAL SUBMITTED: ____ WILL BE SUBMITTED: XX TO: NSF-OCE (RIDGE)		
GRANT NUMBER:			DATE: Summer 1992 AMOUNT REQUESTED: 150,000		
AMOUNT OR ANNUAL RATE:	BEGIN DATE:	DURATION:	NEW PROPOSAL NUMBER:	OR	RENEWAL OF GRANT NUMBER:

IMPORTANT: ATTACH MATERIAL ADDRESSING POINTS LISTED ON OVERLEAF

SUBMITTED BY: [signature] SIGNATURE APPROVED: [signature] DEPARTMENT CHAIR or LABORATORY DIRECTOR

NAME, TITLE, ADDRESS & TELEPHONE NUMBER IF DIFFERENT FROM PRINCIPAL INVESTIGATOR:

TELEPHONE: ( )

UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

DEEP SUBMERGENCE VEHICLE ALVIN

TIME REQUEST

DATE: 8 June 1992

To: Chairman ALVIN Review Committee
c/o UNOLS Office
P. O. Box 392
Saunderstown, RI 02874

USE OF THE ALVIN SUBMERSIBLE RESEARCH SYSTEM IS REQUESTED FOR 1993/4 (YEAR) FOLLOWS:

PURPOSE: (Project, Title and brief outline of program)

Chemical sampling of hydrothermal fluids associated with the deeps of the Red Sea

PRINCIPAL INVESTIGATOR: (Name, Title, Address, Telephone Number)	OTHER INVESTIGATORS INVOLVED:
J. M. Edmond E34-201, MIT, Cambridge, MA, 02139 617 253 5739	W. Shanks, USGS W. Zierenberg, USGS
PROPOSED CHIEF SCIENTIST: W. Shanks	TOTAL NUMBER OF SHIPBOARD PERSONNEL: 15

PROJECT REQUIREMENTS

# OF DIVES REQUESTED:	PREFERRED DATES:	ALTERNATE DATES:
5	October-March	

AREA OF OPERATIONS: LATTITUDE AND LONGITUDE (Attach page-size chart showing location of dives and bathymetry)

18-26 N, 38 E, 2,000 meters water depth

NAME OF NEAREST PORT: Jiddah, Port Sudan — DISTANCE, IN NAUT. MILES: 200

LIST SPECIAL EQUIPMENT REQUIREMENTS: (e.g., sensing, sampling and navigation requirements; attach brief description of proposed escort/surface support ship if one is required)

Transponder navigation, Ti-samplers

COUNTRIES FOR WHICH RESEARCH CLEARANCE WILL BE REQUIRED: Saudi Arabia, Sudan

FUNDING STATUS

PLEASE INCLUDE THE GRANT NUMBER FOR PROJECTS ALREADY FUNDED, THE PROPOSAL NUMBER FOR PROPOSALS SUBMITTED

NOTE: NSF research proposal requiring the use of facilities (e.g., ALVIN) must include a completed NSF-UNOLS Ship Time Request Form 831 (R-9/81).

FUNDED			NOT FUNDED		
FUNDING AGENCY:			PROPOSAL SUBMITTED: ______		WILL BE SUBMITTED: XX
			TO: NSF-OCE		
GRANT NUMBER:			DATE: summer 1992		
			AMOUNT REQUESTED: 150,000		
AMOUNT OR ANNUAL RATE:	BEGIN DATE:	DURATION:	NEW PROPOSAL NUMBER:	OR	RENEWAL OF GRANT NUMBER:

IMPORTANT: ATTACH MATERIAL ADDRESSING POINTS LISTED ON OVERLEAF

SUBMITTED BY: JM Edmond (SIGNATURE) APPROVED: NA (DEPARTMENT CHAIR or LABORATORY DIRECTOR)

NAME, TITLE, ADDRESS & TELEPHONE NUMBER IF DIFFERENT FROM PRINCIPAL INVESTIGATOR:

TELEPHONE: (   )

UNIVERSITY OF VICTORIA
P.O. BOX 1700, VICTORIA, B.C., CANADA V8W 2Y2
TELEPHONE (604) 721-6120, FAX (604) 721-6200

SCHOOL OF EARTH AND OCEAN SCIENCES
E-Hut 118

Jack, for your Arabian Sea Alvin file.
Karen

May 28, 1992

Dr. K. Wishner,
Graduate School of Oceanography,
University of Rhode Island,
Kingston,
RI 02881

Dear Karen,

I read a notice in the last issue of EOS concerning expressions of interest for ALVIN programmes beyond 1993. You were named to possibly coordinate a `voice' for the Indian Ocean/Arabian Sea. As a Canadian worker, I may not be very helpful in the NSF politics, but I wish to let you know my interest.

I have used ALVIN through U. S. programmes for six years now to further my work on the ecology and evolution of the hydrothermal vent fauna. I feel that we have reached a critical point in understanding the origin of the vent fauna through examination of systematics, biogeography and plate tectonics. However, tests of several hypotheses remain to be made: the best areas are on the unexplored ridges of the southern Oceans and the Indian Ocean. There is a tremendous value in simple exporation and collection. Numerous workers can be supported in several facets of hydrothermal work.

This type of work falls into the mandate of the RIDGE initiative in which I am active. I worry that tightening budgets are reducing ALVIN's scope. Her experience and utility remain unparalleled. Please let me know if I can make any contribution to your effort.

Yours sincerely,

Verena

Verena Tunnicliffe

ISRAEL OCEANOGRAPHIC & LIMNOLOGICAL RESEARCH LTD. חקר ימים ואגמים לישראל בע"מ
TEL SHIKMONA, P.O.B. 8030, HAIFA 31080 TEL: 04-515202 :תל־שקמונה, ת״ד 8030, חיפה 31080 טלפון
BITNET: ZSEA401@HAIFAUVM TELEX: 371704 GOLDNT IL/ATT:GLD5:MGB690 FAX: 04-511911 :פקס

FAX MESSAGE

TO:
Dr. J.P. Fox
ALVIN review Committee
UNOLS Office
Saunderstown, RI
USA
Fax: 1-401-792-6486

FROM:
Yossi Mart
National Institute of Oceanography
Haifa, Israel
Fax: 972-4-511-911

June 14, 1992.

Dear Jeff,

Your EOS call for research proposals for the forthcoming international cruise of the ALVIN seems very interesting, and although you mention that the overall response is not overwhelming, I understand that the call raised some interest in the community of Mediterranean geoscientists. Since EOS reaches me in, at least, a delay of one month, I would like to know if the call is still applicable, what stage of a proposal are you looking for - a mature proposal or a pre-proposals, and are you still looking for a regional coordinator for the eastern Mediterranean for this world tour?

I have two ALVIN targets that I would like to carry out in the eastern Mediterranean. I want to observe and carry out judicious sampling in the Eratosthenes Seamount, to study the details of the early stages of the continental collision between Africa and Anatolia, and I am interested in the outcropping diapirs at the Mediterranean Ridge and adjacent terrains, and I would try to uncover the stress field and the strain regime under which these bodies rise to the surface.

Do you think that the ARC would be interested in such projects?

Very best regards,

Yossi

Yossi Mart

Mineral Resources Department,
Geological Survey of Japan
1-1 Higashi, Tsukuba, Ibaraki 305 Japan

FAX COVER SHEET

6486

++

TO: UNOLS Fax #: 1-401-792-[redacted]
P.O.Box.392, Saunderstown, RI

FROM: Tetsuro URABE Fax: +81-298-54-3533 or +81-298-56-4989
Phone: +81-298-54-3634 (direct)
Telex:3652511 GSJ J
E-mail address: urabe@gsjrstn.gsj.go.jp

DATE: June 15, 1992
No. of Sheets: **1** (including this cover sheet)

++

Dear sirs;

I read your article on *EOS* newsletter (May 12, 1992, p.215) regarding the possible use of Alvin in relatively distant areas from its "home ground". As an user of Alvin for two times; once in Galapagos and once in Bonin arc, I appreciate the capability of the submersible as a tool in detailed survey of hydrothermal activity on ridge crests. This reply may be too late but I receive *EOS* recently via sea mail, and I would like to make a comment on Alvin's mission.

Geological Survey of Japan and other institutions in Japan have been involved in French-Japanese STARMER Project in North Fiji Basin for 5 years (see *EOS*, March 17, 1992, p.116-117). We are planning to start another 5-year project called "Ridge-Flux", in 1993, in cooperation with IFREMER and, possibly with some American colleagues, under the umbrella of *Interidge* initiative.

We are currently planning to bring brand-new Japanese submersible Shinkai 6500 to Southern East Pacific Rise for the first time, because we are interested in its superfast spreading rate and thus vigorous hydrothermal activity including mega-plumes. Although it is exciting, we have several problems mainly because of the vast distance between southern EPR and Japan. For our purpose to monitor the hydrothermal activity, it is crucial to visit the same locality for more than twice to deploy and recover equipments. However, it is unlikely for us to bring Shinkai 6500 for more than two times during the first 3 year period of the 5-year project of Ridge-Flux. Therefore, we need to cooperate and combine the diving opportunity of Shinkai 6500 with that of Alvin for the apparent benefit of both parties. I would confess that Shinkai needs more experience to reach the level of performance of Alvin, however, the hardware of the Shinkai is super and the soft is improving rapidly.

I will send you more information if you need. We are currently organizing a working group to discuss research plan, cruise schedule, and possibility of cooperation of the Ridge-Flux project and will submit reports to our funding agency, Science and Technology Agency of Japan, in the end of October (tentative plan) and in the end of March (final plan). Therefore, you input to our reserach planning is highly appreciated.

Regards,

Tetsuro Urabe

(If any pages are missing, please let me know either by fax or E-mail.)

OCEAN DRILLING PROGRAM

Australian Secretariat
Department of Geology & Geophysics
University of New England
Armidale New South Wales Australia 2351
Telephone: 6167(INT)/067(DOM) 732860 Facsimile: 6167(INT)/067(DOM) 712898
E-mail: bmckelve@metz.une.oz.au

I have just seen the short article in the May 12 issue, advertising possibilities of influencing the international destinations of ALVIN for '93 and beyond.

I am assembling other interested parties here (and you may have already heard from some) in Australia and NZ - but in the short term would like to advise of our strong interests in taking the submersible to:-

(1) the Woodlark Basin /Manus Basin

(2) the spreading ridges in the Lau Basin and at the southern end of the North Fiji Basin (especially the actively extruding (we think) boninite areas

(3) the Macquarie ridge (various critical locations)

(4) the Australia-Antarctica Discordance

(5) the Diamantina Fracture zone off SW Australia.

I can nominate people to champion these sites if you believe it to be appropriate

Professor Richard J Arculus
Director Australian Secretariat
Ocean Drilling Program

RECEIVED
JUN 23 1992
UNOLS OFFICE

RECEIVED

VERSION A
(JDF)

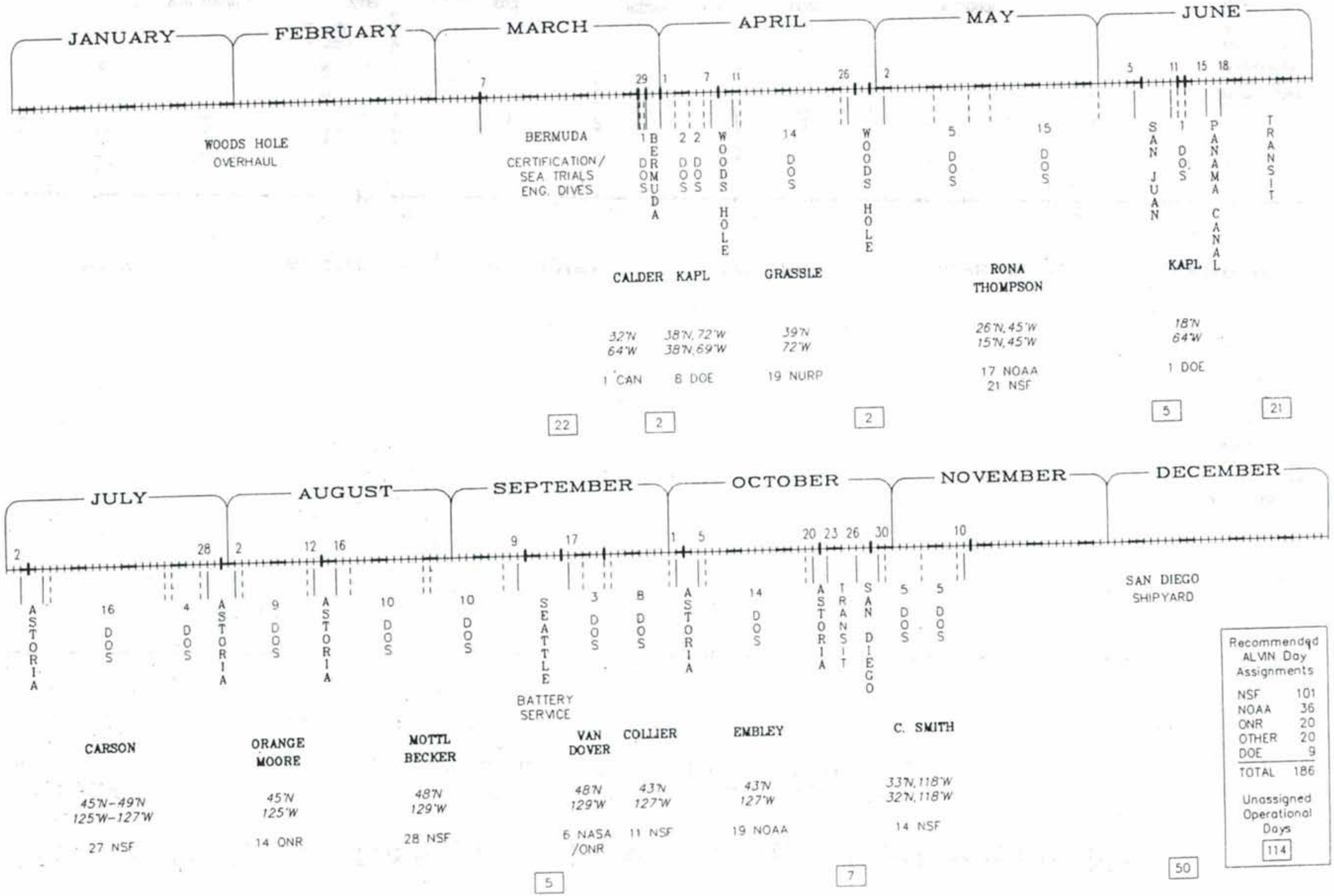
PROPOSED *

R/V ATLANTIS II & ALVIN OPERATIONS

1993

OPERATIONAL SCIENTIFIC SERVICES
WOODS HOLE OCEANOGRAPHIC INSTITUTION

11 JUN 92



* Based upon requests for ALVIN time recieved by the UNOLS ALVIN Review Committee and therefore subject to revisions resulting from supporting agency funding decisions

PROPOSED *

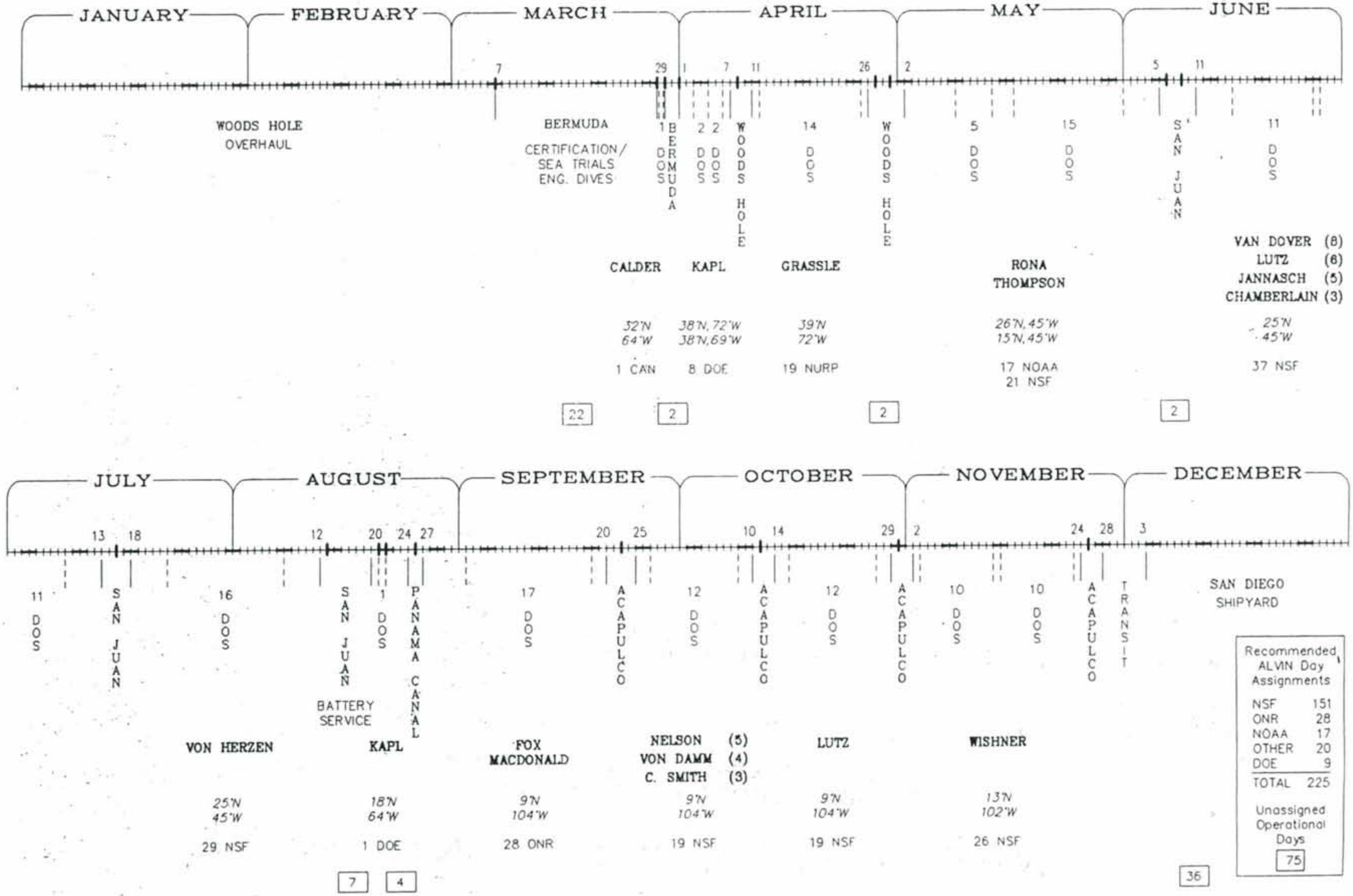
VERSION B
(EPR)

R/V ATLANTIS II & ALVIN OPERATIONS

1993

OPERATIONAL SCIENTIFIC SERVICES
WOODS HOLE OCEANOGRAPHIC INSTITUTION

11 JUN 92



* Based upon requests for ALVIN time recieved by the UNOLS ALVIN Review Committee and therefore subject to revisions resulting from supporting agency funding decisions

PROPOSED *

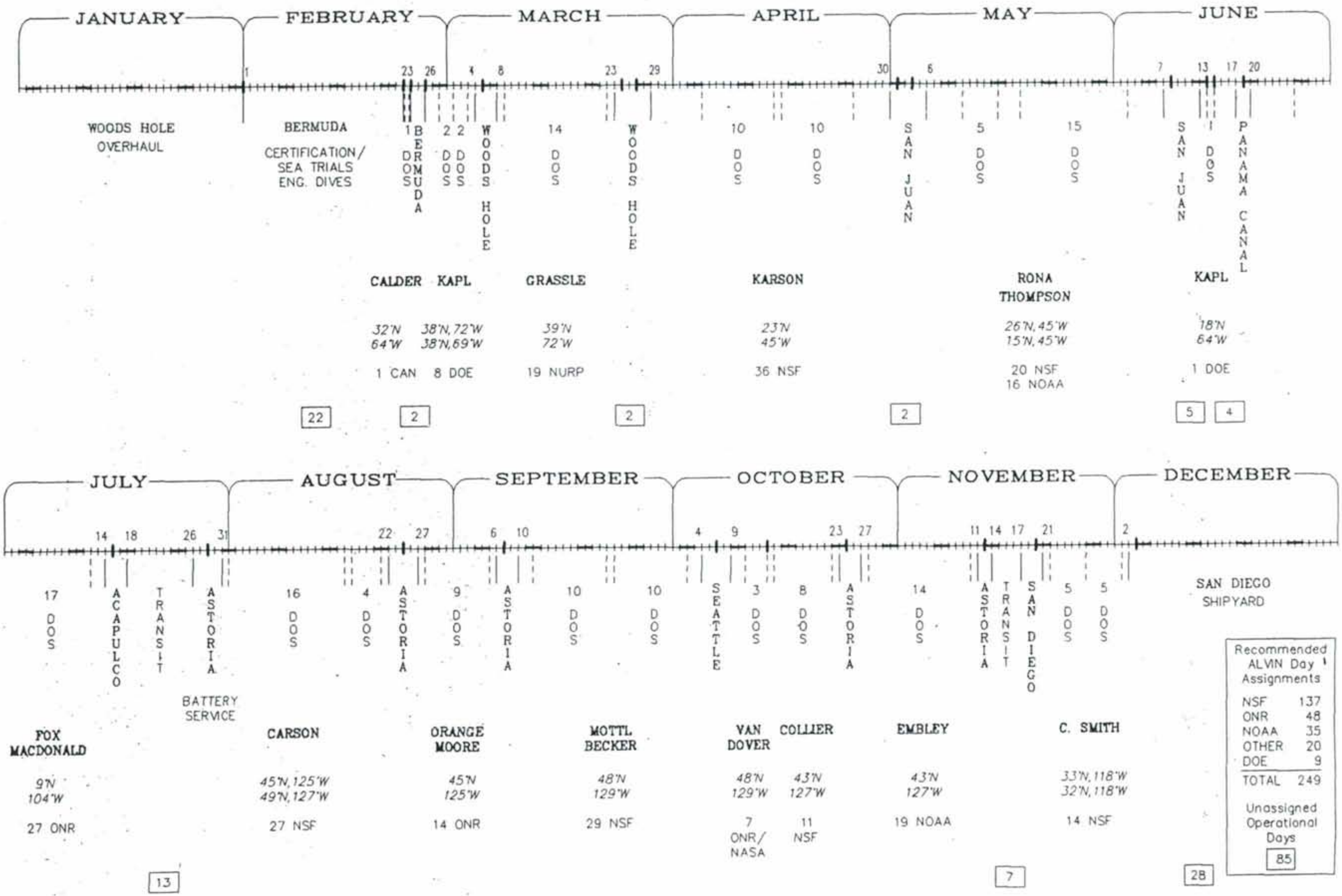
VERSION C
(MAR/EPR/JDF)

R/V ATLANTIS II & ALVIN OPERATIONS

1993

OPERATIONAL SCIENTIFIC SERVICES
WOODS HOLE OCEANOGRAPHIC INSTITUTION

23 JUN 92



* Based upon requests for ALVIN time recieved by the UNOLS ALVIN Review Committee and therefore subject to revisions resulting from supporting agency funding decisions

Date: July, 1992
From: UNOLS
To: NSF, ONR, NOAA

Subject: RECOMMENDATIONS FOR RENEWAL OF THE MEMORANDUM OF AGREEMENT FOR THE NATIONAL OCEANOGRAPHIC FACILITY: ALVIN

In response to requests from the funding agencies, representatives from the ALVIN Review Committee (ARC), Woods Hole Oceanographic Institution and UNOLS have reviewed the current Memorandum of Agreement (MOA) for support of the Deep Submergence Vehicle ALVIN. This letter forwards recommendations which we hope will be considered by the National Science Foundation, Navy and NOAA in the renewal of the MOA.

Over the years, undersea technology has progressively developed and continues to develop in the areas which include submersible instrumentation, deep ocean sampling equipment and ROV technology. These advances can help to enhance the present capabilities of our National Facility and need to be addressed in the renewal of the MOA. Additionally, in light of the 1992 ALVIN/ATLANTIS II operating schedule, it has become obvious that changes are required to ensure the safe and continued operation of ALVIN during lean times. An acceptable scheduling and funding process for the facility needs to be identified by the MOA and adhered to for prevention of another year in which ALVIN is not utilized to an acceptable level.

Attached is a two-part document. The first part provides recommendations on deep submergence support for the next decade and the second is a recommended concept for operation of the National Facility. Part I was prepared by ARC and endorsed by the UNOLS Council. It provides an academic perspective of the need for a National Deep Submergence Facility. ALVIN's history, accomplishments and potential for continued contribution to the realms of benthic science are described. Part II recommends methods in which the MOA can be modified to allow a means for continued safe, beneficial deep oceanographic research using ALVIN and advanced undersea technologies.

We hope that these recommendations are accepted and that the National Deep Submergence Facility can continue in its dominance as a world renown oceanographic research tool.

PART I

UNOLS Recommendations on Deep Submergence Support for the Next Decade: ALVIN and ROVs

It is an undeniable fact that in more than two decades of service, ALVIN has crossed the threshold of greatness. This reliable workhorse has provided a mechanism to place scientists and their equipment in the deep sea where key observations, sampling, and experiments have been conducted resulting in data that has changed, in fundamental ways, the geological, chemical and biological sciences.

In its more than two decades, the marine sciences have experienced a technological revolution, and ALVIN has evolved accordingly continuing to improve and develop new capabilities; so completely that only the name has not been replaced over the years. As important as these improvements have been, however, the characteristic which has made, and continues to make, the submersible unique as an investigative tool remains not only undiminished, but enhanced. This characteristic is the on bottom interactive and cognitive presence of the human mind coupled with a system that permits, even in the most rugged of settings, complex manipulations (sampling and equipment deployment) by powerful and dexterous robotic arms, and that provides the user with the capability to take large payloads to and from the bottom.

Presently, and probably for at least the next 5-10 years, remotely operated vehicles (ROVs) can't match what ALVIN offers the investigator. ROV technology has developed to the point where it is a superb fine-scale imaging and mapping tool, creating a high resolution (centimeters to meters) acoustic (backscatter and bathymetry) and visual data set that makes it possible for the first time to completely image patterns and relationships created by a mix of biological and physical processes at a local scale (meters to kilometers) providing an essential linkage between our regional data sets and the outcrop scale. These results from ROVs, rather than diminish the real relevance of ALVIN, enhance ALVIN's productivity by creating a superbly well-constrained framework into which ALVIN can be placed most effectively to maximize her unique potential.

To illustrate the important contributions that ALVIN's unique capabilities can make during the next decade, let us give a few examples of how these ALVIN-specific capabilities are pivotal in the solution of a range of critical problems. Because the dynamic environment of the axis of the Mid-Ocean Ridge system is the focus of a NSF/ONR/NOAA endorsed national interdisciplinary research initiative, the ridge environment has been chosen as the illustrative area of interest.

· **Cognitive On Bottom Presence:** Photographic and video images of the seafloor, unless taken in stereopairs, are two dimensional creating a flat perspective that makes it impossible to recognize, assess and comprehend complex spatial relationships. On bottom presence allows one to establish an accurate definition of scale and extent of seafloor features that is not possible with remote systems. An observer in a submersible gets an undistorted view of the seafloor and can integrate complex three-dimensional spatial information. The essence of making geological observations lies in pattern recognition and three-dimensional reconstructions. The recent documentation, based largely on submersible observations, that along some magma starved ridge segments the oceanic lithosphere is dismembered along low-angle normal faults has profound implications for our understanding of the processes that govern the formation and evolution of oceanic lithosphere. The key to a definition of the salient kinematic properties of these faults and the properties of the deep seated rocks that they expose will depend on detailed structural observations and the collection of oriented samples of gabbric and ultra-mafic rock at key contacts and localities determined in real time from on bottom observations. Such data can only be obtained by scientists working in a submersible.

· **Sophisticated On Bottom Experimental Implementation:** The ridge axis is a dynamic interface where the consequences of the interplay of extensional tectonism, magmatism, and hydrothermalism lead to a dynamic and evolving physical, chemical, and biological environment that can only be understood if salient parameters of these processes can be characterized by sampling, instrumentation, and visual documentation. Now that we have developed a high resolution definition of the expressions of the ridge axis processes in a few localities (e.g., Juan de Fuca Ridge, East Pacific Rise at 9^{o}N), plans are in progress to establish seafloor observatories where interdisciplinary time series experiments can be implemented. To carry out the investigative protocol that these experiments necessitate, a submersible is needed that can implement demanding tasks in rugged terrain. The shear mass of ALVIN (17 times heavier than the ROV Jason for example), coupled with two manipulator arms give the submersible the capability needed to do these tasks. In the last few years, ALVIN has successfully deployed over 40 different instruments, has carried out sophisticated *in situ* measurements of vent fluids, has selectively sampled specific organisms, and has used a newly developed hydraulically-driven drill to sample consolidated material in demanding settings: these achievements are a ringing testimony to the fact that ALVIN and a skilled support team (pilots and engineers) working in collaboration with scientific investigators are prepared to meet the demanding on-bottom investigative needs of the 1990s.

• **The ALVIN Payload:** Although not immediately obvious to many, one of ALVIN's greatest strengths is its capability to carry material down and/or back from the abyss. During the last decade, thousands of pounds of equipment and samples (water, biological, sediment and rock) have been successfully transported in this manner. To provide just one example, the microhabitat characterizations for clams, mussels and tube worms at vents is central to our understanding of the unique hydrothermal vent environment. To solve this problem it is essential to obtain (a) temperature probe data, (b) real time characterization of reaction compounds in vent fluids (e.g. H^2S and $0^{2)}$, and (c) collection of animals from the characterized habitat. The requisite instruments needed to meet this investigative challenge - temperature probes, a bulky flow-injection analyses system and an insulated collection box - can all be carried and used during an integrated sampling protocol on a single ALVIN dive. This extended payload capacity can't be matched by an ROV, now or in the near future.

• **ALVIN Performance:** Finally, it should be emphasized that although other deep submergence platforms (>2000 m) in this country and abroad have many of the general capabilities mentioned above, none have ALVIN's track record as a reliable platform that can dive day in and day out for weeks at a time, and that can rapidly respond to community needs. This important quality does not happen by accident and is made possible by a dedicated and skilled group of technical staff that have successfully built on almost three decades of deep submergence experience. In addition, there is an organizational stability that schedules programs in a dependable manner. An institutional commitment to the submersible by Woods Hole Oceanographic leadership and the continuity of funding provided to ALVIN by the tripartite agreement have made the ALVIN facility the premier deep submergence operation that it is today.

To conclude, ALVIN represents a mature system with tested technology that is presently uniquely capable of carrying out important tasks on the seafloor. There are exciting and compelling scientific biological, chemical and geological questions that can be most effectively addressed with a submersible and, if US investigators are to remain competitive in the arena of the abyss, then the ALVIN facility must be supported in a way, and at levels, that insure operational stability. Although the manipulative and sampling capabilities of ROV technology are still in the formative stages of development, the existing fine-scale acoustic and optical imaging strengths of ROV driven systems are superb. These capabilities, far from diminishing the utility of ALVIN, in fact, vastly enhance its value for scientists interested in complex instrument deployment and challenging sample recovery. The potential for the development of other capabilities that could eventually duplicate those of the submersible is real and ROV technological development should be nurtured, both in terms of field programs to test and utilize existing systems, as well as laboratory development of new capabilities. For US leadership in marine science to remain broad and complete, the operation of ALVIN and the development of ROVs must both receive agency support.

The UNOLS Advisory Council recommends without qualification and with unbridled enthusiasm that the NSF, NOAA, and ONR forge a new tripartite agreement for ALVIN support. Manned presence in the deep-sea, the last frontier on earth, is necessary and the ALVIN operation represents the premier capability in the world. The development of ROV technology is happening at a number of institutions in an independent fashion as each group explores new avenues of development. It is important that these groups be encouraged to compete for resources set aside for this kind of technology. The challenge before the funding agencies and the marine community is to formulate a robust support strategy that maintains the strengths of ALVIN on one hand and that allows ROVs to reach their promising potential on the other.

PART II

RATIONALE AND RECOMMENDED ELEMENTS FOR THE MEMORANDUM OF AGREEMENT

Rationale:

Benthic science, or the oceanography of so-called "inner space," is both rewarding and challenging. The remarkable discoveries of the past two and a half decades are only harbingers of future enlightenment. These and future discoveries have not come easily as the awesome pressures and nearly impenetrable opaqueness of the ocean deeps have permitted investigators only fleeting, narrow views of this vast realm.

While the past achievements of US benthic science have been great, we are now at a crossroads brought on by the confluence of several factors. Our leadership in the field is being challenged by several nations some of which have copied (indeed have been given) our technology. These nations have their own needs and all have noted our success and wish to share in that success in the future. DSV ALVIN is mature, but with proper care and upgrading is capable of prolonged continued excellent service. Its support ship R/V ATLANTIS II is reaching the end of its service life and must be replaced. Funding paradigms are changing in Washington in the face of such pressures as the budget deficit, the end of the Cold War, and shifting research priorities. Some perceive, incorrectly, that the discovery/exploration phase of deep submergence operations is over and thus much needed research has ended. In the face of these challenges, we can either capitulate and let our lead in this field go elsewhere or we can pull up our socks and craft a program to move to a higher plane of capability and achievement. UNOLS recommends the latter course of action.

In the belief that the United States must continue to lead the fields of benthic science and deep submergence technology development, we urge the strengthening of the national facility now centered around DSV ALVIN its support ship and the team which uses, operates, maintains and engineers it. The US cannot afford to lose its place in this vital field in which the competition is growing rapidly from France, Japan, Russia and Germany among others.

The function of this reinvigorated National Deep Submergence Facility would be to advance the state of the art of benthic science and related technology through closely coupled (1) science users, stating their needs and guiding solutions; (2) technology developers, turning the ideas and needs of science into carefully engineered, reliable upgrades; (3) facility operators, ensuring responsive reliable operations of deep submergence assets and providing vehicles on which to test new tools; and (4) government agencies, implementing national priorities and providing oversight and controls through policy and fiscal management.

Recommended Elements:

Given the rationale outlined in the preceding section, UNOLS proposes the following concepts to achieve continued success and health.

1. Ensure a National Commitment.
2. Enhancement of science utilization.
3. Renew commitment to deep submergence science development.
4. Update procedures to ensure a financially viable operation.
5. Integration of new undersea technologies, ROVs and AUVs into the Deep Submergence Facility.
6. Transition to a new support ship for ALVIN.

Ensure a National Commitment:

This will require a commitment at the National level from all involved agencies as well as Congress with strong support from the users of deep sea submergence vehicles.

Deep submergence is expensive - far beyond the means of individual institutions, states, regional consortia or even single federal agencies (unless budget-based interagency funding transfers were to take place). Therefore, it is incumbent that an interagency approach to this be taken. The US is particularly blessed in this regard because the federal government has for centuries beginning with Benjamin Franklin and continuing through Matthew Fontaine Maury to the present had enlightened leaders who, understanding the national value to this island country, have invested extensively and wisely to enhance and foster the nation's ocean science and technology community. The job is not done and this effort must continue. We encourage continued active participation in every phase and in every element of the revised Deep Submergence Facility including: (1) the issuance of national research goals and priorities; (2) participation in UNOLS and ARC process; (3) frequent, close interaction and support of the technology developers; and (4) management and funding oversight of science and operations/operators.

Enhancement of Science Utilization:

We must put in place a structure which enhances and fosters scientific interaction and stimulation with the facility. This should be done by:

a. Revising the ALVIN Review Committee (ARC) Terms of Reference to give it more life and scope. The new terms will provide for ARC a mandate to evaluate technical advances in submersible operations and the integration of ROVs and AUVs into the planning process.

b. Establish a more vigorous dialogue between ARC and the user community to solicit concerns of present operations and to generate improved procedures. ARC in turn will provide advise and perform its role as advocator for the submergence science community.

c. Establish at the operator institution an in-house science advisory panel for day to day connectivity between science, facilities and the UNOLS community.

d. Revise the methodologies of planning, reviewing and scheduling proposed deep submergence facilities operations with the view of enhancing quality and controlling costs. Encourage earlier proposal submissions to facilitate the revised scheduling procedure.

The root reason for the US's lead in deep submergence is our excellence in and commitment to the associated technologies. This field is moving and dynamic, and requires constant efforts to upgrade and remain on the cutting edge.

To ensure that the tools available to the science community represent the best available state of the art components it is necessary to couple the scientists and engineers who would develop system enhancements with the scientific users (to determine requirements and problems) and also the system operators (to understand operational constraints, safety considerations and testing criteria). Operators will assist developers to formulate funding proposals as well, and vice versa. To a maximum extent developers will take their lead from priorities stated by the user community.

Facility operators will play a central role in leading the National Deep Submergence Facility. First, of course, they will operate the facility in a safe, efficient, proficient and responsive manner. The operators will interact with individual users and, to the extent they are able given time and funding constraints, respond to short-term, cruise specific facility adaptations. The operators will interact with the ALVIN Review Committee to ensure that long term goals for the facility are consistent with established research priorities.

The operators will aggressively market both the deep submergence vehicles to both science and non-science potential users as well as the host ship(s) for general purpose use. Every effort will be made to reduce the expense of the operations without degrading performance.

Support personnel, pilots, engineers and technicians, are the heart of the operation and the key to the vehicles current success. These groups are fragile needing continuing protection. To this end they need consistent training and stability of employment. This requires a healthy submersible schedule for maintaining qualifications and providing adequate funds to ensure an employment level necessary to maintain safe, efficient operation of the facility.

Develop a Workable Planning/Scheduling Process:

The present Memorandum of Agreement outlines a scheduling framework starting with proposal reviews 18 to 36 months before the operating year. It further indicates that the funding agencies decisions will be made in the 12 to 24 month time frame. These are lofty goals and do not seem to be realistic. Currently proposals are received 8 months and reviewed 6 months prior to the operating year. Funding decisions are made from 4 to zero months before the year of operation. This time frame creates innumerable scheduling problems for the operating institution and prevents the ship from fully participating in the UNOLS scheduling meetings to fill in open spots. If Deep Submergence proposals were to be submitted 14 months in advance of the operating year (ie the November panel at NSF and comparable panels at both ONR and NOAA) the operating institution would have adequate time to solidify the support ship's schedule and compete in the UNOLS scheduling cycle.

Update Procedures to Ensure a Financially Viable Operation:

ALVIN and its support ship are inseparable from an operational as well as funding standpoint. ALVIN cannot function without a support ship. The health and viability of the ALVIN operation is inextricably enmeshed in the platform that provides the transportation and nurturing for the submersible. Providing a base funding for the ALVIN Group is but part of the problem. Without support for the entire operation, ALVIN and its support ship, the program is severely handicapped. A safety net to ensure a full operating schedule is not sought. Instituting the scheduling procedures outlined in the above section goes a long way in providing the operator with time necessary to generate non-ALVIN use for the support ship during voids in the submersible schedule. This reduces the likelihood for the need to invoke the safety net. Hopefully the reinvigoration of the science users will also enhance the operation's financial viability.

Schedules must afford the operators an opportunity for a few non science dives for the purpose of: training, system checkout, and for testing new science tools-not at the expense of science. This will add to the operational excellence while further reducing the need for safety net support. When these elements are less than fully successful it will be necessary to execute the safety net.

A guarantee of full support of the ALVIN Group costs (estimated at $2M +/- .2) and a half year of support ship time is required for safe operations. Over the next few years additional funding for the ALVIN/JASON Group operations will ramp up as well.

Integration of New Undersea Technologies, ROVs and AUVs Into the Deep Submergence Facility:

Remotely operated vehicles of all sizes and description are rapidly maturing. These devices offer the potential of enhancing (perhaps by an order of magnitude) the capabilities of existing manned and towed systems. These tools must be integrated into deep submergence research in a planned and methodical manner in order not to jeopardize the viability of ALVIN. These vehicles must be science-driven and configured for maximum flexibility at minimum cost. ARC's new Terms of Reference will address this integration and the mechanism by which these tools can be most productively utilized.

Transition to a New Support Ship:

It is well recognized by the operating institution that ATLANTIS II is in need of replacement. It is further planned that KNORR can be outfitted as that replacement Submersible Handling Vessel. KNORR's size and extensive capability will provide a new dimension as support ship. The ability of KNORR to perform multidisciplinary non-submersible science is considerable. Because KNORR is sought after as a general purpose oceanographic ship the need to execute the base funding is lessened even more. The planning for this conversion, however, must take into account well thought out timing so as not to deprive the science community in the Atlantic Ocean the capabilities of a Class I ship.

Summary:

In summary, we feel very strongly that new direction, energies and commitment are needed for the United States to maintain its leadership in deep submergence science. We believe that ALVIN is still the right vehicle to anchor this effort. New tools to enhance ALVIN such as ROVs, AUVs and a replacement support ship(s) are now available or on the horizon and should provide additional capabilities and dimensions for this already highly effective submersible. We stand ready to work with the federal agencies in forging a Memorandum of Agreement that will revitalize this most important asset.