UNIVERSITY - NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

UNOLS
DEEP SUBMERGENCE SCIENCE COMMITTEE MEETING

SUMMARY REPORT

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

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PLANNING MEETING
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I. INTRODUCTION: The Fall DESSC planning meeting was held on December 10, 1995 in Room 220 of the Moscone Center, San Francisco, CA. The meeting was called to order at 9:00 a.m. by Mike Perfit, DEep Submergence Science Committee (DESSC) Chair. He welcomed the community by indicating that the time is now to plan for operations in 1997 and beyond. The meeting agenda is included as ***Appendix I.*** These minutes reflect the order in which items were addressed. A list of meeting participants is included as ***Appendix II.***

II. 1995 SCIENCE REPORTS: PI's who conducted science cruises using deep submergence assets over the past year were invited to present brief overviews of their science programs along with critiques of the ALVIN operations. Viewgraphs presented by the PI's are presented in ***Appendices III*** through ***X***. These viewgraphs provide summaries of the science objectives, maps of the dive regions and dive results. A very brief review of each program is provided below.

Bob Embley began with a review of his ALVIN dive series (2940-2951), AII Voyage 132 - Leg IX. A total of 12 dives were conducted; ten for NOAA and two for Meg Tivey, an NSF

funded program. Bob's group carried out chemistry and biology time-series operations and focused on the CoAxial site with concentration on the FLOC and Source sites, see ***Appendix III***. One dive was made on Axial Volcano. This was a revisit after seven years. Big changes in macrofauna were observed. Bob commented that the Mesotech scanning altimeter was a very useful ancillary tool for mapping small-scale structures at vent field scale. The on-board NOAA GIS system provided a user friendly interface and was helpful in dive planning. He expressed concern over the limited number of people in ALVIN's operation group. The lack of personnel appears to be placing a strain on the existing ALVIN at-sea group.

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

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

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

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

sea surface magnetic field data. There were two deeptow magnetic tows. Six ABE launches and recoveries were successfully conducted.

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

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

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

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

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

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

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

III. UNOLS REPORT: Ken Johnson, UNOLS Chair, reported on UNOLS activities. He indicated that there is some good and bad news. The ship scheduling committee met in the fall to review 1996 ship schedules. In 1996, there are roughly 4300 days scheduled, in contrast to approximately 4900 days in 1995. Budgetary constraints continue to be a problem. A UNOLS subcommittee chaired by Peter Betzer was convened to develop a fiscal plan to prepare for anticipated budget constraints. By the end of the century we could be facing a $15M deficit for UNOLS Fleet operations. As recommendations, the report suggests building new partnerships, accommodating the ship time of non-traditional users and working with FOFCC for future planning. UNOLS recognizes that it is easy to remove a ship from the fleet, however, the process of adding ships can be quite lengthy. Assessing the coastal science needs will continue to be a high priority.

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

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

A. Operational Statistics - Rick Chandler, WHOI, presented operational statistics for the past year, including ALVIN bottom time averages per leg, see ***Appendix XI***. In 1995,

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

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

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

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

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

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

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

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

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

DESSC subcommittee recommendations. In Phase II the DESSC subcommittee recommendations will actually be implemented.

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

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

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

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

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

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

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

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

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

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

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

VI. NEW DEEP SUBMERGENCE SUPPORT VESSEL:

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

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

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

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

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

Modifications to make ATLANTIS a submersible support ship are expected to be complete by April 1997. The ship will arrive at WHOI on 6 May 1997. DSOG demonstrations and trials will be conducted between 20 May 1997 and 3 June 1997. ATLANTIS will be available for science in traditional operating areas (MAR, NEPR, JDF, etc.) between June and December 1997. The ship will be available for unlimited science operations by approximately February 1998. At this time, a global expedition to the more non-traditional ALVIN operating areas can begin. Given the long lead-times needed to obtain funding, the science community needs to gear up quickly for operations in 1997, both for ALVIN and ROVs.

VII. AGENCY REPORTS:

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

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

the ALVIN program winding down in the summer. NSF does not expect to participate in the IMAX program that is planned for 1996.

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

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

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

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

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

VIII. 1996 Science Operations and Logistics:

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

operator. ATLANTIS II's Master and Chief Engineer have been announced to fill the same respective positions on ATLANTIS.

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

IX. Other Facilities Operations:

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

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

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

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

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

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

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

Debra showed a video demonstrating deployment of various instrument packages.

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

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

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

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

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

X. LONG-RANGE PLANNING:

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

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

B. Letters of Interest - Annette DeSilva provided a summary of ALVIN/ROV letters of interest for 1997 and beyond, see ***Appendix XX***. Forty-nine letters of interest and ship time

requests were received. These include new letters, letters on file and ship time requests. Of the 49 letters/requests, 31 were for ALVIN and 18 were for ROVs (one indicated both ALVIN and ROVs for the same cruise).

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

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

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

C. Global Deep Submergence Science Initiatives - NSF has indicated that they are feeling budgetary restraints. Most requests for ALVIN and ROVs have been coming to NSF. Now is the time to start planning global deep submersible initiatives. Mike Perfit challenged the community to seek other ways/agencies to support submersible science operations.

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

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

XI. Other Business And Issues:

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

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

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

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

APPENDIX I

DEEP SUBMERGENCE SCIENCE COMMITTEE
PLANNING MEETING - FALL AGU
Moscone Center, Room 220
San Francisco, CA

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

09:15 1995 Science Reports
- a. Brief reports from PIs on science and facilities

10:30 National Facility Operators Report (ALVIN and ROVs)
- a. Operational Statistics (including bottom time average per leg)
- b. Status of Ongoing Development, Upgrade or Technical Efforts
  - Navigation upgrades (J. Bellingham)
  - Electronic Still Camera (D. Fornari)
- c. Major Overhaul - Impact and Upgrades to Operational and Science Systems

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

12:45 Status of New Deep Submergence Support Vessel (J. Andrews, ONR & D. Pittenger, WHOI)
- a. Decision from Agencies, Operator, and DESSC on new ATLANTIS
- b. Capabilities, Berthing, Lab Space, Facilities
- c. Timing/Logistics/Shakedown-Engineering Dives

13:30 Agency Reports
- a. NSF (D. Heinrichs)
- b. ONR (J. Andrews)
- c. NOAA Supported Operations

14:00 1996 Science Operations and Logistics (WHOI)
- a. ALVIN and ROVs - 1996 Schedule

14:30-14:45 Coffee Break

14:45 Other Facility Operations
- a. Navy Deep Submergence Operations (Cdr. Green)
  - Operational Statistics (including bottom time average per leg)
  - Key Areas of Operational/Equipment Effort or Problems
  - Status of Ongoing Development, Upgrade or Technical Efforts
- b. MBARI ROV Operations (D. Stakes)
- c. ROPOS/ROV Operations (S. Scott)
- d. NOAA/HURL

15:15 Long-Range Planning (M. Perfit)
- a. 1997 and Beyond (Impact of delivery of new support ship)
- b. Letters of interest (A. DeSilva)
- c. Global Deep Submergence Science Initiatives
  - Manned versus ROV/AUV science in the 21st Century
  - Utilization and Funding of Deep Submergence Assets
- d. Programmatic Ties to other National Programs (RIDGE, ODP, DOE)
- e. Vehicle Assets and Technology - 3rd party tool development update

16:15 Other Business and Issues

17:00 Meeting Adjourned

APPENDIX II

ATTENDEES

DESSC Meeting - December 10, 1995

NAME	AFFILIATION	PHONE/FAX/E-MAIL
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APPENDIX III

ATLANTIS II VOYAGE 132 - LEG IX

DIVES 2940-2951

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

JUAN DE FUCA

NORTH CLEFT - NSF - RECOVER INSTRUMENTS...
- CONTINUE VENT FLUID TIME SERIES

COAXIAL - TIME SERIES CHEMISTRY AND BIOLOGY AT FLOC AND SOURCE SITES

GEOLOGICAL MAPPING AND SAMPLING OF YOUNG LAVAS AND HYDROTHERMAL ACTIVE FISSURE SYSTEM

AXIAL VOLCANO - (1 DIVE)

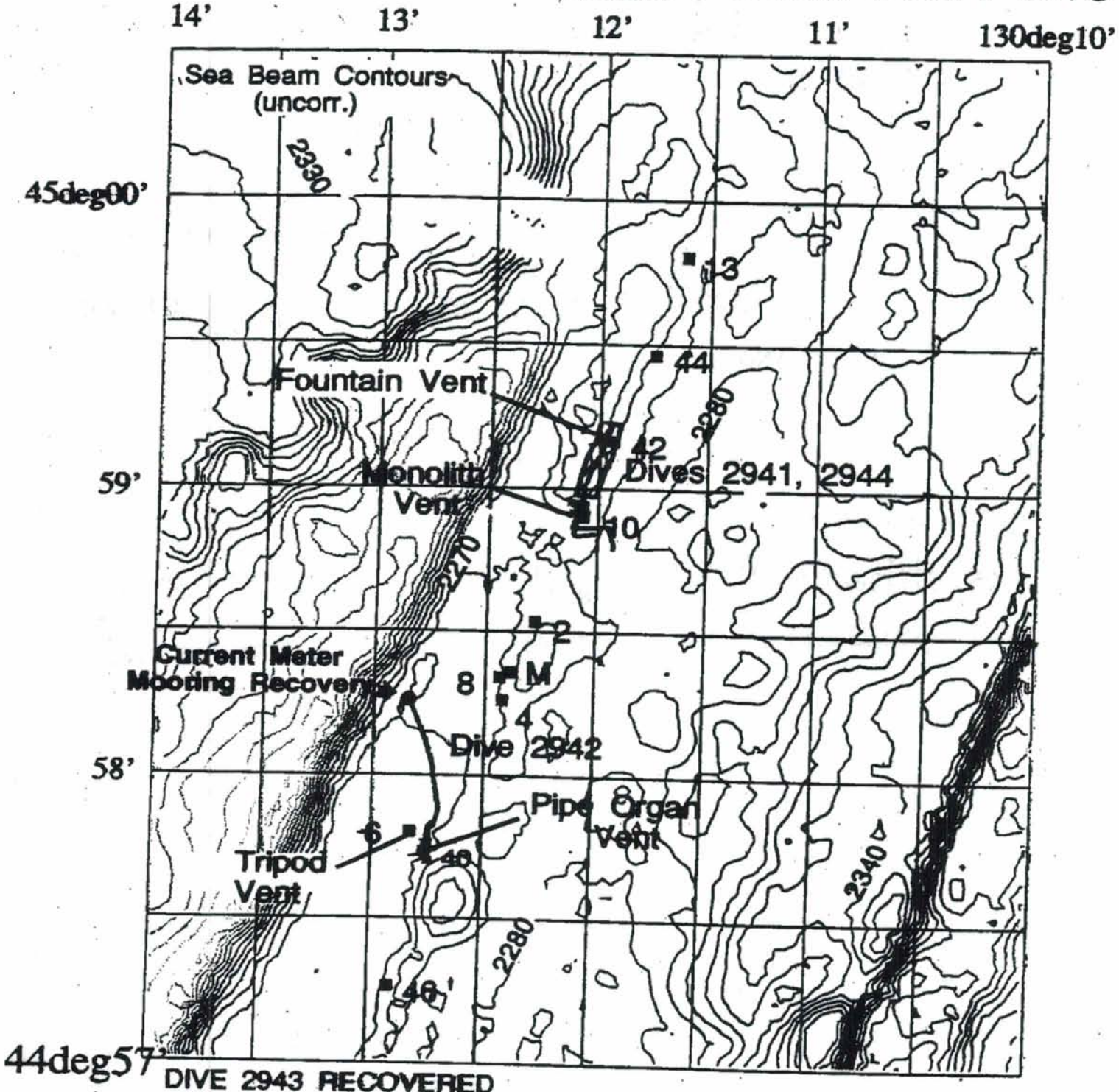
REVISIT AFTER 7 YRS
~ +20°C (AVERAGE OF 4 SMOKERS)
BIG CHANGES IN MACROFAUNA

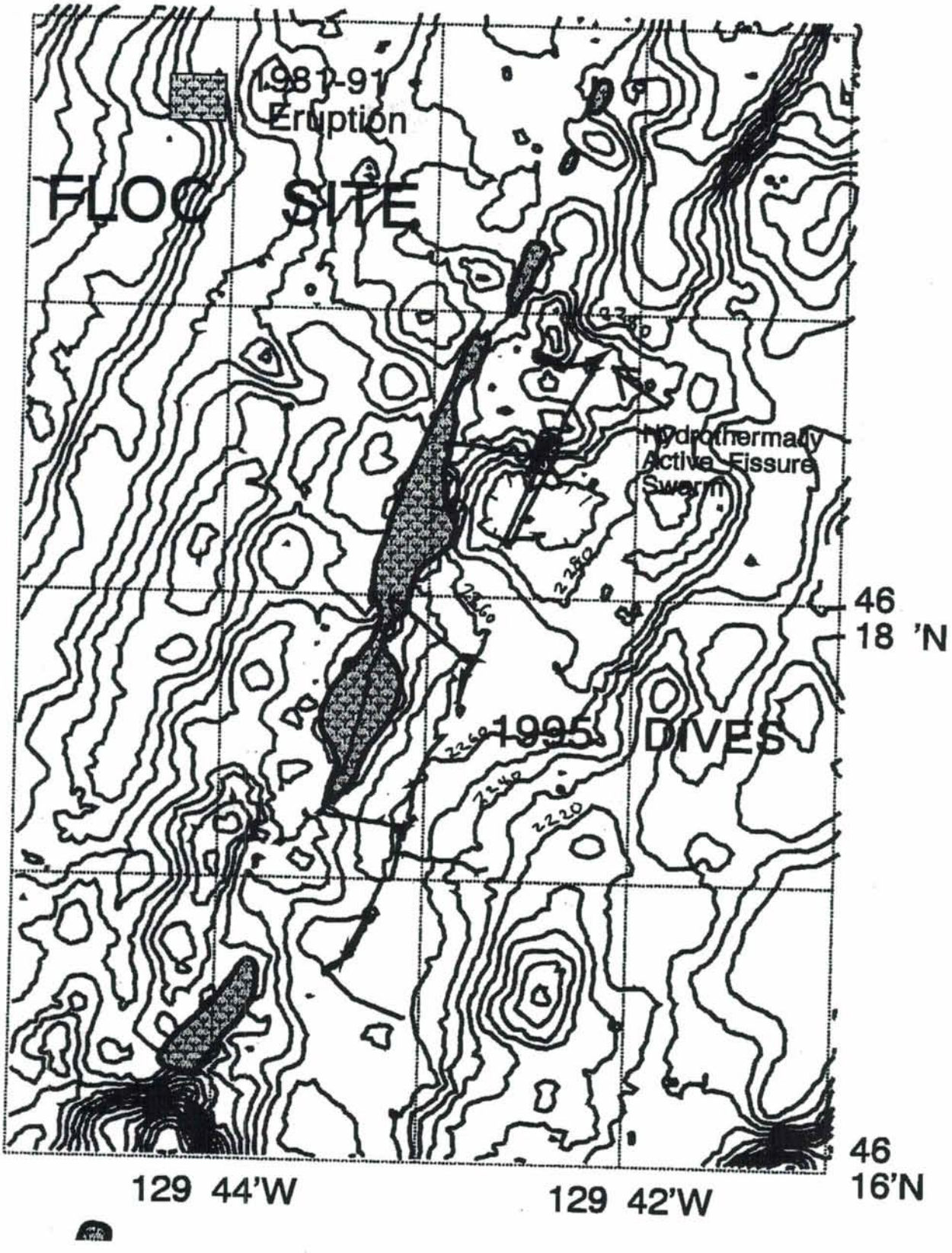
OTHER COMMENTS:

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

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

1995 DIVES, WITH VENTS AND MARKER SITES - NORTH CLEFT SITE




1981-91
Eruption
FLOC SITE
Hydrothermally
Active Fissure
Swarm
2250
2260
2240
2220
1995 DIVES
46
18 'N
46
16'N
129 44'W
129 42'W

APPENDIX IV

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

Two instruments, each with 2 working pods, were deployed in summer, 1994 at the Monolith and Table Vent sites, Cleft Segment (JFR), and were recovered June 27&30, 1995.

Approach produced continual records of fluid temperatures, recorded once per minute, at 18 to 20 discrete points in each of 4 areas (2 of high temperature and 2 of low temperature diffuse flow).

A chimney grew inside the stainless steel ring and through the thermocouple array at Monolith. Data recorded during the first 16 days provide an account of wall temperature during growth of the chimney.

(Unfortunately by the end of the 16th day the inconel-sheathed thermocouples had corroded; titanium-sheathed thermocouples will be used in the future).

The 5.5 month records of temperatures associated with the other 3 sites are being examined.

Deployment and recovery of the instrument packages went relatively smoothly, owing in large part to working out strategy with the *Alvin* group during instrument development and prior to each cruise.

An inductively coupled link was used during instrument deployment in 1994 to interrogate the instruments to make sure they were working properly once deployed.

Results will be presented on Thursday in Session S41B, Geology and Geophysics of the Juan de Fuca Ridge I Posters.

APPENDIX V

TAG 1995
R/V ATLANTIS II LEG 132-02
Dates: 2/20/95-3/16/95

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

OBJECTIVES:

1) Retrieve instruments monitoring the TAG mound:
   Plume Thermistor Array (von Herzen)
   Medusas (Schultz)
   Gamma Spectrometer (Kadko)
   Time Lapse camera (British)
   Daibutsu (Japanese)

2) Re-survey areas studied prior to ODP drilling to identify changes to the system.

3) Perform extensive heat flow, water sampling, sulfide sampling and sediment coring program.

4) Nighttime work involved camera tows led by M. Kleinrock.

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

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

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

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

APPENDIX VI

University of Alaska Fairbanks
Geoff Wheat

University of Hawaii
Mike Mottl
Frank Sansone
Craig Moyer
Nathan Becker
Rex Miyashiro

University of Miami
Dave Kadko
Burtin Dixon

University of Washington
Marv Lilley
Eric Olson

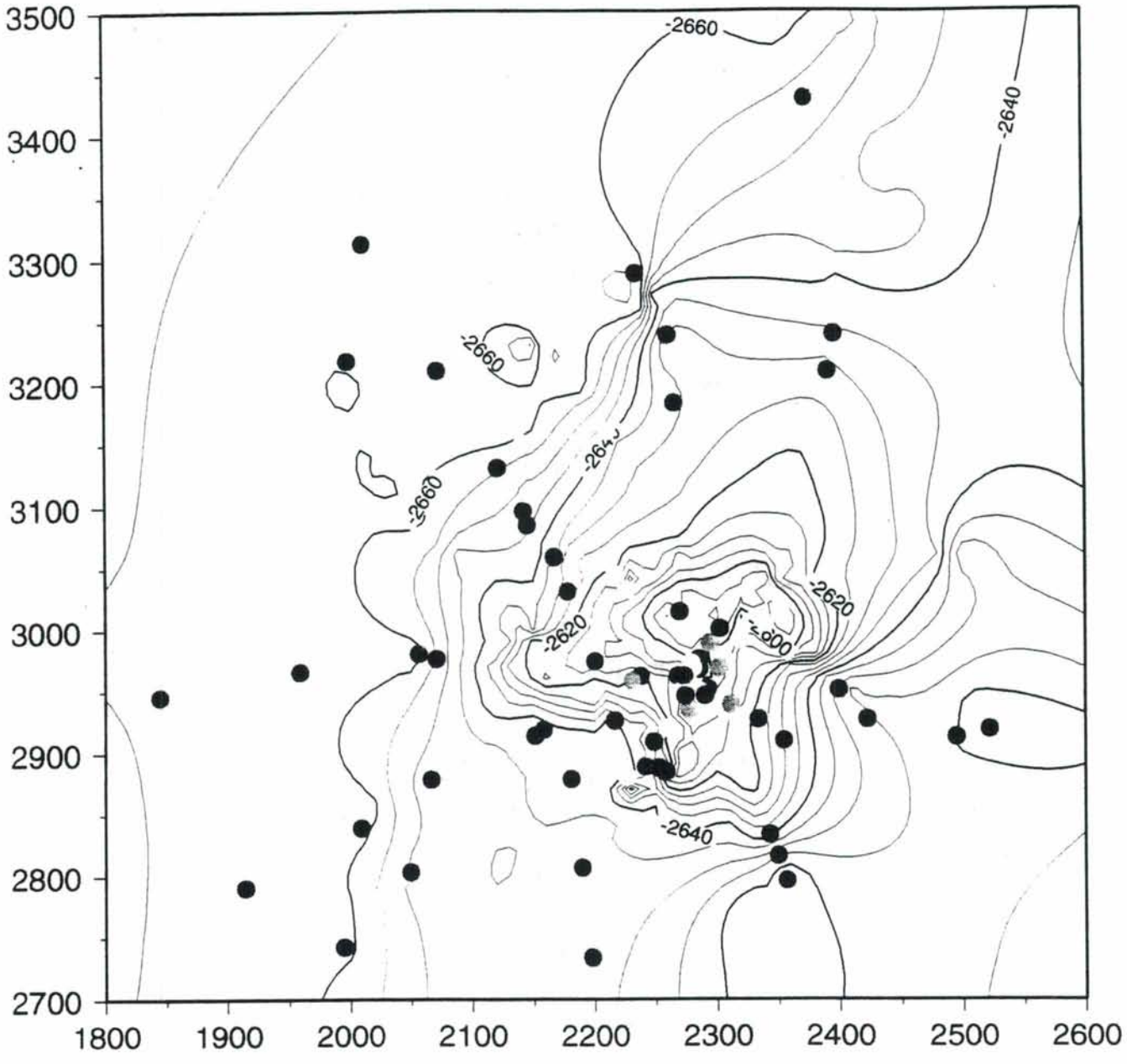
NOAA Vents Program
Gary Massoth
Richard Feely
Ed Baker
Geoff Lebon
James Gendron
Sharon Walker

University College, Galway, Ireland
Anthony Grehan

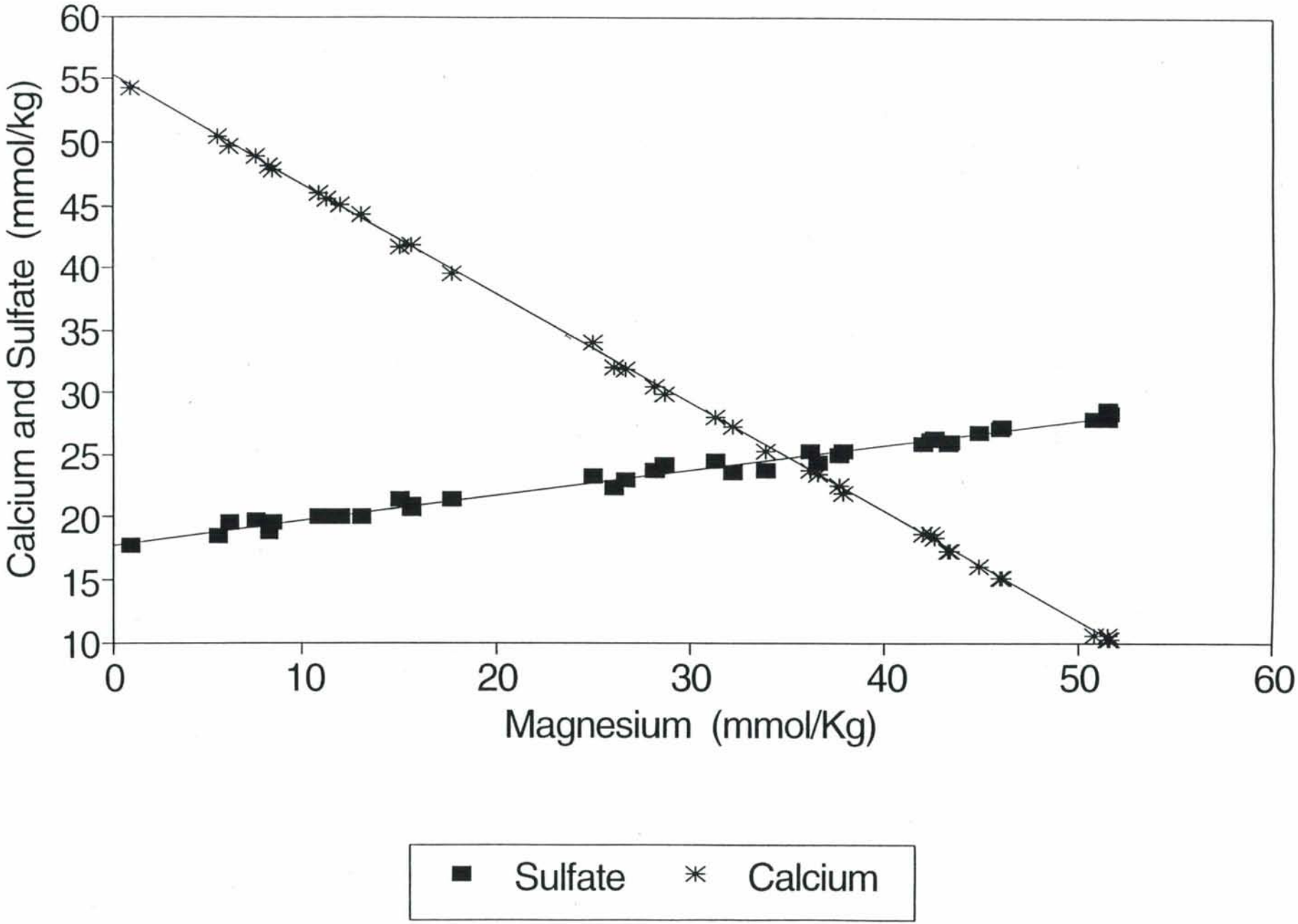
IOS Sidney, Canada
Rick Thomson

Baby Bare upward fluid velocity data from *DSV Alvin* cores

units are cm/y



FF95 Vent Samples



APPENDIX VII

BLANCOVIN 1995

Chief Scientist: Maurice A. Tivey

Dates: 13th July - 30th July 1995

Location: Western Blanco Fracture Zone, Southern Juan de Fuca

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

Results:

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

NSF Grant OCE-9400623
Title: Direct Measurement of a Polarity Boundary with Depth in Ocean Crust
P.I.: Maurice A. Tivey

Summary

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

- Second year

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

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

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

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

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

BLANCOVIN 1995
Cruise objectives

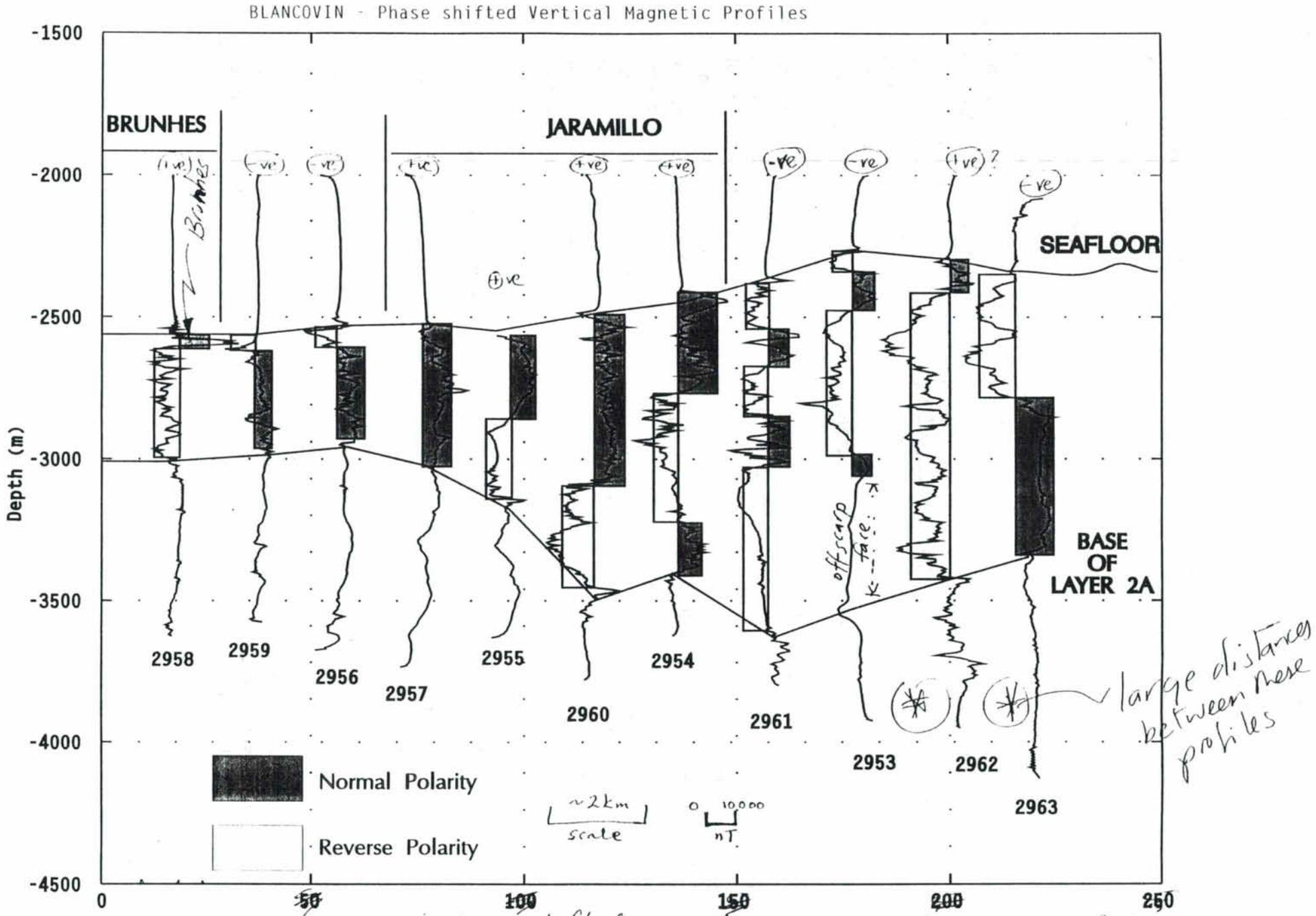
The main goal of the BLANCOVIN research cruise was to map the spatial variation of a magnetic anomaly polarity reversal boundary with depth where exposed in a cross-section of oceanic crust. The nature of the reversal boundary is of prime importance to the question of the source of the magnetic anomalies.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

- directly determine the nature of the reversal boundary with depth in the upper oceanic crust.

- determine the source of sea surface magnetic anomalies by defining the upper contributions, but also in doing so, putting constraints on the contribution from the lower crust.

- directly relate the measured magnetic structure of the crust to the overlying magnetic anomalies measured near the sea floor and at the sea surface.

- define the distribution and timing of the crustal processes responsible for emplacement, accretion, tectonic disruption, and alteration of oceanic crust. These observations can then be related to the observations at the current axis of spreading.



large distances between these profiles

Anomalies have been phase-shifted by a constant amount to remove effect of inclination and slope of the scarp. They have not been corrected for distance from the scarp etc.

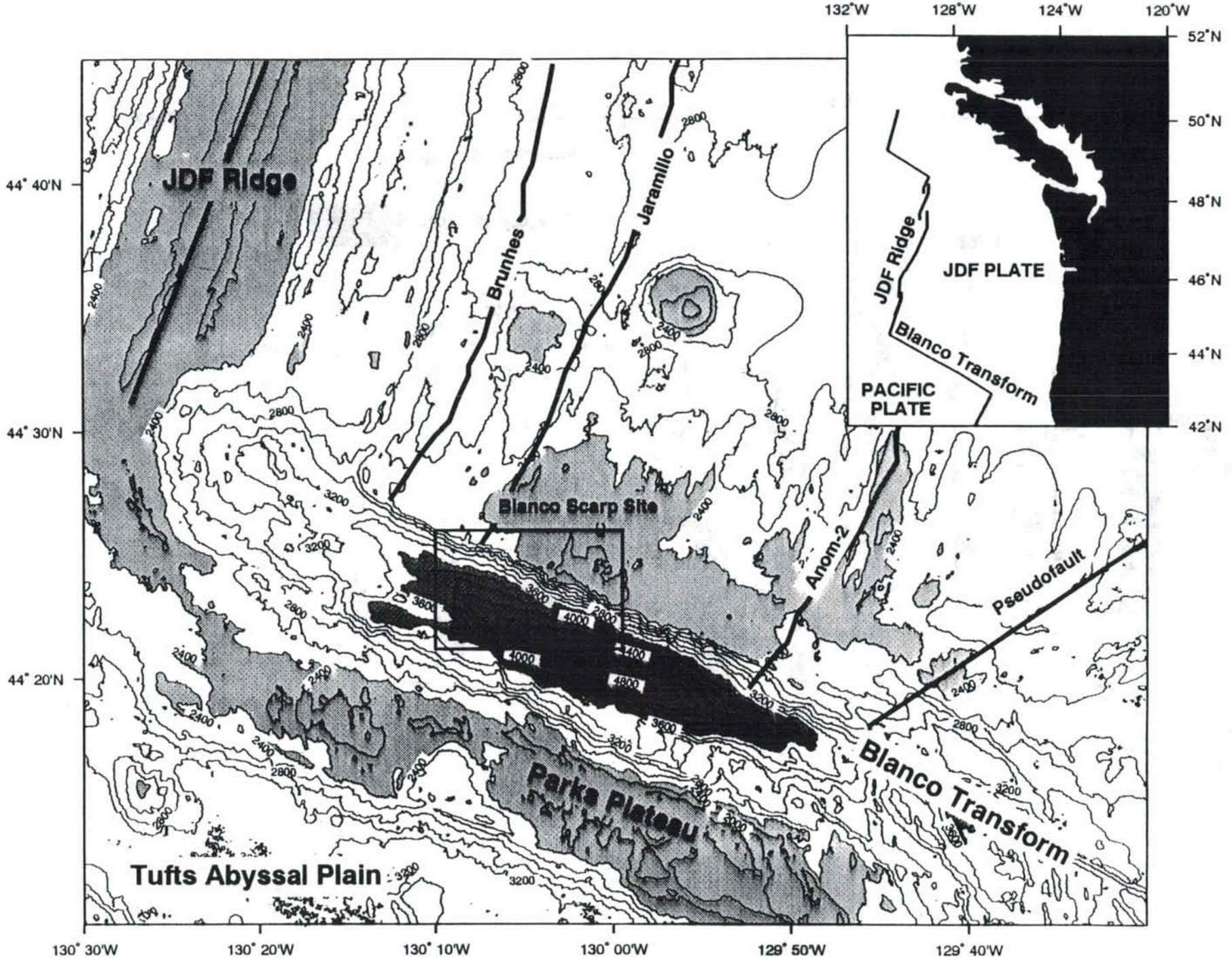
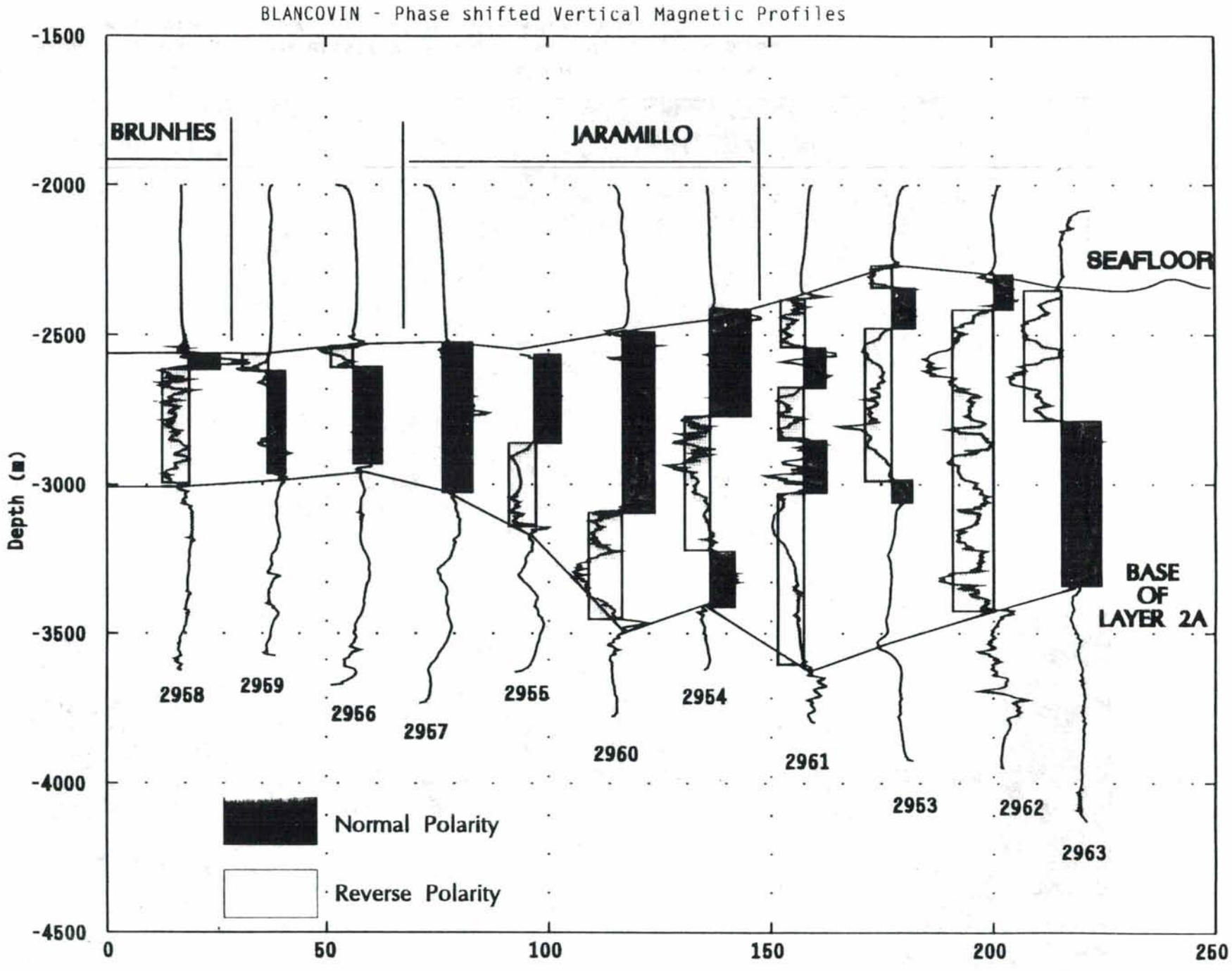


Figure 1 Location map showing the BLANCOVIN cruise area on the northern scarp of the Blanco Transform zone at the southern end of the Juan de Fuca Ridge in the northeast Pacific.


BLANCOVIN - Phase shifted Vertical Magnetic Profiles
BRUNHES
JARAMILLO
SEAFLOOR
BASE OF LAYER 2A
Depth (m)
-1500
-2000
-2500
-3000
-3500
-4000
-4500
0
50
100
150
200
250
2968
2969
2966
2967
2965
2960
2964
2961
2953
2962
2963
Normal Polarity
Reverse Polarity

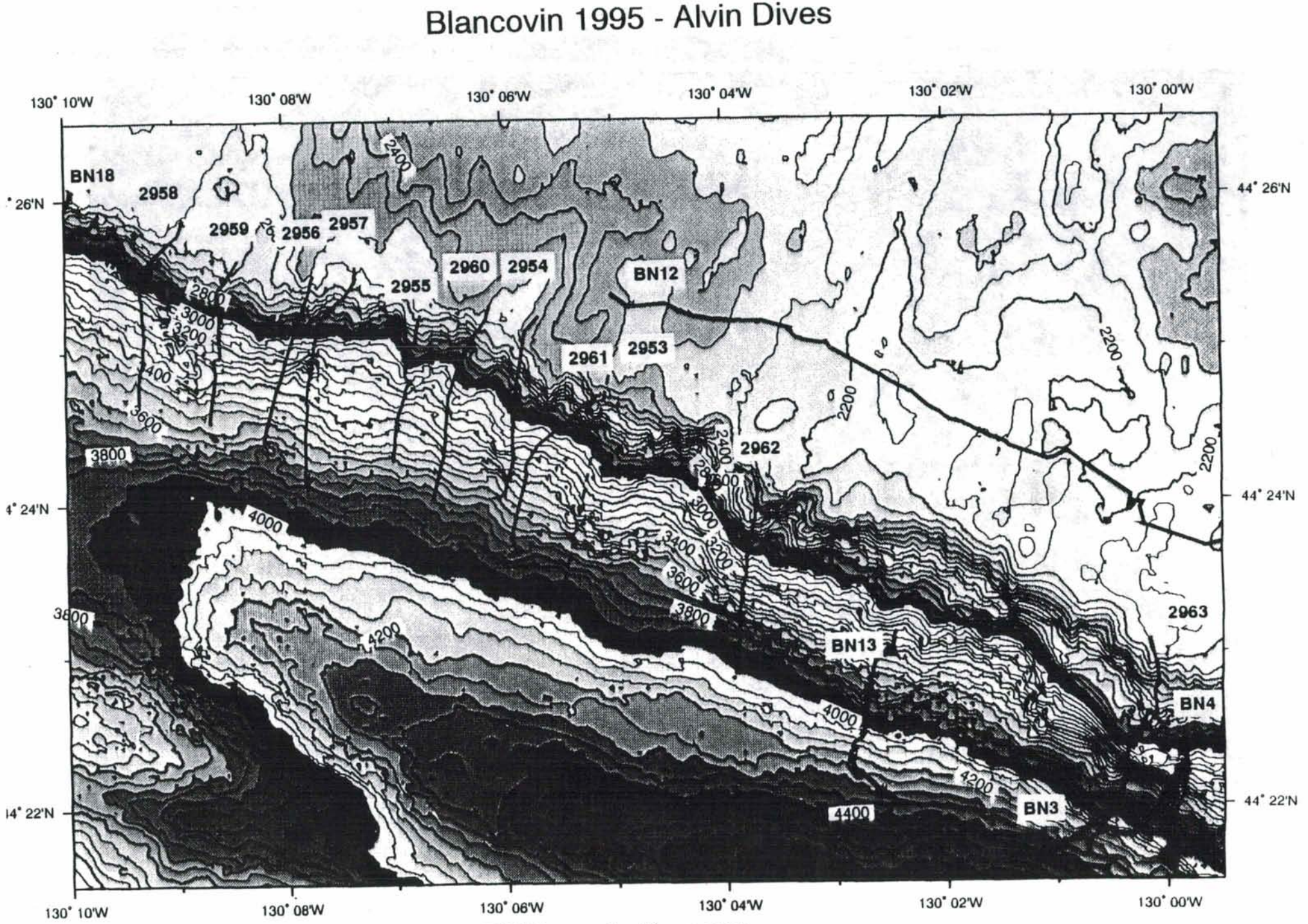


Figure 2. Location bathymetry map of 1995 ALVIN Dives on the Blanco scarp

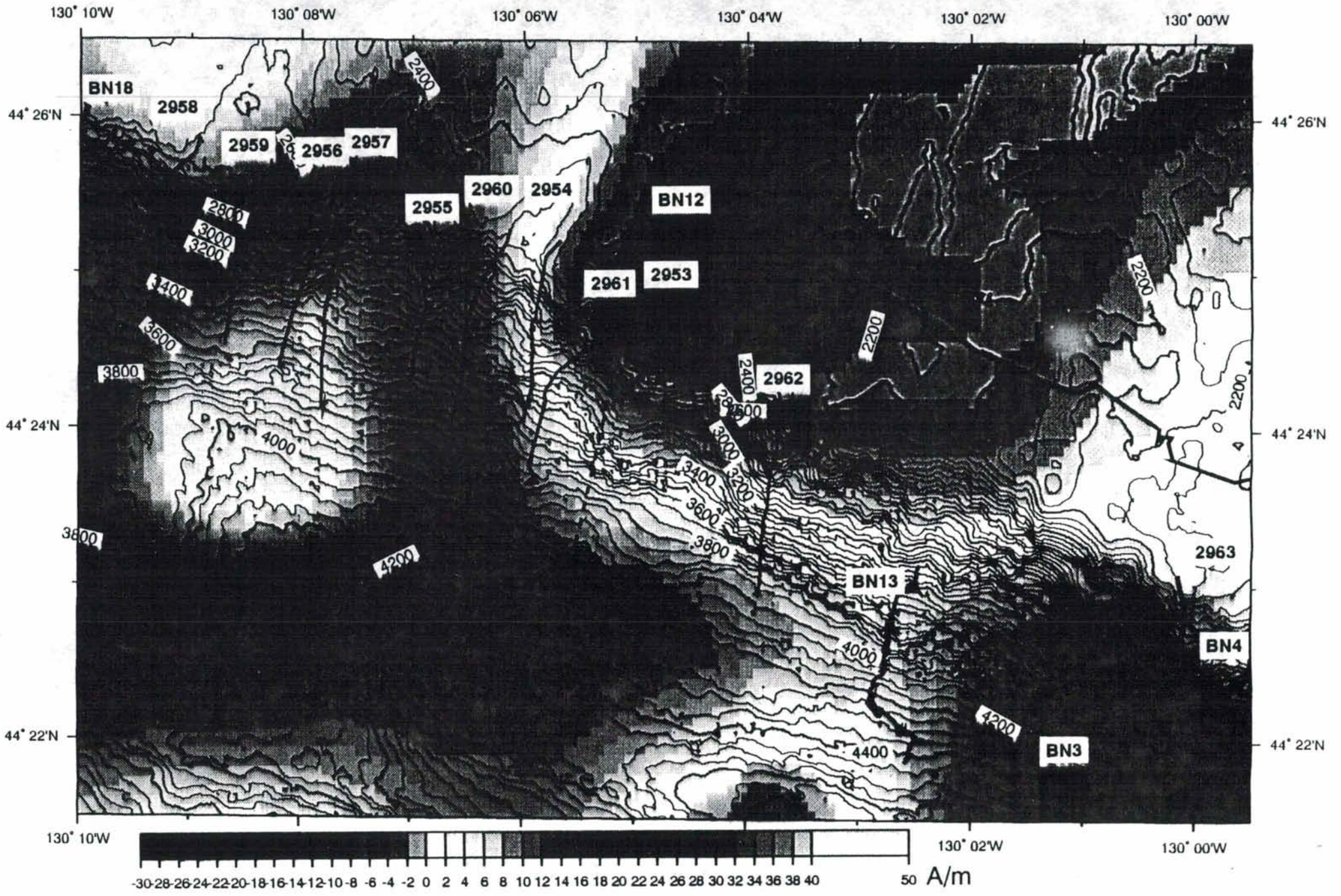


Figure 3. Location map of Blancovin ALVIN Dives showing crustal magnetization inferred from sea surface anomalies.

APPENDIX VIII

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

ALVIN/ATLANTIS II Expedition to the
CoAxial Segment of the Juan de Fuca Ridge

26 August to 10 September, 1995

Astoria, Oregon to Astoria Oregon

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

Chief Scientist: Paul Johnson

Scientific Personnel

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

Specific Experiments - 13 dives in 1995

1. ALVIN magnetometer surveys
   (basket-mounted)

2. Bell gravity meter surveys
   (in-hull deployment)

3. Mesotech high resolution bathymetry
   (hull-mount on ALVIN)

4. Deploy 5 sea floor magnetometers and tilt meters (year-long deploy, recover in '96)

5. deploy a bare rock heat flow blanket

6. ABE near-bottom magnetometer survey

7. recover rock samples; map HT activity, fissure density, geological observations of area overlying the feeder dike.

CoAxial-95 Cruise- GOALS

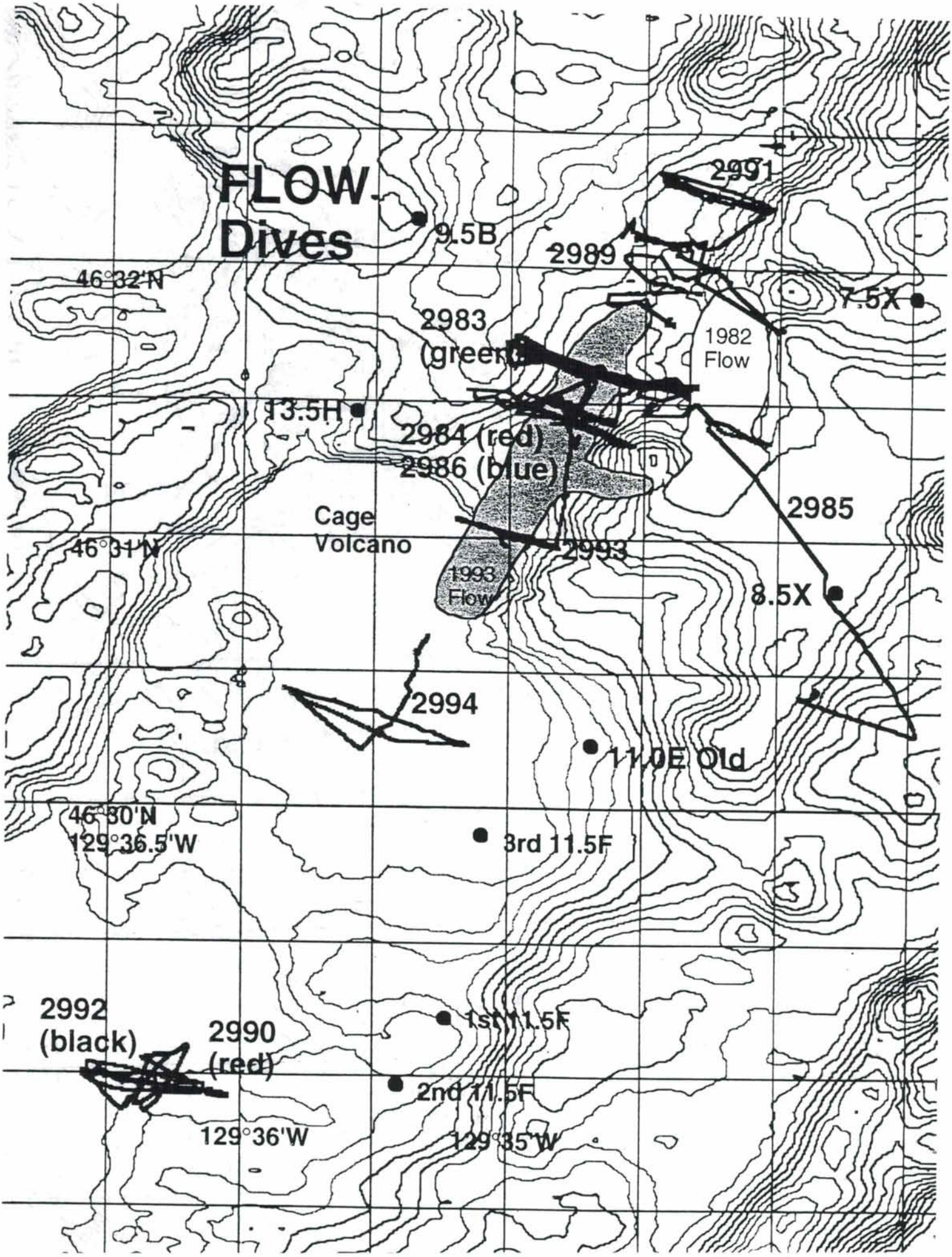
1. Determine the time-dependent changes in magnetization and density of the (zero-age) New Flow and surrounding crust.

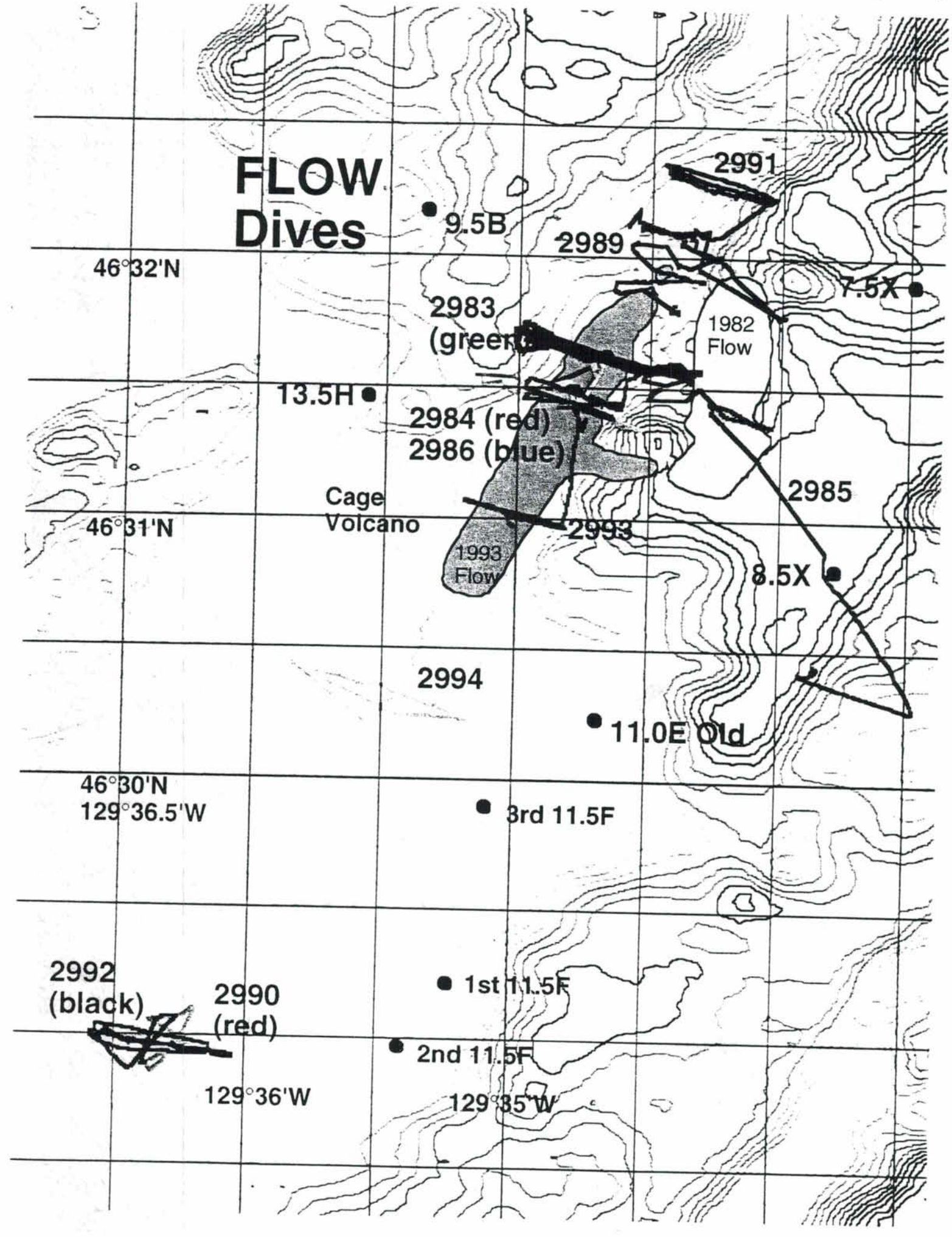
2. Characterize the geophysical signature of the 'diking event' associated with the New Flow eruption.

3. Determine the details of the thermal budget of crustal formation process.

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

Oct 1993 - ALVIN
Sept 1994 - TURTLE/ATV
Aug 1995 - ALVIN/ABE/AII
Sept 1996 - Jason/Thompson


FLOW
Dives
9.5B
2991
2989
46°32'N
7.5X
2983
(green)
1982
Flow
13.5H
2984 (red)
2986 (blue)
2985
Cage
Volcano
46°31'N
2993
1993
Flow
8.5X
2994
11.0E Old
46°30'N
129°36.5'W
3rd 11.5F
2992
(black)
2990
(red)
1st 11.5F
2nd 11.5F
129°36'W
129°35'W


FLOW
Dives
2991
9.5B
2989
46°32'N
7.5X
2983
(green)
1982
Flow
13.5H
2984 (red)
2986 (blue)
Cage
Volcano
2985
46°31'N
2993
1993
Flow
8.5X
2994
11.0E Old
46°30'N
129°36.5'W
3rd 11.5F
2992
(black)
2990
(red)
1st 11.5F
2nd 11.5F
129°36'W
129°35'W

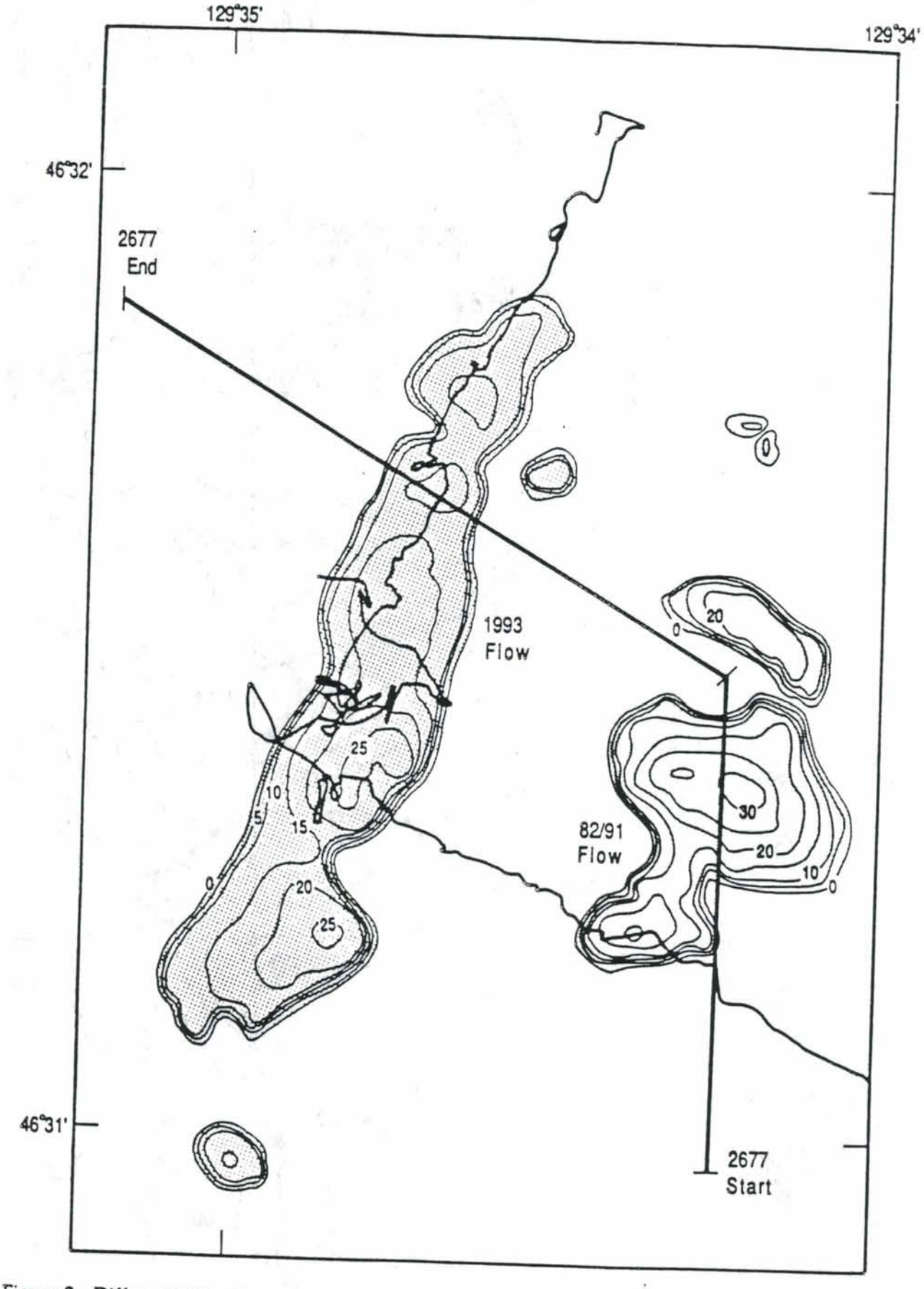
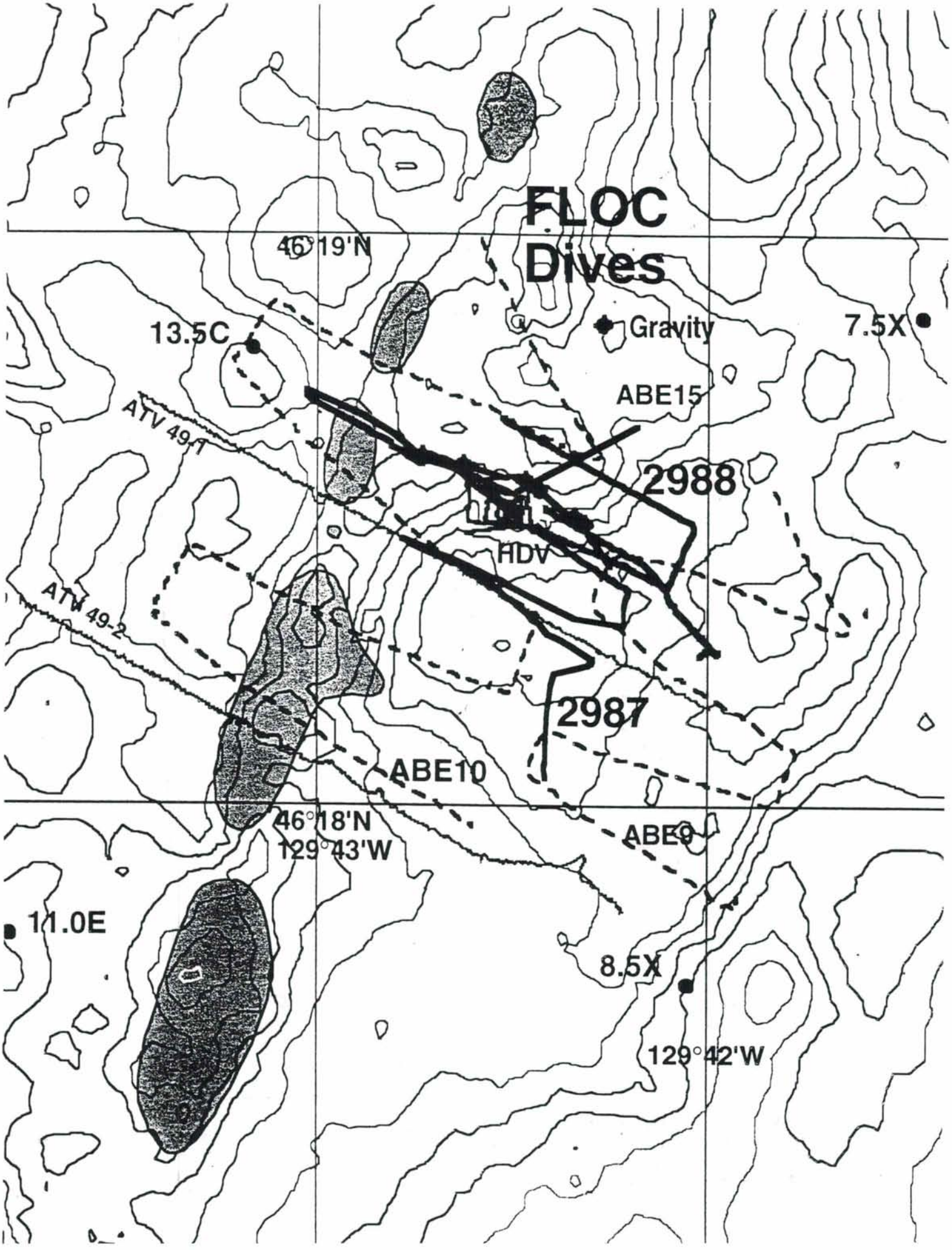
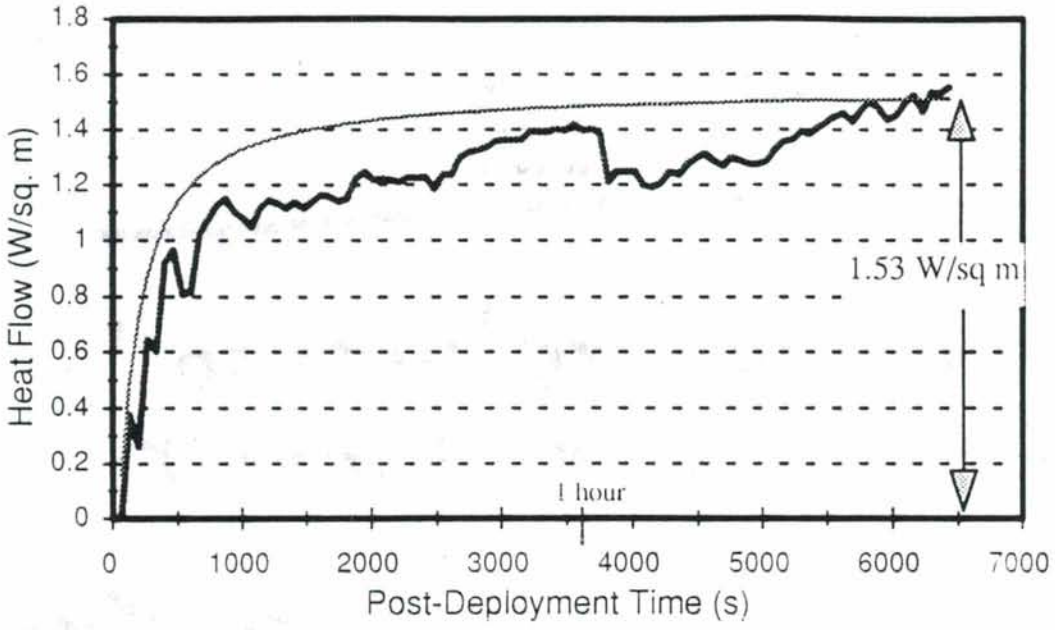
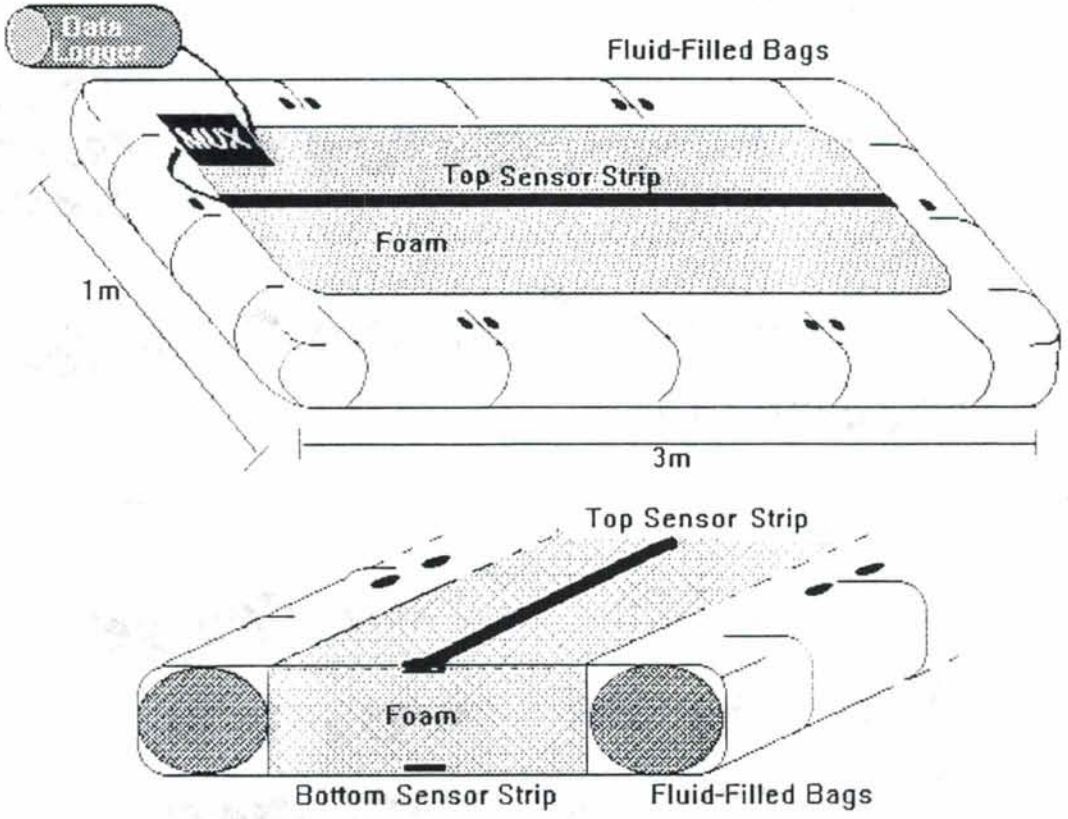


Figure 2 - Differential Sea Beam anomalies of the 1993 and 82/91 flows obtained by subtracting the NOAA Sea Beam coverage in the area from surveys in 1982, 1991 and 1993 (Chadwick et al, 1993). Heavy solid line is a schematic trackline for the ALVIN dive 2677 profile shown in Figure 6. Lighter solid line is the trackline of the August ROPOS/ROV survey. Contour interval is 5 meters.


FLOC
Dives
46°19'N
13.5C
Gravity
7.5X
ABE15
ATV 49-1
2988
HDV
ATV 49-2
2987
ABE10
46°18'N
129°43'W
ABE9
11.0E
8.5X
129°42'W

Juan de Fuca Spreading Center
Flow Area: Channel 1





CoAxial Cruise Results

1) All Experiments "worked" - Bell, SF Mag, Blanket

2) New Flow has large-scale central notch

3.) Dikes have signature — still processing data

4.) Flow is still "warm" + cooling conductively

1996 - Two week Jason Cruise
- Recover SF Mags
- Mesotech + photo map
- Sample Time Series
- Deploy New Blanket

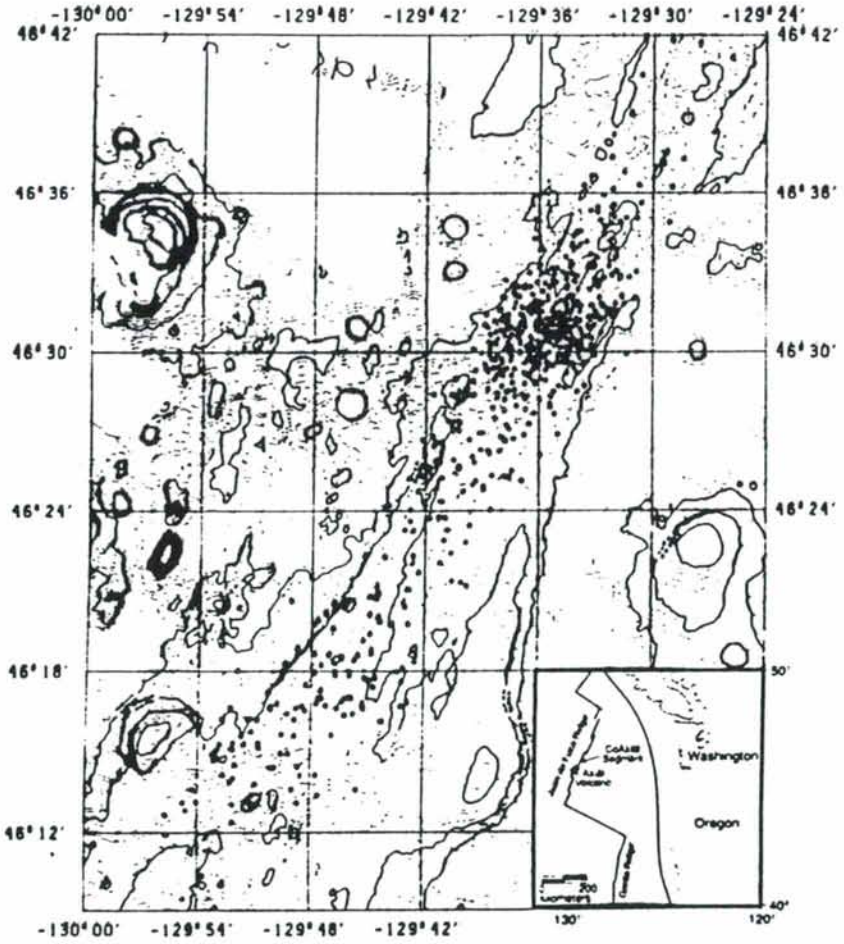


Figure 1. Bathymetric map of the CoAxial segment, Juan de Fuca Ridge (50-m contours). The circles show the estimated epicenters of the 676 swarm earthquakes recorded during the 23 days of most intense activity. Inset map shows sketch of the northeast Pacific plate boundaries, with geographic location of the CoAxial segment. Detailed bathymetry/structure maps of Axial Volcano and CoAxial segment available in Figure 1 from *Embley et al.* [this issue].

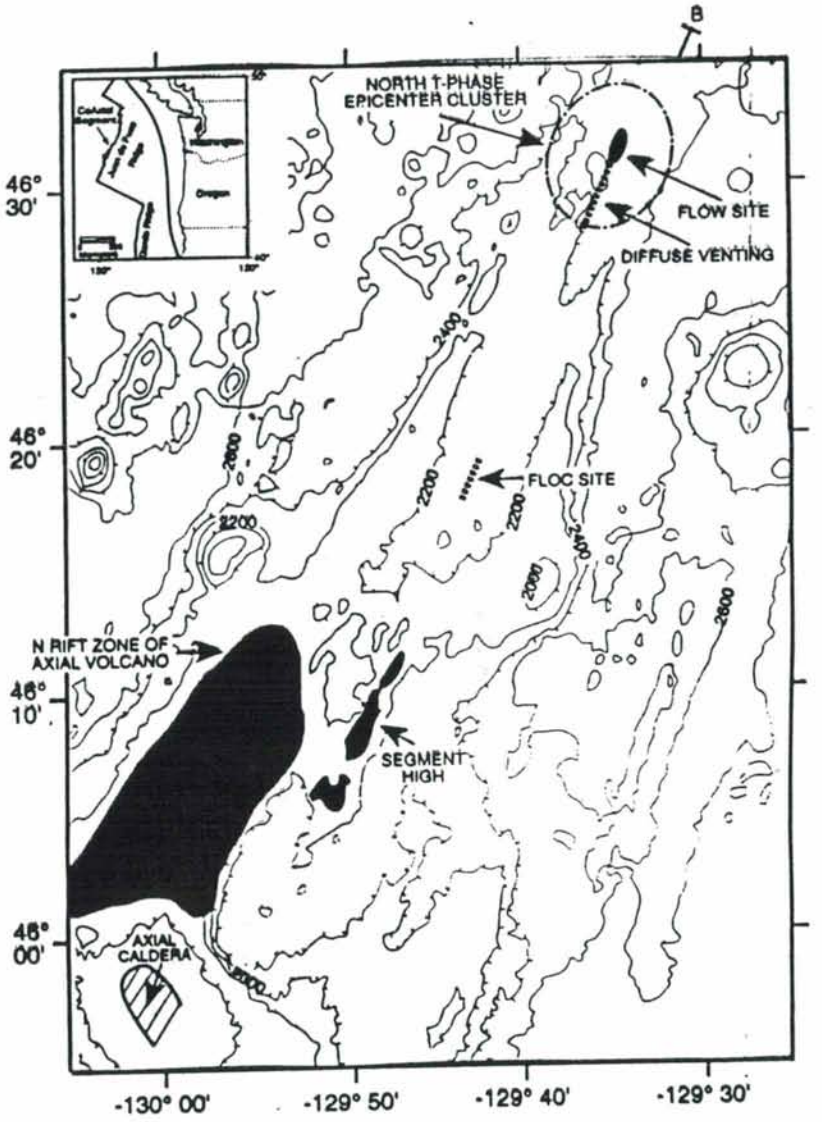


Figure 1. Simplified Sea Beam bathymetry of CoAxial Segment.

APPENDIX IX

Alvin/A II 132-17

HYALOCLASTITES

Science:

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

Technology:

- √ ALVIN SUBMERSIBLE
- √ HOLLOWAY-STAKES DRILL
- √ CAMERA

Rodey Batizа's
View graphs.
(in Order.)

(1)

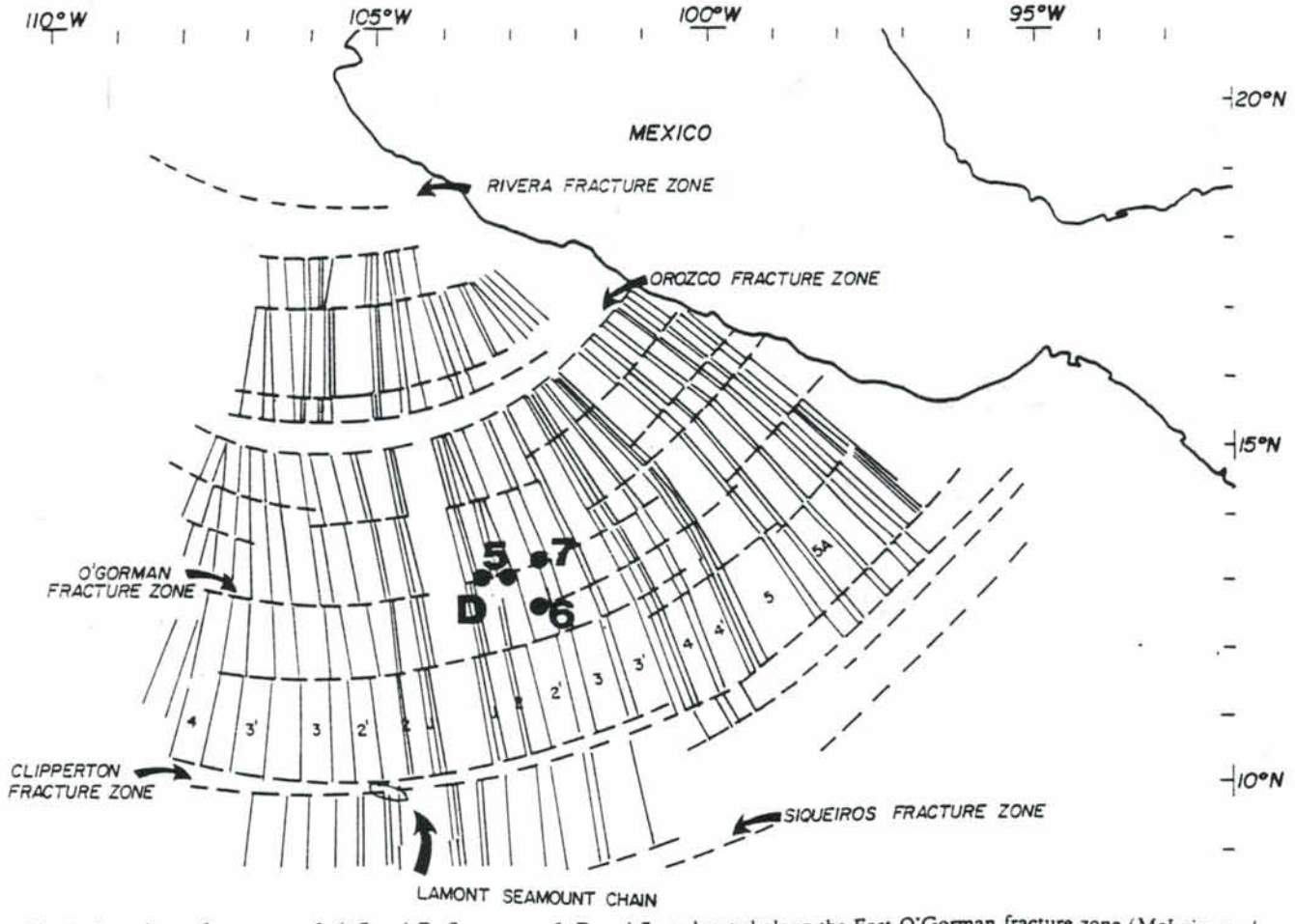
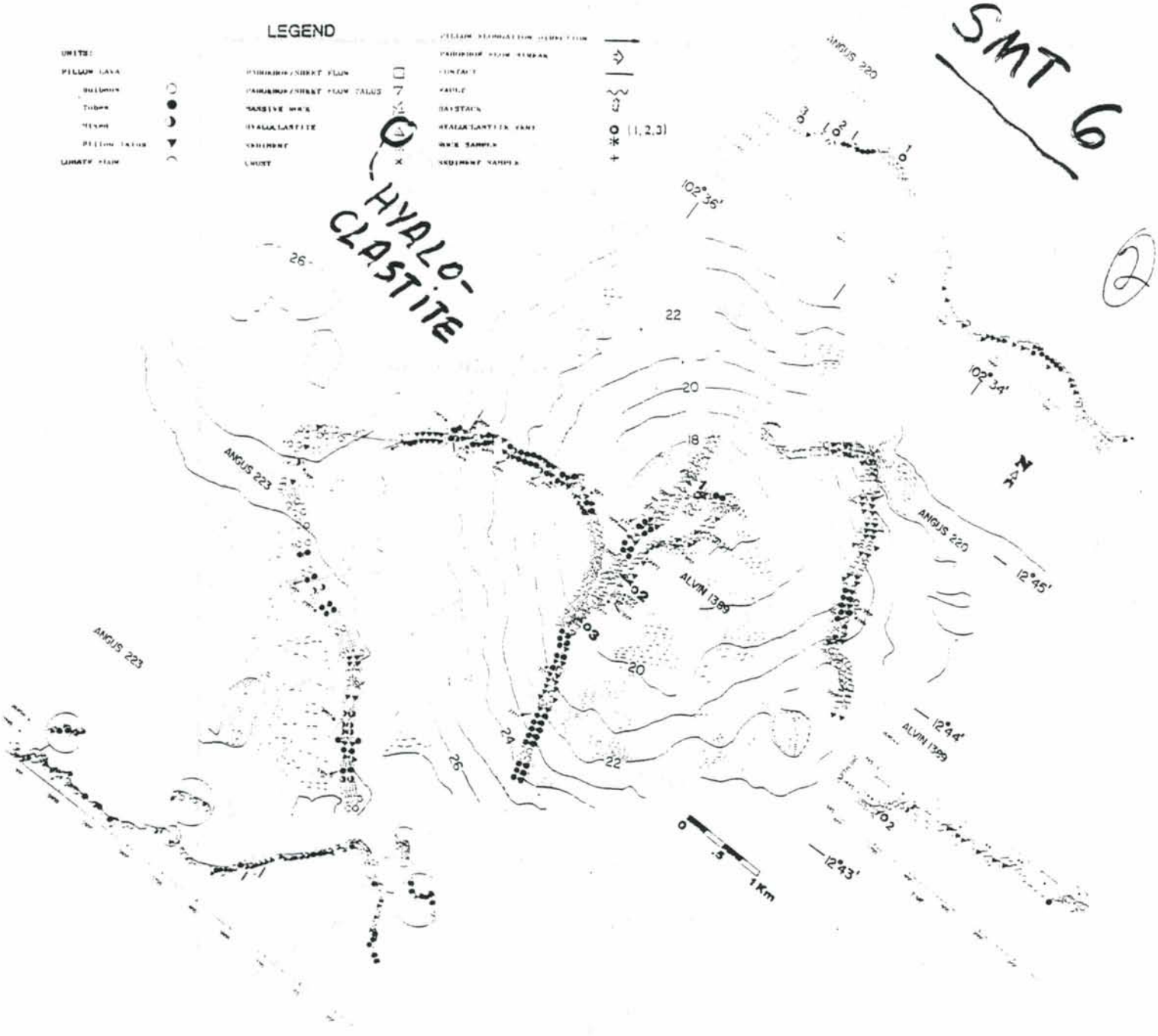
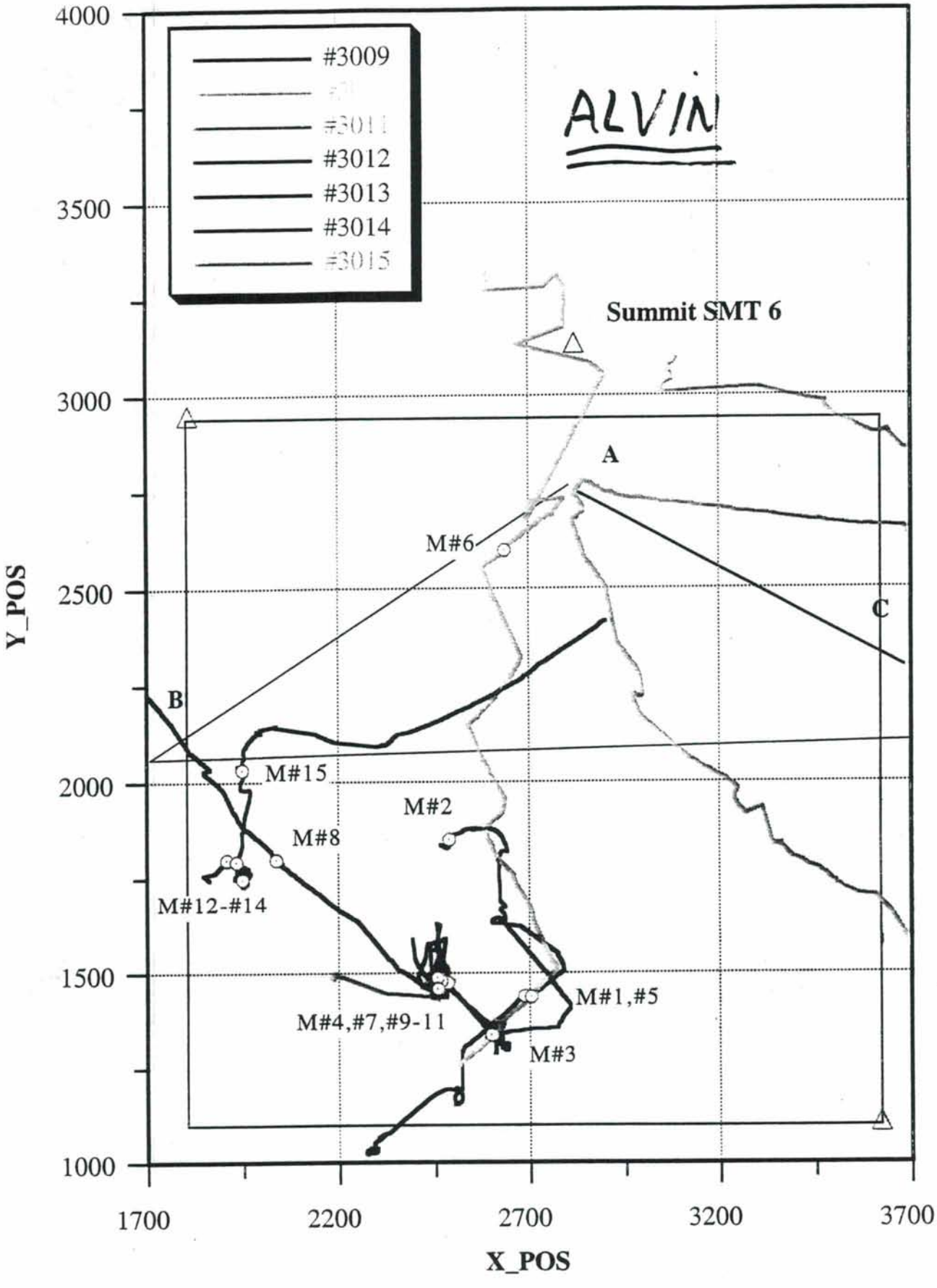


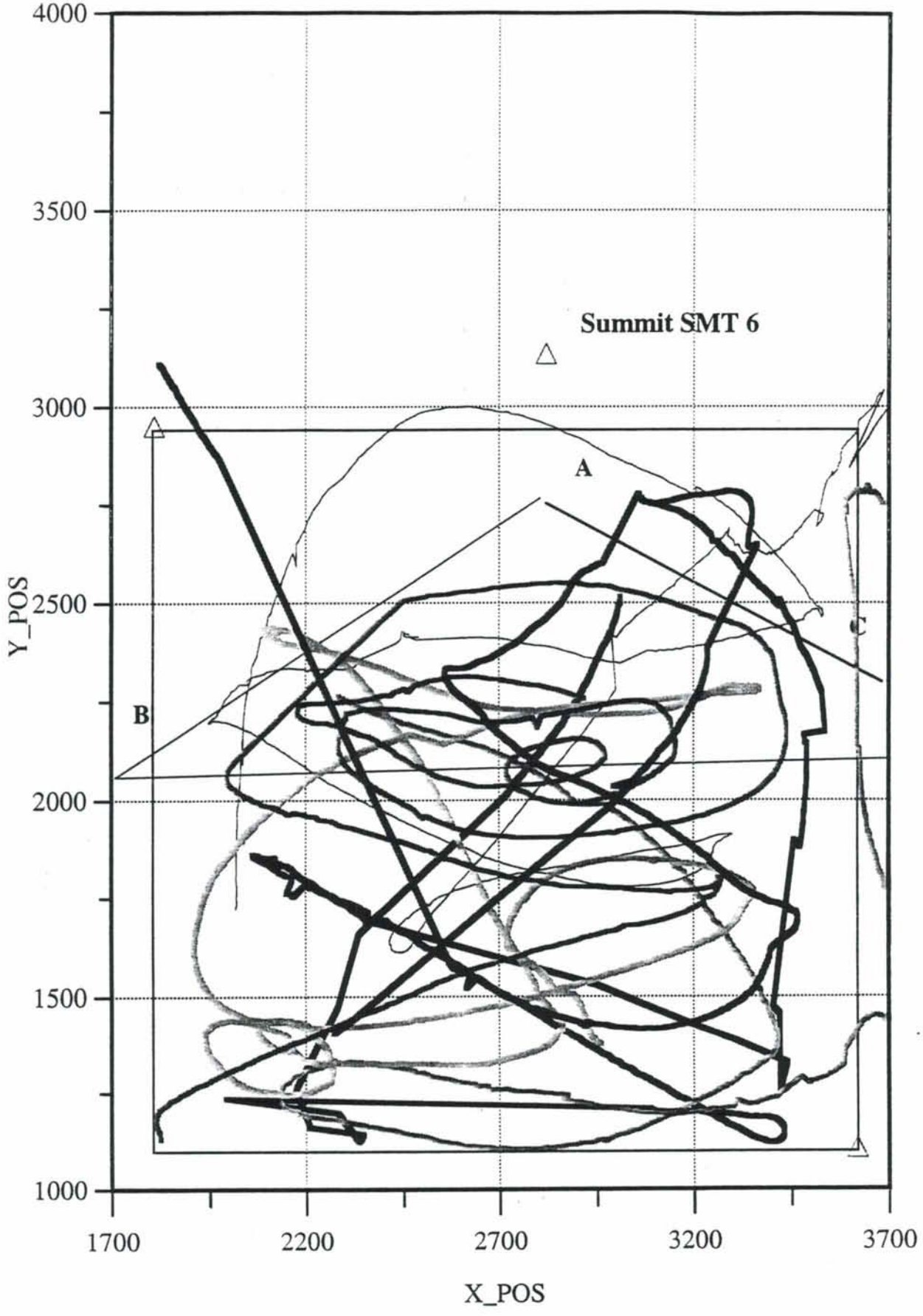
Fig. 1. Locations of seamounts 5, 6, 7 and D. Seamounts 5, D and 7 are located along the East O'Gorman fracture zone (McLain *et al.*, 1988). Seamount 6 is located south of this feature. Magnetic lineations after Klitgord and Mammerickx (1982).



g. 5. Geologic map of Seamount 6C based on ANGUS and ALVIN study. Vertical exaggeration of profiles is: ANGUS 223 — 6X; ANGUS 220 — 4X; and ALV 1389 — 12X. ALVIN and ANGUS were insponder navigated such that relative positions within the transponder net are accurate to ±20 m. Absolute position accuracy in latitude-ongitude coordinates is ±100 m. Geologic interpretations own in map and cross-section views are based on integrating all available data including: 28-mm and 16-mm ANGUS films, transcripts of dive observations, ALVIN 35-mm external camera film and nd-held 35-mm film, external ALVIN video film and study of rock samples collected with ALVIN. Trends of linear elements and strike and dip of planar features were estimated by dive observers and in me cases checked against ALVIN photos which give ALVIN's heading. For ANGUS films, estimates are based on the assumption that ANGUS tows straight, without significant yaw. Depths along LVIN traverse are pressure depths recorded by ALVIN; and along ANGUS traverses, bottom depths were computed by summing ANGUS depth and altitude


#3009
#3011
#3012
#3013
#3014
#3015
ALVIN
Summit SMT 6
A
B
C
M#6
M#15
M#2
M#8
M#12-#14
M#1,#5
M#4,#7,#9-11
M#3
4000
3500
3000
2500
2000
1500
1000
1700
2200
2700
3200
3700
Y_POS
X_POS

LEG 132-17
Camera Tows #2-#7



APPENDIX X

Gametogenic Ecology of a Hydrothermal Vent Community

Spatial analysis of reproductive activity within field -- tests whether reproduction of vent species is continuous.

If not continuous -- tests whether synchrony is controlled by tidal cycles

Second set of samples collected 1 month later permits a time-series approach.

Sea Cliff/ATV Operations

Highlights

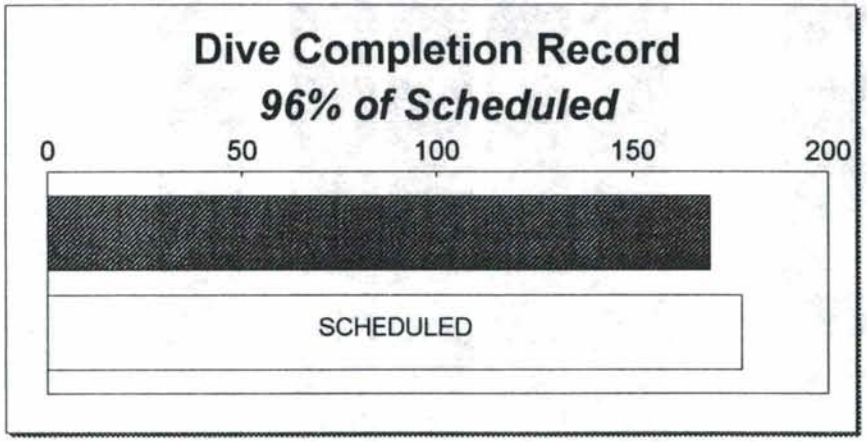
- ATV sampling of biota
- ATV sampling of black smokers
- ATV temperature measurements
- ATV small package deployment and recovery
- Sea Beam survey on arrival
- 24 hour operations maximize bottom time
- Launch and recovery in sea state 4
- Professional, competent, courteous crew

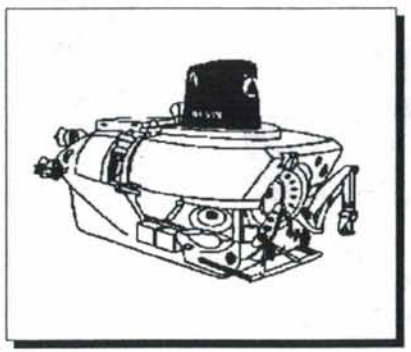
(~24 members of combined Sea Cliff and ATV crew)

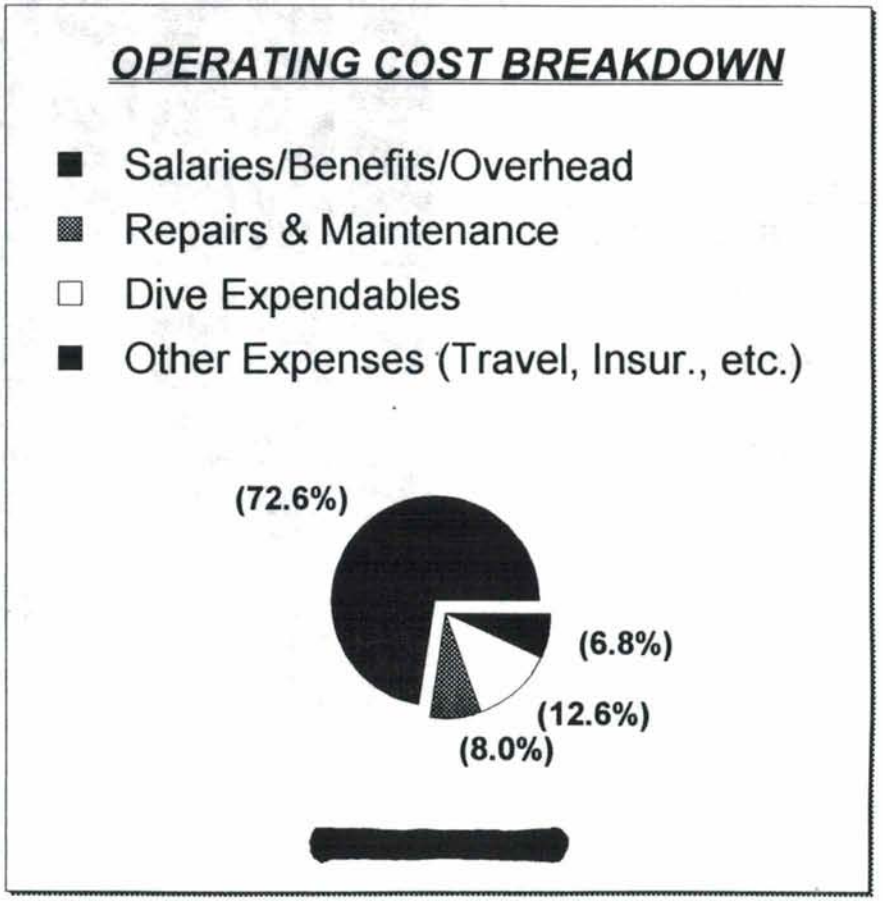
APPENDIX XI

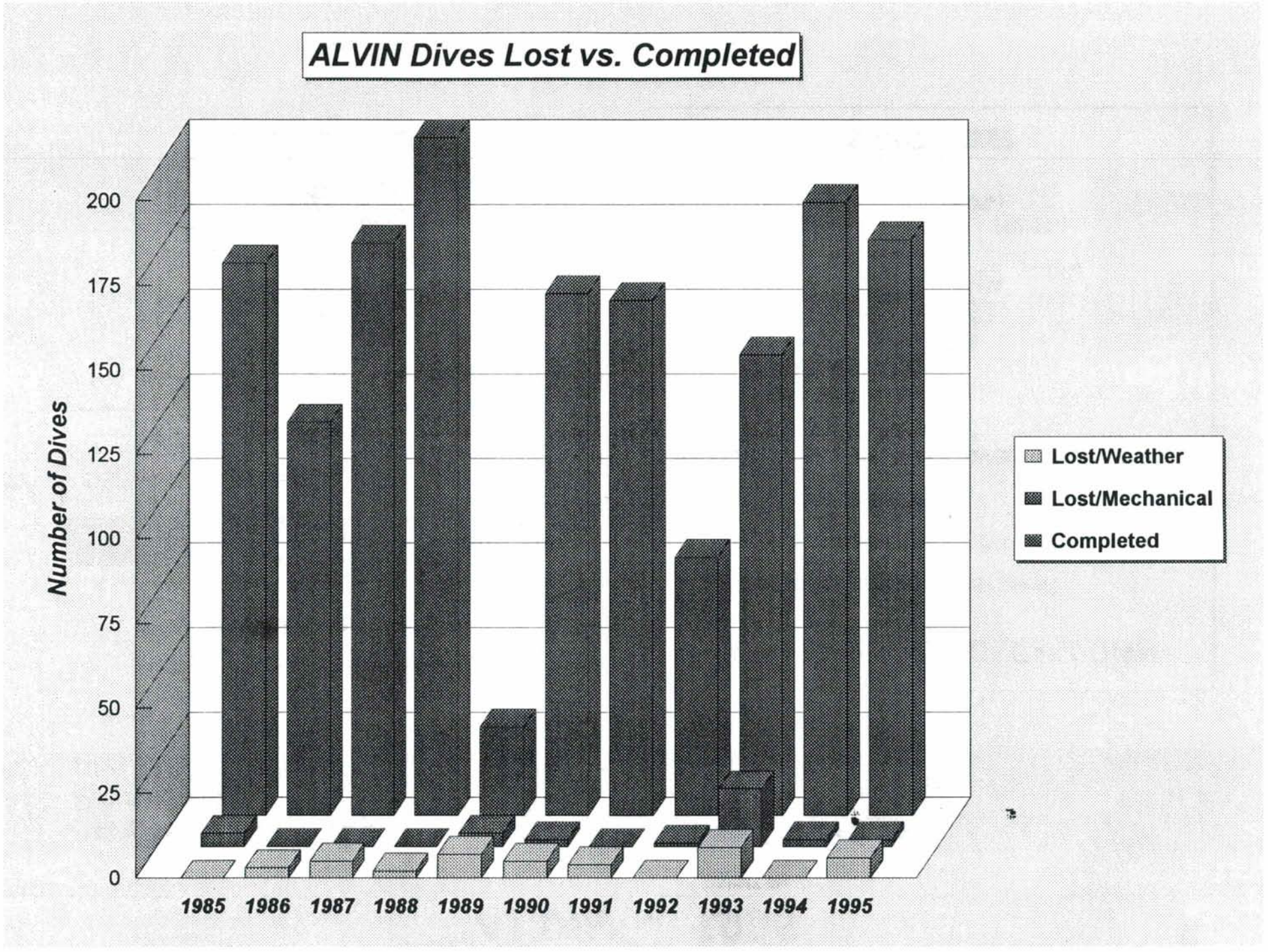
ALVIN - 1995

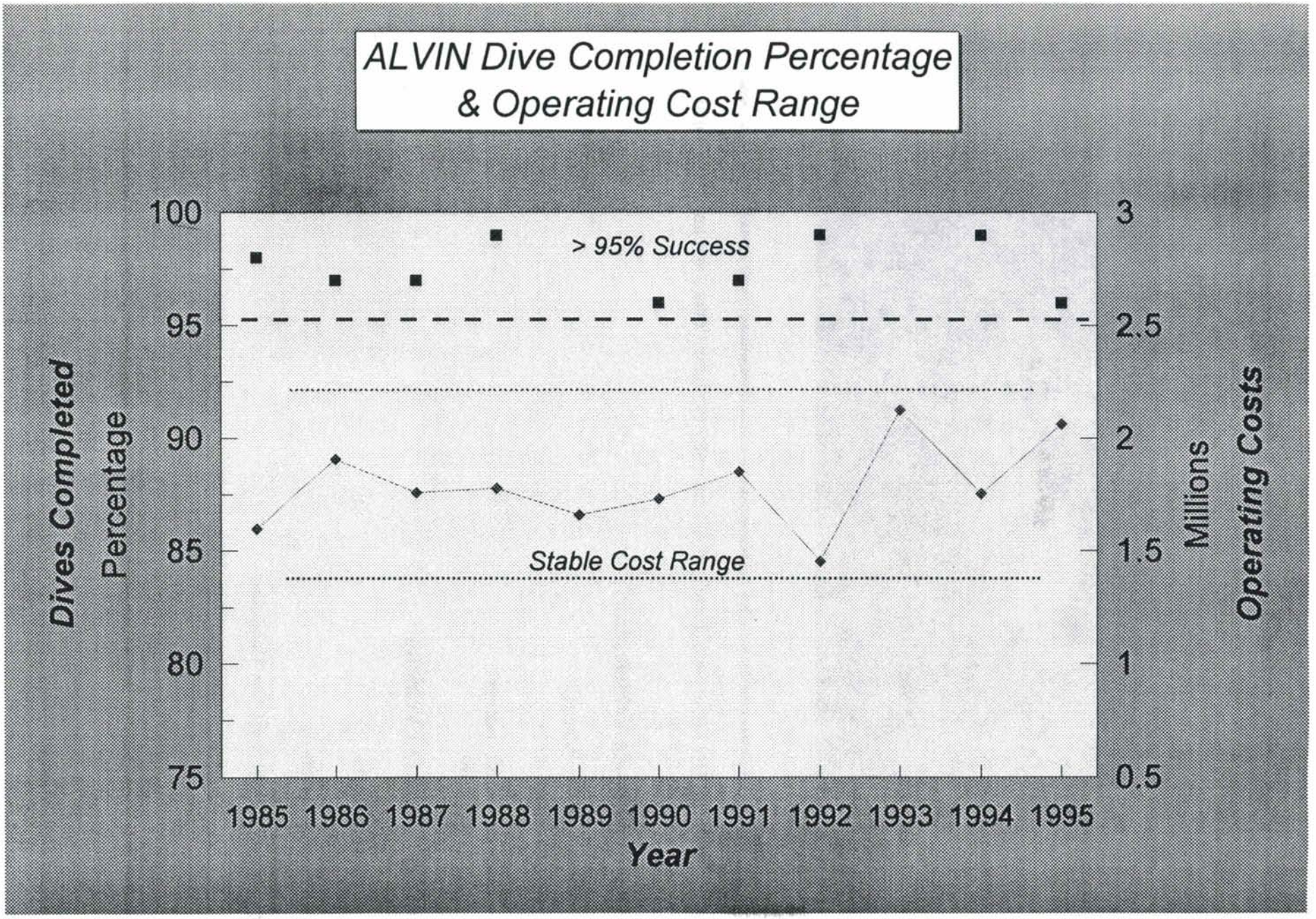
Assigned Operating Days	282	***Hours Submerged***	1,084
Days at Sea	278	***Avg Dive Duration (hr)***	8.1
Dives	170	***Scientific Cruises***	13








ALVIN Dives Lost vs. Completed
Number of Dives
0
25
50
75
100
125
150
175
200
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
Lost/Weather
Lost/Mechanical
Completed


ALVIN Dive Completion Percentage
& Operating Cost Range
Dives Completed
Percentage
100
95
90
85
80
75
> 95% Success
Stable Cost Range
3
2.5
2
1.5
1
0.5
Millions
Operating Costs
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995
Year

Deep Submergence Operations Group

Woods Hole Oceanographic Institution

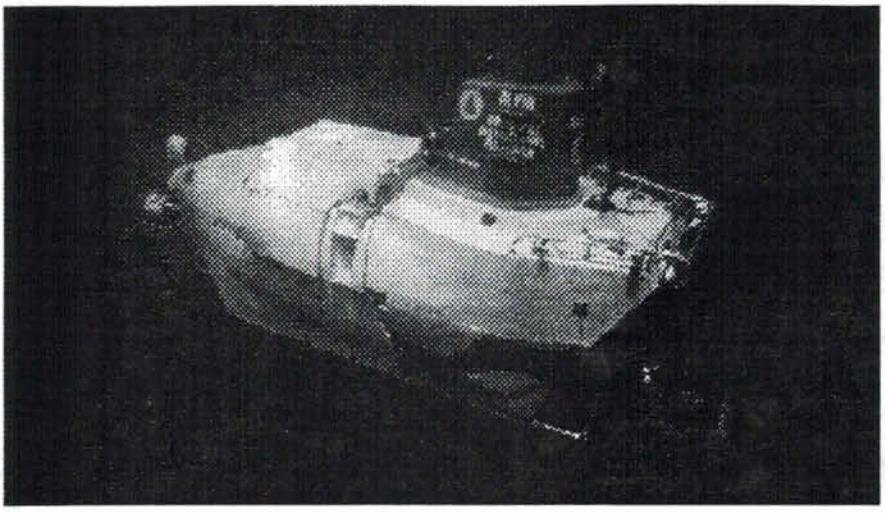


Photo: Rod Catanach

Welcome to the DSOG home page. Here's what's currently available (links), and an idea of what is planned for the near future.

Deep Submergence Vehicle *ALVIN*

- *ALVIN* User Manual
- Cruise Synopses
- Dive Log
- Observer Information
- Group Photo

Remotely-Operated Vehicles

- Jason/Medea
- Argo II
- Sonar Systems

Autonomous Underwater Vehicles

- Autonomous Benthic Explorer (ABE)

Shipboard Scientific Services Group (SSSG)

- Marine Technicians
- Shared-Use Equipment

Shipboard Computing

- *ATLANTIS II*
- *KNORR*
- *OCEANUS*

- Mooring & Rigging Services
- Diving Program

Links to Other Related WHOI Sites

- *ATLANTIS (AGOR-25)* Construction Update
- WHOI Research Vessel General Information and Schedules
- The Jason Project

Links to Other Submersible/Submarine Sites

- Japan's Marine Science and Technology Center - JAMSTEC
- French Institute for Marine Research - IFREMER
- Harbor Branch Oceanographic Institution
- World Submarine Invitational 1996 underwater races
- U-Web - The U-Boat Archive site
- Scotland's ROV and submersible information source
- MIT's Sea Grant AUV Lab

Send mail or comments to **Rick Chandler**, *rchandler@whoi.edu*

Go to WHOI Home Page □

APPENDIX XII

DSOG Unmanned Vehicle Status

Jason/Medea

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

Argo II

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

DSL 120

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

DSOG Sonar Upgrade Proposal

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

DSOG Acoustic Navigation Upgrade

Two Phase Implementation of DESSC Subcommittee Recommendations

Phase One:

- Purchase three copies of Pelagos Inc. Winphrog software

- Purchase two computers (PCs) to support Winphrog

- Install and test on Atlantis II for Alvin surface control

- Integrate into portable navigation and control

- Test Winphrog as in hull navigation processor and display

- Determine preferred technical approach for permanent in hull installation to be proposed in phase two

- Review DESSC subcommittee recommendations and incorporate in future upgrade proposals (ie. ACDP/USBL/DR)

Jason Manipulator Development Program

Objectives

- Improve reliability

- Test at maximum rated pressure

- Develop techniques for handling and triggering "double major" hydrothermal vent fluid samplers

- Design and test new elevator system

- Redesign gripper

- Improve spares and documentation

- Demonstrate ability to work with temperature probes and "bio. boxes"

APPENDIX XIII

New Equipment Used, Tried or Evaluated
ALVIN - 1995

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

Battery Power

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

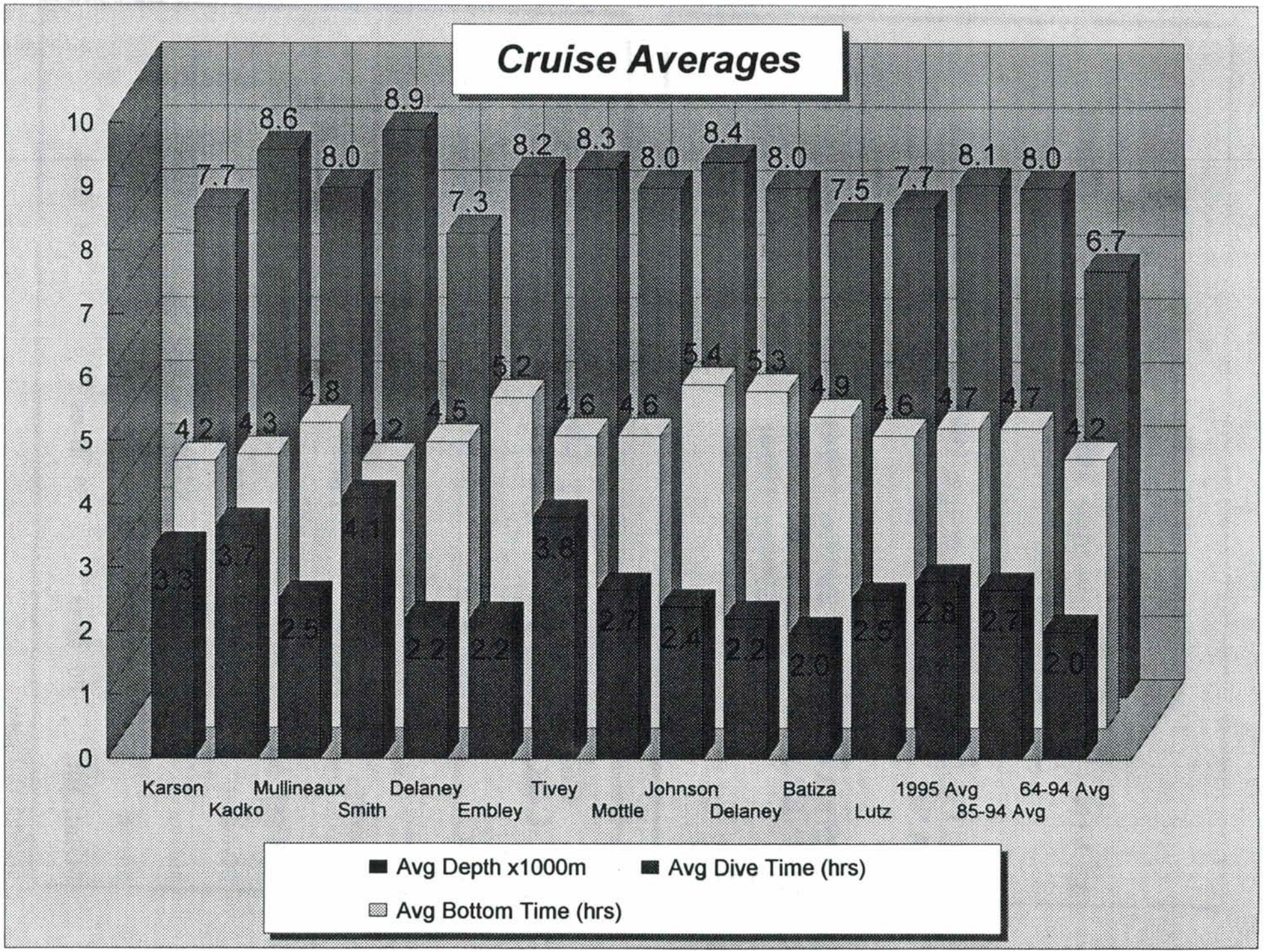
Comparison of On-Bottom Times for Different Deep Diving Submersibles

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

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

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

5/26/95-D. Foster


Cruise Averages
10
9
8
7
6
5
4
3
2
1
0
7.7
8.6
8.0
8.9
7.3
8.2
8.3
8.0
8.4
8.0
7.5
7.7
8.1
8.0
6.7
4.2
4.3
4.8
4.2
4.5
5.2
4.6
4.6
5.4
5.3
4.9
4.6
4.7
4.7
4.2
3.3
3.7
2.5
4.1
2.2
2.2
3.8
2.2
2.4
2.2
2.0
2.5
2.8
2.7
2.0
Karson
Kadko
Mullineaux
Smith
Delaney
Embley
Tivey
Mottle
Johnson
Delaney
Batiza
Lutz
1995 Avg
85-94 Avg
64-94 Avg
Avg Depth x1000m
Avg Dive Time (hrs)
Avg Bottom Time (hrs)

Variables Affecting *Alvin* Power and Bottom-Time

Long-Term Variables

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

Short-Term Variables

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

Improvement Efforts

Continue Monitoring Battery Market

Continue to Optimize Charge Cycle

Continue to Optimize Battery Maintenance

Continue Pilot Efficiency Training

Continue Electronic Monitoring Development

Increased payload possibilities

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

Imaging Proposal Status

Complete:

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

Pending:

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

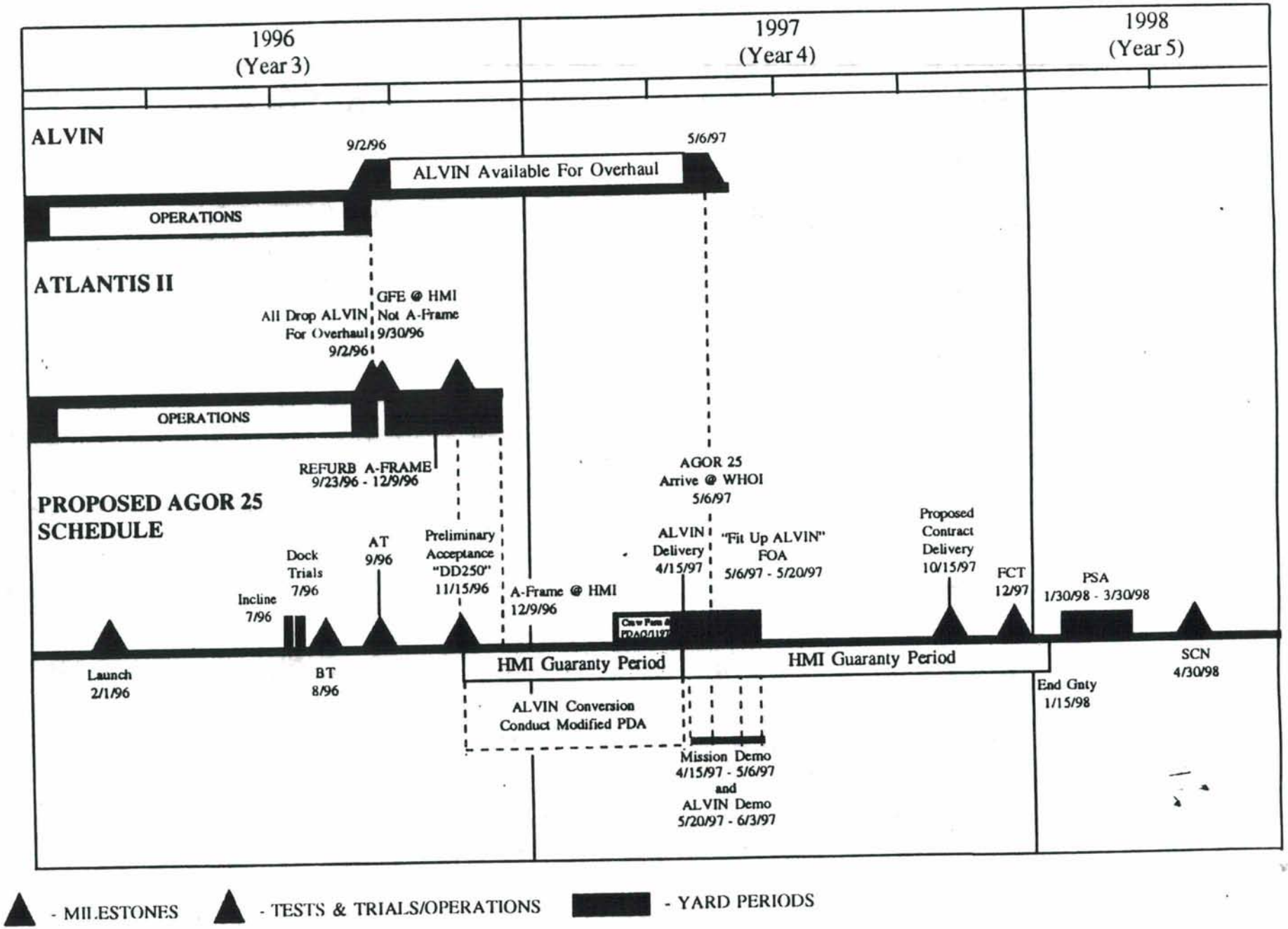
Motor Controllers

- ☐ **Housings complete**
- ☐ **Testing new endcaps and connectors**

APPENDIX XIV

	LULU	*ATLANTIS II*	*KNORR*	*ATLANTIS*
LOA	105 ft	210 ft	279 ft	274 ft
Beam	48 ft	44 ft	46 ft	52.5 ft
Crew	9	22	22	22
Science	17	28	34	37
Generators	150 kw	600 kw	1,780 kw	6,645 kw
Cruising Speed	6.5 kts	10.5 kts	12 kts	15 kts
Endurance	20 days	30 days	60 days	60 days
Range	2,000 mi	9,000 mi	12,000 mi	11,300 mi plus 30 days on station
Labs	One Van	4 Labs 1,031 sq. ft.	6 labs 1,981 sq. ft.	6 labs 4,000 sq. ft.

AGOR 25/ATLANTIS II/ALVIN Schedule



APPENDIX XV

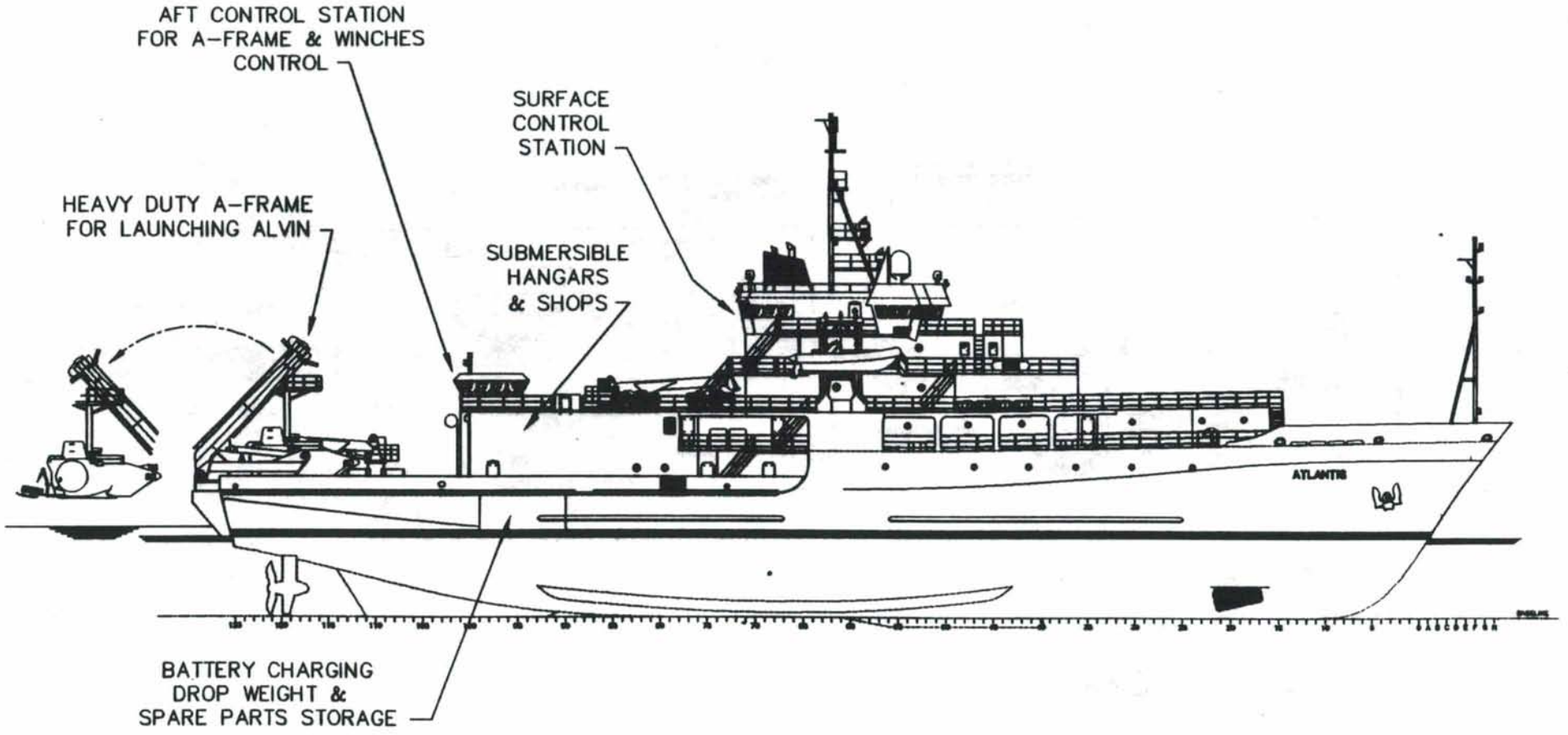
Deep Submergence Science Committee

New Deep Submergence Support Vessel Plans

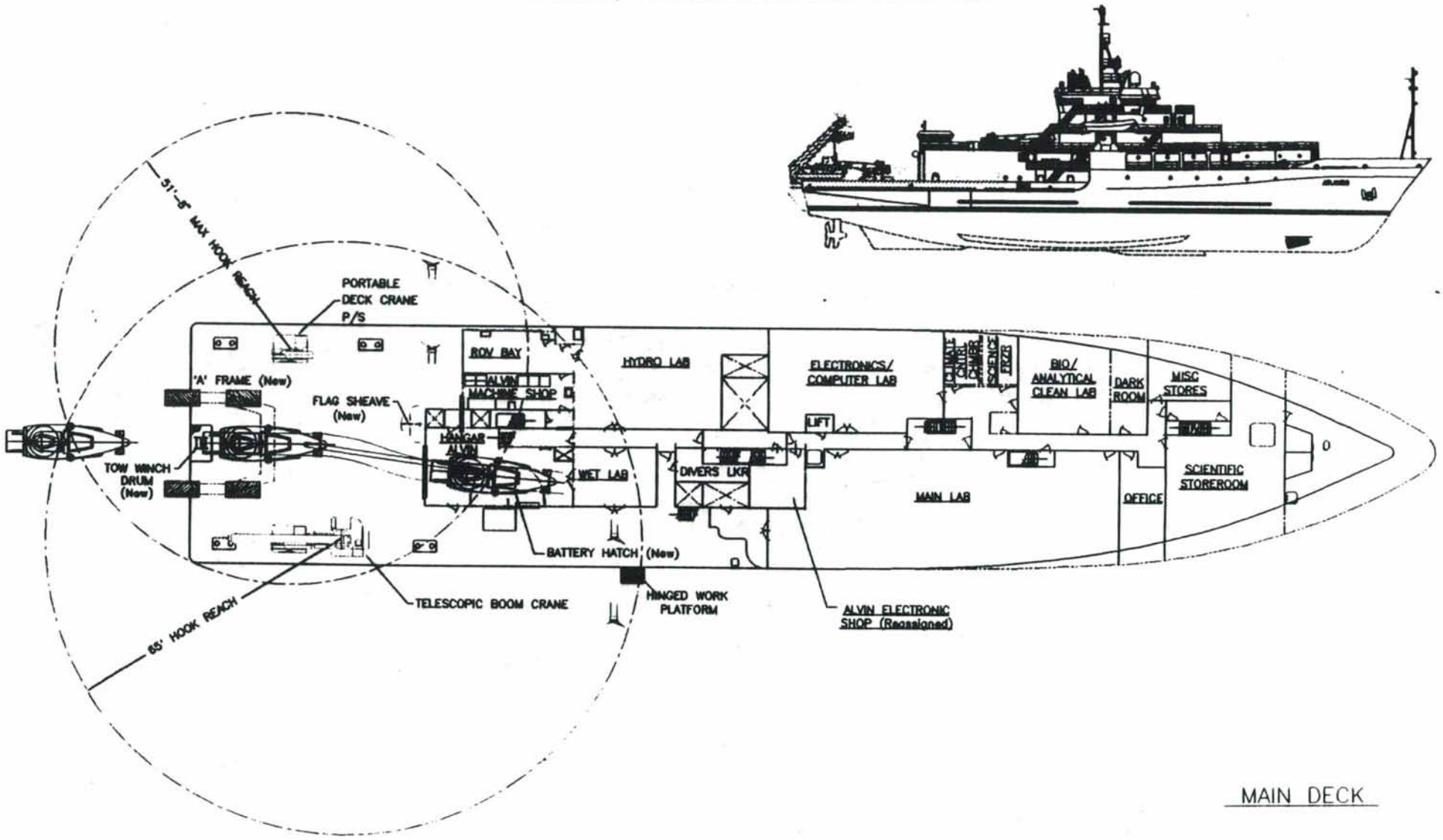
Sunday, 10 December 1995
San Francisco, CA

Woods Hole Oceanographic Institution

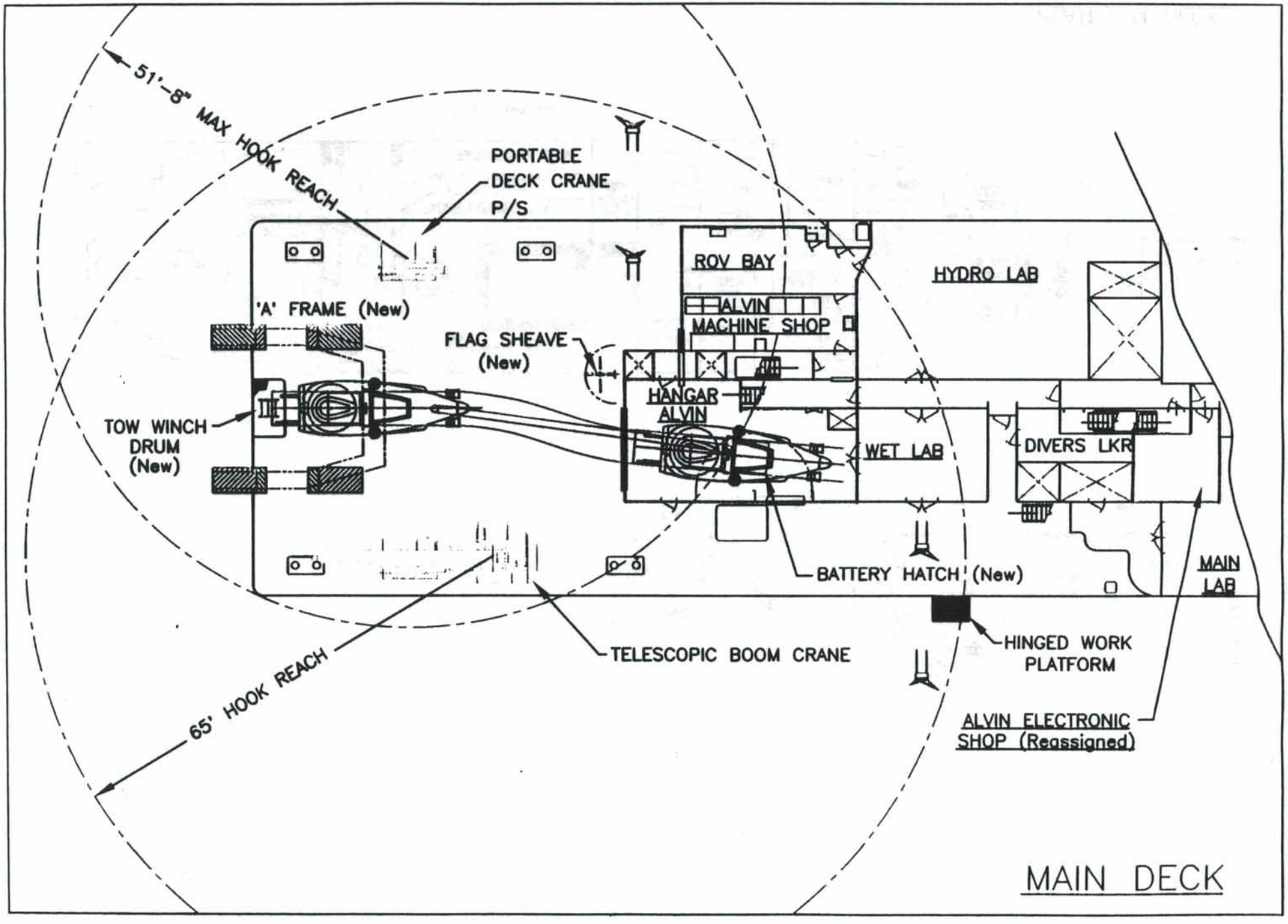
	Lulu	*Atlantis II*	*Knorr*	AGOR-25 *Atlantis*
LOA	**105 ft.**	**210 ft.**	**279 ft.**	**274 ft.**
Beam	**48 ft.**	**44 ft.**	**46 ft.**	**52.5 ft.**
Displacement	**480 Ltons**	**2,300 Ltons**	**2,685 Ltons**	**3,250 LTons**
Crew	**9**	**22**	**22**	**22**
Science:				
DSV/Tech	**9**	**9**	**13**	**13**
Party	**8**	**19**	**21**	**24**
Generators	**150 kw**	**600 kw**	**1,780 kw**	**2,145 kw**
Cruising Speed	**6.5 kts**	**10.5 kts**	**12 kts**	**12 kts**
Endurance	**20 days**	**30 days**	**60 days**	**60 days**
Range	**2,000 mi.**	**9,000 mi.**	**12,000 mi.**	**11,300 mi.**
Labs	**One Van**	**4 labs**	**6 labs**	**6 labs**
		1,031 sq. ft.	**1,981 sq. ft.**	**3,890 sq. ft.**

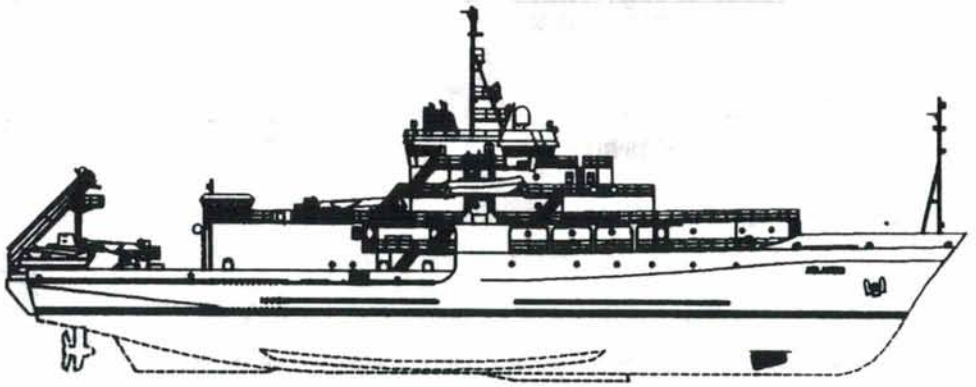


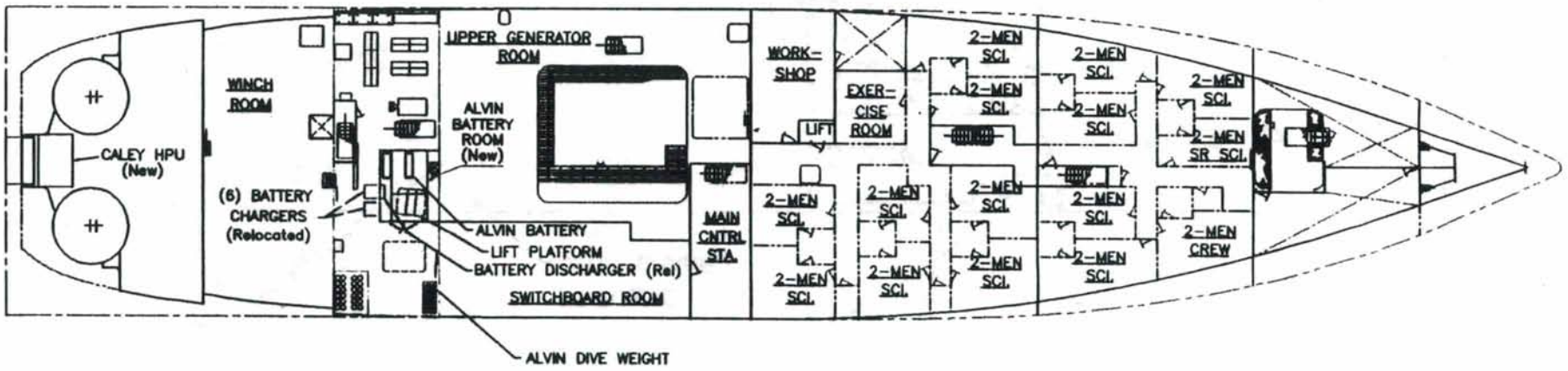
ATLANTIS OUTBOARD PROFILE STARBOARD


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

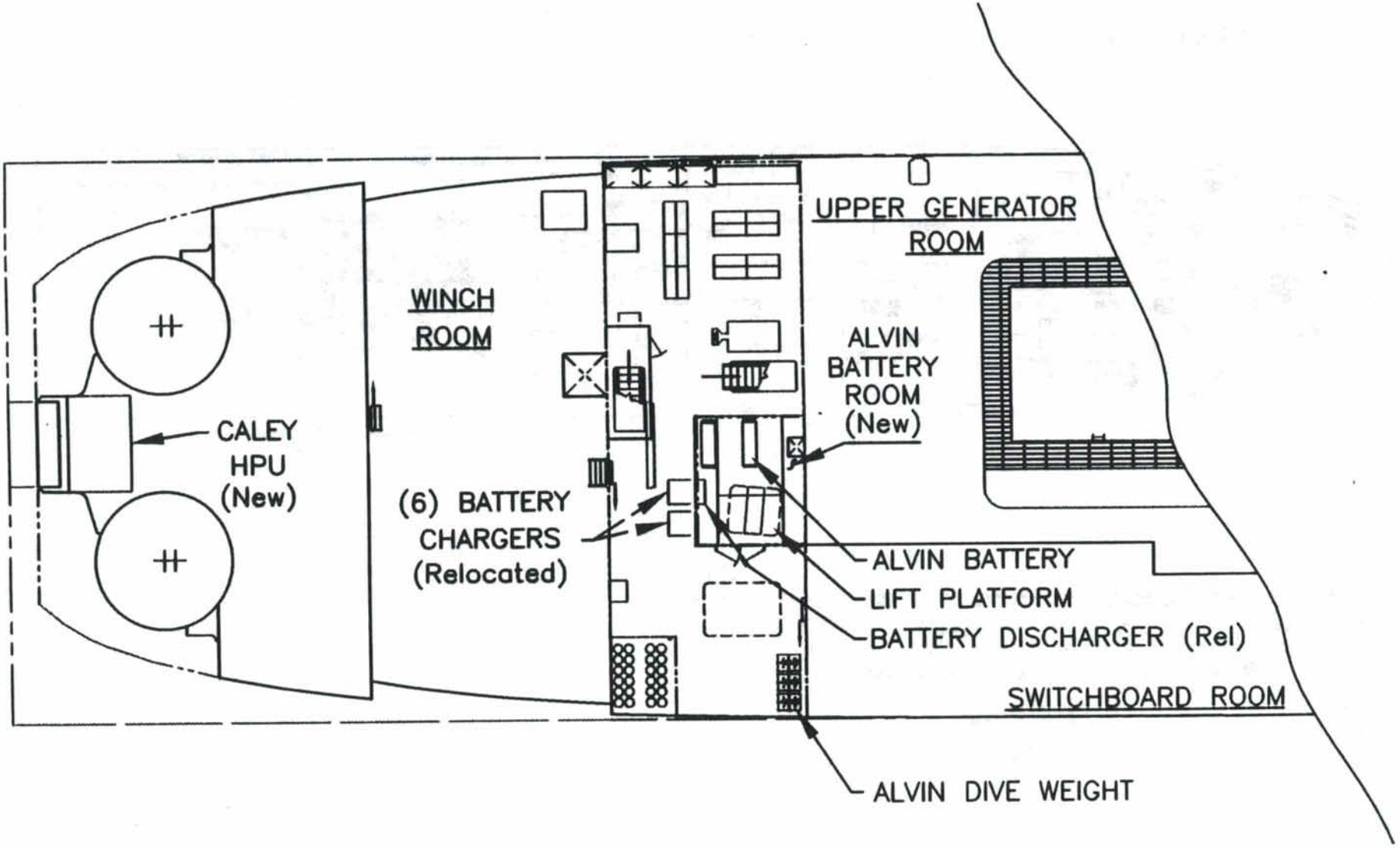
MAIN DECK


51'-8" MAX HOOK REACH
PORTABLE
DECK CRANE
P/S
'A' FRAME (New)
FLAG SHEAVE
(New)
TOW WINCH
DRUM
(New)
ROV BAY
HYDRO LAB
ALVIN
MACHINE SHOP
HANGAR
ALVIN
WET LAB
DIVERS LKR
MAIN
LAB
BATTERY HATCH (New)
TELESCOPIC BOOM CRANE
HINGED WORK
PLATFORM
ALVIN ELECTRONIC
SHOP (Reassigned)
65' HOOK REACH
MAIN DECK

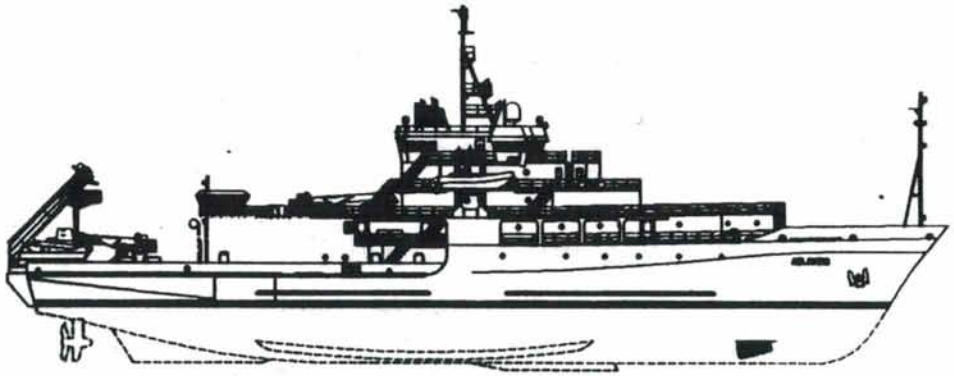


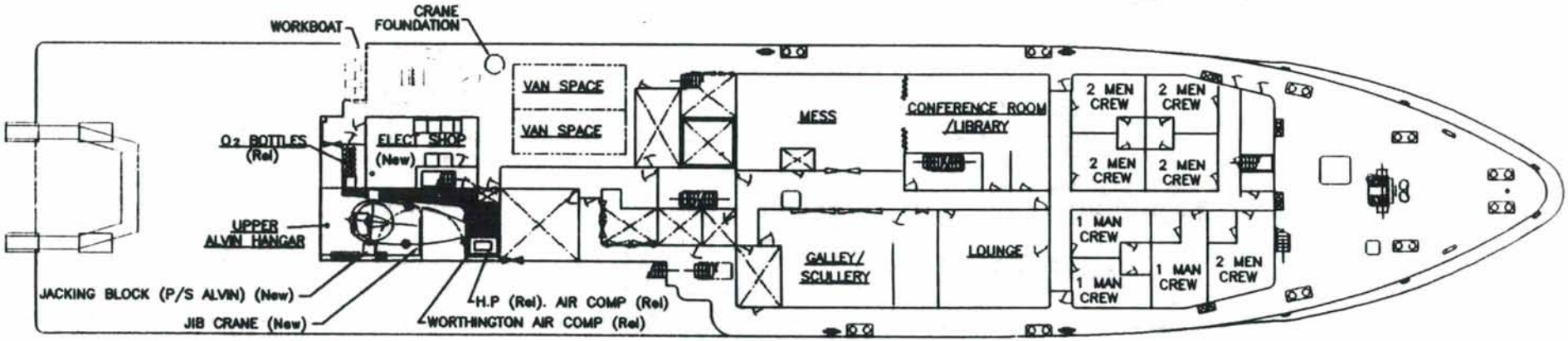


1ST PLATFORM DECK

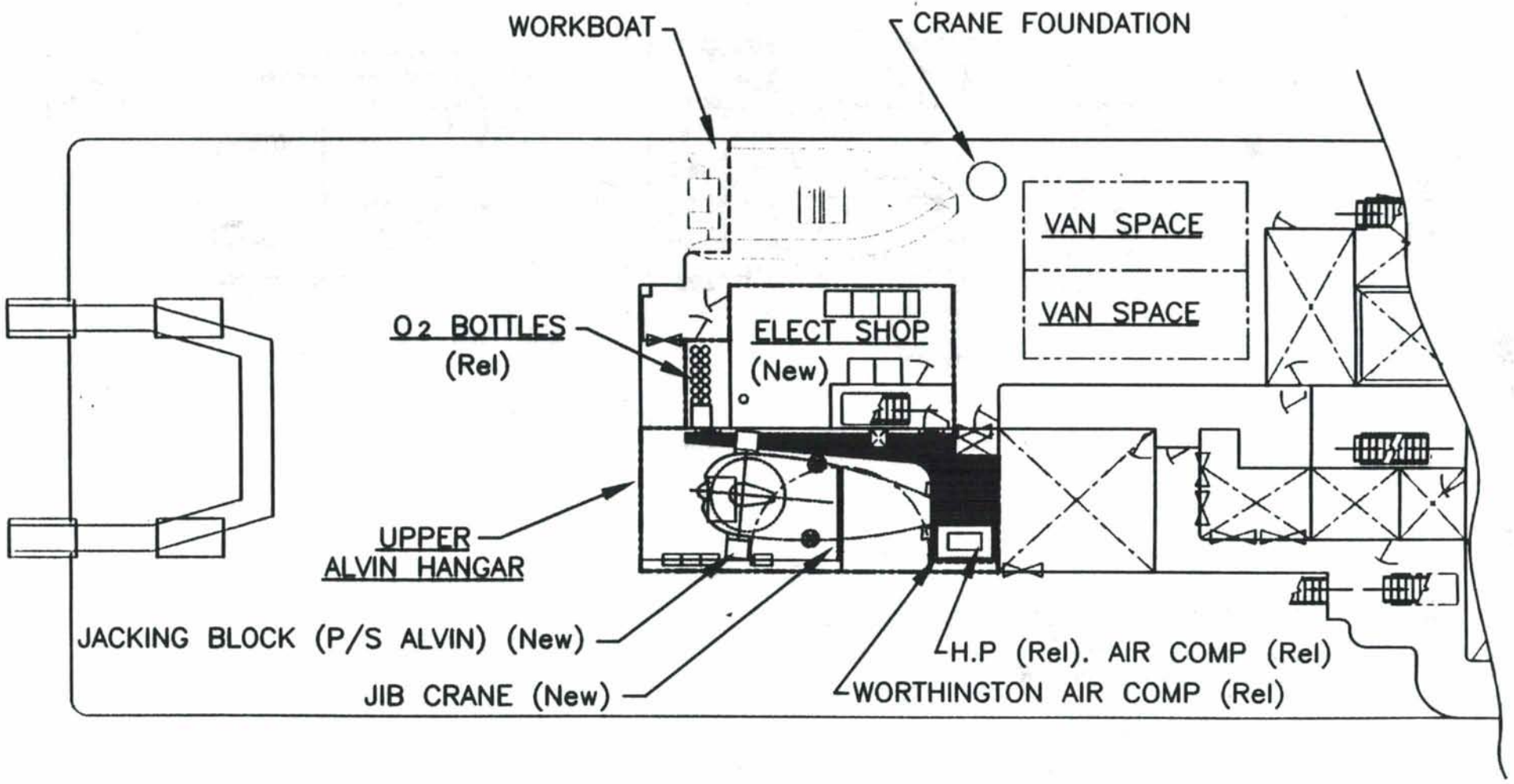


1ST PLATFORM DECK

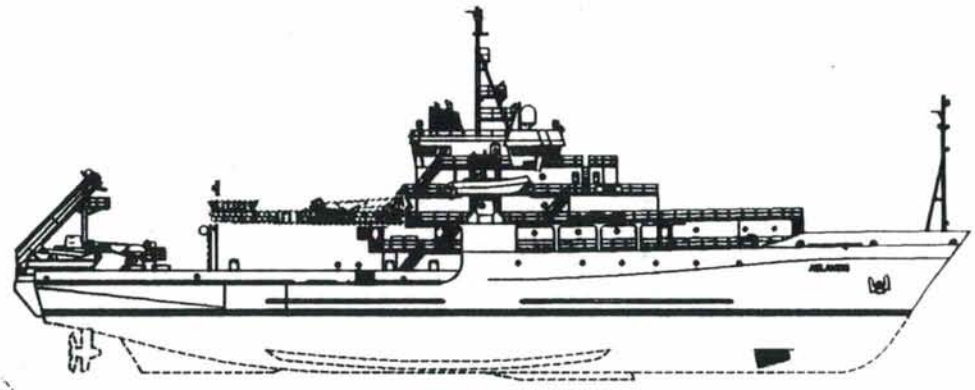


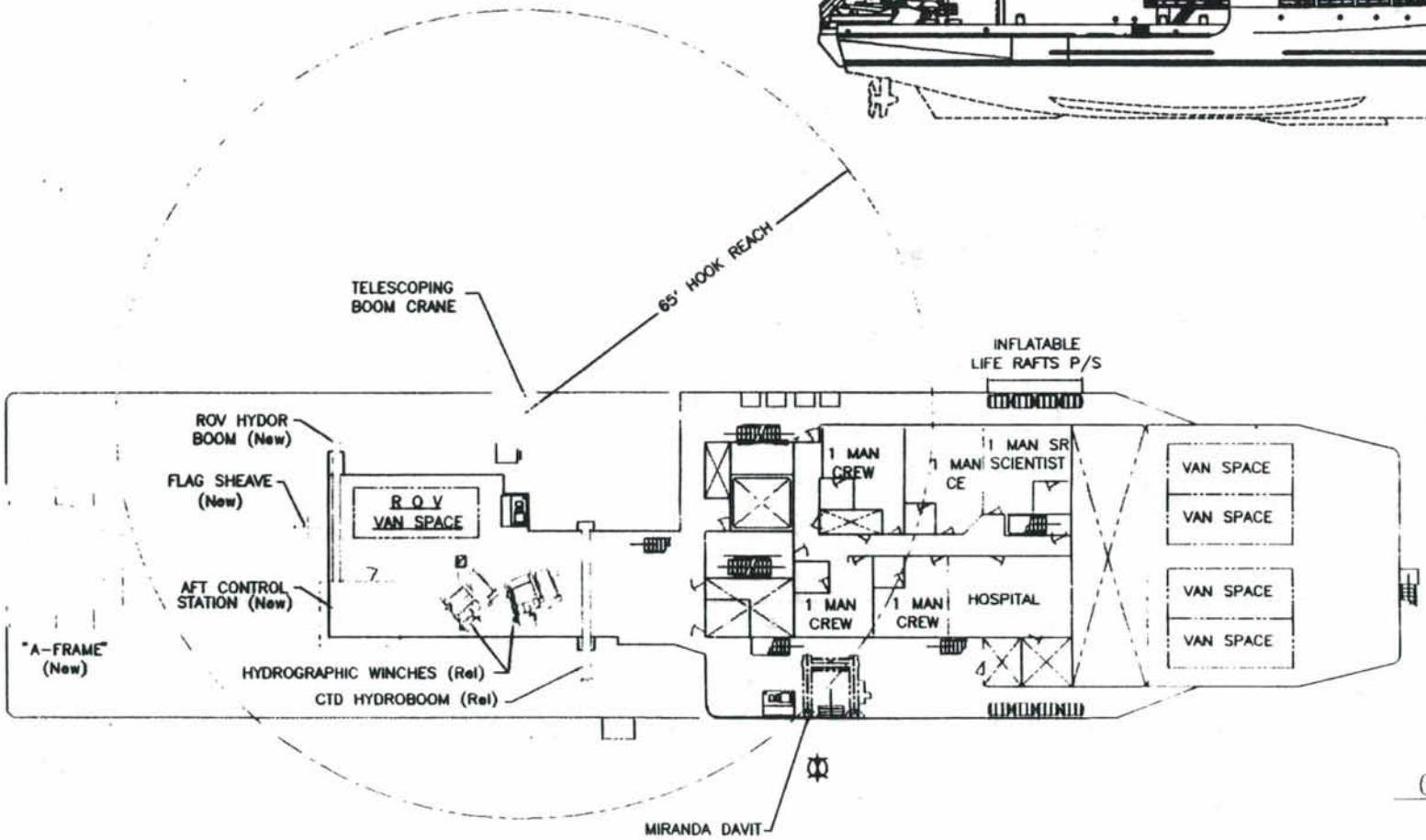


FOCSLE DECK (01 LEVEL)

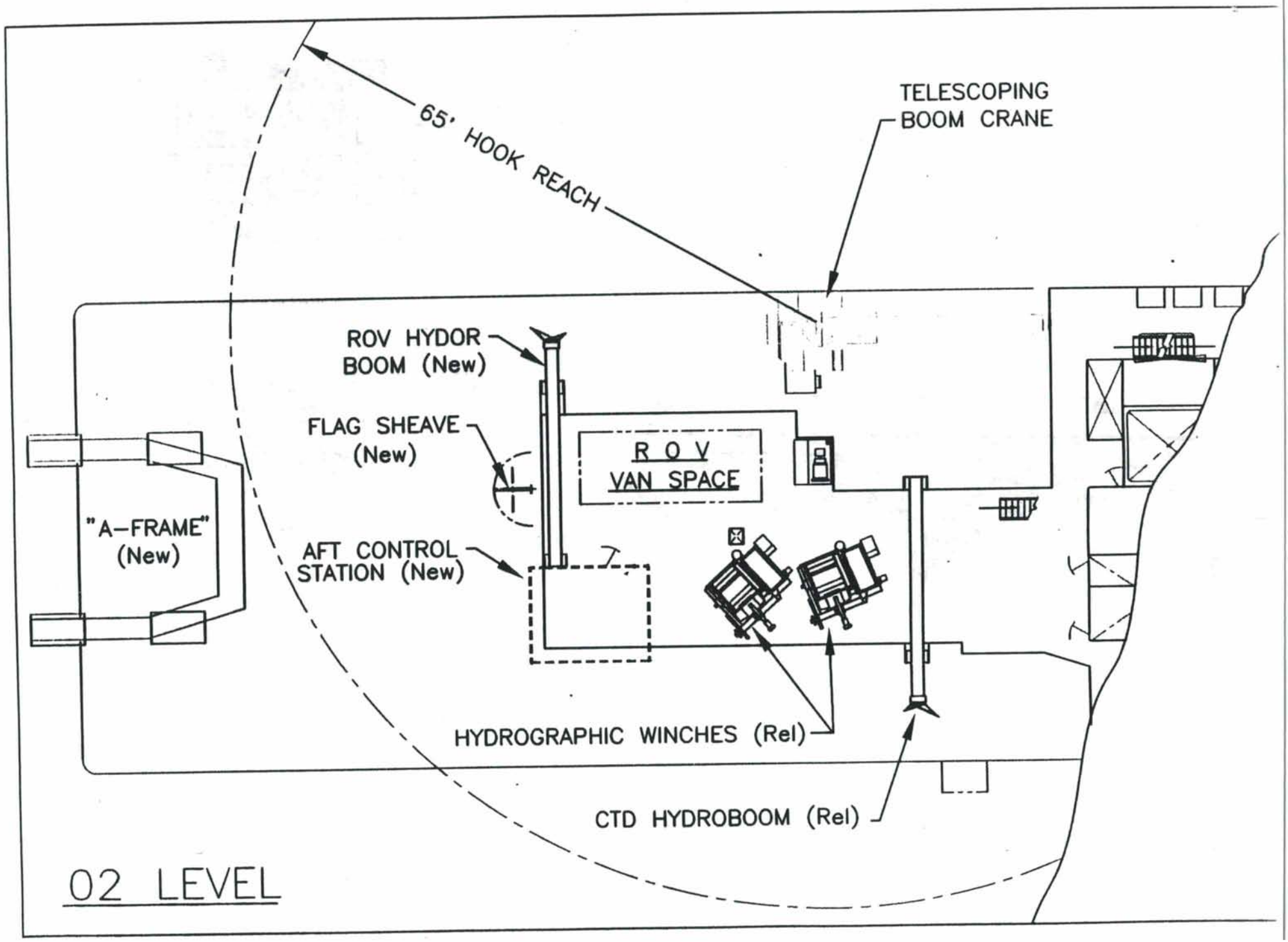


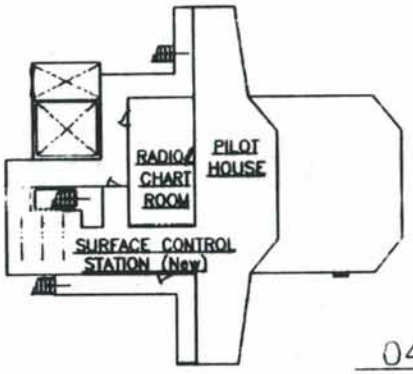
FOCSLE DECK (01 LEVEL)



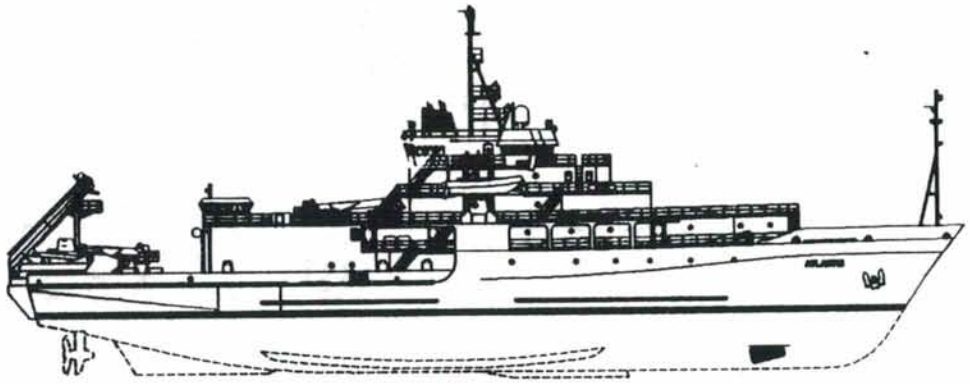

TELESCOPING BOOM CRANE
65' HOOK REACH
INFLATABLE LIFE RAFTS P/S
ROV HYDOR BOOM (New)
FLAG SHEAVE (New)
R O V VAN SPACE
AFT CONTROL STATION (New)
"A-FRAME" (New)
HYDROGRAPHIC WINCHES (Rel)
CTD HYDROBOOM (Rel)
MIRANDA DAVIT
1 MAN CREW
1 MAN CE
1 MAN SR SCIENTIST
1 MAN CREW
1 MAN CREW
HOSPITAL
VAN SPACE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

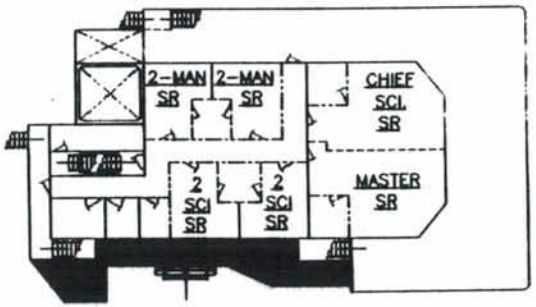
02 LEVEL


65' HOOK REACH
TELESCOPING BOOM CRANE
ROV HYDOR BOOM (New)
FLAG SHEAVE (New)
R O V VAN SPACE
"A-FRAME" (New)
AFT CONTROL STATION (New)
HYDROGRAPHIC WINCHES (Rel)
CTD HYDROBOOM (Rel)
02 LEVEL

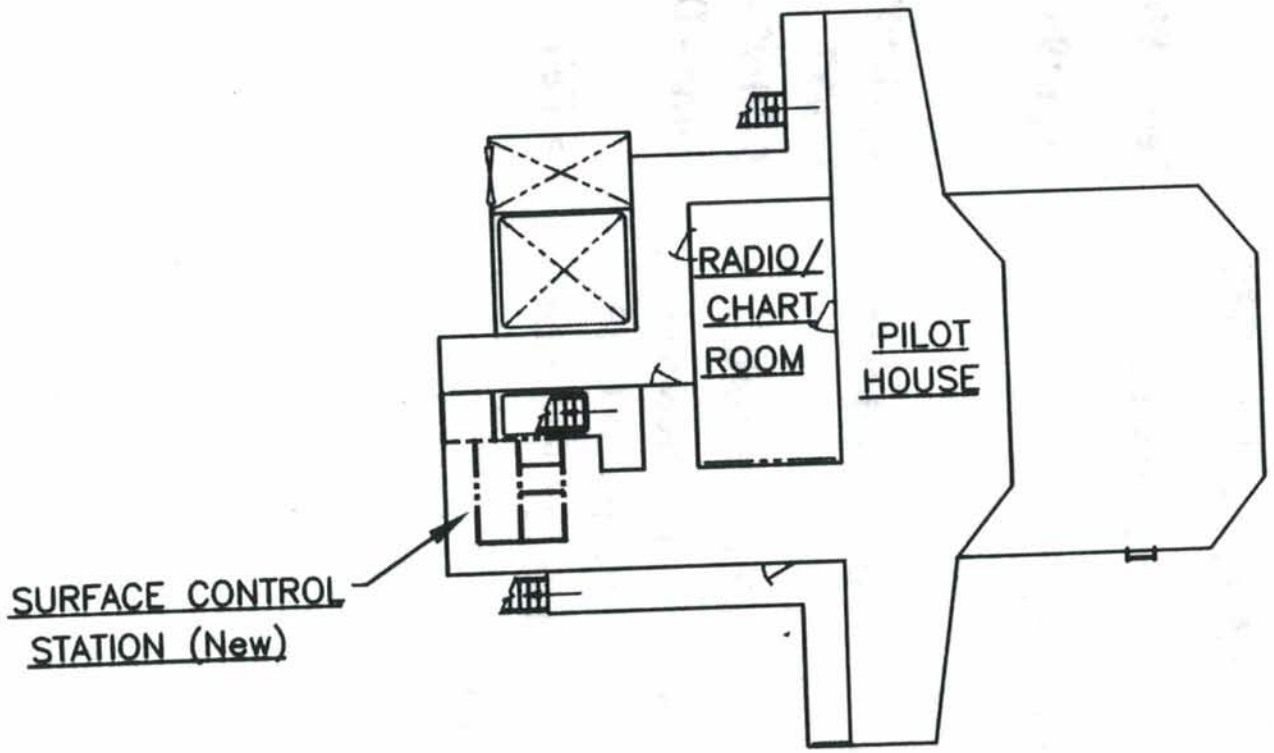


04 LEVEL





03 LEVEL



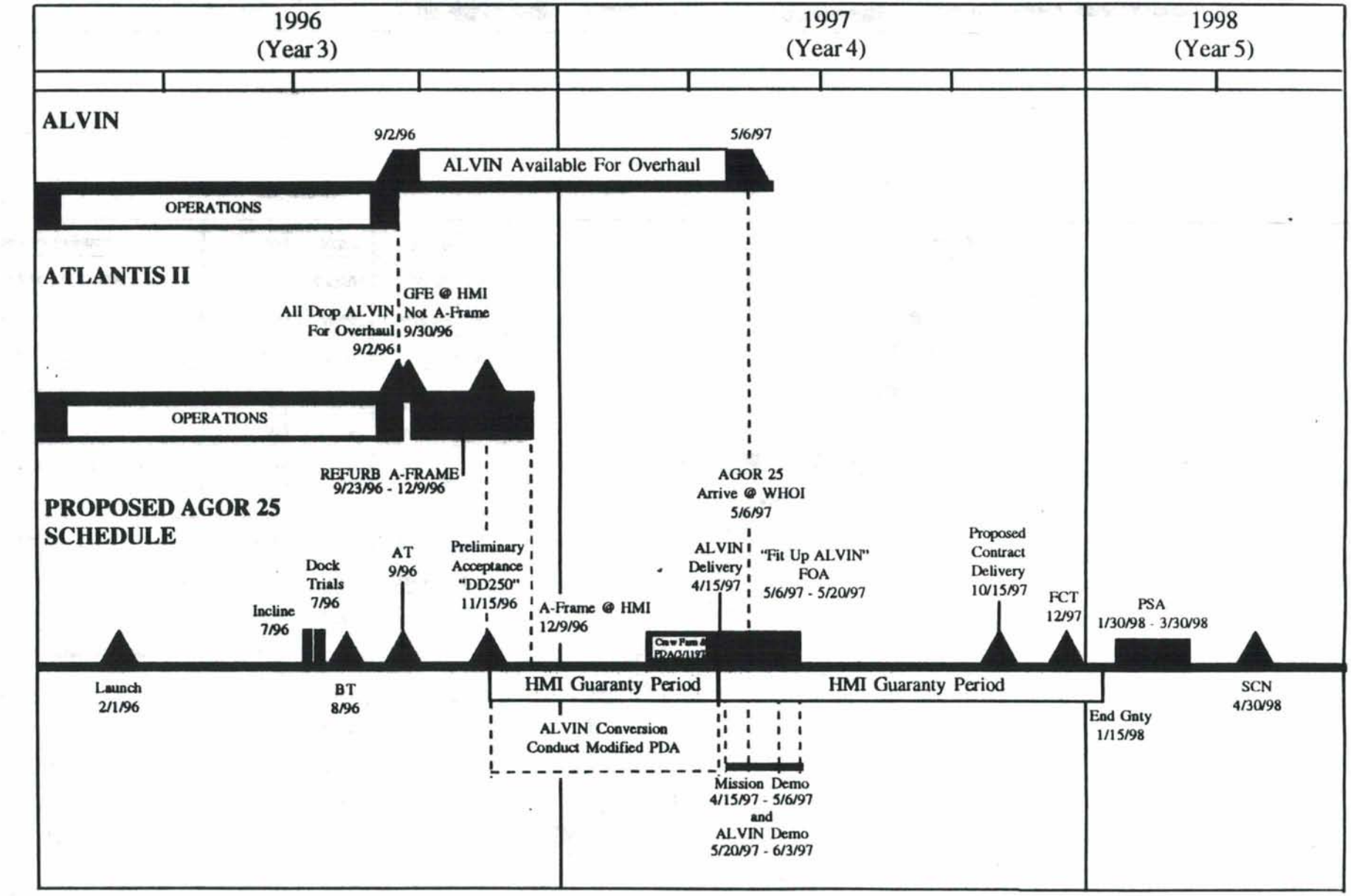
04 LEVEL

ATLANTIS
(AGOR-25)

Schedule of Key Events

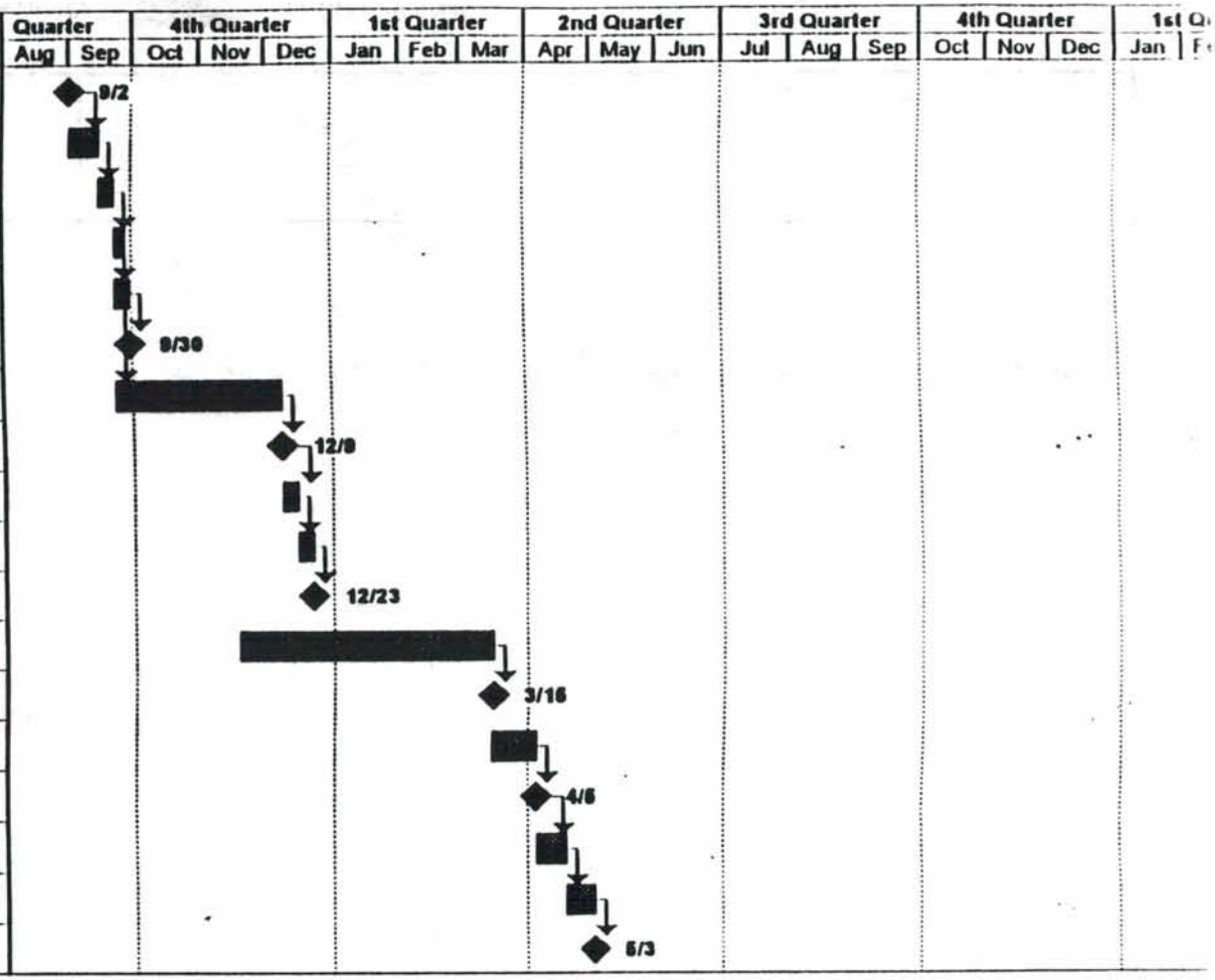
• *Atlantis II* out of service	Sept. '96
• *Alvin* Overhaul	Sept.'96 - Apr.'97
• *Atlantis* (AGOR-25)	
⇒Conversion Complete	April '97
⇒Arrive WHOI	5/6/97
⇒DSOG Demo/Trials	5/20/97 - 6/3/97
⇒Available for Science (contiguous to USA)	June - Dec. '97
⇒Available for Science (unlimited)	> Feb. '98

AGOR 25/ATLANTIS II/ALVIN Schedule



▲ - MILESTONES ▲ - TESTS & TRIALS/OPERATIONS ■ - YARD PERIODS

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



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

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

APPENDIX XVI

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

Mike,

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

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

APPENDIX XVII

TENTATIVE *

R/V ATLANTIS II & ALVIN OPERATIONS

1996

OPERATIONAL SCIENTIFIC SERVICES
WOODS HOLE OCEANOGRAPHIC INSTITUTION

07 DEC 95
~~29 SEP 95~~

JANUARY | **FEBRUARY** | **MARCH** | **APRIL** | **MAY** | **JUNE**

3 10 17 19 21 24 28 2 4 26 28 5 13 26 30 14

SAN DIEGO — 7 DOS — *SMITH* — 33N 118W

SAN DIEGO – STAND DOWN

3 DOS ENG. DIVES — SAN DIEGO — 3 DOS — *SMITH* — 33N 118W — SAN DIEGO

TRANSIT

MANZANILLO — 14 DOS — *CARY (5) van DOVER (4) CAVANAUGH (2) RAVIZZA (3)* — 10N, 13N 104W

PANAMA

TRANSIT

WOODS HOLE — 12 DOS — *MARTIN* — 40N 70W — WOODS HOLE

14 DOS — *GRASSLE* — 39N 72W — WOODS HOLE

JULY | **AUGUST** | **SEPTEMBER** | **OCTOBER** | **NOVEMBER** | **DECEMBER**

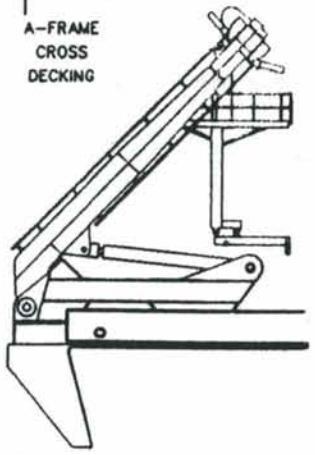
23

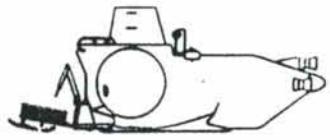
TRANSIT TO GULF PORT — TBA

A-FRAME CROSS DECKING

All DECOMMISIONED

ALVIN OVERHAUL (July–December)





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

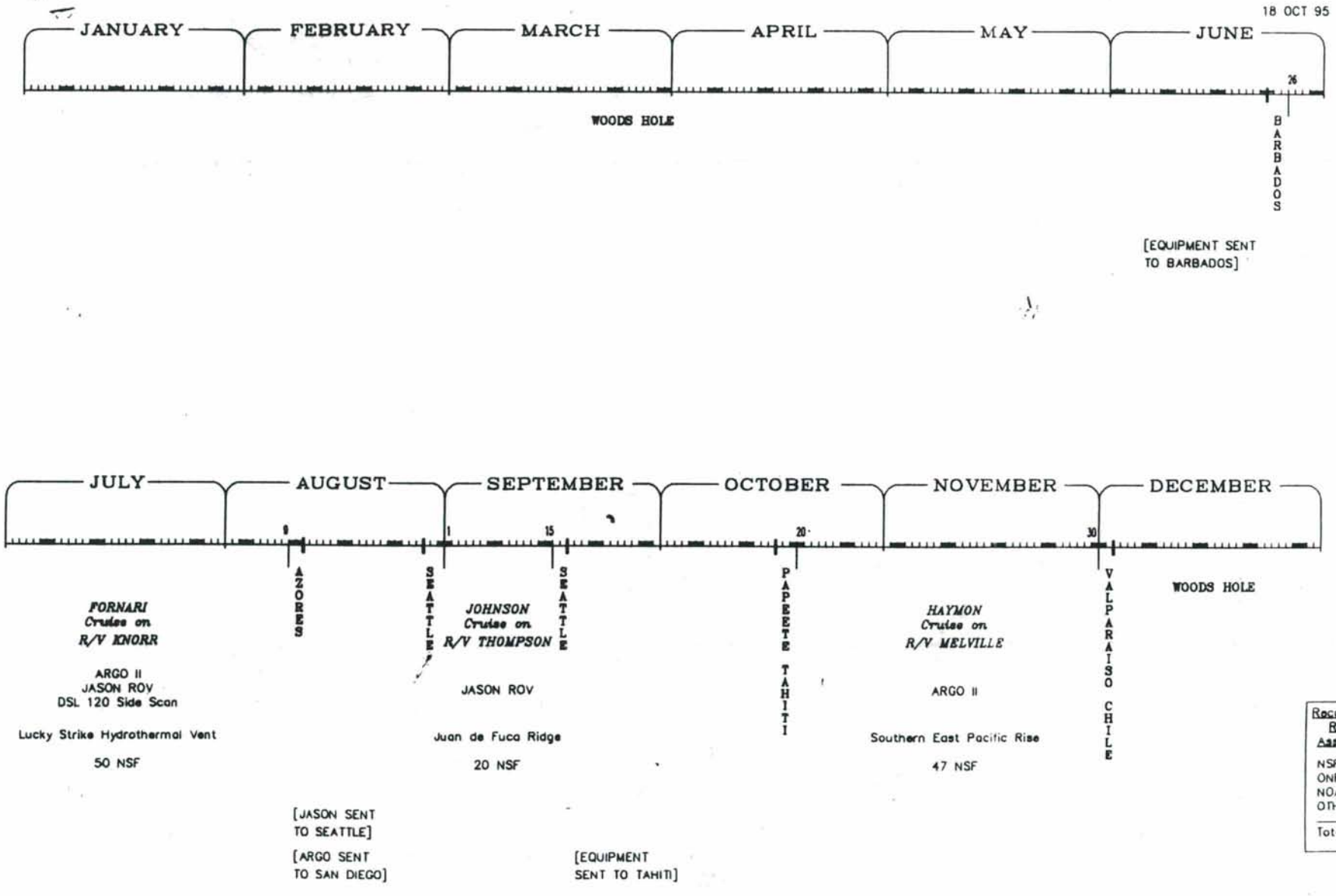
DOS = Dive Days On Station

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

ROV OPERATIONS

OPERATIONAL SCIENTIFIC SERVICES
WOODS HOLE OCEANOGRAPHIC INSTITUTION

1996



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

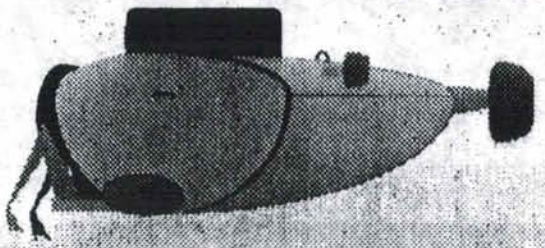
APPENDIX XVIII

1995 Science Operations

Advanced Tethered Vehicle (ATV)

DSV TURTLE

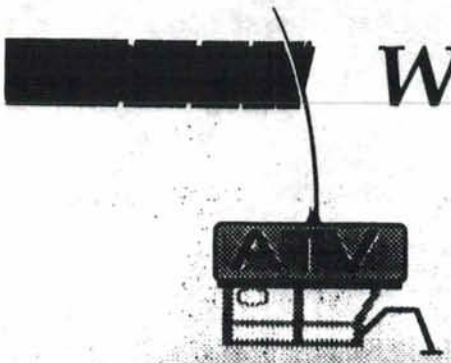
DSV SEA CLIFF

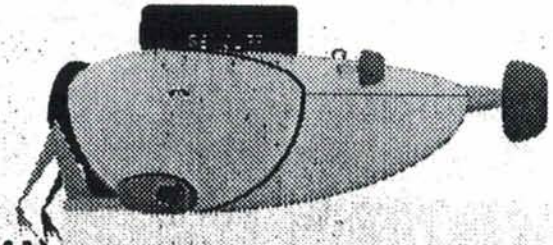


- 28 April to 14 May: Southern California
- 9 to 16 August: Southern California
- 23 August to 13 September: Juan de Fuca Ridge
- 15 to 26 September: Mendocino Ridge
- 1 to 11 October: Juan de Fuca Ridge
- 26 to 28 October: Southern California

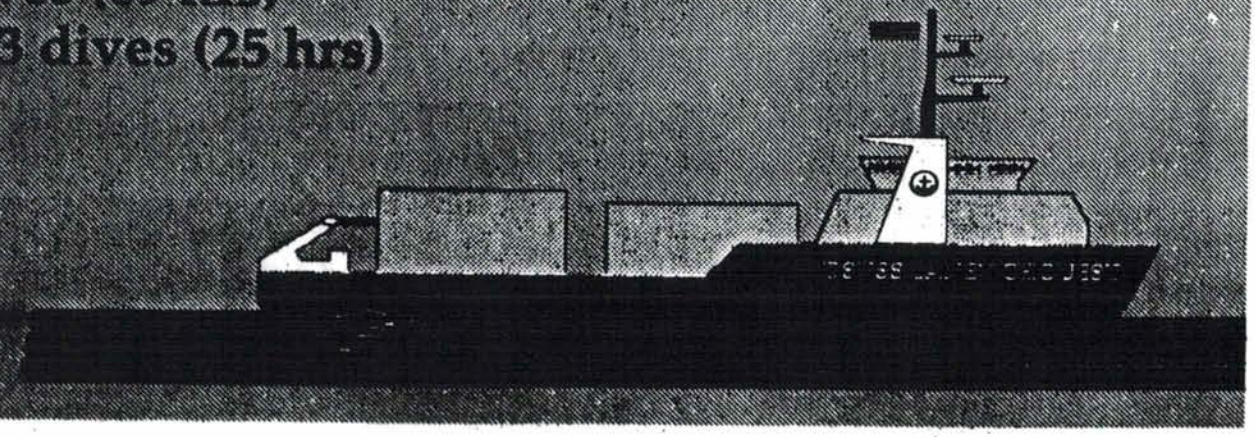
Whale-Fall Communities

Catalina Basin:
29 April - 8 May



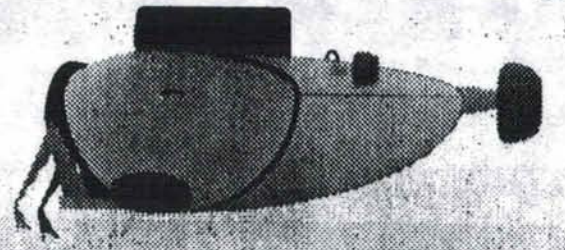


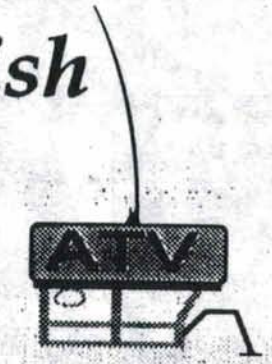
- **Dr Craig Smith (University of Hawaii)**
- **Investigated significance of whale-fall communities as dispersal stepping stones for sulfide-dependent species**
- **Recovered 36 vertebrate segments, 41 core and scoop samples, 62 hours of video recordings, 550 still frames**
  -ATV: 7 dives (69 hrs)
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



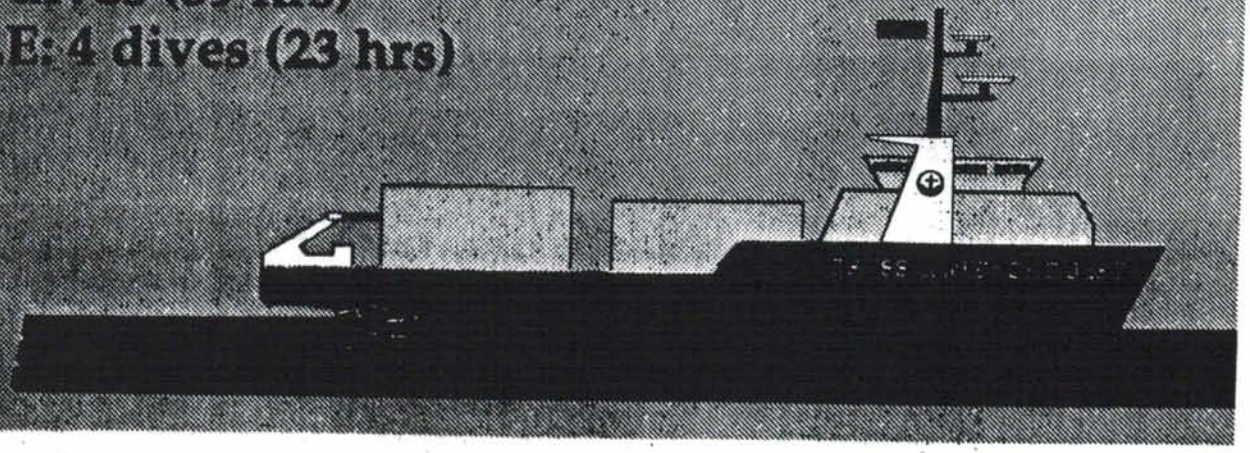
Deep-Sea Brittlestar Fish

San Diego Trough:
8 May - 14 May

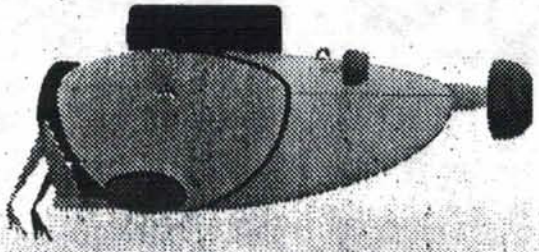




- Dr Gordon Hendler (Natural History Museum of Los Angeles
- Interpretation of brittlestar behavior pattern
- Recovered over 100 specimens, 65 hours of video, 950 still frames
  -ATV: 5 dives (59 hrs)
  -TURTLE: 4 dives (23 hrs)

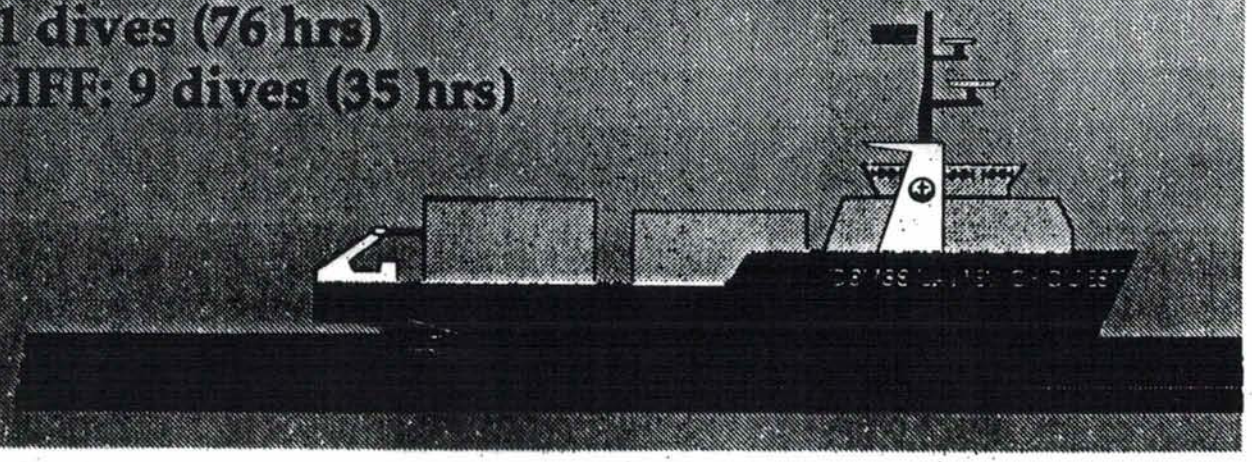


Submarine Canyon Studies

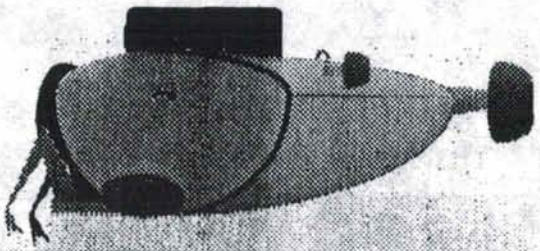


La Jolla Canyon:
9 - 16 Aug
26 - 28 Oct

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

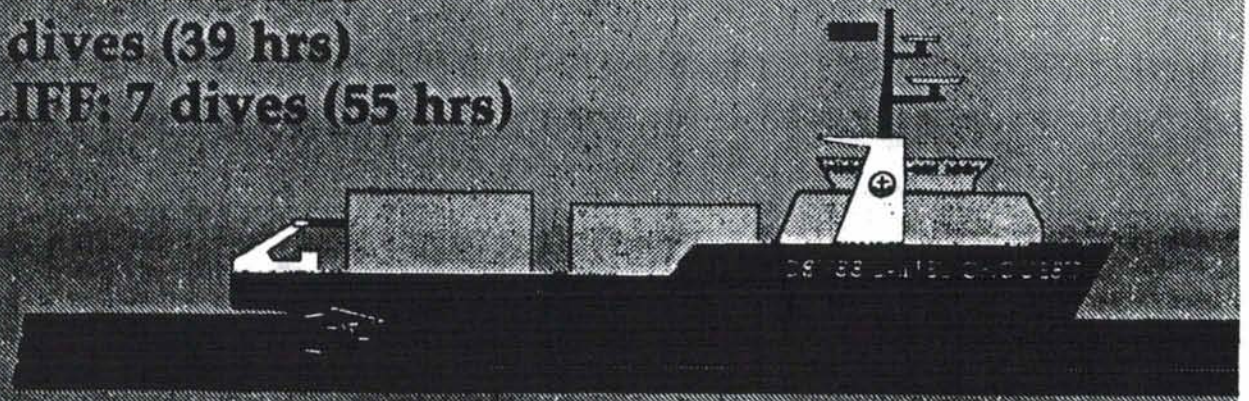


Hydrothermal Microhabitats



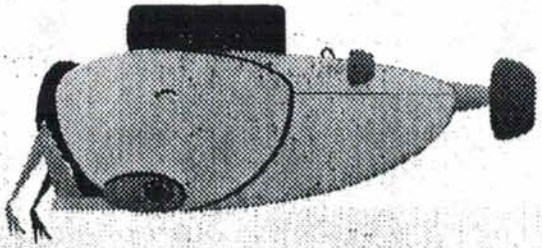
Juan de Fuca Ridge:
23 Aug - 13 Sep
1 Oct - 10 Oct

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

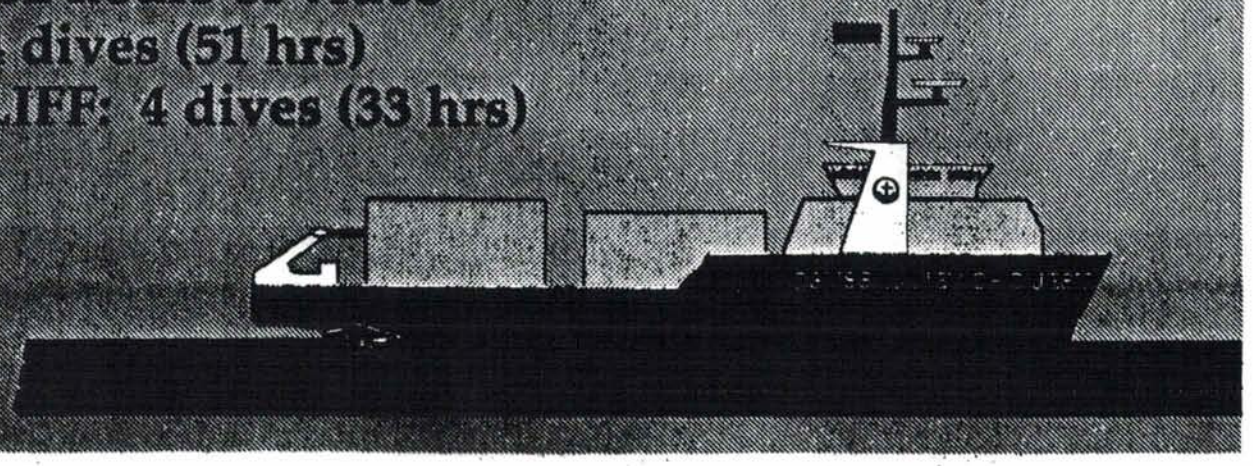


Mendocino Ridge Studies

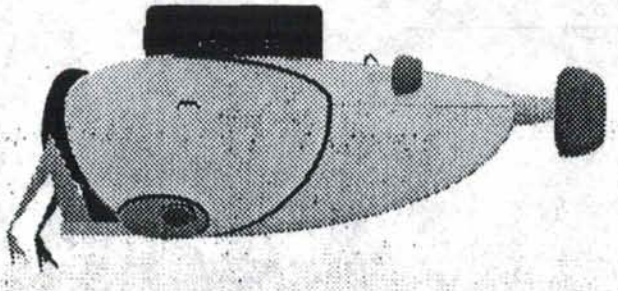
Mendocino Ridge:
14 Sep - 26 Sep



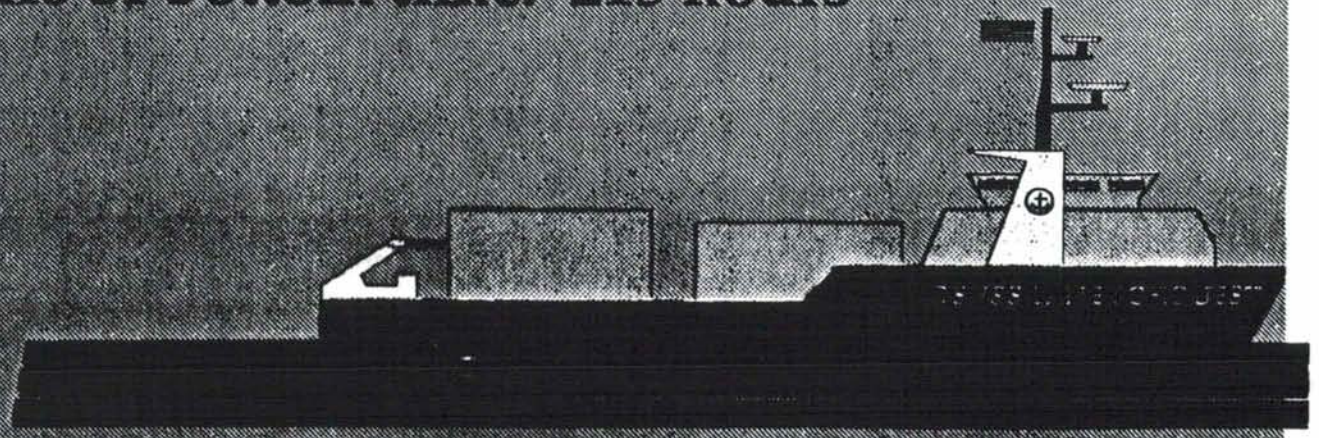
- **Dr Martin Fisk (Oregon State University)**
- **Ridge's Impact on the Surface Circulation of Pacific Ocean**
- **Conducted 120 hours of SEA BEAM, 92 rock samples, 22 biological samples, 1500 still frames, 52 hours of video**
  -ATV: 4 dives (51 hrs)
  -SEA CLIFF: 4 dives (33 hrs)



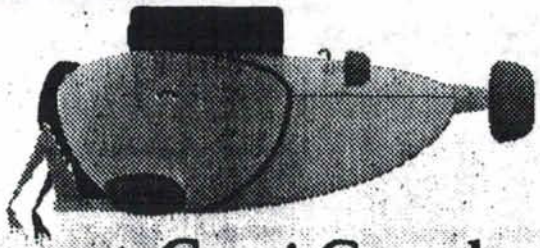
Summary of Operations



- Total days on station: 40 days (4 lost to weather)
- Depth of operations: 923 - 10,500 feet
- TURTLE dives: 7 dives/48 hours
- SEA CLIFF dives: 20 dives/123 hours
- ATV dives: 33 dives/294 hours (longest: 37hrs)
- Total hours of bottom time: 215 hours



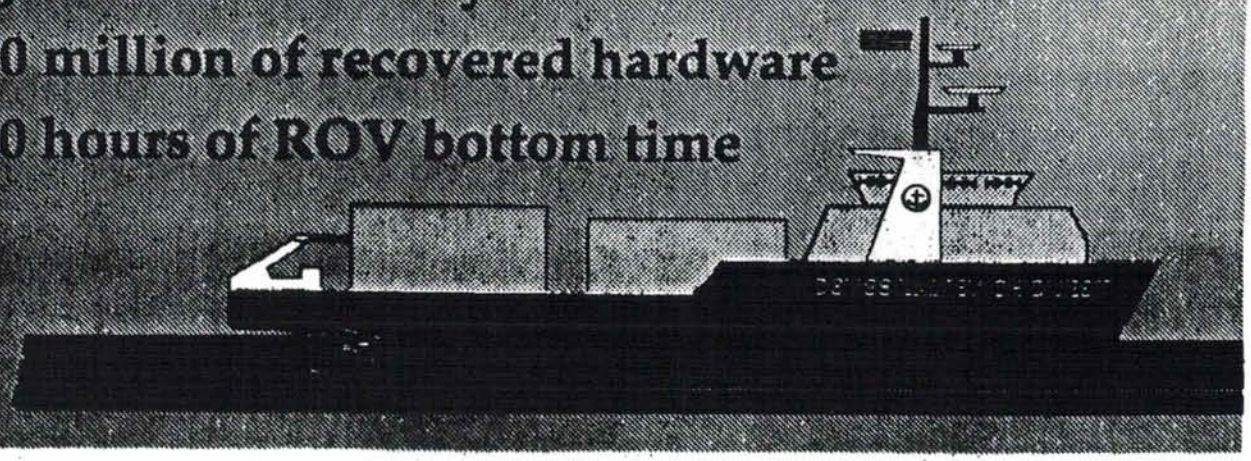
Recent Military Operations

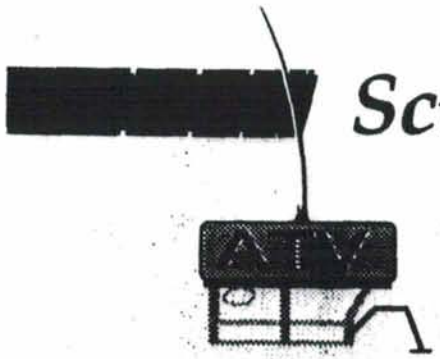


- Coast Guard mishap investigation
- Three high value R&D Recoveries
- F-14 and F-18 Air Mishap Boards
- SEAL Delivery Vehicle (SDV) Search in Hawaii
- Pacific Missile Range Operations in Hawaii
- Training Minefield Surveys

** Over $60 million of recovered hardware

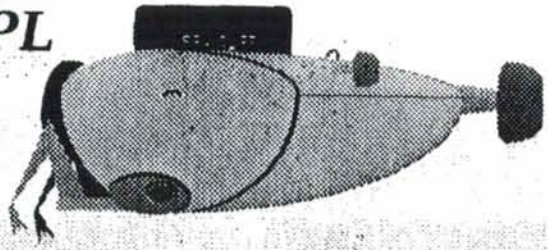
** Over 500 hours of ROV bottom time



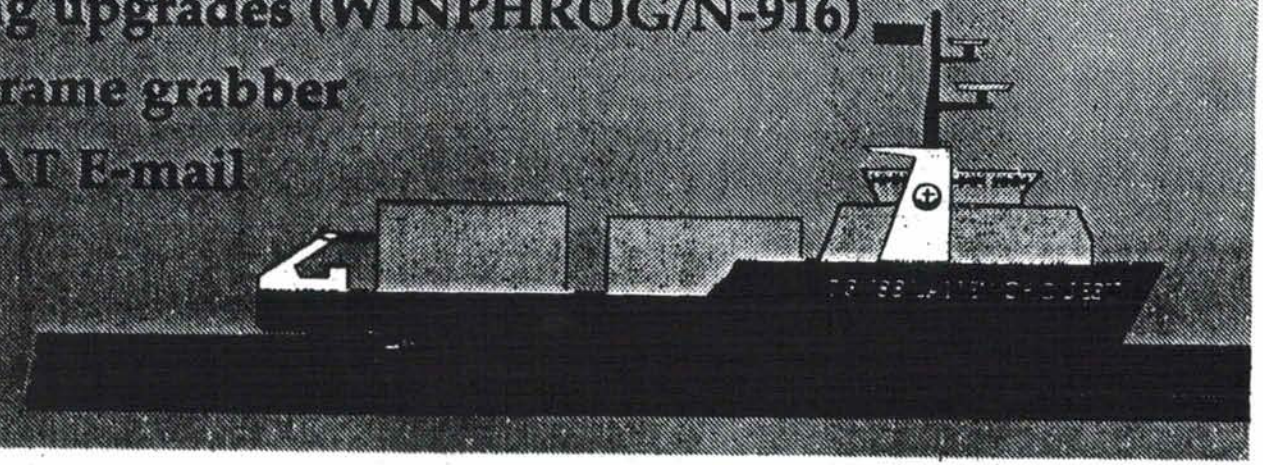


Science Related Initiatives

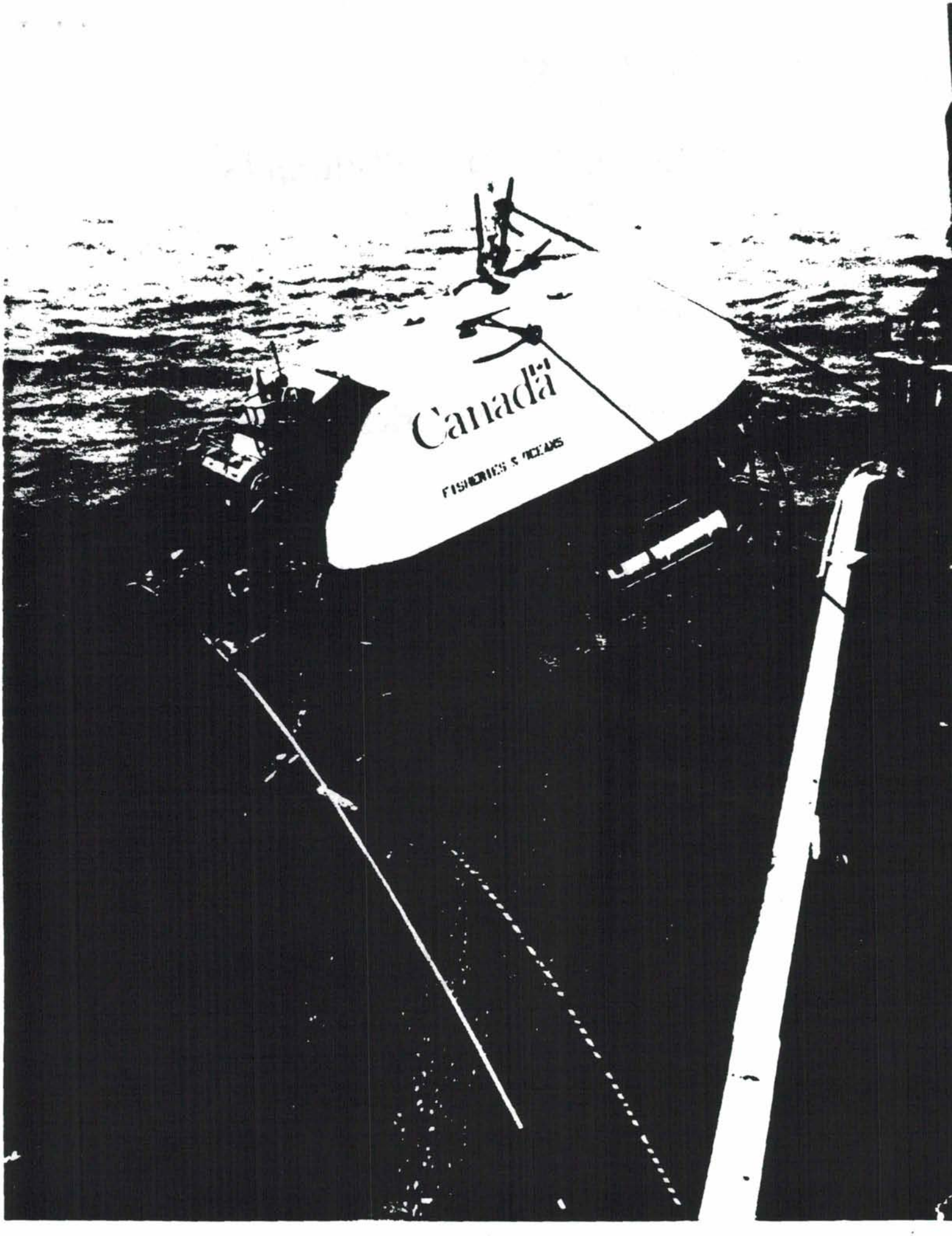
(including WHOI/MPL support)



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



APPENDIX XIX


Canada
FISHERIES & OCEANS

ROPOS

Remotely Operated Platform for Ocean Science

DFO

Department of Fisheries and Oceans Canada

CSSF

Canadian Scientific Submersible Facility

Newly incorporated not-for-profit company

President:	Steve Scott
Sec-Treas:	Kim Juniper
Director:	Larry Mayer

ROPOS System

- Fiber-optic tethered ROV
- 5000 m capability: 3000 m with present cable but 5200 m cable planned for 1996
- 2 manipulators, excellent dexterity
- variety of specialized sampling tools, e.g.:
  ...titanium water samplers
  ...temperature probe
  ...chemical scanner (NOAA/PMEL)
  ...suction sampler
  ...tube worm stainer
  ...sample tray
- EM experiments (Nigel Edwards)
- 2 video cameras: SIT for continuous logging and 3CCD color Betacam for detail
- 7 simultaneous RS232 connections

ROPOS System continued ...

- Deep water system with cage (>350 m):
  ...vehicle 2700 kg
  ...cage 4000 kg
  ...winch & 4000 m cable 24,500 kg
  ...6 pilot/engineers for 24 hr day

- Shallow water system without cage (<350 m):
  ...vehicle 1600 kg
  ...winch & 500 m cable 2200 kg
  ...3 pilot/engineers for 8 hr day

- Ship requirements
  ...A-frame: 14 t SWL, 6 m high x 3.7 m wide
  ...winch deck area 3 x 4 m
  ...cage deck area 4.5 x 5 m
  ...consoles floor area 2.5 x 3 m
  ...power for system: 460 VAC, 100 A, 60 Hz
  ...power for winch: 460 VAC, 200 A, 60 Hz

- Problems we are working on:
  ...heave compensation
  ...navigation (Oceano/MORS, Datasonics, EdgeTech)

ROPOS SYSTEM RATES

$CDN ($US)

STANDBY/TRANSIT/WEATHER RATES

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

PER DAY	$2740 ($2000)

OPERATIONAL RATES

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

3500 metre system with cage

PER DAY	$5480 ($4000)

350 metre liveboating system (no cage)

PER DAY	$2740 ($2000)

****INSURANCE EXTRA****

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

PERSONNEL

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

SHOP RATES

ENGINEERING SERVICES, PER PERSON, PER DAY

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

Standby rates are negotiable depending upon the term of the contract and the number of days involved. All travel expenses to be covered by the client. Any additional costs to be borne by the client.

Rates are subject to change without notice.

APPENDIX XX

ALVIN/ROV Letters of Interest - Summary 1995 - 1997

#	Source	Investigator	Area	Title	Sponsor	Date	Alternate	Dives	Platform/Remarks	Disc.
ATLANTIC:										
1.	new	D. Calder, ROM	Bermuda Pedestal 32 35'N, 64 55' W	Bathymetric zonation of hydroids, from shallow-waters to deep-sea, at Bermuda	Canada Sub 10/15/95	Jul-Aug 1996		2	ALVIN	Biol.
48.	new	J.F. Casey, U.Houston H. Dick, WHOI P. Rona	MAR 15 N, 45 W	FARA ALVIN 15N: Mantle-crust processes	NSF	1997		22	ALVIN	G&G
2.	new	A. Chave, WHOI C. Van Dover, U.Alask J. A. Tyson, AT&T	MAR TAG/Snakepit hydrothermal areas	ALISS: Ambient light Imaging and Spectral System	NSF FUNDED OCE 9407774	Jul-Aug 1997		4	ALVIN	Biol.
3.		Hollister		DSL 120 Survey of Russian Yankee Submarine	ONR				DSL 120	Survey
4.		S. Humphris, WHOI	MAR	ARGO II and DSL 120 surveys for linking morphology, petrology and geochemistry to understanding crustal construction at the MAR	NSF				ARGO II, DSL 120	G&G
5.		M. Kleinrock	MAR	Detailed investigation of development and evolution of abyssal hill morphology along the Mid-Atlantic Ridge	NSF				JASON/MEDEA, ARGO II	G&G
23 Alt	new	R. Lutz, Rutgers J. Delaney, UW S. Humphris, WHOI	TAG - MAR or 9-10 NEPR	Research and Educational Opportunities Associated with Production of an IMAX documentary on Deep-Sea Hydrothermal Vents	NSF Sub 11/95	Feb-Jun 1996		12	ALVIN	Biol
49.	new	P. Rona, Rutgers Kleinrock, Vanderbilt M.A. Tivey, WHOI	TAG 26N, 45 W	TAG Relict Hydrothermal Zones: Role in Evolution of the TAG field	NSF sub 2/15/96	1997		10	ALVIN	G&G
6.	831.	J.-C. Sempere, UW	MAR, 29 N	Fine-scale segmentation and structural variability within a slow-spreading segment	NSF RIDGE	1997		37	DSL-120 AGOR II	G&G
7.	831.	D. K. Smith, WHOI	25 35'N, 45 05'W, 24 50'N, 45 30' W 25 55 N, 45 05'W, 25 15 N, 45 25 W	Linking Morphology, Petrology and Geochemistry to understand crustal construction at the Mid-Atlantic Ridge	NSF RIDGE	Feb - Jul 1997		24	AMS 120 & ARGO II	G&G

ALVIN/ROV Letters of Interest - Summary 1995 - 1997

#	Source	Investigator	Area	Title	Sponsor	Date	Alternate	Dives	Platform/Remarks	Disc.
ROMANCHE TRENCH										
8.	831.	H. P. Johnson, UW	0 N, 17 W	A geophysical study of a vertical section of oceanic crust: *The* north wall of the Romanche Fracture Zone	NSF	early 96	late 96	20	ALVIN	G&G
MEDITERRANEAN										
9.	new	R.D. Ballard, Inst. for E D. Yoerger, WHOI D. Mindell, MIT	Straits of Sicily north of Skerki Bank	Exploration of the Straits of Sicily	ONR	Jun/Jul 1997		21	MEDEA-JASON	Other
JUAN DE FUCA										
10.	new	K. Becker, UM	JDF Ridge - ODP 48 n, 129 W	Instrumented borehole seals for 1996 ODP drilling on the Juan de Fuca Ridge.	NSF ODP Funded	1) Sum 97 2) Sum 98		1) 6 2) 6	1) JASON 2) ALVIN	G&G
11.	new	W. Chadwick, OSU	JDF Ridge, Cleft Segment	Acoustic Extensometer: A seafloor *Observatory* Experiment	NSF RIDGE sub 8/15/95	1) Sum 1996 2) Sum 1997 3) Sum 1998 4) Sum 1999 5) Sum 2000		1) 12 2) 4 3) 3 3) 3 3) 3	MEDEA-JASON (Could be added on to P. Johnson 1996 *Cruise*)	G&G
12.	831.	J.R. Delaney, UW	ROBE sites 44 N 130 W 44 N 129 W	Spatial Control for Temporal Variability Studies: 3-D Multiscalar Mapping of seafloor features and water column plumes within the RIDGE observatory (ROBE) sites.	NSF	jul 15-Aug 15 1997 1998	Jul 15-Sep 15 1997 1998	 33 27	JASON, DSL 120	G&G
13.		J. R. Delaney, UW	JDF	Active processes at ridge crest: establishing a baseline for recent and *future* diking-eruptive events on the Juan de Fuca Ridge	NSF				DSL 120	G&G
14.		D. Kadko, UM	North Cleft Seg	Monitor short term variability of diffuse flow from the North Cleft Segment of the Juan de Fuca Ridge	NSF				JASON-MEDEA	G&G
15.	new	J. Karsten, UH	Endeavor Seg. JDF 48 N, 129 W	Submersible and petrologic study of the recent magmatic history of the Endeavour Segment, Juan de Fuca Ridge: Establishing a time-series of ridge axis volcanism.	NSF Sub 2/15/96	Summer 1997		10	ALVIN	G&G

ALVIN/ROV Letters of Interest - Summary 1995 - 1997

#	Source	Investigator	Area	Title	Sponsor	Date	Alternate	Dives	Platform/Remarks	Disc.
16.	831.	M.D. Lilley, UW M. Mottl, UH et al.	1) JDF, 48 N Middle Valley 2) Escanaba Troug Gorda Ridge, 41 N	Temporal variations in sedimented-ridge hydrothermal systems at Middle Valley and Escanaba Trough: an ROV study	NSF - MGG proposal ODP	late spring early sum '96 and Summer 97		1996 1) 14 2) 7 1997 1) 14 2) 7	JASON	G&G
17.	831.	M.A. Tivey, WHOI	Juan de Fuca: 48N, 129W	Development of Flow Sensors for Active High and Low Temperature Seafloor Vents	NSF RIDGE	Jun-Sep 1997		5	ALVIN any active site would be acceptable if ALVIN	G&G
SOUTHERN CALIFORNIA/SAN DIEGO TROUGH/MONTEREY CANYON										
18.	new	J.E. Eckman, Skidaway D. Thistle, Fla State	San Diego Trough 32 51'N, 117 46'W	Evaluating Impacts of Predation by Large, Motile Epifauna on Macrofauna and Meiofauna in the Deep Sea: A Test of Cage Performance	NSF sub 8/15/95	1997	1998	12	ALVIN (two dive series, 6 dives each, separated by 4-8 months)	Biol
19.	new	C. R. Smith, U.H. D. DeMaster, NCSU	S. California 32d 12'N, 118d 30' W	Age dependent bioturbation of deep-sea sediments: tests at three bathyal sites.	NSF FUNDED OCE 9022116	Jul-Dec 1997	Jan - Mar 1998	4	ALVIN (MEDEA-JASON if ALVIN not available)	Biol
GUAYMAS BASIN										
20.	new	H. Jannasch, WHOI	Guaymas Basin Gulf of CA	Microbial Transformations at Deep-Sea Hydrothermal Vents	NSF 831-12/12/94	1) Dec 95 to Apr-96 2) Dec 96 to Apr-97		1) 10 2) 10	ALVIN or JASON ALVIN	Biol
NORTH EAST PACIFIC RISE										
21.	new	A. Chave, WHOI C. Van Dover, U.Alaska J. A. Tyson, AT&T	NEPR - 9N	ALISS: Ambient light Imaging and Spectral System	NSF FUNDED OCE 9407774	Jan-Feb 1998	Mar-Apr 1998	4	ALVIN	Biol.
22.	new	S.C. France, UNH	9-11 N, 104 W EPR	Spatial and Temporal Genetic Structure of Populations of Brooding Crustaceans at Hydrothermal Vents	NSF RIDGE Sub 8/15/95	Fall 96	Winter 97	1	ALVIN	Biol
23.	new	R. Lutz, Rutgers J. Delaney, UW S. Humphris, WHOI	9-10 NEPR or D168TAG - MAR	Research and Educational Opportunities Associated with Production of an IMAX documentary on Deep-Sea Hydrothermal Vents	NSF Sub 11/95	Feb-Jun 1996		12	ALVIN	Biol
24.	new	R. Lutz, Rutgers	9 50' N EPR	Temporal changes in biological community structure as Nascent Hydrothermal Vents on the EPR Crest	NSF sub 8/15/95	1) Oct 96 2) Oct 97 3) Oct 98	1) Fall 96 2) Fall 97 3) Fall 98	23 23 23	MEDEA-JASON	Biol

ALVIN/ROV Letters of Interest - Summary 1995 - 1997

#	Source	Investigator	Area	Title	Sponsor	Date	Alternate	Dives	Platform/Remarks	Disc.
25.	new	L. Mullineaux, WHOI C.H. Peterson, UNC C.R. Fisher, Penn S	9-10 N, EPR	Roles of biological and physical factors in colonization of hydrothermal vents (LARVE Project)	NSF sub 2/96	early 1997		8	ALVIN	Biol
26.	new	L. Mullineaux, WHOI D. Manahan, USCal C. Young, HBOI	9-10 N, EPR	Biological and physical constraints on larval ecology, metabolism and dispersal at hydrothermal vents (LARVE Project)	NSF Sub 2/96	1) late 1997 2) 1998 3) 1999		1) 10 2) 10 3) 10	ALVIN	Biol.
27.	831.	C.L. Van Dover, U.Alas H.Jannasch, WHOI J. R. Cann, U.Leeds	EPR - 9N 9 49'N	Recruitment of Chemoautotrophic Microorganisms and Hydrothermal Vent Invertebrates of Diffusional Sources of Sulfide at a Mid-Ocean Ridge	NSF	1) 10/15/97 2) 1/15/98	1)11/15/97 2) 2/15/98	14 5	ALVIN: Two dive series separated by 3 months	Biol
EQUATORIAL PACIFIC										
28.		H. Dick	Hess Deep	Crustal Structure and Neotechtonics at Hess Deep An ODP survey for science in support of drilling	NSF				ARGO II, DSL 120	
22.	new	S.C. France, UNH	Galapagos Rift 1 N, 86 W	Spatial and Temporal Genetic Structure of Populations of Brooding Crustaceans at Hydrothermal Vents	NSF RIDGE Sub 8/15/95	Fall 96	Fall 97	1	ALVIN	Biol
29.	on file	R.A. Stephen, WHOI S. Swift R. Detrick	Site 504 1 13.6' N, 83 43.8'	High resolution imaging of recent faulting in six million year old crust at DSDP Site 504: Implications for hydrothermal flow and stress regime	NSF ODP	fall 1996	winter 1996		DSL 120, ARGO	G&G
SOUTHERN EAST PACIFIC RISE:										
21 AL	new	A. Chave, WHOI C. Van Dover, U.Alaska J. A. Tyson, AT&T	SEPR - 17 S	ALISS: Ambient light Imaging and Spectral System	NSF FUNDED OCE 9407774	Jan-Feb 1998	Mar-Apr 1998	4	ALVIN - Alternate for 9 N EPR site	Biol.
30.	on file	J.M. Edmond, MIT	Southern EPR Easter Island and vicinity	Hydrothermal Studies on the Easter Microplate.	NSF 9312950	Austral Summer 1996/7		30	ALVIN	Chem
22.	new	S.C. France, UNH	17 - 20 S, 113 W S. EPR	Spatial and Temporal Genetic Structure of Populations of Brooding Crustaceans at Hydrothermal Vents	NSF RIDGE Sub 8/15/95	Fall 97	Winter 98	1	ALVIN	Biol
32.	831.	G. M. Kent, WHOI	17 25 S, 113 13 W	The GEMS Dive Program: A high resolution, geophysical investigation of upper crustal emplacement & evolution along the ultrafast spreading EPR at 17 25 S.	NSF RIDGE	Austral Summer 1997		20	ALVIN	G&G

ALVIN/ROV Letters of Interest - Summary 1995 - 1997

#	Source	Investigator	Area	Title	Sponsor	Date	Alternate	Dives	Platform/Remarks	Disc.
33.	new	R. Hey, UH E. Baker, PMEL, NOAA J. Lupton, PMEL	S. EPR between Easter & Juan Fernandez microplate 28-32 S, 112-113 W	Hydrothermal and structural investigations along the fastest spreading center: The 28-32 S EPR reorganizing plate boundary.	NSF sub 8/15/95	southern summer 1996/1997		29	120 KhZ side-looking Sonar	G&G
34.	831.	M.D. Lilley, UW K.L. Von Damm, UNH L.E. Lupton, NOAA	17 S, 113 W 21 30 S, 113 W	Gas and fluid chemistry of hydrothermal systems on a superfast spreading center: Southern East Pacific Rise	NSF RIDGE FUNDED	1997		27	ALVIN	Chem
35.	831.	J.H. Trefry, FIT J. Lupton R. W. Embley	NSF	Relative importance of low-temperature venting, plume scavenging and seafloor spreading rate on sources and sinks of trace metals in the ocean.	NSF	Austral summer 1997		10	ALVIN	Chem
36.	on file	J. Lupton, NOAA	S. EPR 13.5 -20 S, 112-11	Investigation of hydrothermal systems This is in collaboration with the Japanese Ridge Flux Project.	NOAA NURP	Austral Summer 1997-1998		25	ALVIN	G&G
37.	new	R. Lutz, Rutgers R. C. Vrijenhoek, Rutg	17 22 S EPR	Gene Flow, Dispersal, and Systematics of Deep-Sea Hydrothermal Vent Organisms	NSF FUNDED will submit renewal 2/96	1996, 1997, 1998		14	ALVIN (may be able to use JASON)	Biol
25.	new	L. Mullineaux, WHOI C.H. Peterson, UNC C.R. Fisher, Penn S	17-20 S, EPR	Roles of biological and physical factors in colonization of hydrothermal vents (LARVE Project)	NSF sub 2/96	1998		10	ALVIN	Biol
38.	new	L. Mullineaux, WHOI S. France, UNH	Sala y Gomez Ridg 22 S - East of Easter Is.	Genetic diversity and gend flow among populations of deep-seamount invertebrates	NSF	1998		8	ALVIN	Biol
39.	on file	D.F. Naar, USF	east of Easter Island 27 S 109.5 W	Detailed geochemical, geological, and geophysical sampling and mapping of critical areas of the Easter Seamount Chain defined by several swath mapping and dredging cruises.	NSF	Austral Summer 1996/97	Austral Summer 1997/98	28	ALVIN	G&G
40.	new	M. Perfit, UF D.J. Fornari, WHOI R. Batiza, UH R. Haymon, UCSB	17 - 20 S, EPR	Vent Site Mapping and Rock Coring Along and Across the Southern East Pacific Rise Crest 17 S to 20 S	NSF Sub 2/96	late 1997	early 1998	4	ALVIN - add on to Lilley/VonDamm	G&G
41.		Sinton	SEPR	Unmanned vehicle support of the volcanological investigation of the superfast spreading mid-ocean ridge using the DSL 120	NSF				DSL 120	G&G

ALVIN/ROV Letters of Interest - Summary 1995 - 1997

#	Source	Investigator	Area	Title	Sponsor	Date	Alternate	Dives	Platform/Remarks	Disc.
HAWAII										
42.	831.	A. Chave, WHOI R. Butler, IRIS	Hawaii 2 Observato 30 N, 140 W	Hawaii 2 Observatory - install a junction box and sensor on a submarine cable between Hawaii and California	NSF ARI FUNDED	Sep-98	Aug-98	10	JASON	EGR
43.		Smith	Hawaii Hot spot	High-resolution magneto-stratigraphic and U-series dating of giant submarine landslides and their correlation with explosive volcanism on the Hawaiian Hot Spot	NSF				ARGO II	G&G
WESTERN PACIFIC										
44.	new	M/R. Perfit, U. Fla K. Farley, Cal Tech B. McInnes, CSIRO D. Colodner, LDEO V. Tunnicliffe, U. Vic.	Solomon Is., Papua New Guinea S.W. Pacific	ALVIN Investigation of Hydrothermally Active Submarine Volcanoes in the New Ireland and Soloman Island Fore-arcs, S.W. Pacific	NSF (maybe ARC) Sub 1996	Fall 1998	Early 1999	20	ALVIN (possibly MEDEA-JASON & 120 KhZ Sonar)	G&G
45.	new	R.J. Stern	13 15'N, 144 30 E 16 N, 145 40 E	Submarine Volcanism in the Southern Seamount Province of the Mariana Arc	NSF sub 2/15/96	TBA 1998?		20	ALVIN	G&G
46.	new	R.J. Stern P. Cleft, WHOI	Mariana Trough 24 N, 141 E 22 n, 142E 22N, 143 E	Volcanic and Tectonic Activity in the Northern Mariana Trough - ODP Site Survey	NSF sub 2/15/96	TBA 1998?		20	ALVIN, ROV one site avoid Typhoon season	G&G
INDIAN OCEAN										
31.	831.	D. Fornari, WHOI	S EPR 24 S, 69.6 E	Detailed Biological, Chemical and Geological Investigation of Hydrothermal Vents on the Central Indian Ridge near 24 S Region	NSF 831 RIDGE	Jan-Mar 1998	Dec 98 to Mar-99	31	JASON, 120 kHz, ARGO I and ALVIN	G&G
SOUTHERN HIGH LATITUDE										
47.	831.	L.A. Lawver, I for Geo. I.W.D. Dalziel, UT R.P. Von Herzen, WHOI	63 S 62 W 61 S, 54 W	Collaborative Research: ALVIN diving in Bransfield Strait	NSF OPP	Jan-Feb 1997		25	ALVIN	G&G

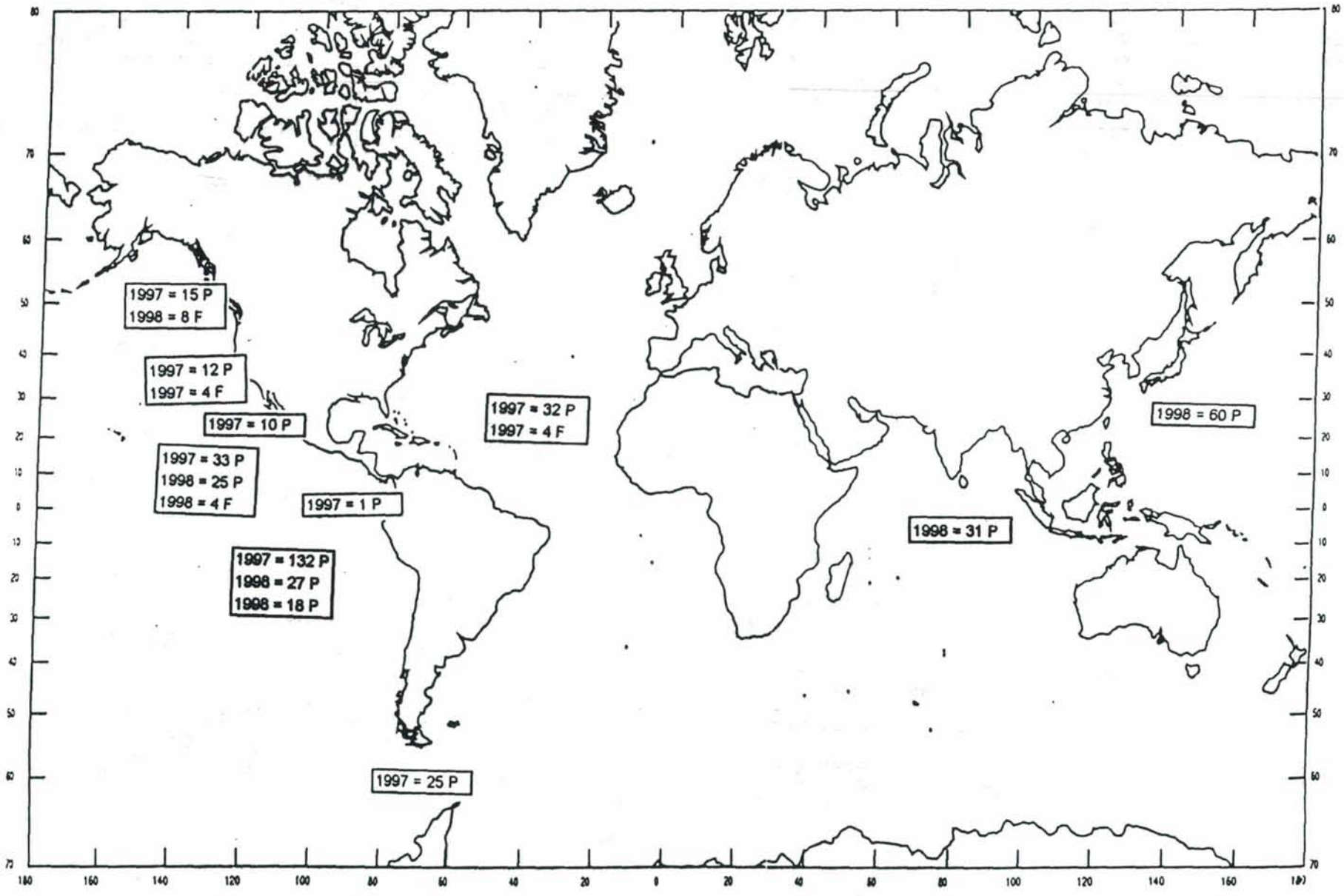
ALVIN Letters of Interest - Summary 1997 and Beyond

		1997 Prop.	1997 Funded	1998 + Prop.	1998 + Funded
ATLANTIC					
2	Chave/Van Dover/Tyson		4		
48	Casey/Dick/Rona	22			
49	Rona/Kleinrock/Tivey	10			
	Total	**32**	**4**	**0**	**0**
JUAN DE FUCA					
10	Becker				6
15	Karsten	10			
17	Tivey	5			
	Total	**15**	**0**	**0**	**6**
S. CAL/SAN DIEGO TROUGH					
18	Eckman/Thistle	12		0	
19	Smith/DeMaster		4		
	Total	**12**	**4**	**0**	**0**
GUAYMAS BASIN					
20	Jannasch	10			
	Total	**10**	**0**	**0**	**0**
NORTH EAST PACIFIC RISE					
21	Chave/VanDover/Tyson				4
22	France	1			
25	Mullineaux/Peterson/Fisher	8			
26	Mullineaux/Manahan/Young	10		20	
27	VanDover/Jannasch/Cann	14		5	
	Total	**33**	**0**	**25**	**4**
EQUATORIAL PACIFIC					
22	France	1			
	Total	**1**	**0**	**0**	**0**

		1997 Prop.	1997 Funded	1998 + Prop.	1998 + Funded
SOUTH EAST PACIFIC RISE					
30	Edmond	30			
22	France	1			
32	Kent	20			
34	Lilley/VonDamm		27		
35	Trefry	10			
36	Lupton	25			
37	Lutz/Vrijenhoek	14			
25	Mullineaux/Peterson/Fisher			10	
38	Mullineaux/France			8	
39	Naar	28			
40	Perfit	4			
	Total	**132**	**27**	**18**	**0**
WESTERN PACIFIC					
44	Perfit et al.			20	
45	Stern			20	
46	Stern, Cleft			20	
	Total	**0**	**0**	**60**	**0**
SOUTHERN HIGH LATITUDE					
47	Lawver/Dalziel/VonHerzon	25			
	Total	**25**	**0**	**0**	**0**
INDIAN OCEAN					
31	Fornari			31	
	Total	**0**	**0**	**31**	**0**

SUMMARY	1997 Prop.	1997 Funded	1998 + Prop.	1998 + Funded
	260	**35**	**134**	**10**

ALVIN AREAS OF INTEREST - 1997 AND BEYOND

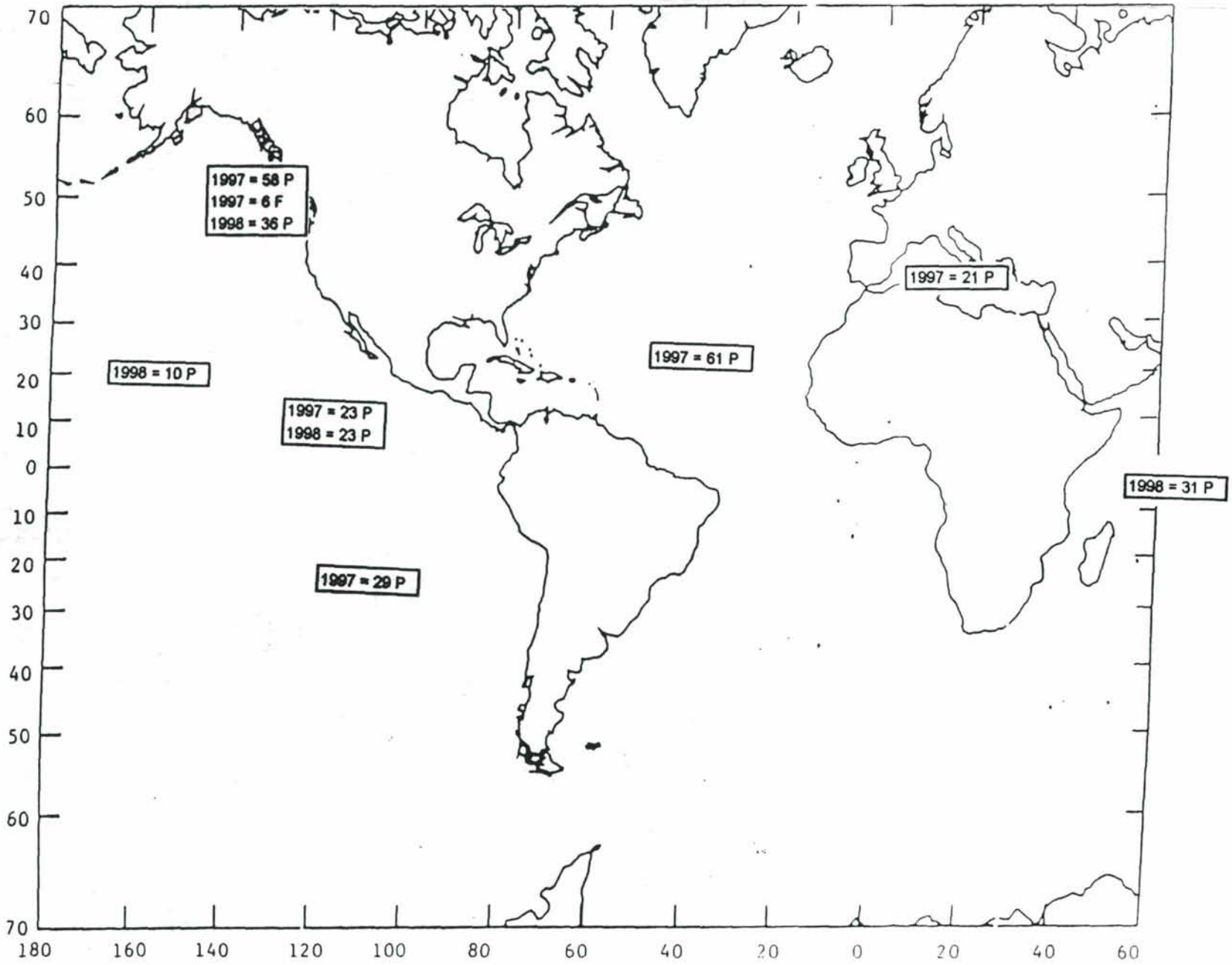


ROV Letters of Interest - Summary 1997 and Beyond

		1997 Prop.	1997 Funded	1998 + Prop.	1998 + Funded
ATLANTIC					
6	Sempere	37	0		
7	Smith	24			
	Total	**61**	**0**	**0**	**0**
MEDITERRANEAN					
9	Ballard/Yoerger/Mindell	21	0		
	Total	**21**	**0**	**0**	**0**
JUAN DE FUCA					
10	Becker		6		
11	Chadwick	4		9	
12	Delaney	33		27	
13	Lilley/Mottl	21			
	Total	**58**	**6**	**36**	**0**
NORTH EAST PACIFIC RISE					
24	Lutz	23		23	
	Total	**23**	**0**	**23**	**0**
SOUTH EAST PACIFIC RISE					
33	Hey/Baker/Lupton	29			
	Total	**29**	**0**	**0**	**0**
Hawaii					
42	Chave/Butler			10	
	Total	**0**	**0**	**10**	**0**
INDIAN OCEAN					
31	Fornari			31	
	Total	**0**	**0**	**31**	**0**

SUMMARY	1997 Prop.	1997 Funded	1998 + Prop.	1998 + Funded
	192	6	100	0

ROV AREAS OF INTEREST - 1997 AND BEYOND



APPENDIX XXI

A PRE-PROPOSAL

To the National Science Foundation

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

J. R. Delaney, School of Oceanography, University of Washington, Seattle, WA 98195-7940
R. A. Lutz, Inst. of Marine & Coastal Sciences, Rutgers University, New Brunswick, NJ 08903
S. E. Humphris, Woods Hole Oceanographic Institution, Woods Hole, MA O2543

Introduction

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

Philosophy

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

Issues of potential interest to the Deep Submergence Community

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

this pre-proposal is to explore parallel scientific and educational rationales for making ALVIN available during one or more of the at-sea filming sessions.

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

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

(3) A third opportunity to emerge from the program may be availability to the science community of a spectrum of unprecedented images. Much of the work will include techniques that involve high-definition video and other approaches to studying the seafloor. Kristof points out that, as in many such IMAX programs, a good deal of the initial imagery is not ultimately included in the final product. He and Low are offering access to these materials for a wide variety of research and educational purposes. With support from NSF, and advice from an NSF-appointed Advisory Committee, researchers and educators involved in the program could oversee a process by which a significant fraction of this "overflow" material (stereo imagery, HDV imagery, stills, etc.) is made available in a timely manner to potential users throughout the world. These issues may have to be explicitly negotiated based on the level of support provided by the scientific community.

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

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

Public Awareness of Deep Submergence Oceanographic Research

The U. S. Deep Submergence Community has rarely been as aggressive or as effective as the NASA community in capturing the public eye with the basic messages and the excitement of our research. Yet scientifically we have discovered earth systems and volcanic processes that easily rival and basically complement discoveries that NASA scientists and engineers have made in the solar system within the past two decades. This imbalance is in part because most of us are funded by specific grants from NSF. Rarely do we apply for (and, in general, NSF research sections do not provide) funds for public outreach related to our individual research programs. But the situation also exists because we the community have rarely gotten behind an opportunity to publicize the activities in which we are so deeply involved. The potential exists in this situation. The issue is how to optimize the benefit to our community.

The Proposal

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

Budgetary Issues

If ALVIN and NSF are indeed to be involved, it is necessary to proceed rapidly. Decisions must be made within a month as to whether the program should go forward. The estimated cost of the program overall is about $6 million. The industrial contacts involved have tendered $3 million. The primary costs borne by NSF would be in the facility support; twelve ALVIN dives would be required on site in order: 1) to allow a serious scientific program to be conducted, 2) to allow sufficient availability of the submarine for documentary efforts, and, 3) to insure quality navigational results. Additional costs would

include the expenses of the scientists involved - salary, lab and sampling costs, analyses, etc. Other costs would involve travel for all participants and the costs of selecting both a film crew and the students and teachers to be involved. Actual costs of the film crew may be born privately with sufficient lead time for planning. These "scientific/educational" expenses are likely to be close to $300,000 not including institutional overhead.

Immediate Steps

If this letter is favorably received, we will assemble details and specifics related to the issues and opportunities sketched herein and produce a formal proposal. It is our understanding that a significant amount of additional funding from sources other than NSF must be raised in the near-term to insure that the entire program comes to full term. Some of the fund-raising will have to be conducted by the scientific institutions represented in the program. We plan a meeting early in December involving all potential participants including both members of the Low/Kristof team, representatives of supporting agencies, selected members of the advisory committee, several educators, the principal investigators and additional scientists who may be involved. The goals of this early meeting would include at least the following items: definition of essential details of scheduling, participation of all scientists, all financial requirements and responsibilities, fund-raising timelines, materials and imagery ownership, responsibilities for the intellectual caliber of the product, and any royalty issues related to intellectual and/or artistic contributions. Following the meeting we will be able to submit a formal proposal to NSF by early January. With this pre-proposal we formally request that $25,000 be made available for advanced planning purposes. Planning will require coordination among all the parties mentioned above, and will involve significant travel for the P.I.'s and other scientists involved in the program. A present no salary money is requested.

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