UNIVERSITY - NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

UNOLS FLEET IMPROVEMENT COMMITTEE

MEETING REPORT

July 20-21, 1995

University of Alaska
Seward Marine Center
Seward, AK

Meeting Report
UNOLS
Fleet Improvement Committee

University of Alaska
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Opening Remarks from FIC Chair: The UNOLS Fleet Improvement Committee met in the Seward Marine Center at the University of Alaska in Seward, Alaska on 20 and 21 July 1995. The meeting was called to order by the Chair, Chris Mooers, at 8:30 am. A list of meeting participants is included as ***Appendix I.*** After introductions of the committee and participants, Chris reviewed the meeting agenda, ***Appendix II.*** A tour of the ALPHA HELIX and Seward Marine Facilities will be provided by Tom Smith during a lunch break on the second day.

1. Approval of Minutes - The minutes of the 12-13 January 1995 FIC meeting were approved as written. Jack Bash pointed out that UNOLS meeting minutes are now being posted to the World Wide Web (WWW) and to Gopher. The minutes from this meeting will be mailed to each committee member in addition to being available electronically.

2. Progress and Information Reports:

2.a. News from the UNOLS Council Meeting - Ken Johnson reported on the events of the previous UNOLS meeting held in April. The highlight of the meeting was Don Heinrich's presentation which portrayed a rather gloomy outlook for future years. The Fleet Improvement Plan predicts fleet operation costs in 1997 to grow to approximately $60M. ONR's funding is expected to remain level in the out years. Other agencies are experiencing reductions in their budgets. Additionally, NSF does not expect to see increases above their present funding levels. As a result, by 1997 it appears that there will not be adequate funding to support the UNOLS fleet. In an effort to help lower the operating costs of the fleet, Don Heinrichs presented NSF's "modest proposal." The proposal calls for the retirement of six ships and realignments of two others. Additionally, NSF and ONR are investigating the feasibility of making AGOR 25 the support ship for ALVIN as opposed to KNORR as originally planned. This could provide the deep submergence community with a support ship with a life of 30 years as opposed to 15 years.

Jack Bash gave a review of the UNOLS Ship Scheduling meeting held in June. In 1996, all of the large ships will be working their way home from the southern oceans. Most of the schedules are healthy, considering that some of the ship's could use downtime for maintenance deferred over the past year. Operations for the large ships are almost 100% supported by NSF.

With the exception of SEWARD JOHNSON, the intermediate ship schedules are all modest to poor for 1996. WECOMA has a light schedule. POINT SUR and NEW HORIZON both have modest schedules and each are requesting mid-life refits. GYRE's schedule is poor. EDWIN LINK's schedule will depend on funding of NURP work. CAPE HATTERAS' schedule is very light and may result in a lay-up for the year. CAPE HENLOPEN's schedule is healthy. ENDEAVOR and OCEANUS each have approximately a half year of operations.

ONR's ship use in 1996 is down. One reason may be that program managers are not encouraging ship use. Jim Andrews pointed out that recent events may begin to turn this trend around.

2.b. Approval by UNOLS Council of the FIC Three-year agenda - Chris Mooers reported that the Council approved FIC's three-year agenda. FIC will continue to march along to the guidance of this agenda, see ***Appendix III***.

2.c. Whither UNOLS?: Vision for UNOLS in an Era of Downsizing - Peter Betzer began this discussion by asking "What can FIC do to support the fleet?" In the years 1990 to 1997, 30% of the Fleet's ships will either be new or refit. There will be three new Class I ships and two refit Class I ships. This will be a very capable fleet. In 1968, ONR provided

approximately 38% of the fleet support. In 1995, ONR's support is less than 15%. During this same period, NSF provided approximately 50% support in 1968, growing to approximately 75% in 1995. Peter has been polling the agencies to obtain a feel for their level of future support. He and Jack Bash met with Admiral Stubblefield last week to determine NOAA's future contribution to the fleet. The future of NOAA is very unclear, and it was concluded that at present predictions cannot be made.

Peter continued by reporting that Dick Pittenger has been asked to contact both ONR and NRL to determine their future UNOLS ship needs and see if any increases in use might be possible. The USGS has provided the R/V WORTHY to the Army. The ship will operate in the Marshall Islands. USGS anticipates a 700-person RIF on 1 August. Next year, after things settle out, they expect to interact with UNOLS. Ship use will likely be approximately 35 days for either a Class III ship or EWING. USGS has the potential to become a steady UNOLS contributor. EPA's research vessel, ANDERSON, is aging and may go out of service soon. The UNOLS ships should be ready to accommodate any EPA field work.

Jim Andrews reported that changes are being made to encourage ship use within ONR. In 1996, the ONR science programs will be asked to contribute 20% for ship time with the ONR Research Facilities Program paying the remaining 80%. The science programs had been providing 45% of the ONR ship time costs. This reduction in contribution would be advertised to the ONR program managers. Additionally, ONR has added "DRI" programs. The top two DRI programs selected for funding must be field programs.

Jack Bash pointed out that a number of years ago UNOLS suggested developing a White Paper to address what is special and unique about UNOLS. Perhaps this should be revisited. A White Paper could help in attempts to increase support from other agencies. Dick Pittenger's MTS Journal Article, "The Academic Research Fleet," provides a good framework for such a White Paper (see ***Appendix IV***). It was also recommended to read Will Connelly's MTS Journal Article titled, "Commercial Ships Serving Science and Technology," see ***Appendix V***.

2. d.& e. Primer and Inventory of small R/Vs - Jack Bash reported on the status of the Primer and Inventory projects for small research vessels. Bob Dinsmore is working on the Primer which will compile science mission requirements for small R/Vs. It is expected to be complete in late fall. The inventory of small R/Vs is being compiled regionally and is posted on the WWW and Gopher. There are ten regions, with each region having a point of contact responsible for collecting the inventories for their respective region. To date, three of the ten regions are posted: the Gulf of Mexico, the Northwest and the Great Lakes. Hopefully by the end of August all regions will be posted.

FIC Nomination - FIC voted unanimously recommending to the UNOLS Council Larry Atkinson's appointment to FIC. Larry will be filling Don Wright's position on the Committee.

2.f. "Customer Satisfaction" Questionnaire - Jack Bash reported that over 300 questionnaires were sent to recent users of UNOLS ships, see ***Appendix VI***. 58 responded to

the survey. Each questionnaire was signed by the individual responding, so if additional information or clarification is needed the individual can be contacted. On the whole, comments were skewed to the "very satisfied" side of the scale. Crew support on UNOLS vessels received many complimentary comments. Most negative comments were in regard to the post cruise assessment process. It was noted that this area will need further attention. Chris requested that everyone look over the survey carefully and be prepared to discuss it tomorrow.

2.g. Safety Training/Orientation - Suzanne Strom reviewed her point paper titled, "Chief Scientists' Responsibility for Safety Orientation, etc." see ***Appendix VII***. She started by indicating that in preparing the paper she had received input from the ad-hoc committee members Jack Bash, Peter Betzer, Joe Coburn and Rich Findley. The paper first addresses responsibility and liability for safety at sea. Currently the captain and his/her institution have been held 100% responsible for safe vessel operations, including the safe conduct of scientific operations. Suzanne asks if it fair and proper to hold the captain completely liable for scientific operations. It is difficult for the captain to be on top of all safety issues and operations along with his/her regular duties. It was decided to discuss this issue later in the meeting.

The paper addresses whether safety problems are actual or potential. Information suggests that the UNOLS fleet is quite safe relative to other fleets. Joe Coburn indicated however, that accident rates are difficult if not impossible to calculate. Organizations know the number of accidents which occur, but they do not know the exposure rates. Shipyard rates are much higher than those of UNOLS. Suzanne listed some considerations which might help improve safety awareness: pre-cruise training and distribution of safety information, using diving operations as a model. It was pointed out that the safety inspections conducted by NSF are rather thorough.

Crew stability was addressed relative to safety. A major strength of the UNOLS fleet is the experience and dedication of the ships' crew. UNOLS, however, has no way of enforcing crew stability as a desirable feature. This topic will be returned to tomorrow.

2.h. Quantitative Analysis of Ten Years of R/V Use - Annette DeSilva reviewed the geographic distribution of the UNOLS fleet operations over the past ten years with projections for 1996 and 1997. The information was summarized using tables and charts, see ***Appendix VIII***. Before reviewing the summary, a number of conditions were pointed out:

1) Only Class I/II and Class III ship operations were examined.
2) For the years 1986 through 1993, statistics were generated using cruise reports.
3) For years 1994 through 1996, the latest ship schedules available to UNOLS were used.
4) 1997 statistics were generated using ship time request forms. A good deal of the ship time indicated may still be in a pending status.
5) Non-science days were not included in the statistics (transit cruises, ship ops, inspections, etc.)

The summaries were split into regions: North and South Atlantic, North and South Pacific, Indian Ocean, Great Lakes, Arctic and Antarctic. Large ship operations in both the Atlantic and Pacific show a dip in the years 1989 to 1992. This is most likely due to KNORR and MELVILLE being off line for their mid-life refits. Correspondingly we see a peak during these same years in intermediate ship use. Most likely this is due to these ships accommodating the work that would have normally been conducted off large ships. The North Atlantic shows a general decline in large ship operations over recent years. The Indian Ocean sees a peak in large ship operations during 1995 as a result of the WOCE and JGOFs operations currently being conducted. The Pacific will see increased operations in 1996 as the large ships return home from the southern oceans. Intermediate ship use in the Indian Ocean, Great Lakes, Arctic and Antarctic has been minimal over the years.

This same information was presented to the UNOLS Council in April. A few suggestions included: (1) evaluate using a smaller grid size, and (2) include Class IV in the statistics. Annette pointed out that it should be no problem including statistics for Class IV vessels. However, refining the grid size will present difficulties. Many of the cruise reports from the earlier years did not provide sufficient information to allow us to refine the grid size further.

FIC recommends modifications to the statistical presentation of the data included providing bar graphs for the following regions: East and West Pacific, East and West Atlantic, Alaska (NP2/5/6) and the Gulf of Mexico. Additionally, FIC suggested presenting the information on a world map, four maps total. Each map would have an overlay of the UNOLS grid. Three of the maps will provide an average over ten years of ship use for Class I/II, Class III, and Class IV (a separate map for each Class). The fourth map will provide a five-year average of ship use.

2.i. ARV Oversight - Tom Royer provided the status of activities relating to the ARV. GAO conducted and completed a study for NSF titled, "Need for Additional Icebreaking Research Vessel Not Demonstrated," see ***Appendix IX***. Additionally, the National Academy of Sciences (NAS) conducted a study and it is now under review. In support of the study, Ken Johnson was requested to provide UNOLS' position, regarding the ARV for the NAS study, see ***Appendix X***.

NSF has funded the University of Alaska for support of Glosten Associates continued work and efforts involving the NAS study. Additionally, Alaska Science and Technology has contributed $20K to continue ARV design work. The 1997 NSF budget process includes a line for Research Facilities. To compete for these funds, the proposed facility must be reviewed by a Blue Ribbon Panel. The NAS study will qualify as a Blue Ribbon Panel.

2.j. Organization of HEALY committee for USCG - Chris Mooers reported that he requested the Coast Guard to provide terms of references for the HEALY advisory committee. CDR Rooth of the Coast Guard responded by indicating that although they cannot support the travel expenses for such a committee, they see the need for a subcommittee of 15 members, see ***Appendix XI***. Chris has not responded to CDR Rooth's request. The discussion was tabled until later in the meeting.

2.k. Nuclear Submarine Meeting Report - Jack Bash reported that the nuclear submarine workshop report is not out yet. Lloyd Keigwin is having difficulty getting input from the other people involved. The objective of the workshop had been to explore the possibility and potential applications of using a nuclear submarine to conduct science. It was conceived that a Sturgeon Class submarine could be utilized. All weapon systems would be removed and the ship's mission would be dedicated to science. FIC indicated that the report should be published as soon as possible. Ken Johnson will call Lloyd to see if any assistance is needed.

2.l. Status of NSF Inspection Reports: Do they have enough teeth? - Jack Bash had contacted Dick West regarding the NSF inspections. Dick feels that the inspections are complete and very effective. Also, they require a quick response by the operator. It was concluded that additional action is not needed.

2.m. Goals and Objectives for Post Cruise Assessment Reports - Chris Mooers requested that this topic be addressed later in the meeting. We need to determine how we wish to use the assessments so that they can be modified to be effective. It was pointed out that Chief Scientists should have a means for obtaining feedback from the operator on assessments they submit.

2.n. Report on ALVIN Support Ship Conversion - Jim Andrews reported on the status of activities related to the ALVIN support ship conversion. In February, WHOI presented plans for the KNORR conversion to NSF, NOAA and ONR. The proposed cost was high and none of the agencies had budgeted for these expenses. The agencies decided to explore other options such as outfitting AGOR 25 for ALVIN handling. ONR requested a special study from NAVSEA to explore the feasibility of such an option. The study indicated that the option is feasible. Additionally, Halter Marine (the shipyard constructing AGOR 25) has expressed an interest in the project. Halter is being tasked to perform a special study to identify the cost and time schedule for implementing the ALVIN handling modifications on AGOR 25. They have been asked to complete the study by late September.

DESSC has endorsed the concept of modifying AGOR 25 for ALVIN handling. However, they have expressed concern of a potentially long down time in ALVIN operations while the ship is being outfitted. It was pointed out that the option of converting KNORR is not yet dead. A final decision of which ship to convert will be made after completion of the special study by Halter. Jim Andrews said that by considering AGOR 25 as the support ship for ALVIN, the agencies are expressing their long-term commitment to deep submergence science.

AGOR 24/25 Construction Schedule - Annette DeSilva reported on the construction schedule of REVELLE and ATLANTIS. REVELLE was launched in April of this year and delivery is scheduled for 8 June 1996. The ship is 69% complete. In 1996, limited science operations on REVELLE are planned. The ship construction funds will expire in August 1997. Launch of ATLANTIS is scheduled for 21 February 1996 with delivery planned for 15 April 1997. The

ship is 41% complete with all modules integrated. The construction and test schedule for each ship is included as ***Appendix XII***.

2.o. Van Study Report - The FIC was asked to review the van study report prepared by Suzanne Strom, see ***Appendix XIII***. The report will be revisited later in the meeting.

3. Agency Reports:

3.a. National Oceanographic and Atmospheric Administration (NOAA) - The NOAA report was presented by Captain Martin Mulhern. Present NOAA fleet modernization activities include several recently approved contracts, including conversion of a surplus Navy T-AGOS vessel at MCI, Bellingham, WA to support oceanographic programs, and repairs-to-extend the life (RTE) of the DELAWARE II, a fisheries vessel, by Detyens Shipyard, Charleston, SC. In addition, progress is on or ahead of schedule for construction of the "NOAA AGOR", named the NOAA Ship RESEARCHER, with launch expected in June 1996.

The Federal Oceanographic Fleet Coordination Council has been revitalized, with participating federal agencies expressing strong interest in this organization. Rear Admiral Stubblefield of NOAA is presently Chair of the Council.

NOAA is downsizing, and employees of the Office of NOAA Corps Operations have been notified of Reduction in Force affecting about 30 employees at headquarters and the Marine Centers. This is in addition to reductions in the number of Wage Marine and NOAA Commissioned Corps personnel.

A brief overview of the FRAM plan was presented. The initial NOAA plan was dated March 1991. In November 1993, the plan was submitted to Congress. There have been a number of other studies affecting the plan, including the Department of Commerce (DOC) Ocean and Atmosphere Management Advisory Committee (OAMAC) report, the National Academy of Engineering Marine Board study, DOC Office of Inspector General reviews, and the Vice President's Reinventing Government program. A common theme has been for NOAA to consider other sources, and the reviews and other applicable law require cost comparisons of the alternatives. A revised FRAM plan is being prepared that updates the program requirements, reduces overall plan cost, and addresses academic and private sector partnerships. The revised plan is still administratively restricted while being reviewed at higher levels in the Administration.

The NOAA Ships FAIRWEATHER, DAVIDSON, and OCEANOGRAPHER are presently inactive, and the process for disposition is being explored. Several of these ships are inactive due to programmatic decisions and not because of physical condition or age of the vessels. Three more ships, the SURVEYOR, MT MITCHELL and HECK, will become inactive at the end of this fiscal year.

Among a number of bright spots is the condition of the NOAA Ship MALCOLM BALDRIGE, which is in the Indian Ocean along with a number of the academic vessels. A nagging

problem with shaft alignment was cured several years ago, recently new evaporators and new ship service generators were installed, and her performance and overall condition are excellent.

NOAA use of the academic research vessel fleet this year includes GLOBEC program support by the R/V SEWARD JOHNSON in the vicinity of Georges Bank, and Marine Mammals program support provided by the R/V PELICAN.

3.b. Office of Naval Research (ONR) - Jim Andrews gave the report for ONR. In July, the CNO held an Executive Board Meeting (CEB). The last CEB meeting on Naval Oceanography was ten years ago. That CEB led to the development of large computer facilities for ocean modeling at Stennis, MS and Monterey, CA. It also led to the purchasing of the large Navy research ships.

The principle outcome of this CEB is the determination that Naval oceanography is vital to the Navy and critical to national security. Many of the CEB findings and recommendations will be presented at the next Ocean Studies Board meeting. As a result of the CEB, attempts to protect the ocean sciences budget for 1996 is a high priority. The goal will be to obtain new funding as opposed to dipping into other programs.

Jim reported that he has presented a ten-year study of ONR ship use to Fred Saalfeld. The use has been rather cyclic over the years. ONR will attempt to turn this around. One method to be implemented is reducing the amount of ship time support to be paid by the science programs. The Research Facilities Program in turn will make up the difference. ONR plans to continue subsidizing NRL ship time at approximately $0.5M per year. NRL is encouraging programs funded by 6.2 money to use UNOLS ships.

3.c. Oceanographer of the Navy - Pat Dennis gave the report for the Oceanographer. They are still holding to their plan to reduce from 12 ships to eight ships. All of their old ships are being replaced. Two ships are being delivered this year. PATHFINDER, a TAGS 60 Class ship, has been delivered and has experienced transformer problems. This is a class problem and possible fixes are being explored.

The Oceanographer of the Navy's program has become stronger and eight ships may not be sufficient to meet all of their needs. This may result in future opportunities for use of UNOLS ships, provided funding can be obtained.

3.d. United States Coast Guard (USCG) - A representative from the Coast Guard could not be present due to budgetary restraints. However, Captain Alan Summy sent FIC the latest information on the HEALY project, see ***Appendix XIV***.

3.e. Commander, Naval Metrological and Oceanography Command (CNMOC) - Captain Dieter Rudolph, CO/NAVOCEANO reported on their data collection requirements and their ship use. Presently, they receive $60 million dollars for operating their ships. Of this, 15% goes to MSC. He indicated that CNMOC was interested in exploring the possibility of using

UNOLS ships for NAVOCEANO data collection when these ships are in areas of interest to the Navy. His interest is encouraging and could potentially result in adding to the overall Navy contribution to the UNOLS Fleet. He distributed a matrix indicating their data collection requirements along with their operating locations, see ***Appendix XV***.

4. Role of Regional Consortia-White Paper - Before the meeting Chris Mooers distributed for review a draft White Paper on the Role of Regional Consortia, see ***Appendix XVI.*** Chris started the discussion by first reading a letter he sent to NSF which asked that the FIC review all major overhauls and mid-life refits of UNOLS ships and that these reviews would be made with a view toward regional or consortium interests, see ***Appendix XVII***. Letters were also sent to Larry Atkinson and Otis Brown in regard to their respective consortia efforts, see ***Appendix XVIII.*** Chris further reported that the RSMAS/TAMU and UT (Austin) consortium agreement for SECOR had been re-visited and the three institutions were discussing ways to make it work. Doug Biggs provided an outline of the TAMU-UM Joint Marine Operations Program, see ***Appendix XIX.*** Considerable discussion followed. Several committee members were hesitant to set guidelines for consortia believing that they are formed for the self-interest of the institutions and are viable so long as the issues are relevant. To try to impose consortia was thought to be counter-productive. It was suggested that UNOLS should (1) encourage consortia where they fit, and (2) review proposals when appropriate. After more discussion later in the meeting it was decided that Chris should contact the existing consortia and solicit from them those elements that work and those that don't. After review of this additional information, the Committee felt it would be able to respond to the White Paper.

5. UNOLS R/Vs as Continuous Data Collection Platforms for GOOS, etc - Chris Mooers opened the discussion by reminding the committee that technology now allows the collection of data on a real-time basis and efficient communication permits this data to be transmitted where it can be put to use. Chris then introduced Chris Noe of NOAA's National Ocean Service.

5.a. NOS representative - Chris Noe presented several view graphs, ***Appendix XX.*** The first view graph depicted the Shipboard Environmental Data Acquisition System (SEAS) program. Chris explained how this program is maturing with automatic data collection on NOAA, UNOLS and commercial ships. Meteorological data, XBT data, and sea surface temperature are all being collected and transmitted via Inmarsat Standard "C". The system is integrated with the Automatic Mutual-assistance Vessel Rescue System (AMVER). The program is into its fourth revision which includes increased quality control, modified equipment design, and AMVER. NOS is involved in a joint venture with COMSAT and the USCG.

To be able to accommodate SEAS IV, a ship must have Standard "C" on the bridge, connection to a PC and permission from the ship management. Presently five UNOLS ships are participating in the program. These are MOANA WAVE, WECOMA, THOMPSON, GYRE and CALANUS. ENDEAVOR is starting up. The program would welcome other UNOLS vessels that qualify. Ship position reports can be made available to the ship's institution through SEAS. RVTEC was tasked to further investigate implementation. Rich Findley invited Chris to the next UNOLS RVTEC meeting.

5.b. CNMOC Representative - Capt. Rudolph provided his report as part of the agency reports. Chris indicated that UNOLS is interested in 1) NAVO's data processing, 2) whether or not there is a role for UNOLS, 3) deploying drifter's, etc. from NAVO vessels, 4) receiving synoptic ocean information products from NAVO and FNMOC.

Rich Findley introduced a discussion on NET-CDF. RVTEC recommended Net-CDF as UNOLS Data Information Format (UDIF), but has had little backing from other UNOLS Committees. FIC moved to support the availability of UDIF on UNOLS ships. It was recommended that a letter be sent to NSF encouraging them to move in this direction.

6. Status of FIC/CZRV Plan Development - Chris Mooers lead the discussion on the FIC Coastal Zone Research Vessel Plans.

6.a.) CZRV Science Mission Requirements - Don Wright has passed the task of drafting science mission requirements to Larry Atkinson. Larry will take this action item for the next meeting. Chris advised that the summary of responses from the federal agencies on coastal science will be passed to Larry to provide input for the regional SMRs. The possibility of using Class I and II ships should be considered too.

6.b.) Regional SMRs - Chris explained that we should start with one region then build the SMRs for the various regions.

6.c.) Synopsis of Williamsburg, VA meeting - No synopsis of the Williamsburg meeting was given. (NOTE: Chris Mooers will prepare and circulate it.)

6.d.) MARCO/Duke Proposals - Larry Atkinson explained that a proposal has been submitted to NSF requesting funds to evaluate the need and the conceptual design for a coastal research vessel for the Mid-Atlantic Region. The proposal calls for a meeting of scientists and ship operators from the region along with a naval architect. Several FIC members will be included. The workshop, if funded, would be conducted this fall with the results out by the end of the year.

Joe Ustach summarized a letter requesting funds from NSF for a feasibility study that will evaluate the possibility of a 20 to 24 foot stretch for CAPE HATTERAS. Berthing would be increased form 20 to 24 berths. Considerable discussion followed concerning both of these proposals. The potential admeasurement problem for the CAPE HATTERAS stretch was a major concern. With the new admeasurement rules, there is a probability that the ship will measure over 500 gross tons which would require the ship to fall under the USCG inspection rules. If this were the case, the stretch would not be feasible. The committee concluded that they should recommend that the feasibility study go forward and that the admeasurement aspect be dealt with first. This would provide a go/no-go decision point. If the admeasurement is not a problem, the study could be helpful, MARCO as a possible alternative to their needs.

Because the two studies are linked the committee felt the studies could be compatible and should both be funded. The committee had no illusions about the availability of new money for new construction but suggested to Larry that the MARCO effort should evaluate existing platforms

that could satisfy their needs. It was also suggested that potential funding sources should be investigated to determine if "new" money could be used for this project.

Chris Mooers and the UNOLS Office were tasked to write a letter to NSF recommending that both of these proposals be funded and that the Duke/UNC feasibility first investigate the admeasurement problem before proceeding further. FIC wishes to review the results of both proposal efforts.

6.e.) Regional inventory of Assets and Capabilities - No action taken.

6.f.) Regional science plans and requirements - No action taken.

6.g.) Analysis of assets/capabilities vs plans/recommendations - No action taken.

7. Report on Agency Plans for Coastal Ocean Research - Chris briefly reviewed the responses he received from USGS, NRL, NSF, NOAA, MMS and DOE. Responses are included as ***Appendix XXI.*** Much uncertainty exists in the science planning because of funding considerations. Chris did get an indication that Class I/II ships should be considered for coastal work. Jim Andrews said that he will prepare a response from ONR in August. ONR has been in some flux, but things are becoming clearer since the CEB.

8. POA for FIC/CZRV Plan Development - No action taken, other than to conduct a series of regional workshops following the MARCO workshop. A FIC subcommittee will be formed to follow-up.

9. Presentation by Seward Association for Advancement of Marine Science (SAMS) - The University of Alaska's Seward Association for Advancement of Marine Science provided a tour of their excellent facilities. In addition, the Committee had the pleasure of visiting ALPHA HELIX. These excursions added to the excellent venue provided at Seward.

10. Long Range Science Plan POA - Action on this item was postponed until the winter meeting.

A number of discussions which began on the first day of the meeting were revisited during Day 2:

Van Study - Suzanne reviewed the study conducted on the vans, see ***Appendix XIII.*** Suzanne received information from RVTEC, RVOC, Jack Bash, Peter Betzer, Ken Robertson (NERC) and Tony Robertson (Thomas International) in compiling the study. The paper provides an overview of van design considerations for those desiring to develop vans for their own use. It addresses size constraints, access, heating and cooling, and power. Suzanne will collect additional information and comments and incorporate them into the paper.

Safety Training/Orientation - Suzanne Strom indicated that additional information is being forwarded to her regarding safety issues. She will incorporate these comments. The question

was asked "What is FIC's role making safety awareness more effective?" It was suggested that letters should be sent to the principle investigators addressing safety responsibilities.

"Customer Satisfaction" Questionnaire - It was suggested that letters indicating the outcome of the survey should be sent to those ship users who responded to the questionnaire. Also it was suggested to include the results in the UNOLS newsletter. Follow-up to items receiving lower ratings would be addressed prior to the UNOLS Council meeting.

Organization of HEALY Committee for USCG - Chris Mooers will draft a response to CDR Rooth's letter indicating that the final decision of whether or not UNOLS can support a HEALY Committee rests with the UNOLS Council, which is considering formation of a standing Polar Research Vessel (PRV) committee.

Goals and Objectives for Post Cruise Assessment Reports - Chris Mooers provided draft goals and objectives for post-cruise assessment reports, see ***Appendix XXII.*** Many times, PIs are hesitant to submit negative comments. The word needs to get out that these comments can help to correct problems. It was suggested that operators need to respond to any less than satisfactory reports. RVTEC and RVOC will be tasked to examine the assessments and review the goals and objectives. Ken Johnson offered to help design a new form.

Whither UNOLS? - Peter Betzer will examine various scenarios for support of fleet operations into the out years:

1) Doom and gloom scenario - NSF is level funded, other agencies continue level to downward funding trends.
2) Middle of the road scenario - NSF receives moderate funding increases. Some new funding is introduced from other agencies.
3) Optimistic outlook - NSF's support continues to grow. Other agency support grows consistently.

It was noted that dialogues between ONR, NRL and NAVOCEANO should continue, since these organizations may hold the greatest potential for increased use of the UNOLS fleet.

11. FIC Membership - The term of Tom Royer expires and both Ken Johnson and Don Wright are resigning as members. Ken, as UNOLS Chair, can not serve on the committee as a regular member but is an ex-officio member. Don Wright has been assigned as Acting Director, Virginia Institute for Marine Science necessitating his resignation. Larry Atkinson has been named as a replacement for Don. He will need confirmation at the UNOLS Council meeting in September. Several scientists were suggested for the two remaining positions. Because both Tom and Ken are from the Pacific area, it was suggested that their replacements also come from this area. Chris Mooers will present candidates for approval of the Council at the September Council meeting.

12. Other - Captain Rudolph invited the committee to hold its winter meeting at the Stennis Center in Mississippi. This would permit a tour of the Navy center and is also near Halter Marine at Moss Point, MS, the construction site of the new AGORs, REVELLE and ATLANTIS. It was decided that this location would also be an opportunity for the UNOLS Council to see

NAVOCEANO. If it can be arranged, the plan is to have the meeting in mid-January with the FIC meeting Monday and Tuesday, Wednesday being a tour day and would include the UNOLS Council. Then, the Council would meet on Thursday and Friday. The UNOLS Office will coordinate this plan.

Tasking - The following Committee tasking was assigned:

Chris Mooers (with UNOLS Office assistance):

- Letter to NSF recommending approval of the MARCO and Duke/UNC proposals.
- Letter to survey respondents thanking them for participation and explaining that a follow-up will be forthcoming.
- Letter to RVOC and RVTEC requesting revised assessment forms.
- Letter to existing consortia requesting the pros and cons, limitations and advantages of a consortium.
- Letter to RVTEC on the need to work toward data standards, copy to NSF.
- Present new FIC member candidates to the UNOLS Council.

Larry Atkinson:

- Draft of coastal RV science mission requirements.

Peter Betzer:

- Continue work on "Whither UNOLS".

Joe Coburn:

- Keep RVOC informed of FIC activities.

Bob Detrick:

- Will follow the Navy dual use data collection where there is a good fit.
- Investigate continuous operations of multi-beam systems.

Rich Findley:

- Work on data standards with RVTEC.
- Keep RVTEC informed of FIC activities.
- Communicate with NOS/GOOS on data collection from UNOLS vessels.

Eric Firing:

- Will work with RVTEC on data standards.

Tom Royer:

- Off going member

Suzanne Strom:

- Complete the Van Study.
- Complete the Safety Study.

UNOLS Office:

- Incorporate additional charts/maps for UNOLS geographic operations summary.
- Follow up on UNOLS White Paper being drafted by Paul Ljunggren, Jack Bash and Mike Prince.

- Provide support for FIC members on their action items.
- Provide FIC with Master's thesis paper on UNOLS.
- Coordinate with NAVO for winter FIC & UNOLS meetings.

Ken Johnson:

- Contact Lloyd Keigwin regarding the Nuclear Sub report.

The meeting was adjourned at 1630 hrs. 21 July 1995.

APPENDIX I

NAME	INSTITUTION/ORGANIZATION	PHONE/FAX/E-MAIL
Jim Andrews	ONR	(703) 696-8699/(703) 696-2007/andrewj@onrhq.onr.navy.mil
Larry Atkinson	ODU	(804) 683-4926/(804) 683-5550/atkinson@ccpo.odu.edu
Jack Bash	UNOLS	(401) 792-6825/(401) 792-6486/unols@gsosun1.gso.uri.edu
Peter Betzer	U of So Florida	(813) 553-3940/(813) 893-9189/prb@marine.usf.edu
Doug Biggs	TAMU	(409) 845-3423/(409) 845-6331/biggs@triton.tamu.edu
Joe Coburn	WHOI	(508) 289-2624/(508) 540-8675/jcoburn@whoi.edu
Patrick Dennis	JOI/USN Support	(202) 653-1295/(202) 653-1435/dennisp@onrhq.onr.navy.mil
Annette DeSilva	UNOLS/ONR	(401) 792-6825/(401) 792-6486/desilva@gsosun1.gso.uri.edu
Bob Detrick	WHOI	(508) 289-3325/(508) 457-2150/rdetrick@whoi.edu
Rich Findley	U of Miami/RSMAS	(305) 361-4175/(305) 361-4174/rfindley@rsmas.miami.edu
Eric Firing	U of Hawaii	(808) 956-7894/(808) 956-4104/efiring@soest.hawaii.edu
Ken Johnson	MLML	(408) 755-8657/(408) 755-2826/johnson@mlml/calstate.edu
Chris Mooers	U of Miami/RSMAS	(305) 361-4825/(305) 361-4701/cmooers@rsmas.miami.edu
Martin Mulhern	NOAA	(301) 413-0106/(301) 413-0413/mmulhern@banyan.doc.gov
Chris Noe	NOAA/NOS	(301) 713-2790/(301) 713-4499/cnoe@nos.noaa.gov
Tom Royer	U of Alaska	(907) 474-7835/(907) 474-7204/royer@ims.alaska.edu
Dieter Rudolph	Naval OCE Office	(601) 688-4203/(601) 688-5287/dcr@navo.navy.mil
Suzanne Strom	Western Washington U	(360) 293-2188/(360) 293-1083/stroms@henson.cc.wwu.edu
Joe Ustach	Duke	(919) 504-7579/(919) 504-7651/joeu@duncoc.ml.duke.edu

APPENDIX II

Agenda

UNOLS FLEET IMPROVEMENT COMMITTEE

20-21 July 1995
University of Alaska
Seward Marine Center

Thursday AM

1. Accept FIC Meeting Minutes of January '95

2. Progress and Information Reports
   a) News from UNOLS Council Meeting (Ken Johnson and Chris Mooers)
   b) Approval by UNOLS Council of FIC Three-year agenda (Chris Mooers)
   c) Whither UNOLS?: Vision for UNOLS in an era of downsizing (Pete Betzer)
   d) Primer on small R/Vs (Jack Bash)
   e) Inventory of small R/Vs (Jack Bash)
   f) "Customer Satisfaction" questionnaire (Jack Bash and Chris Mooers)
   g) Safety training/orientation (Susan Strom)
   h) Quantitative analysis of 10 year R/V use (Annette DeSilva)
   i) ARV oversight (Tom Royer)
   j) Organization of HEALY committee for USCG (Chris Mooers)
   k) Nuclear Submarine Meeting report (Jack Bash)
   l) Status of NSF Inspection Reports: Do they have enough teeth? (Jack Bash)
   m) Goals and objectives for Post-cruise Assessment reports (Chris Mooers)
   n) Report on ALVIN support ship conversion (Annette DeSilva)
   o) Van study report (Suzanne Strom)

Thursday PM

3. Agency Reports
   a) Status of NOAA Fleet (Capt. Martin Mulhern)
   b) ONR (Jim Andrews)

4. Role of Regional Consortia-White Paper (Chris Mooers)

5. Status of FIC/CZRV Plan Development (Chris Mooers)
   a) CZRV SMR (Larry Atkinson)
   b) Regional SMRs
   c) Synopsis of Williamsburg, VA meeting
   d) MARCO/Duke Proposals (Atkinson/Ustach)
   e) Regional inventory of assets and capabilities
   f) Regional science plans and requirements
   g) Analysis of assets/capabilities vs plans/requirements

6. Report on Agency Plans for Coastal Ocean Research (Chris Mooers)
   a) ONR
   b) USGS
   c) NRL
   d) NSF
   e) NOAA
   f) MMS
   g) DOE

Friday AM

7. POA for FIC/CZRV Plan Development (Chris Mooers)

8. UNOLS R/Vs as Continuous Data Collection Platforms for GOOS, etc. (Chris Mooers)
   a) NOS rep (Chris Noe)
   b) CNMOC rep (Capt. D. Rudolph)

9. Presentation by Seward Association for Advancement of Marine Science (SAMS)

10. Long range science plan POA
    a) Post-FOFCC activity
    b) Large vessels
    c) Intermediate vessels
    d) Small vessels

Friday PM

11. FIC Membership
    a) Tom Royer - member since 10/89 (term expires 10/95)
    b) Ken Johnson - member since 10/89 (retiring)
    c) Don Wright - member since 10/90 (term expires 10/96); he has resigned due to his recent assignment as Acting Director, VIMS

12. Other
    a) Discussion of issues and tasks
    b) Task assignments

APPENDIX III

FIC AGENDA FOR NEXT THREE YEARS - The remainder of the meeting was spent in considerable discussion on the action items that the FIC would be addressing in the next three years. The letters with recommendations for FIC from Don Heinrichs, Ken Johnson, Joe Coburn and Marty Mulhern were all reviewed. It was decided to divide the agenda items into three priority categories immediate: mid-range and long term. An outline of these agenda items follows:

A. IMMEDIATE

1. Coastal Zone Research Vessel (CZRV) activity.
    a. Scientific Mission Requirements
    b. Primer on Small Research Vessels
    c. Inventory of Small Research Vessels
    d. Analysis: Assets, Capabilities, and Requirements
        (1) Synthesis of Williamsburg Workshop Report
        (2) Regional SMRs (types A, B, and C)
        (3) Regional Inventory of Assets and Capabilities
        (4) Regional Science Plans and Requirements
        (5) Analysis of Assets/Capabilities Versus Plans/Requirements

    (ACTION: Completed - 1996)
2. Quantitative Analysis of Recent (3 to 10 year) R/V use by Ocean Region
3. Customer Satisfaction Survey Questionnaire

    (ACTION: Chris Mooers to revise, circulate to FIC for comment, and present to FIC Council at April meeting; aim for results by July FIC meeting.)
4. Chief scientists' responsibility for safety orientation, etc.

    (ACTION: Ad hoc subcommittee of Suzanne Strom, Chair, Peter Betzer, Joe Coburn, and Rich Findley to develop a point paper by July FIC meeting.)

B. MID-RANGE

1. Evaluation of NSF Inspection (ABSTECH) process. Does it need more teeth?

    (ACTION: Jack Bash discuss with Dick West and invite him to meet with FIC.)
2. Arctic Research Vessel oversight activity
3. Development of a long range science plan (especially for Class I/II vessels) in coordination with post-SFOFC activity.
4. Nuclear Submarine report and follow-up action

    (ACTION: Chris Mooers to call Garry Brass regarding moving forward.)
5. Use of UNOLS vessels as continuous data collection platforms (IMET/ ADCP/MULTIBEAM/etc.)

    (ACTION: Chris Mooers to contact Mel Briscoe, OES/NOS.)

C. LONG TERM

1. Specialized Facility Oversight (FLIP/AUV/etc)
2. Involvement in mid-life reviews for NEW HORIZON, CAPE HATTERAS, POINT SUR
3. Fleet Improvement Plan update by summer 1997
4. FIC oversight on new vessel acquisition (MARCO CZRV/ RSMAS Catamaran/SOEST SWATH plus University of Hawaii and University of Miami.)

   (ACTION: Ken Johnson to write letters.)
5. Joint effort with DESSC on ALVIN replacement.

The meeting was adjourned at 1530 hrs.

APPENDIX IV

COMMENTARY

The Academic Research Fleet

Richard F. Pittenger, RADM, USN (ret.)
Marine Operations
Woods Hole Oceanographic Institution
Woods Hole, Massachusetts

ABSTRACT

The United States Academic Research Fleet is a jewel in the crown of U.S. science. Operated by and for the country's oceanographers, this small fleet of research vessels is efficient and responsive to the ever-changing needs and increasingly global interests of science. Nourished by benevolently engaged federal and state agencies, the academic fleet provides quality afloat facilities for our extensive coastal waters (including the Great Lakes) as well as the "blue" waters of all the world's oceans.

INTRODUCTION

The United States academic research fleet is a unique jewel. No other country comes even close to matching this fleet in either size, condition, diversity, or capability. Most other research vessels are government owned and operated. The University-National Oceanographic Laboratory System (UNOLS) fleet reflects the nation; it is a loosely organized amalgam of private, state, and federally owned vessels that compete entrepreneurially in an extremely collegial fashion to provide services to its constituents, the ocean scientists.

THE ACADEMIC RESEARCH FLEET TODAY

Dedicated academic ships are a relatively new phenomenon. There were no dedicated ships until the early 1930s and the military provided most of the research vessels through World War II and into the 1950s. However, today the fleet has grown in numbers and in quality, and enjoys remarkable safety and performance records.

The configuration of the fleet is driven by science needs. A product of continuing evolution, the UNOLS fleet now comprises twenty-seven ships operated by nineteen separate institutions. Scientists participate actively in every phase of the fleet operations from sitting in on committees that draft ship design specifications, to design and procurement of scientific tools for ship board use to ship scheduling, inspection, and safety standards.

The user community is involved and sets the standards. This user to operator to funding agency connection is extremely important and effective. By having the ships operated by oceanographic institutions, quality of service provided is assured. The users are able to directly oversee ship operations. This modality also results in distributing the fleet throughout the community with enormous advantages (and a few disadvantages). The following details point out several of the advantages of a distributed fleet.

- Direct contact with the scientists and technicians who use the ship with constant feedback on performance and ideas for improvements.
- The feeling of ownership and pride of performance that comes from being members of the oceanographic community.
- Cost management: Because ship operating costs and science funding come from the same pot, the ocean science community as a whole shares mutual goals in keeping costs within reasonable bounds. Federal agency representations play an appropriately strong role in this process.
- Constituency: The ships become magnets for state, regional, and federal programs. Operating institutions become advocates for facility funding.
- Research and education are enhanced at the local level. Quality ships attract quality people into oceanography.
- Smaller vessels, because of their short range, need to be distributed on a regional or institutional basis—it would be impractical any other way.
- Composition of the academic fleet offers significant opportunities for cost sharing from non-federal and non-governmental sources. This cost sharing typically amounts to $1-2 million dollars annually.
- Additionally, the local presence and availability of vessels invites and enables marine scientific instrumental testing and development.

The downsides occuring from this distributed fleet are emphasized by the following points.

- Cost: There are some minor inefficiencies of distributing the fleet mostly stemming from the requirement for duplications of shore-side infrastructure.
- Unevenness of quality: More often, however, these are differences in standardization. The overall quality remains high.

- Parochialism: In-fighting over who gets the assets can have a negative effect on cohesiveness and common purpose, however, competition can be healthy and invigorating as well.

In the "old days," the fleet was small and operated as a "home" fleet by and for a few large institutions, but this model had many flaws, principally being unfair to the "have not" institutions that wanted to participate in the growing field of oceanography. The home fleet model tended to be driven to a certain extent by ship (expedition schedules) rather than by science needs. And the reality of ship operations is that they are expensive; community use is an economic necessity. The formation of UNOLS in the early 70s overcame many of the home fleet model problems, namely:

- Community-wide scheduling is more efficient and equitable;
- Standards set by the community through UNOLS enhance fleet effectiveness and afloat safety;
- Spreading the wealth improved the overall effectiveness and responsiveness of the academic fleet; and
- UNOLS provides a powerful voice for the community.

However, the challenges ahead are many and large for UNOLS for the following reasons:

- Managing growth to match both science needs and funds;
- Anticipating and advocating new facilities to support new science needs; and
- Keeping the precious spirit of collegiality in balance with the inevitable pressures of competition.

SUMMARY

The UNOLS fleet continues to be a unique and essential part of the national system. Further development should strengthen the already close relationship between the ships and the science they support.

APPENDIX V

Commercial Ships Serving Science and Technology

PAPER

Will Connelly
Oceanographic Center
Nova Southeastern University
Ft. Lauderdale, Florida

ABSTRACT

Perhaps 100 privately-owned vessels that fly the U.S. flag and range in overall length from ~10 to ~80 meters (m), work at least part of the time as platforms for marine research and technical operations. These ships are the U.S. commercial research "fleet." The fleet has two parts—the first comprises generally newer, mission-focused, and equipped ships that collect seismic data, and a second group that consists of various hull forms, including fishing vessels, offshore supply boats, and ex-military craft, which are used for the full gamut of marine technical projects involving pure and applied science, research, and development. The first group serves the offshore energy resource industry, while the latter has provided ship support to a wide variety of commercial, academic, and governmental interests, with the federal government, until recently, being the most important client. The seismic data collection market has been stabilized by oil company decisions to stop owning ships, and to charter competitively, while the federal market for commercial ships has shrunk with declining budgets and more pressure to do work in-house. This shrinking market has not been fully sustained by commercial and local government work, and there is evidence that the fleet size is declining.

INTRODUCTION

The commercial, U.S. flag ships that are used to perform offshore technical work, some in connection with pure science programs and projects, are strikingly different from the research vessels owned by government agencies and academic institutions. Where public research ships are typically designed and built to committee-drawn specifications and requirements (such as the AGOR class vessels the U.S. Navy built and utilized, along with several universities, since the end of WWII), the privately-owned research ships are, with rare exceptions, conversions or adaptations of vessels built for other purposes.

The differences in public and private platforms arise from several reasons. Commercial ships are not generally tasked to support pure research involving simultaneous activity in several scientific disciplines. Because customers can choose from an inventory of ships, appropriate matches between functional requirements and ship size and characteristics are more readily made. Additionally, the impetus of competition motivates operators to own ships that are adaptable, and thus more fully, employed.

However, privately owned and operated research and technical ships have successfully performed the same kinds and classes of work done by the public sector ships, often more efficiently and at lower cost.

IN THE BEGINNING . . .

Historically, the first flotilla of privately owned ships converted for technical work at sea was launched in 1959 by scientist-entrepreneur Stanford T. Crapo, who founded Marine Acoustical Services (later Tracor Marine) in Miami, Florida. By 1970, the company had converted three war surplus 41 m (136 feet) wooden-hulled YMS class minesweepers, a 20 m (65 feet) Army "T" boat, two 26 m (85 feet) U.S. Coast Guard cutters, a 56 m (185 feet) Army mine planter, three offshore supply boats, a 53 m (175 feet) ship originally built for seismic work, and a 26 m (85 feet) hydrographic survey boat surplused by the U.S. Coast and Geodetic Survey. These ships were used for benthic, bathymetric, and biological surveys; acoustical propagation studies; instrumentation array; and buoy implantments/recoveries as well as countless other purposes. The U.S. Navy's Oceanographic Office and Laboratories, the National Aeronautics and Space Administration (NASA), the National Science Foundation (NSF), the U.S. Army Corps of Engineers, and virtually every defense contractor with an ocean interest employed these vessels. Although the company's bread and butter came from federal activities—oil companies, engineer/architect/construction firms, and several universities contributed to its business.

Only one other commercial organization, Edison Chouest Offshore, has ever brought together as large a group of ships for the single purpose of general marine research and technology support. The future prognosis for such firms will be influenced, but not dominated, by long-term political decisions as to how much of the nation's ocean research will be done by government-owned ships and how much by private industry contracts.

MAKE UP OF THE PRESENT FLEET

The current private fleet of technical service ships is divided into two groups. There are at least twenty-eight ships under the U.S. flag that gather seismic and geophysical data worldwide, and a somewhat larger group of multipur-

pose ships that fluctuates in response to the dynamics of market opportunity.

The Seismic Ships . . .

Seismic survey ships are generally newer, larger—up to 94 m (308 feet) length over all—and are outfitted by users or owners with a full complement of mission-appropriate equipment such as sound sources, hydrophone arrays, coring equipment, associated laboratory and deck gear, and even helicopters. Many of these ships were designed and built for seismic work, although some are adaptations of offshore supply boats. Several of the owning companies support geophysical exploration work to the exclusion of all else, while others cross over into tug, crew transport, and rig supply operations. It appears that substantially more—perhaps twice as many—American-owned seismic ships operate under foreign flags than sail under U.S. colors.

While the seismic ships are rarely involved in the work of pure science, its existence is significant for two reasons:

- Contribution to important advances in marine engineering and naval architecture, which have resulted in improved research ships. Features of modern AGORs like the *Thomas G. Thompson*, for example, were pioneered in R/V *Shell America* in the 1970s.
- The flotilla, along with the ships' operating and technical crews, are a complete and ready-to-go national resource for precision mapping and charting in compliance with the most demanding international standards. Because the industrial sector is not restrained by agency and congressional budgeting and procurement processes, and is competition driven, it fits out with the latest, most advanced systems for navigation, data logging, and analysis.

The major U.S. flag seismic ship operators are listed in Table 1.

TABLE 1. Owners of U.S. Flag Seismic Vessels

Location	Company	Number of U.S. Flag Vessels	Size range (Length)
Galliano, LA	Edison Chouest Offshore	6	185′–308′
Gibson, LA	Gulf Ocean Services, Inc.	1	112′
Prairieville, LA	Kinsella-Cook & Associates	2	132′
Houston, TX	SEACOR Marine, Inc.	2	217′
Houston, TX	Western Geophysical Co.	4	135′–180′
Layfayette, LA	John E. Chance & Co.	4	122′–155′
Galveston, TX	Seal Fleet Inc.	2	185′
Houston, TX	Sea Mar Management, Inc.	10	115′–180′

And All The Rest

The second subset of the commercial technical service fleet is an amorphous collection of perhaps thirty to fifty vessels, ranging in size from less than 10 m (33 feet) to more than 46 m (150 feet) in length that derive significant—but rarely all—income from scientific or technology-related projects. It is difficult to estimate the number of vessels in this category because many function as technical service vessels as well as in other commercial arenas: a vessel that is doing bathymetric surveying or coring today may be supporting offshore construction diving, deploying oil containment booms, or hauling freight next week.

Because of the competitive nature of the multidimensional market in which they operate, the entrepreneurs and companies that operate these vessels tend to be inventive in adapting their ships to different mission opportunities, and often do so on a "quick reaction" basis. Some of the ships that have reputations and experience in marine technical operations are listed in Table 2. Not listed, but discoverable by talking with local marine interests such as bait and dive shops, are scores of diving support and fishing boats, some of which are occasionally, but not regularly, mustered for research projects.

Most of the smaller craft—those under about 27 m (90 feet)—that are in service today were built as fishing trawlers or oil industry crew or utility boats. When trawlers are used for fisheries research, they are used basically as built; used for other work, fish holds are converted into laboratory and additional berthing spaces. Few permanent modifications are needed to adapt crew and utility boats for research applications, although transducer wells and through hull fittings may be installed to allow easy installation and removal of special mission transducers and sensors. Navigational equipment (i.e., radar, gyrocompasses, Global Positioning System receivers) of better-than-average quality is a common feature in vessels that regularly engage in research and technical tasks even though they may not do this work exclusively.

To broaden its opportunities for finding work, and to respond quickly to search requirements, one shipowner now trucks a 40-foot, former navy admirals' barge equipped to do multibeam bathymetry to sites anywhere in the country. While most smaller vessels concentrate on inshore work, this one tackled survey work involving deployments to 225 km (140 sm) offshore.

The larger vessels, some of which have worked worldwide and a few of which work Arctic waters, are mostly conversions of the simple,

TABLE 2. Commercial Technical/Research Ships

Location	Vessel	Length × Beam × Draft (feet)	Hull Type When Built	Owner
Ft. Lauderdale, FL	*Brittany*	65 × 18 × 4.5	Navy utility boat	Doral Marine Services, Inc.
Ventura, CA	*Cavalier*	110 × 26 × 9	Utility Boat	Buccaneer Marine Ltd.
Lafayette, LA	*Coastal Surveyor*	40 × 12 × 4	Admiral's barge	C & C Technology, Inc.
Walnut Crook ,CA	*Cordell Explorer*	43 × 15 × 5		Cordell Explorations
Bainbridge Is., WA	*Discovery*	54 × 14 × 7	Tug	Sea-Lease, Inc.
Camarillo, CA	*Glorita*	147 × 27 × 12	Seismic Survey	Geo3, Inc.
Miami, FL	*Moby Ruth*	110 × 30 × 7	Tug	Moby Marine Corp.
Miami, FL	*Moby II*	85 × 23 × 7	Workboat	Moby Marine Corp.
Chicago, IL	*Neptune*	67 × 18.5 × 6	Survey boat	Hydrographic Survey Co.
Ft. Lauderdale, FL	*Offshore Venture*	158 × 30 × 9	Offshore Supply	General Offshore
San Diego, CA	*Recovery One*	151 × 35 × 12	Offshore Supply	Coast Enterprises
Miami, FL	*Seaward Explorer*	105 × 30 × 9	Offshore Supply	Seward Explorer, Inc.
Miami, FL	*Seismic Explorer*	165 × 36 × 12	Seismic survey	Moby Marine Corp.
Santa Cruz, CA	*Shana Rae*	52 × 16.5 × 6.5	Trawler	Monterey Canyon Research Vessels, Inc.
Portsmouth, RI	*Sub Sig*	118 × 28 × 13	Acoustical research	Raytheon Corporation
San Diego, CA	*Transquest*	106 × 39 × 7	Submersible support	Lockheed Engineering & Science Co.
	Weatherbird	115 × 28 × 9		
Alameda, CA	*White Lightning*	75 × 20 × 6.5	Trawler	West Coast Seaworks, Inc.
Santa Barbara, CA	*Wm. A. McGraw*	106 × 26 × 10	Offshore Supply	Ocean Enterprises, Inc.

efficient, no-frills supply and tug/supply work boats that were originally built to carry pipe, drilling mud, and provisions to offshore drill rigs. Like their smaller sisters, these ships have usually been fitted with first-class navigational gear. Again, internal configuration changes usually provide more berthing to accommodate scientific parties and to provide laboratory space.

The single most common characteristic of these larger ships is a large clear afterdeck with low freeboard, often with removable bulwarks to provide protection in heavier seas and easy overboard access in calmer seas. Large open decks make it possible to add portable laboratories and customer-supplied or rented deck handling equipment to configure these ships for almost any kind of mission. In fact, vessels in the quick reaction fleet usually depend on a variety of customers who do a mix of work that can include surveying (bathymetric, hydrographic, seismic), diving and submersible support, towing, cable laying, salvage, construction, and a spectrum of research, development, test, and evaluation activities connected to military weapons and sensors, environmental monitoring, and resource management. Over the course of two or three years, a given ship may find employment in nearly all of these jobs.

Other common features that are found in and on dedicated research vessels are hull stabilization systems; bow and stern thrusters and variable pitch propellers that permit precision stationkeeping; and "moon pools" that provide through-deck access to the sea for drill and coring equipment, larger-than-usual generators with stabilized output for laboratory use, and power (i.e., electrical, hydraulic, pneumatic) and utility connections distributed on deck to support add-on laboratory vans/modules.

Because commercial research ships tend to pick up mostly short term work (from a few days to a few months), they are fitted with basic project equipment, with quality navigation gear the most ubiquitous item. All other necessary equiment is installed as needed for specific projects or are included in client-owned drop-on vans or modules.

Most ships are equipped with a complement of cranes, winches, powered reels, and fixed or hydraulic "U" or "A" frames appropriate to the size of the vessel. This deck gear, which provides the ability to handle instrumentation packages, towbodies, nets, samplers, and other objects, is often used in concert with Zodiac or Boston Whaler small boats.

THE MARKET . . . NOW AND TOMORROW

There are three parts to the customer base for quick reaction vessels. Like taxicabs, the ships only earn income when the flag is down and the meter is running—when they are under charter. Many expenses—such as insurance, depreciation, and dock charges—continue or are incurred even when a ship is idle, and the key to survival and success in the intensely *laissez faire* business is to find enough work to stay above breakeven.

The first source of business for quick reaction research ships are the local and state governments and commercial clients such as utilities and architect/engineering firms that con-

tract for pipeline, power, and telephone cable route surveys; pre- and post-dredging surveys; and sewer outfall monitoring. This market segment has been slowly increasing with rising demands for data not only sufficient for design purposes but which also satisfy requirements for environmental impact statements and provide a measure of defense against future litigation. These customers provide from 20 to as much as 60 percent of the work for commercial ships, with the average somewhere around 35 percent and becoming a higher percentage of a shrinking total market.

The second, however small, part of the user base consists of the academic institutions. Most schools that conduct ocean science own their own ships or operate vessels furnished by the government, however, they charter ships on occasion. Most private owners reported doing little or no work for universities, and such work appears to account for well under 20 percent of the market.

The third and largest component of the customer base for at least three decades has been the federal government. The U.S. Corps of Engineers has been a consistent user of commercial vessels for inland water surveys. The U.S. Navy, once a major long-term and short-term user of commercial research ships has over the years acquired oceanographic, weapons test, instrumentation, acoustical research, and other ships of its own displacing their industrial counterparts. Notwithstanding, there remains enough total Navy work combined with that from the Corps of Engineers, National Science Foundation, NASA, and the Departments of Interior and Energy, to support a modest national commercial research fleet.

However, this national resource is declining. Three research ship sources listed in the 1992-1993 *Sea Technology Marine Buyers Guide* report having sold, and not replaced, their vessels; two suppliers could not be located; and another two did not return calls. One vessel introduced into service and three ships that have been in the business for years but did not appear in the *Buyers Guide*, are included in Table 1, reflecting a net loss of at least two and possibly as many as six vessels.

The situation is worst on the west coast, where one owner reported a decline from about 220 revenue days per year in the 1980s and early 1990s to 150 days in 1993 and a projected 125 days in 1994. Other owners say that results would have been similarly dire had they not found non-research work to keep their ships working. West coast owners attribute the downturn to the reduction charter work available from the Navy brought about by defense budget cutbacks, and also to environmental activism that has shut down California oil production and related charters. One owner commented that the practice of one federal agency of requiring ships to be used on short term (typically < 6 months) Alaskan charters to travel to Seattle for inspection before a contract selection is made creates unacceptably high bidding risk, and stifles competition and opportunity for California-based vessels. Only one owner, who is closely connected to the oil industry, anticipated buying or building another vessel of 100 feet or more in the next two years.

DISCUSSION

Nationally, there is strong sentiment among commercial research ship owners that they are in competition with highly subsidized, federally-owned ships, but none offered any specific plans for action to change this situation. Some owners expressed the hope that the Republican-controlled Congress, which took office in January 1995, will legislatively mandate more use of private vessels for federal research and technical work where it is shown that lower national costs will result.

Government use of leased or chartered commercial ships has been recommended as an efficient and economical alternative to federal ship ownership by a series of studies for NOAA that have examined the twenty-plus vessel research fleet owned and operated by NOAA and its $1.9 billion fleet modernization and replacement plan.

Notwithstanding some unusual perils that attend doing business with the government, it is clear that industry will risk major capital to build and convert ships for research or technical support work if there are reasonable odds that a profit can be made eventually. Marine Acoustical Services did it thirty-five years ago. And much more recently, by offering five year charters that offered hope of a payback if the program continued for a longer time, the U.S. Navy induced a commercial shipbuilder/operator to make a competitive proposal and invest several million dollars to create east and west coast tenders for its Deep Submergence Research Vessel program. The National Science Foundation charters the 92 m (303 foot) *Nathaniel B. Palmer*, which was built to its specifications. In each of these cases, the government benefited from quick delivery of ships precisely tailored to its mission without fronting the cost, and there is no question that similar bargains could be struck by other federal agencies. An August 1994 report by the General Accounting Office hints that more such deals, which would strengthen the national commercial technical fleet resource, could be in the offing.

APPENDIX VI

UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

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

31 May 1995

Dear Colleague:

As the new Chair of the UNOLS Fleet Improvement Committee, I am writing to you as a recent chief scientist in a UNOLS R/V to invite your input on some critical issues in particular, and welcome your comments on the status of the UNOLS Fleet in general.

Enclosed is a questionnaire with a few leading questions. Please do not let your responses be limited by those questions.

Replies received by 20 June will be assured of receiving full consideration. Please send your completed survey to Mr. Jack Bash, UNOLS Executive Secretary.

Sincerely,

J. F. Bash for

Christopher N.K. Mooers
Professor and Director
Ocean Pollution Research

Encl.

P.O. Box 392
Saunderstown, RI 02874

Phone: (401) 792-6825
FAX: (401)792-6486

UNOLS "Customer Satisfaction Survey" for Chief Scientists

The UNOLS Council and Fleet Improvement Committee are interested in knowing your response to the issues listed below. The responses will guide thinking about short-term improvements as well as long-range planning for the UNOLS Fleet.

Complete the statements by circling or checking one of the five listed responses. You are also encouraged to make general and specific comments, which would be most useful if expressed as recommendations.

1. The follow-up to issues raised in the UNOLS Post Cruise Assessment Reports is -

   superb **very good** **satisfactory** **fair** **poor**

   Comments:_____

   _____

   _____

2. The design of UNOLS Post Cruise Assessment Reports is -

superb very good satisfactory fair poor

Comments:_____

_____

_____

3. The capability of R/Vs as platforms available in the UNOLS Fleet to meet your research requirements is -

superb very good satisfactory fair poor

Comments:_____

_____

_____

4. The capability of standard oceanographic equipment available on UNOLS R/Vs to meet your requirements is -

superb very good satisfactory fair poor

Comments:_____

_____

_____

5. The capability of standard deck gear on UNOLS R/Vs to meet your requirements is -

superb **very good** **satisfactory** **fair** **poor**

Comments:_____

_____

_____

6. The capability of standard data centers (including recording media, formats, graphics, etc.) on UNOLS R/Vs to meet your requirements is -

superb **very good** **satisfactory** **fair** **poor**

Comments:_____

_____

_____

7. The adequacy of safety standards (esp. Chapter 1 of the Safety Training Manual and pre-cruise briefings) of the UNOLS Fleet to meet your expectations is -

superb **very good** **satisfactory** **fair** **poor**

Comments:_____

_____

_____

8. The adequacy of safety conditions in the UNOLS Fleet to meet your expectations is -

superb **very good** **satisfactory** **fair** **poor**

Comments:_____

_____

_____

9. The level of professionalism (competence and cooperativeness) of the crews on UNOLS R/Vs to meet your expectations is -

superb **very good** **satisfactory** **fair** **poor**

Comments:_____

_____

_____

10. The adequacy of the experience level of the crews on UNOLS R/Vs to support your research cruises is -

superb **very good** **satisfactory** **fair** **poor**

Comments:_____

_____

_____

11. The level of professionalism (competence and cooperativeness) of the shorebased staffs that support UNOLS R/Vs to meet your expectations is -

superb **very good** **satisfactory** **fair** **poor**

Comments:_____

_____

_____

12. The level of skills of UNOLS marine technician support groups to meet your requirements is -

superb **very good** **satisfactory** **fair** **poor**

Comments:_____

_____

_____

13. UNOLS ship operators provide facilities and services for your research that are -

superb **very good** **satisfactory** **fair** **poor**

Comments:_____

_____

_____

14. The adequacy of specialized non-R/V facilities available (FLIP, ALVIN, etc.) to serve your needs is -

superb **very good** **satisfactory** **fair** **poor**

Comments:_____

_____

_____

NAME: _____ INSTITUTION: _____

Summary - "Customer Satisfaction Survey" for Chief Scientists

QUESTION	SUPERB	VERY GOOD	SATISFACTORY	FAIR	POOR	TOTAL
1	7	14	18	1	3	43
2	3	14	24	3	1	45
3	15	32	4	5	1	57
4	12	30	14	6	1	63
5	13	32	15	3	1	64
6	6	14	21	3		44
7	14	29	10	2	1	56
8	19	30	7	2	1	59
9	28	26	6	1	1	62
10	21	35	7	2	1	66
11	17	26	13	4	4	64
12	24	26	10	4	3	67
13	16	29	10	2		57
14	3	8	7	1		19
TOTAL	198	345	166	39	18	766

Customer Satisfaction Survey - Comments

Question 1

- Poor - Non-existent for all ships & cruises that I've been on...while I've had few complaints, I've never had an operator tell me what they've done to fix things!
- Satisfactory - UNOLS should make more effort to get suggestions from the community about equipping the ships, porting of ships, ship support etc, independently from cruise assessments.
- Very good - Whenever we need repairs or alterations on the AII, they are accomplished cheerfully and quickly.
- Poor - I don't believe I received any follow-up to my cruise reports.
- No comment, don't remember.
- Unknown
- Can't remember if there is any report, what it says, or if there is any follow-up at all.
- Superb - Superintendent Smith also calls and discusses cruise operations with Chief Scientist following cruise completion. Marine Tech and Captain do the same as well.
- Non-existent so far - but I only returned a short time ago.
- I don't remember the report.
- Poor - The commonest effect of my comments seems to be to outrage officials at the operating institution. I generally hear about that - I seldom hear whether constructive criticisms were followed up, so without such feedback it is hard to answer this question. I'd welcome feedback from the operators that isn't couched as denial of the perceived problem, or excuses for it, but is a simple statement of what if anything the operator intends to do about it.
- Superb - This comment is based solely on my experience with my own institutions' regard for users' comments.
- Don't know.
- Very good/satisfactory - Few significant issues. Not enough time to see if action is effective, but a good attitude.
- I'm not sure. It was submitted by the CO-chief.
- N/A
- Don't know - Few scientists go out on the same vessel frequently enough to be able to assess this.
- Don't know.
- I was not requested to provide a report.
- Fair - I have never had anyone speak with me about comments in my Post Cruise Assessment Report.
- I have no information on whether or not issues raised in the UNOLS Post Cruise assessments are followed up!
- Superb - We have not raised any issue - our cruises on the PT. SUR have been outstanding.
- All identified problems have been corrected by subsequent cruise - R/V ALPHA HELIX.
  Don't know - there are immediate and long-term issues.

- Unknown in general, unless the same ship is used again soon. My specific experience in these appropriate circumstances would indicate that neither forms nor direct verbal requests work very well if funds must be spent to correct a problem.

Question 2

- Satisfactory - however, it should never be returned directly to the operator -- stifles truthfulness. Should be returned to UNOLS Office.
- Fair - Need improvement for quantification of results and to provide more accurate reporting of the scientists "true" feelings.
- I'm not sure the correct questions are really asked.
- A copy of the report would have helped here...
- Very good - I recall it didn't take long to fill out.
- Don't know.
- All paper work is a pain!
- Don't remember.
- I'm not sure. It was submitted by the CO-chief.
- N/A
- Satisfactory/fair - Didn't think these work very well - frequently they are not sufficiently critical. Immediately after cruise Chief Scientists rarely want to intrusive a ships operations. Only way this works is private 'one-on-one' discussions at the institutions between operations staff or chief scientist.
- Don't know about these reports.
- ROSCOP form is confusing and outdated - modern measurements often not listed.
- Not applicable.
- The design is not a big deal. Chief Scientists should not be afraid to express their opinion to the point - regardless of form style.

Question 3

- This comment is in response to the word "capability" - "Availability" is poor and getting worse.
- Fair - The only estuarine vessel on the west coast of the US (the R/V BARNES) has/is; 1) insufficiently maneuverable, 2) too unstable, 3) too little lab space, 4) too few bunks, 5) too short a cruising time, 6) only one engine (a safety problem. The R/V SPROUL is almost unusable for estuane physical oceanography.
- Very good - Varies greatly. MELVILLE with excellent Seabeam, good maneuvering, 0.680" wire is ideal. T. THOMPSON with poorly operating multibeam, and poor ship design making instrument recoveries difficult (despite excellent crew work) is the other end of the pack. All the intermediate ships are very good, but (see Question 4)
- Very good - We design our science around the ship's and sub's capabilities.
- Very good - Depending on state of the vessel. My experience with the ISELIN was apparently during a "low" period. I understand that it has improved significantly since that time (i.e. 1991).
- Very good - Only problem is scheduling, when the EWING is the only MCS ship in the fleet. Not much that can be done, however.
- Superb - All ship answers went to R/V OCEANUS. Don't know about rest of fleet!
- Poor - I require a UNOLS operated icebreaker. My arctic research is limited to early fall and limited ice capability of ALPHA HELIX does not permit access to important areas. Aside from ice limitation HELIX rolls/pitches badly. Operations are often terminated in marginally rough weather due to danger to equipment/personnel. HELIX should be used in bays, lakes or subtropical (gentle) waters. It is a credit to the crew's scientists that she accomplishes as much as she does in some of the stormiest seas on earth. We can not depend on the HELIX to work in N Pacific, Bering S arctic seas. A UNOLS arctic research vessel is required. A more stable platform for the N Pacific work is required.
- Fair - Only one ship is available for serious seismic projects (R/V EWING) which can be a problem for scheduling good projects. At least one other ship (MELVILLE or REVELLE?) should be equipped to collect multi-channel seismic (maybe 60+ channels with a 3000 cu.in. air gun array). The seismic ships should be equipped with SEA BEAM 2000 or better and with P-code GPS for superior navigation.
- Superb - All except for the z-drive not working on the R/V MELVILLE on one of the thrusters. Was fixed in Valparaiso, Chile.
- Highly variable - the only ones I'd rate "very good" are those that I've put capability-enhancing effort into.
- Very good - The limited number of scientist berths on some vessels sometimes limits the number of hands available to perform the tasks required.
- Very good - for R/V COLUMBUS ISELIN, R/V SEWARD JOHNSON, R/V CAPE HATTERAS.
- Superb - I have never had a disappointing cruise on a UNOLS ship. I have also used Navy and Navy contract ships and this has not been my experience on those platforms.
- Very good - Like to work in worse weather without the hazard and discomfort.
- My only experience is with ATLANTIS II.
- Satisfactory - low cost coastal vessels are needed in Alaska.

- Very good - Cranes, winches, maneuverability and skill of officers and crew are generally excellent. Sometimes they slip a net, but rarely.
- Very good - In general, very good, but quality varies from ship to ship.
- Fair - The fact that there is only one ship (EWING) capable of firing a large tuned argus array is a major handicap to my research. The EWING's hydrosweep system, which is not state-of-the-art, is also an independent.
- We have had complete success with all projects using UNOLS R/Vs.
- There is a documented need for an Arctic research vessel with UNOLS to support US scientific objectives.
- ALPHA HELIX comes to a superb suite of equipment, a tech who knows the equipment and the ability to trouble-shoot it all at sea. The result is very little research time lost. The HELIX is small and flexible - in terms of daily scheduling. This is most useful or we modify our work as we go along.
- Fair - A vessel capable of northern North Atlantic winter, including ice strengthening, is needed.

Question 4

- Satisfactory - XBT hardware/software not always as good as it should be; mixed quality of meteorological sensors; mixed quality of depth sounders; CTD support for non-CTD cruises sometimes has problems - example, how do you get bottle salts done?
- Very good - Does vary a lot between ships though.
- Very good - Depends on the ship. Very wide range in equipment, expertise and reliability.
- Fair - The vessel (R/V/ BARNES) is set up for mooring work, but lacks an ADCP, and is less than ideal for CTD work. It is relative to have only one wire over the side at a time.
- Satisfactory - (Continued from Question 3)...but, I would like to see 0.680 conducting wire on more ships. Also, most ships need a few more MAC's and PC's - 486's, mac quadras and Mac PC's.
- Satisfactory - It would seem to me to be much more cost-effective (and fair) for NSF to equip the UNOLS vessels w/state-of-the-art equipment to be used by a broad user group (eg. Sea-Soar, ADCPs, etc) rather than funding a few individuals to obtain their own equipment. Some vessels have such equipment, though in some cases investigators are charged extra fees for the use of the equipment. Small scientific programs could benefit just as much as large problems with open access to such equipment. This is not a personal bias due to lack of access. I have successfully been funded to receive my own equipment, but I believe, especially in tight fiscal times, an equipment pool associated with UNOLS vessels would not only be cost effective, it would allow more talent access to high quality sampling equipment.
- Fair - All should have SAIL systems or similar and many smaller vessels do not.
- Very variable from ship to ship, depending on operator.
- Superb - Staff/scientists/crew work hard to maintain and upgrade HELIX equipment.
- Superb - Both in regards to SEA BEAM 2800, standard mgd, xbt's and dredging.
- Highly variable, with a very uneven opinion of what "standard oceanographic equipment" is - eg. lack of magnetometers on WHOI ships.
- Very good - Instruments (flow-through fluorometers, anemometers) occasionally go to sea functioning poorly.
- Very Good - For COLUMBUS ISELIN and CAPE HATTERAS.
- Very good - While all available equipment operated according to expectations, the lack of some equipment for use was disappointing. Specifically, I refer to CTD units. I feel there should be standard equipment, rather than prohibitively expensive gear (as a benthic ecologist, I could not afford the $2,500 to rent a CTD for any of my 3 cruises). My experience in other countries has been that even tiny research vessels have CTDs available as routine equipment.
- Very good - There is a clear need to work consistently on replacing older equipment with modern versions and to introduce entirely new instrumentation. Broad UNOLS standards for modern equipment might be set.
- Superb/very good/satisfactory/fair - Varies.
- Fair - We need to test some equipment for sampling hard rock through sediments.
- Very good - "Standard" equipment varies between large (e.g. MELVILLE) and intermediate (e.g. OCEANUS) ships.
- Generally not great on AII but understandable. Acquisition of P-code GPS was great.

- Very good - One problem is the constant "improvement" of the 12 Khz echo sounder that makes it less useful for acoustic tracking and telemetry.
- Superb - The PT. SUR is well equipped for our needs.
- Very good - Would like all institutions to include CTD/rosette in basic cost of ship (block funded) so PIs don't get thousands charged on one ship that would be free on another. For example, I would need to know years in advance of a cruise if it will be on a Scripps ship (charges for CTD) or PT. SUR (no charge) to properly write the grant proposal! Also - good availability of 30L bottles would help my program.
- Any problems we have had were turned around by the vessels engineering staff. All equipment has performed superbly.
- Larger selection of "back-up" sampling gear and back-up on board monitoring equipment are desirable.
- (Small size R/V) is good for inshore work, small size is a liability for open oceans in bad weather.
- Some variation between ships. Equipment charges are on some ships, and not on others. Why do we need to pay for equipment funded by NSF?
- Satisfactory - Not "standard"; always requires upgrading.
- Very good - Why do some ships charge so high a rental fee, while others have no fee for equipment rental?

Question 5

- Fair - Capstan/crane problems not uncommon; cranes on some ships impose limits on weather conditions for work.
- Very good - Depends on ship. Gear on most ships getting very old and less reliable.
- Satisfactory - Mooring deployments are often a problem. Varies with ship.
- Satisfactory - Mounting our ADCP over the side now goes reasonably well. BARNES needs a CTD winch and davit separate from the main crane.
- Satisfactory - The ships need better capstans, for extended use at high load.
- Superb - Primarily because of our "standard" needs.
- Fair - AII winch is and has been problematic.
- Very variable from ship to ship, depending on operator.
- Satisfactory - Some equipment on the EWING is marginally functional but should be upgraded before complete failure (esp. capstans).
- Superb - Note, the resident tech is an important and crucial aspect to this question.
- Very good - Mainly concerned with CTD and winches. During one cruise, a small backup CTD for the main unit would have been very helpful.
- BLUE FIN - satisfactory, CAPE HATTERAS - satisfactory, COLUMBUS ISELIN, very good.
- Very good - Usually - but some old equipment requires excess baby-sitting/repair.
- Very good/satisfactory - Varies.
- Very good - Faster winches would help.
- My only experience is with ATLANTIS II.
- Very good - Cranes are capable but not always able to reach all parts of deck - stretch problem, hopefully to be rectified in time.
- Superb - PT. SUR is well equipped, and the crew keep the gear in excellent condition.
- For mooring work, variable speed capstans are a necessity, some vessels may not be equipped with this item.
- Larger selection of "back-up" sampling gear and back-up on board monitoring equipment are desirable.

  Very good - Winches, frames, cranes seem much improved over several years ago.

Question 6

- Fair - Some platforms have little or no computing hardware; some much better; little or no standardization across fleet; better access to underway data needed on some.
- Satisfactory - Depends on ship.
- Satisfactory - Depends on the ship. PELICAN was much better than THOMPSON.
- What data center?
- Very good - Much improved on AII from a few years ago.
- Very good - As of 1990/1991 - I do not know if standard data centers on UNOLS vessels currently have the capacity for real-time graphics displays, etc., which may be useful - designing synoptic sampling regimes.
- I don't really have much experience here.
- Satisfactory - Not a lot of contact with such centers.
- Much improved - recent additions to AII improves things significantly.
- Need to have your own in-house capability - but at least SUNS, GMT, etc. are becoming standards.
- Very good - Consistent improvements made by marine tech Steve Hartz and UA programmers.
- Satisfactory - Should have more computers and tape drives available for work during cruise.
- Satisfactory - The R/V MELVILLE would have benefited from having 1/4" in tape cartridge readers for Sun Sparcs - not everyone uses 8mm exabyte tapes.
- Satisfactory - highly variable - as good as can reasonably be expected.
- Satisfactory - The capabilities change from cruise to cruise over a several month period. These changes make each cruise a new challenge even though the same vessel is used. Ship to ship variables add to the problem.
- Not Applicable.
- Very good - This varies from ship-to-ship although I have never had a problem in adapting to the local standards. A continuing effort to standardize on commercial or public domain standards should be undertaken by UNOLS.
- Satisfactory - Incompatibility always exists somewhere in the chain - provide my own.
- Satisfactory - Out put of multibeam could be better.
- Minimal experience with data centers.
- Not sure what a "data center" is. Highly variable from vessel to vessel - cannot generalize. (Assume you mean routine data collection of nav. parameters, etc.)
- Satisfactory - Highly variable from institution to institution - with Scripps excellent.
- SAIL loop great; better networking and computer capability needed.
- Fair - Some systems are quite outdated and arcane. No uniformity among ships.
- R/V ALPHA HELIX is showing great improvement.
- Satisfactory - Not "standard".
- Satisfactory - Data output from ADCP should include other media than IBM-PC 1.4 Mbyte floppies, 8mm tape or internet access would be much more efficient.
- We can bring our own software.

Question 7

- Satisfactory/fair - Mixed across the fleet as to how serious and complete briefings are.
- Superb - No problems here.
- Very good/satisfactory - Crew wisely emphasizes safety of R/V BARNES. R/V SPROUL is so conservative that its capabilities are quite limited (e.g. no night-time transits on the Columbia, master must be on bridge during all transits). It is effectively impossible to use the SPROUL 24 hr./day in estuane waters, except at anchor.
- Very good - Re Chapter 1 -Does anyone ever read this?
- Very good - On several occasions, I was glad to see that suggestions for safety improvements were taken seriously and implemented.
- Satisfactory - Should be taken more seriously.
- Superb - Captain and crew take safety as their primary responsibility.
- Very good - Yes, but note that acquisition of foreign clearance could be improved by sending a copy of request to Chief Scientist before going to the country to make sure correct map is used, etc.
- I'm not sure.
- Very good - As far as I know.
- Satisfactory - This issue worries me - we need to increase pressure on this. There seems to be an increasing number of very inexperienced scientists out there who need to be watched carefully!
- Very good - I didn't know this was UNOLS, thought it was Coast Guard.
- My experience on UNOLS vessels notes extreme safety conscious officers and crew, all standards are superb and have been met.
- Crew needs to set a good example in use of vests, helmets, etc.

Question 8

- Satisfactory/fair - Mixed level of safety concern across fleet; mixed policies for crews about hard hats/steel-toed shoes/work vests.
- Very good - We cannot operate in some areas we need to, because this would violate safety standards on both BARNES and SPROUL. However, safety is fine during existing operations.
- Fair - With no overtime pay available for deck ops, I question the wisdom of putting science staff in hard hats for over-the-side ops. This is a serious safety time-bomb.
- Superb - R/V BLUE FIN - superb, others: satisfactory
- Very good/satisfactory - Some variation from inst. to inst. exists. Perhaps asking PIs on a regular basis how their cruises went would help flesh this out.
- Superb - PT. SUR is outstanding.
- Crew needs to set good example in use of vests, helmets, etc.

Question 9

- Superb/very good - The crews compensate for the platform deficiencies in most cases; resistance and lack of cooperation in the rare case.
- Very good - Highly ship dependent, but generally very good.
- Superb/very good - The Master of the R/V BARNES (Ray McQuin) is terrific. The SPROUL is very accommodating, given the limited motion required of it. We could not do physical oceanography off the SPROUL, however.
- Very good - Crew can get grumpy if they've been out too long, or if they feel that cost-cutting efforts are compromising their abilities to do a good job. Overtime concerns make scheduling difficult and often constrain science activities.
- Very good - I have always had excellent help from the deck and engineering crew. "Officers: have also been most helpful in ensuing our scientific goals are met.
- Superb - With a few exceptions.
- Very good - Usually.
- Superb - Outstanding work by AII crew, above and beyond the call of duty.
- Superb/Very good/satisfactory/fair/poor - Highly variable.
- Superb - While not so in the past recent changes have led to considerable improvement. Capt. Rook is the best UNOLS skipper I have ever had.
- Superb++ - The captain and crew always gave 110% but at the same time insisted on safety and clearly took great pride in their work.
- Superb - Highly variable - "superb" in the case of those I have worked with most.
- Superb - BLUE FIN - superb, COLUMBUS ISELIN, very good, CAPE HATTERAS, very good to satisfactory.
- Superb - They were all great; very cooperative and accommodating.
- Superb - UNOLS has the most professional crews I know of in modern oceanography.
- Superb - Always been great.
- Superb - THOMAS WASHINGTON grew was great!
- Very good - Most of crew is highly skilled and helpful. Some are skilled but not helpful. Few are not skilled. Officers are generally highly motivated and helpful.
- Satisfactory - Cooperativeness is a problem on some vessels.
- Satisfactory - Varies quite a bit among ships and personnel.
- Superb - On the PT. SUR - The PT. SUR has been an outstanding ship for our needs (midwater training). The crew work nice together, and with the scientists. The winch and crane operator make the operation run smooth and safe with their experience. The food is exceptional, an unexpected bonus! The engineers keep all their equipment in top shape and have been great helping us when we had equipment problems. I have only been on one other UNOLS R/V and it was not the same as the PT. SUR. We got the work done and it was satisfactory, but I would rate the PT. SUR superb. It would be a good model for the rest of the fleet.
- Officers and crew have always gone out of their way to accommodate us.
- Unparalleled by international standards!
- HELIX is superb this year; a great crew and very good ship handling by skipper and mate.
- Satisfactory - Unfortunately this varies dramatically with the particular ship.

Question 10

- Very good/satisfactory - But, if there are layoffs and some ships are not used for periods of time - will the experience be lost?
- Very good/Fair - Depends on ship!
- Very good - Aside from Ray McQuinn, other vessel operators have to be "borrowed" from other vessels at UW.
- Very good - Submersible piloting stays good as long as turnover doesn't get too high.
- Very good - Our work has not required especially unusual equipment, plus the experience level has been fine. (eg. MOCNESS, CTD, moorings, ADCP...) Occasionally the technical support has not been adequate, but this occurred with a new technical employee.
- Superb - Outstanding work by AII crew, above and beyond the call of duty.
- Superb/Very good/Satisfactory/Fair/Poor - Highly variable.
- Very good - Most of the crew is superb. Occasional new crew without experience.
- Superb - Although some of the crew were young, they were all very mature, and responsible.
- BLUE FIN - superb, CAPE HATTERAS, COLUMBUS ISELIN - very good.
- Very good - Have run into "on-the-job" mate/crew training that hinders ideal ops.
- Superb/very good - some variability.
- Superb - Lets try to keep it this way.
- Very good - A few problems from inexperience, but rare.
- I have utilized the R/V ALPHA HELIX for the past 10 years and overall have found the crew excellent.
- Satisfactory - Again this varies with ship and with who is on vacation.

Question 11

- Satisfactory - Lack of pre-cruise information in timely fashion, such as specifics on ship's payload, on policy of crew helping/not helping with science deck work, sometimes occurs; better coordination of State Department/UNOLS operator/NOAA reporting needed.
- Fair - Probably the one consistent thing in the fleet - shore support is lacking (pre-cruise liaison, billing, post cruise follow-up).
- Fair - Problems include/have included: overly bureaucratic approach, lack of understanding of estuarine/coastal operations, unrealistic safety standards (restrictions on use of the R/V SPROUL in the Columbia River), and poor communication skills (U of WA).
- Satisfactory - ENDEAVOR (URI) - very good, ISELIN (Miami-1991) - fair to poor - hard to communicate with, also we were not informed of known problems with the ISELIN's ADCP.
- Poor - WHOI billing practices appear random; if not malicious; foreign port problems with unscrupulous agent; answers to questions often difficult or impossible to decipher.
- Very good/Satisfactory/Fair/Poor - Variable.
- Variable - Rawson at LDEO is superb.
- Very good - Yes, but note that acquisition of foreign clearance could be improved by sending a copy of request to Chief Scientist. Before going to the country to make sure correct map is used etc.
- Some very good/some poor - I find the ship's crew support (eg. marine superintendents, port captains, etc) very good. The ship scheduling/foreign-clearance-getting staffs unskilled and often unhelpful; these jobs should be filled by people who know something about logistics, shipping, geography and diplomacy, not just secretaries with on-the-job training.
- Satisfactory - Some of the shorebased staff was extremely competent, but others were incommunicative and less than helpful. I have no recommendations for this other than hoping it is better next time...
- Superb - Participation by RSMAS SWAB team (Ostlund, Topp, Grall) is crucial to maintaining our capability of collection samples for natural 14C &3H abundances. Their interests are important, & funding of this group essential.
- Very goods - This is more important during planning.
- Superb - Very helpful and cooperative.
- Satisfactory - Not as responsive to requests as the crews/mar techs are.
- Excellent (consistent) support.
- The people are excellent. I have become disappointed with their difficulties for keeping day charges down. I'm not sure that distributed operation is still the best mechanism for operating UNOLS vessels.

Question 12

- Very good/satisfactory - These folks always seem over-worked but always also seem to come through. They cannot be experts on all the gear now on some ships.
- Superb/Very good/Satisfactory/Fair/Poor - Depends on the ship, obviously!
- Very good/satisfactory - Varied. PELICAN - very good. THOMPSON - marginal.
- Superb/very good - Both U of WA and Scripps have good technical people.
- Very good - Occasionally the technical support has not been adequate, but this occurred with a new technical employee. The technical staff at URI was very helpful.
- Unknown - WHOI sea-going tech support is ambiguous. Is this the DESSC tech? Deck assistance? Its very unclear.
- Very good/satisfactory - Variable.
- Variable, even within an institution
- Superb - Both marine techs go beyond their responsibilities to assist.
- Superb - Note, the resident tech is an important and crucial aspect to this question. Computer support was also superb.
- Poor - It is increasingly difficult to find first class and up-to-date electronic engineers, systems analysts, programmers etc. who are willing to go to sea. Too many people in these support groups are expensive long-servers with out-of-date skills and declining motivation.
- Very good - This varies with the experience of the technical staff. It always has been very good and occasionally superb.
- Superb - CAPE HATTERAS, Tim Boynton, satisfactory - COLUMBUS ISELIN.
- Superb - They were all great; Very cooperative and accommodating.
- Very good - Usually not required, but...
- Considerable variability.
- Very good - Mostly expert at what I want, occasionally expert only at something I don't care about and not too good at what I need.
- Satisfactory - Highly variable - some are superb and some fair.
- Very good - This form does not address cooperativeness of marine techs. On some vessels this is clearly an issue.
- Satisfactory - Varies greatly among institutions.
- Steve Hartz is excellent in all ways - hard working, competent, and forward thinking.
- Superb - They are usually enthusiastic and helpful.

Question 13

- Very good/satisfactory - The refit Oceanus class with new limitations due to heavy cranes and the large AGOR 25 ships indicate a trend toward ships that may prove to be less useful. There is need for low cost (small science party), weather-capable, vessel that could carry a large deck payload. The refit has lowered pay load and weather capacity. The big ships are very expensive.
- Satisfactory - As an overall comment, each R/V is an independent operation and there is little consistency between operations (although this is slowly changing). This is a particular problem when you are forced to use a ship other than the one you requested.
- Fair - The only facilities on the R/V BARNES are a bare, overly small lab. However, the navigation equipment (GPS and gyrocompass) is functional.
- Satisfactory - AII a bit cramped, but adequate.
- Very good/satisfactory/fair - Variable.
- Mostly good.
- Very good - Always willing to adapt to contingencies.
- Very good - (When they are available) Long delays for cruise scheduling are the biggest problems. If the availability is taken into account, the rating would be "fair".
- AII has problems doing ancillary work at night because can't use main A-frame and lacks conduction .68" coaxial.
- Very good - Some docks, receiving departments, and shipping support are better than others. Mostly they are very good or superb.
- In the specific instance of northern North Atlantic winter work, the UNOLS fleet is lacking.

Question 14

- No basis for comment.
- None exist for estuarine work.
- Very good - FLIP deserves wider support from UNOLS.
- No experience.
- No contact.
- Fair - ALVIN - inattention to upgrades; poor navigation; pilot retention; all issues we're addressing on DESSC.
- No experience with these.
- Very good - When using equipment from the Alvin group for a French Nautile Dive, I was given excellent instructions, and the equipment was fully tested, etc.
- Satisfactory - I haven't used Alvin for several years; then it was ok.
- No opinion.
- Not applicable.
- Superb - My experience is solely with Alvin.
- Alvin is ok, but not exactly the best in the world anymore.
- Not sure.
- Satisfactory - Alvin facility needs improvement in way of support personnel and the reliability of some of the instrumentation.
- Haven't used them in a long time.
- No experience.
- Not applicable.
- Don't know.
- We do not use such vessels.
- Generally not applicable to our cruises, but others I have been on.
- Not relevant in my work.
- FLIP is a non-consideration. ALVIN has become a political object that is difficult to obtain for locating other than those on the "yo-yo" route.

Comments

I think this sort of survey is useful. However, an evaluation of chief scientists, their preparations for a cruise, and their attitudes, by R/V operators would also be useful! I've seen too many who came half-prepared, with mickey-mouse equipment, trying to do crazy things. Then, if it doesn't work, you'll probably see "unsuccessful" in the chief scientist's cruise evaluation. That sort of think is just as wasteful of time and money as inadequacy of ship's equipment, etc. - yet we don't seem to have a mechanism to correct such occurrences.

This questionnaire is well-intended, but is far to general on the one hand, and far too detailed on the other!

New Question:
The adequacy of this questionnaire as a constructive guide to user's opinions.
Poor - I think you should have made a distinction (or had 2 separate questionnaires) between comments applicable to the chief scientist's own institution's hip, and those of other operators. When we use our own ships, then any deficiencies are to some degree our own fault.

Also, the only rational answer to most of your questions, to people who have used several ships from several operators, is "highly variable" - sometimes very good, sometimes inadequate.

APPENDIX VII

7/18/95

DRAFT

POINT PAPER

CHIEF SCIENTISTS' RESPONSIBILITY FOR SAFETY ORIENTATION, ETC.

By Suzanne Strom with input from ad-hoc subcommittee members: Jack Bash, Peter Betzer, Joe Coburn, Rich Findley

Safe operation of UNOLS vessels is an issue of fleet improvement. During recent discussions of the FIC, various safety issues were raised. These issues may be particularly timely for several reasons. 1) The fleet profile is changing, with increased inclusion of smaller vessels and more specialized platforms. 2) Scientific operations at sea are continually evolving, often in the direction of increased complexity and expense. 3) Fleet users are changing. Multi-institution and multi-national user groups are now the norm on the larger vessels. Use of research vessels by students and other first-time or inexperienced users may be increasing; certainly NSF now stipulates that even the large vessels be used for undergraduate education on a regular basis. These changes are likely to accelerate due to the changing nature of national and international support for ocean science. This position paper will outline some safety issues and pose potential solutions. It should be a starting point for future discussions and policy decisions on the part of the FIC and UNOLS.

A. Responsibility and liability for safety at sea: Historically and currently, the captain and his/her institution have been held 100% responsible for safe vessel operations. This includes responsibility for safe conduct of scientific operations. In practice this assumes a more detailed involvement in scientific activities than is practical or desirable on most cruises. Research cruises are perhaps unique in that they involve a mix of typical ship operations and scientific operations that may be technically and logistically complex. The current situation could cause the captain to play a much larger role in the conduct of science that the scientists want. Conversely, the chief scientist, who in actuality oversees the details of daily and hourly scientific operations, currently may not take an active part in safety-related training and decision-making.

Is it fair and proper to hold the captain completely liable for scientific operations at sea? To what extent should the chief scientist be responsible for safety? What are the trade-offs between liability and autonomy in the conduct of safe science? To what extent can or should UNOLS be involved in formalizing this partitioning of responsibility?

B. Actual and potential safety problems: It is important to determine whether UNOLS safety issues stem from actual or merely potential problems in conduct, training, and operation. Qualitative information suggests that the UNOLS fleet is

actually quite safe relative to other fleets. The fleet has not been criticized for being unsafe, and the results of the last questionnaire indicated that the fleet was perceived as very safety conscious. According to Jack Bash, there have been 5 fatalities in the past 15 years. Three occurred during routine ship operations/maintenance and two during transit at night. Two small research vessels were lost at sea without a trace in about 1978. These vessels were from UNOLS institutions and, though they technically did not come under UNOLS rules, in at least one case the courts held their activity to the UNOLS safety standards. (Info from Joe C. about accident rate?) It is not clear how this safety record compares with that of other fleets, e.g. in terms of accidents or fatalities per hour of vessel operation time. A quantitative comparison may not be possible.

Potential safety problems may exist. These arise from the unique organization of a science mission. Ship time is expensive and scientists tend to work extremely long hours while at sea. Science operations may equal or exceed routine ship operations in logistical complexity, e.g. putting large pieces of expensive gear over the side in rough seas. Scientific personnel change frequently and nearly every cruise has untrained and inexperienced people in the scientific party. Currently there appears to be no mechanism or program that explicitly addresses the safety issues arising from these features of a research cruise. Should the FIC/UNOLS be involved in developing such a program?

Some considerations:

Pre-cruise training. Currently consists of a safety lecture by captain or first mate, generally on the first day of the cruise, as well as a fire and boat drill. The safety lectures I have heard have been thorough, but are mystifying to the seasick first-time sailor with no knowlegde of the jargon. They may or may not cover aspects of scientific operations. Should a more rigorous safety training program be required?

Safety information: a copy of the Research Party Supplement to the RVOC Safety Training Manual theoretically resides in every stateroom of every research vessel. It is admirably free of jargon and touches on the major safety issues of sea-going research life. I had never heard of it, however, until I joined the FIC. This seems like a problem. How widely distributed is the Supplement in actuality? How can the research party be made aware of its existence? How can anyone be made to actually read it in the rush to load, set up, and get underway?

Diving operations model: the dive community has addressed the safety issue by instituting a set of training and prodedural standards (Chapter 16, UNOLS Resarch Vessel Safety Standards). Research dives do not happen until the dive master has met with the captain and presented a dive plan and evidence of qualification for each of the divers. A single lead institution is designated for each cruise; the procedures and reguations of this institution govern the diving operation and this institution approves the dive plan of any scientist involved in diving work. Should this be a model for

safety training for all ocean-going scientists? Training could consist of a short CPR-type class that explicitly addresses safety issues arising during oceanographic cruises. This could tie in specifically with the chief scientists' responsibility for the safe execution of scientific operations. It would also separate the safety training issue in space and time from the activities of loading and getting underway on the actual cruise.

C. Safety inspections: Non-Navy owned UNOLS vessels currently undergo safety inspections once every two years. These are conducted by NSF Inspection, under the auspices of the Facilites Section (headed by Dick West). The inspections are contracted out to 'ABSTEC', a part of the American Bureau of Shipping. Navy-owned UNOLS vessels are inspected every three years by the Navy's Board of Inspection and Survey (INSURV). The consensus at the last FIC meeting seemed to be that these inspections are quite thorough as far as routine vessel operations are concerned. What aspects of scientific operations are routinely covered by the two types of inspections? Do these need to be expanded?

D. Crew experience and turnover. One of the major strengths of the UNOLS fleet is the experience and dedication of the ships' crews. This relates closely to safety issues: experience with the range of scientific operations perfomed on research vessels translates directly into increased safety and better science. While most UNOLS vessels have retained a stable cadre of experienced, highly trained crew members, a few have not. How can high rates of crew turnover be dealt with? Is there some means of training new crew members to deal specifically with the requirements of working on a research vessel? Should there be some crew turnover rate beyond which a ship is reviewed regarding inclusion in the UNOLS fleet? How is this type of information obtained (inspections?) and who would keep track of it?

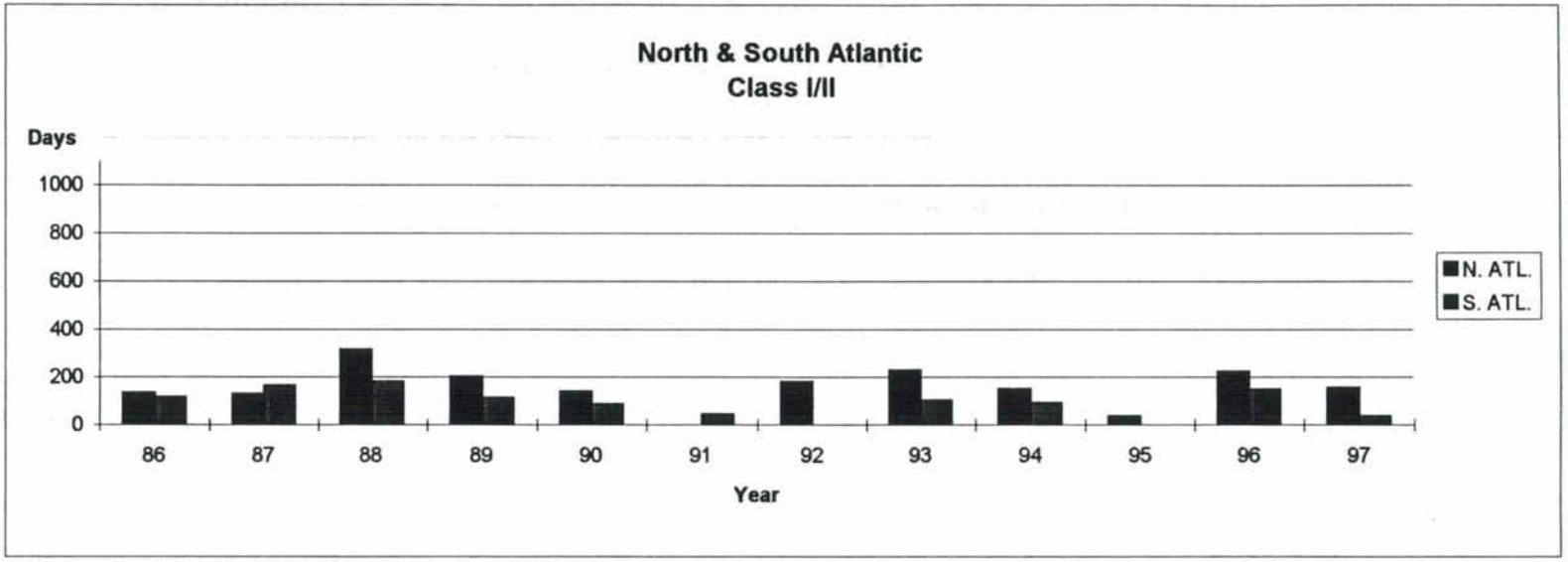
APPENDIX VIII

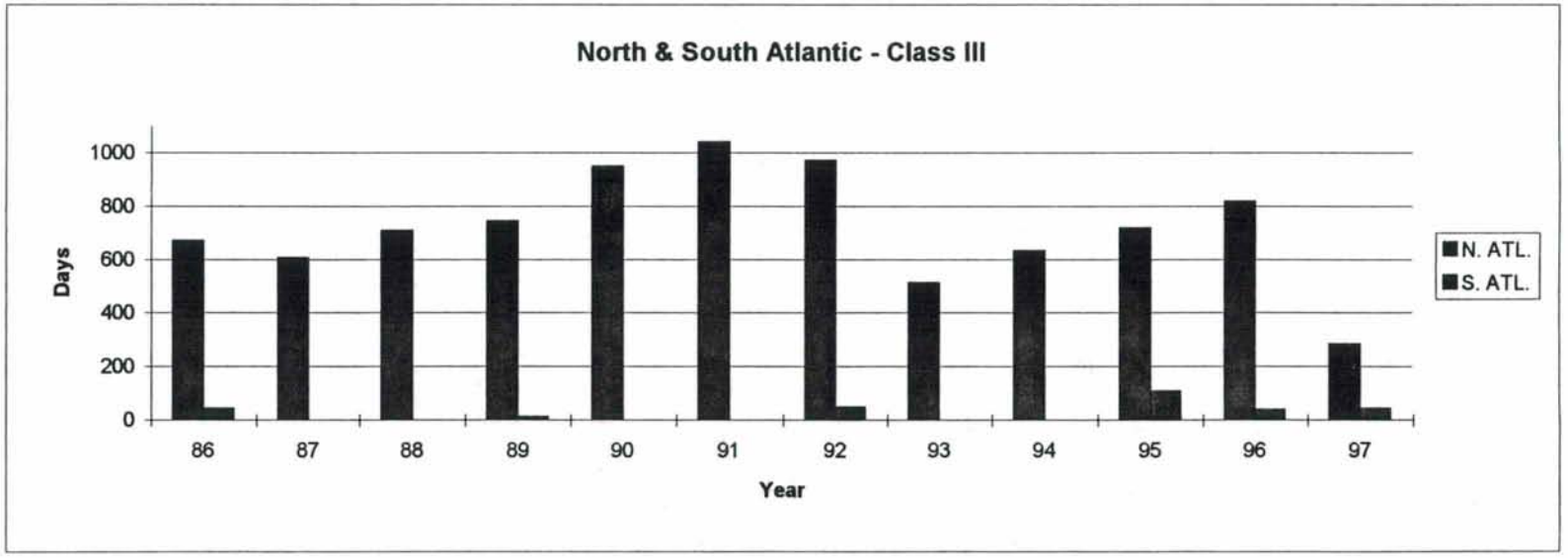
GEOGRAPHIC OPERATING AREAS: 1986 - 1995

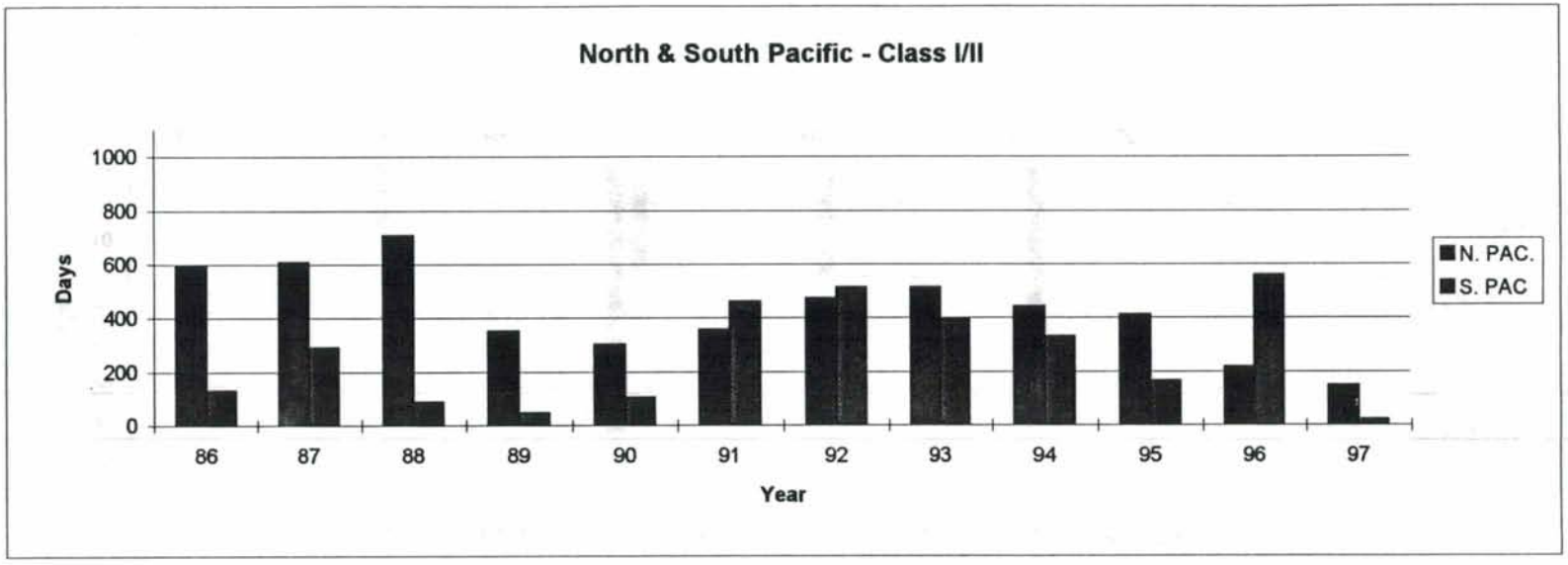
OCEAN AREA	86 I/II	86 III	87 I/II	87 III	88 I/II	88 III	89 I/II	89 III	90 I/II	90 III	91 I/II	91 III	92 I/II	92 III	93 I/II	93 III	94 I/II	94 III	95 I/II	95 III	96 I/II	96 III	97 I/II	97 III	TOTALS I/II	TOTALS III
ANTARC.	0	0	0	0	12	0	0	0	0	0	14	0	30	0	8	0	0	0	0	0	0	0	0	0	64	0
ARCTIC	0	0	0	0	6	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	10
GREAT LK	0	0	0	0	0	0	0	0	0	36	0	0	0	15	0	0	0	35	0	0	0	0	0	0	0	86
INDIAN O.	184	0	0	0	36	0	0	0	0	14	12	0	0	0	0	0	179	0	709	0	164	0	159	0	1443	14
N. ATL.	133	669	128	603	312	707	200	743	139	947	0	1038	179	968	227	510	150	629	34	715	223	817	155	281	1880	8627
S. ATL.	114	40	162	0	178	0	113	10	86	0	43	0	0	46	103	0	92	0	0	105	147	36	36	40	1074	277
N. PAC.	596	233	608	349	706	367	352	354	302	368	355	376	472	350	511	411	440	321	409	391	215	366	147	104	5113	3990
S. PAC	128	0	290	0	85	36	45	0	101	51	460	17	512	62	394	172	329	0	164	42	556	0	20	0	3084	380
TOTALS	1155	942	1188	952	1335	1120	710	1107	628	1416	884	1431	1193	1441	1243	1093	1190	985	1316	1253	1305	1219	517	425	12600	13384

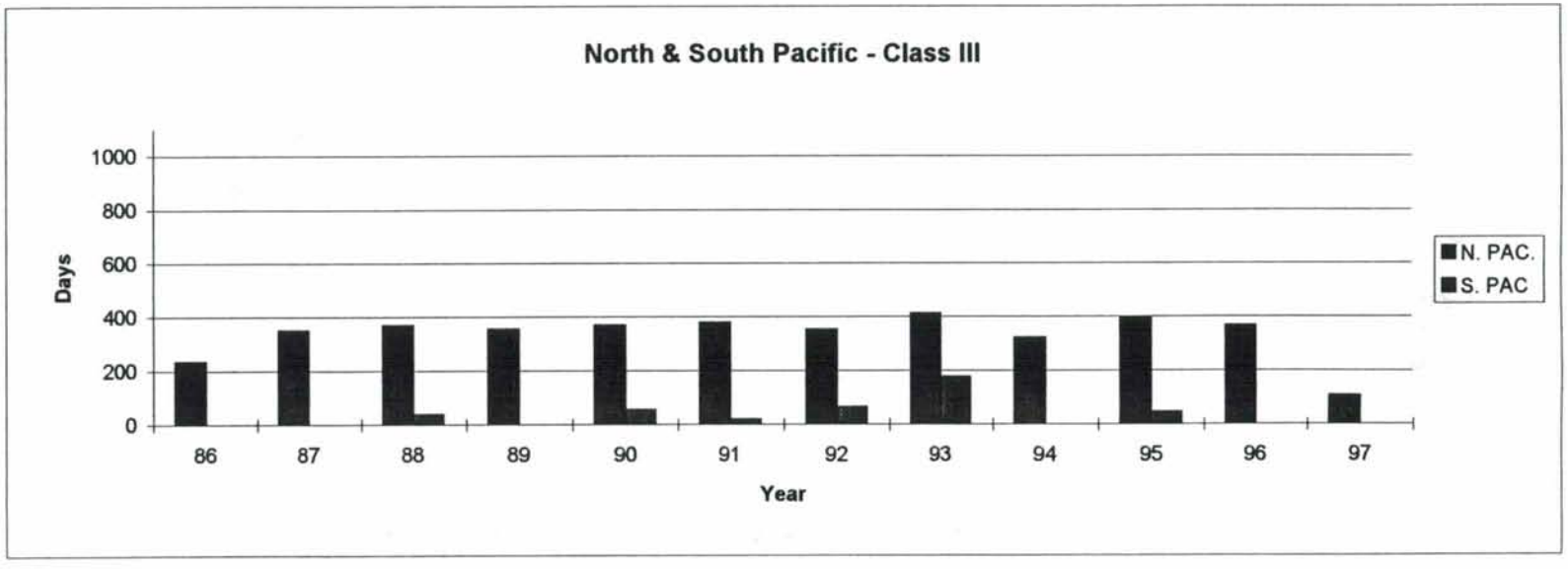
NOTES:

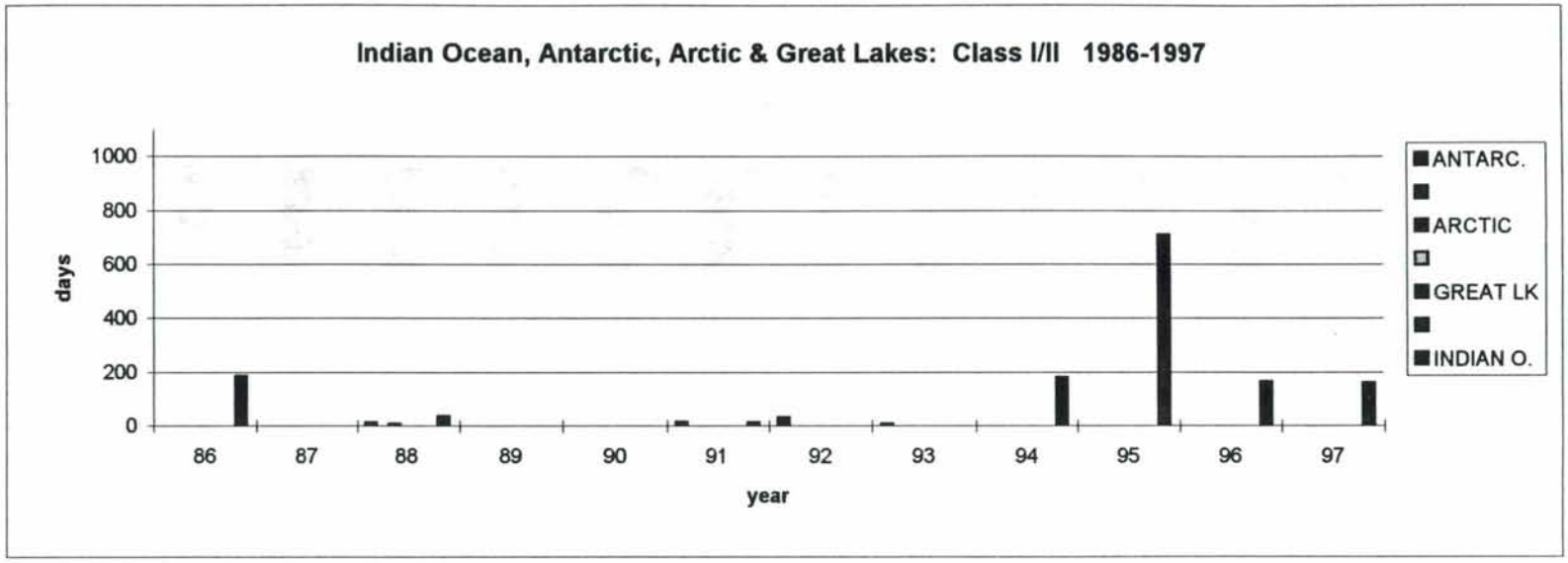
1. Statistics for years 1986 through 1993 were compiled from the ship utilization cruise reports.
2. Statistics for 1994, 1995 and 1996 were taken from the latest ship schedules available on OCEANIC as of 7/17/95.
3. Non-science days (port days, transits, and shipop days) were excluded from the statistics.
4. Summaries are provided for the Class I/II and the Class III ships only.
5. Operation days for ATLANTIS II are not included in the summary.
6. Statistics for 1997 were taken from the ship time requests.

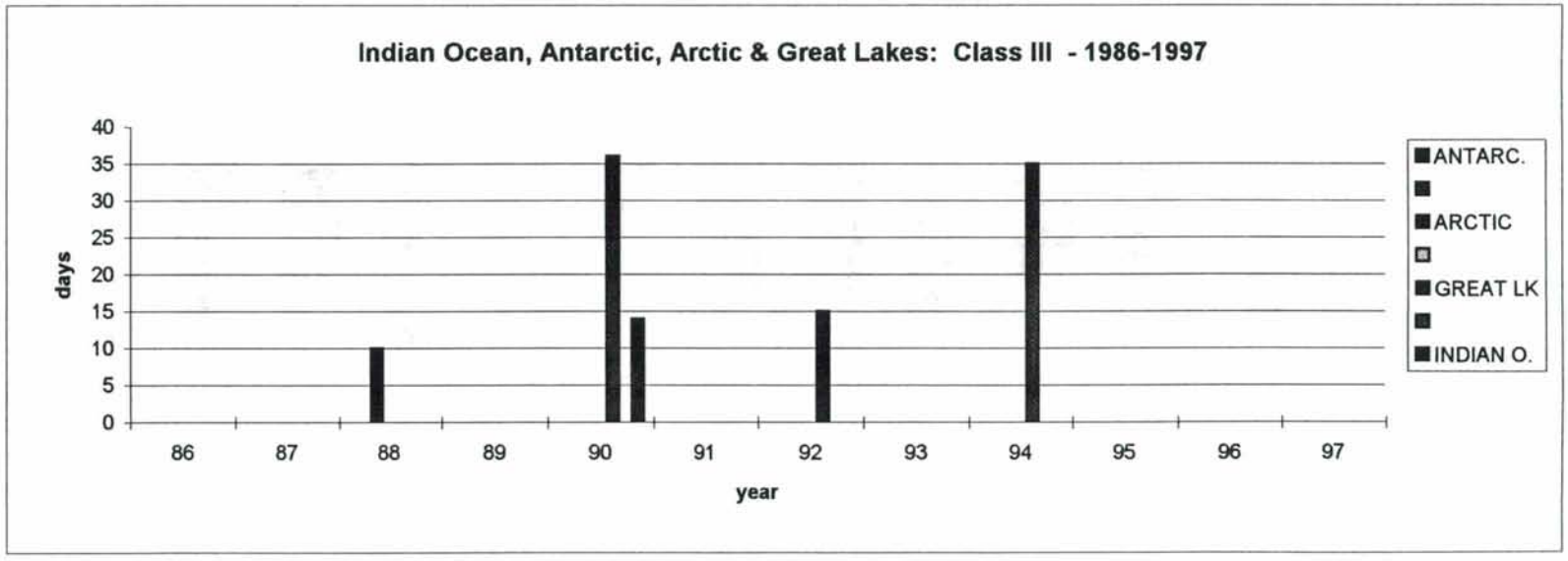

North & South Atlantic
Class I/II
Days
1000
800
600
400
200
0
86
87
88
89
90
91
92
93
94
95
96
97
Year
N. ATL.
S. ATL.

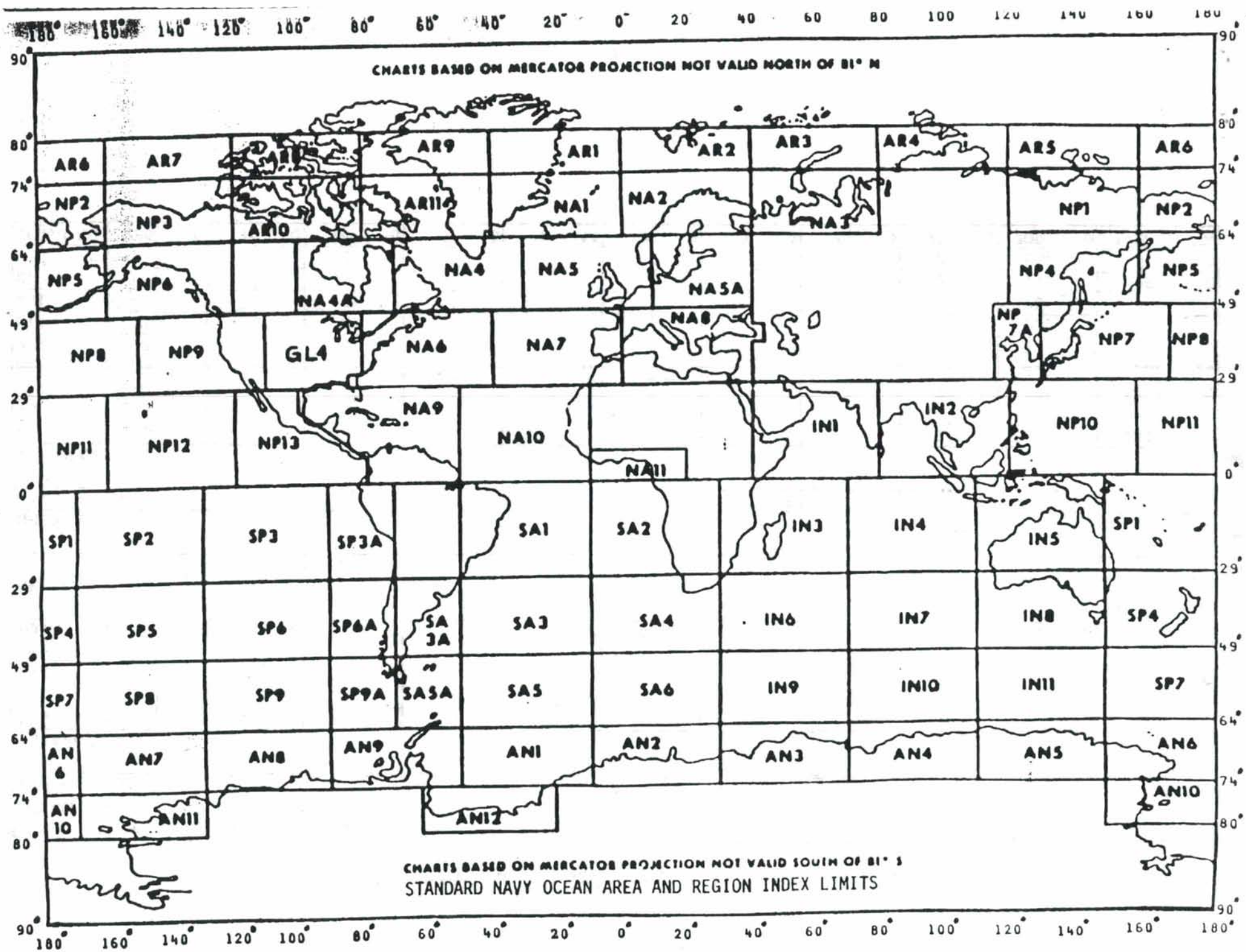

North & South Atlantic - Class III
Days
1000
800
600
400
200
0
86
87
88
89
90
91
92
93
94
95
96
97
Year
N. ATL.
S. ATL.


North & South Pacific - Class I/II
1000
800
600
400
200
0
Days
86
87
88
89
90
91
92
93
94
95
96
97
Year
N. PAC.
S. PAC


North & South Pacific - Class III
1000
800
600
400
200
0
Days
86
87
88
89
90
91
92
93
94
95
96
97
Year
N. PAC.
S. PAC


Indian Ocean, Antarctic, Arctic & Great Lakes: Class I/II 1986-1997
days
1000
800
600
400
200
0
86
87
88
89
90
91
92
93
94
95
96
97
year
ANTARC.
ARCTIC
GREAT LK
INDIAN O.


Indian Ocean, Antarctic, Arctic & Great Lakes: Class III - 1986-1997
days
40
35
30
25
20
15
10
5
0
86
87
88
89
90
91
92
93
94
95
96
97
year
ANTARC.
ARCTIC
GREAT LK
INDIAN O.


CHARTS BASED ON MERCATOR PROJECTION NOT VALID NORTH OF 81° N
AR6
AR7
AR8
AR9
AR1
AR2
AR3
AR4
AR5
AR6
NP2
NP3
AR10
AR11
NA1
NA2
NA3
NP1
NP2
NP5
NP6
NA4A
NA4
NA5
NA5A
NP4
NP5
NA8
NP7A
NP7
NP8
NP8
NP9
GL4
NA6
NA7
NP11
NP12
NP13
NA9
NA10
NA11
IN1
IN2
NP10
NP11
SP1
SP2
SP3
SP3A
SA1
SA2
IN3
IN4
IN5
SP1
SP4
SP5
SP6
SP6A
SA 3A
SA3
SA4
IN6
IN7
IN8
SP4
SP7
SP8
SP9
SP9A
SA5A
SA5
SA6
IN9
IN10
IN11
SP7
AN 6
AN7
AN8
AN9
AN1
AN2
AN3
AN4
AN5
AN6
AN 10
AN11
AN12
AN10
CHARTS BASED ON MERCATOR PROJECTION NOT VALID SOUTH OF 81° S
STANDARD NAVY OCEAN AREA AND REGION INDEX LIMITS

GEOGRAPHIC OPERATING AREAS: 1986 - 1995

OCEAN AREA	1986		1987		1988		1989		1990		1991		1992		1993		1994		1995		TOTALS	
	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III
ANTARCTIC																						
AN5					12																12	0
AN6													15								15	0
AN7													15								15	0
AN9											14				8						22	0
TOTAL AN	**0**	**0**	**0**	**0**	**12**	**0**	**0**	**0**	**0**	**0**	**14**	**0**	**30**	**0**	**8**	**0**	**0**	**0**	**0**	**0**	**64**	**0**
ARCTIC																						
AR2					6	10															6	10
GREAT LAKES																						
GL4										36				15				35			0	86
INDIAN OCEAN																						
IN1	33																77		331		441	0
IN2	15				12												10		25		62	0
IN4	41																7		97		145	0
IN5	31									14	12								47		90	14
IN6	36																		23		59	0
IN7	28																30		85		143	0
IN8					12												29		29		70	0
IN10																	8		17		25	0
IN11					12												18		55		85	0
TOTAL I/O	**184**	**0**	**0**	**0**	**36**	**0**	**0**	**0**	**0**	**14**	**12**	**0**	**0**	**0**	**0**	**0**	**179**	**0**	**709**	**0**	**1120**	**14**

OCEAN AREA	1986		1987		1988		1989		1990		1991		1992		1993		1994		1995		TOTALS	
	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III
NORTH ATLANTIC																						
NA1			25		35	10		59	15												75	69
NA2			9			18			16												25	18
NA4					5	5			1			23			17	10					23	38
NA5						8		26	60			73			18						78	107
NA6	104	311	58	425	21	260	46	281	22	379		282	19	308	124	198	15	309	0	450	409	3203
NA7		90			35	32	9					65	21	121	16	40	32				113	348
NA8				76	129							12			15		21				165	88
NA9	29	188	5	86	30	351	113	281	25	479		434	66	409		246	4	320	34	265	306	3059
NA10		80	31	16	57	23	32	96		89		94	73	120	37	16	78				308	534
NA11												55		10							0	65
TOTAL NA	**133**	**669**	**128**	**603**	**312**	**707**	**200**	**743**	**139**	**947**	**0**	**1038**	**179**	**968**	**227**	**510**	**150**	**629**	**34**	**715**	**1502**	**7529**
SOUTH ATLANTIC																						
SA1	29	40	94		94		73	10			14			27	38		40			39	382	116
SA2					33										8						41	0
SA3	18		68		26		32		86		14			19			24				268	19
SA3A					5										10		14			66	29	66
SA4	16				20		8								28						72	0
SA5	34														10						44	0
SA5A	17										15				9		14				55	0
TOTAL SA	**114**	**40**	**162**	**0**	**178**	**0**	**113**	**10**	**86**	**0**	**43**	**0**	**0**	**46**	**103**	**0**	**92**	**0**	**0**	**105**	**891**	**201**

OCEAN AREA	1986		1987		1988		1989		1990		1991		1992		1993		1994		1995		TOTALS	
	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III
NORTH PACIFIC																						
NP2			27		44																71	0
NP5	7		27		75										13		29				151	0
NP6	18		55	8	65	33					9	41	7		36		40				230	82
NP7	7				14										90		83		59		253	0
NP7A	57																				57	0
NP8	62	27	39	32			35							2	17			16			153	77
NP9	188	184	45	273	129	296	28	326	43	275	56	288	50	201	105	282	73	231	107	301	824	2657
NP10	43				99				55	16	62		48	27	71	25	66		47		491	68
NP11					62		34		29	9	37		70	41	42	26	19		28		321	76
NP12	130	22	206	36	73	38	125		102	68	148	31	200	79	93	54	75		90		1242	328
NP13	84		209		145		130	28	73		43	16	97		44	24	55	74	78	90	958	232
TOTAL NP	**596**	**233**	**608**	**349**	**706**	**367**	**352**	**354**	**302**	**368**	**355**	**376**	**472**	**350**	**511**	**411**	**440**	**321**	**409**	**391**	**4751**	**3520**
SOUTH PACIFIC																						
SP1	118		48				38		42		69		122	28	92	25	121		53		703	53
SP2	10		112		12	36	7		12	51	109	17	160		26	4	48		21		517	108
SP3			66		12				5		112		62		183	17	24		43		507	17
SP3A			64		12				13		11			34	13	126	24			42	137	202
SP4									24		11		37						16		88	0
SP5											33		51						4		88	0
SP6									5		79		25		21		40				170	0
SP6A					49								13		23		72				157	0
SP7													15						27		42	0
SP8													27								27	0
SP9											21				7						28	0
SP9A											15				29						44	0
TOTAL SP	**128**	**0**	**290**	**0**	**85**	**36**	**45**	**0**	**101**	**51**	**460**	**17**	**512**	**62**	**394**	**172**	**329**	**0**	**164**	**42**	**2508**	**380**
	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III	I/II	III

GEOGRAPHIC OPERATING AREAS: 1996 -1997

OCEAN AREA	1996 I/II	1996 III		1997 I/II	1997 III		TOTALS I/II	TOTALS III
INDIAN OCEAN								
IN1	17						17	0
IN3	25			44			69	0
IN4	24			44			68	0
IN5	12			42			54	0
IN6	12						12	
IN7	11						11	0
IN8	18			29			47	0
IN9	26						26	0
IN11	19						19	0
TOTAL I/O	**164**	**0**		**159**	**0**		**323**	**0**
NORTH ATLANTIC								
NA1	47						47	0
NA2	0						0	0
NA4	0	33			16		0	49
NA5	0			20	25		20	25
NA6	35	488		70	200		105	688
NA7	77						77	0
NA9	24	282		30	40		54	322
NA10	40	14		35			75	14
TOTAL NA	**223**	**817**		**155**	**281**		**378**	**1098**
SOUTH ATLANTIC								
SA1	16	36		18	40		34	76
SA2	0	0					0	0
SA3	39			18			57	0
SA4	44						44	0
SA5	0						0	0
SA6	48						48	0
TOTAL SA	**147**	**36**		**36**	**40**		**183**	**76**
NORTH PACIFIC								
NP6	0			15			15	0
NP8	0						0	0
NP9	84	172		54	35		138	207
NP10	0						0	0
NP11	0						0	0
NP12	92	43		43	35		135	78
NP13	39	151		35	34		74	185
TOTAL NP	**215**	**366**		**147**	**104**		**362**	**470**

SOUTH PACIFIC

SP1	188						188	0
SP2	91						91	0
SP3	135			20			155	0
SP4	55						55	0
SP5	0						0	0
SP6	18						18	0
SP7	19						19	0
SP9	50						50	0
TOTAL SP	**556**	**0**		**20**	**0**		**576**	**0**

TOTALS	1996			1997			TOTALS	
	I/II	III		I/II	III		I/II	III
	1305	**1219**		**517**	**425**		**1822**	**1644**

APPENDIX IX

United States General Accounting Office

GAO

Report to the Ranking Minority Member, Subcommittee on VA, HUD, and Independent Agencies, Committee on Appropriations, U.S. Senate

May 1995

NATIONAL SCIENCE FOUNDATION

Need for Additional Icebreaking Research Vessel Not Demonstrated

GAO/RCED-95-77

GAO

United States
General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

B-259759

May 12, 1995

The Honorable Barbara Mikulski
Ranking Minority Member
Subcommittee on VA, HUD,
and Independent Agencies
Committee on Appropriations
United States Senate

Dear Senator Mikulski:

The Arctic Ocean is one of the least explored regions of the world. Furthermore, this region is believed to play a key role in global climate systems, world fishery production, and other natural phenomena. The U Coast Guard currently provides and operates icebreakers in support of t nation's Arctic research program.

The National Science Foundation (NSF) received funds in fiscal year 199 to begin design work on an icebreaking research ship (the proposed vessel) and subsequently sought funds to acquire the vessel. As agreed with your office, this report examines the justification for the proposed vessel. Also, as requested, we are providing you with information on NSF analysis of the costs of buying versus leasing the proposed vessel. (See app. I.)

Results in Brief

NSF has not adequately justified the need for the proposed $120 million icebreaking vessel. A 1990 interagency study of national icebreaker nee called for a fleet of four icebreakers, three of which are currently in operation. The fourth icebreaker is being built for the Coast Guard to serve primarily as an Arctic research vessel and was designed with inpu from the scientific community. Although research needs in the Arctic ha evolved since 1990, NSF and the scientific community have not demonstrated a net increase in icebreaker requirements sufficient to justify a fifth icebreaker. Currently, the existing icebreaker fleet is underutilized, and no research cruises in the Arctic region are planned f 1995 or 1996, primarily because of funding constraints. Recognizing the need to update requirements for Arctic research and icebreaker support, NSF contracted with the National Research Council of the National Academy of Sciences to study this issue. A report on the study's findings expected during the summer of 1995.

Many Arctic scientists justify the acquisition of the proposed vessel on the grounds that the Coast Guard is unwilling and unable to provide efficient and reliable support to research activities in the Arctic region. While these criticisms have merit, they are not convincing, given recent improvements in the Coast Guard's commitment and ability to support research in the region.

Background

Awareness of the environmental and economic importance of the Arctic region is growing. The Arctic region is a very harsh operating environment, making research expensive and risky. NSF is the largest federal provider of funds for research in this region.[1] The U.S. Coast Guard, part of the Department of Transportation, is charged with providing and operating icebreakers to meet U.S. military, logistic, and research needs in the Arctic and Antarctic regions. From 1966 to 1991, the U.S. Coast Guard operated the nation's icebreakers.[2] The mission of the Coast Guard's Ice Operations Division, Office of Navigation Safety and Waterways Services, includes assisting other governmental and scientific organizations in scientific research and supporting national interests in the polar regions. Investigators representing or sponsored by universities, private institutions, and government agencies—including the Office of Naval Research, the U.S. Geological Survey, and the National Oceanic and Atmospheric Administration—conduct research aboard the Coast Guard icebreakers.

The Arctic Research and Policy Act of 1984, as amended, calls for coordination among agencies over the use of logistics resources, including icebreakers, in the conduct of research. The act established the Arctic Research Commission to promote research in the Arctic region and to recommend Arctic research policy. Also under the act, responsibility for promoting the coordination of all Arctic research activities among agencies, including logistics (e.g., icebreaker support), rests with the Interagency Arctic Research Policy Committee. The Committee is headed by NSF and includes the Coast Guard among its members. Furthermore, in a 1987 agreement aimed at minimizing conflict and serving national interests, NSF and the Coast Guard pledged "to plan together, to the maximum extent possible, for the use of U.S. [Coast Guard] icebreakers in the support of polar research."

[1]NSF's mission is to promote and advance scientific progress.

[2]In 1991, NSF funds were used to lease the newly constructed Antarctic icebreaking research vessel, the Nathaniel B. Palmer. The vessel is operated for the oceanographic research community by a private contractor under a long-term lease.

The Arctic research community has sought a vessel dedicated to Arctic research for many years. The Arctic Research Commission recommended that such a vessel be acquired. The Interagency Arctic Research Policy Committee echoed this recommendation. Beginning in 1987, the scientific community, through the University National Oceanographic Laboratory System (UNOLS),[3] used funds from NSF to study the requirements for, and possible designs of, an Arctic research vessel. Comments from the Arctic scientific community from 1990 to 1992, discussions in the Interagency Arctic Research Policy Committee, and other forums were used to define the characteristics of the vessel. From 1990 to the present, NSF and UNOLS, working with a private engineering firm, developed preliminary designs for Arctic research vessels of increasing size and icebreaking capability. The first design called for a 200-foot vessel with modest icebreaking capability whose estimated cost was about $40 million. After the Arctic scientific community reviewed and commented on this design, it was agreed that a larger vessel with greater icebreaking capacity was needed. Accordingly, a 340-foot vessel was designed with significant icebreaking capability and the capacity to perform 90-day missions in the Arctic region. This vessel is expected to cost about $120 million.

Need for Proposed Vessel Not Demonstrated

Acquisition of the proposed vessel is not supported by a quantified analysis of the nation's requirements for icebreakers or by the scientific community's criticism of the Coast Guard's support for research. Moreover, records of actual and projections of future icebreaker use suggest that a fifth icebreaking vessel may not be needed.

Proposed Vessel Not Justified by Quantified Analysis of Icebreaker Needs

A 1990 interagency study of national polar icebreaker requirements (PIRS),[4] the most recent such quantified study, did not call for the construction of the proposed vessel. NSF justifies the proposed vessel on the grounds that (1) Arctic research needs are increasing and (2) the United States does not have a vessel dedicated to Arctic research. However, NSF has not demonstrated that another icebreaker is required to meet research needs.

The study documented the nation's icebreaker requirements and recommended a fleet of four icebreakers. These are the

- Polar Sea and Polar Star (currently operating Coast Guard icebreakers);

[3]An association of organizations with ocean science research programs.

[4]"Polar Icebreaker Requirements," October 1990. The study is a collaborative effort by the Departments of Transportation and Defense, NSF, and the Office of Management and Budget.

- Nathaniel B. Palmer (an Antarctic icebreaking research vessel); and
- Michael A. Healy (a planned Coast Guard icebreaker).

The proposed vessel would be the fifth U.S. icebreaker, one more than recommended by the 1990 study. Funds for the Healy have been approved, and the vessel is scheduled to begin duty in 1998. According to Coast Guard officials, the Healy will serve primarily as an Arctic research vessel except when circumstances require its use elsewhere.[5]

To determine icebreaker requirements, the 1990 study quantified operational and research mission needs. To quantify needs, the number of days icebreakers were required to accomplish the missions was totaled. Operational missions consisted of the annual resupply of the Thule Air Force Base in Greenland[6] and the McMurdo Antarctic research station (an NSF mission), as well as treaty inspection duties in the Antarctic. Research requirements for icebreaker support were also quantified and used in the study. However, these requirements do not reflect subsequent changes in users' needs, such as the military's reduced needs for icebreaker services resulting from the end of the Cold War and other agencies' increased needs attributed to higher priorities for Arctic research. Areas of increased research emphasis include Arctic fisheries, because of concern over fluctuating fish catches, and Arctic water quality, because of concern over radionuclide and other contamination originating in the former Soviet Union.

The scientific community has produced several reports recommending the acquisition of an icebreaking vessel dedicated to Arctic research. None of these reports attempts to justify the proposed vessel by comparing the realistic demand for icebreakers to be used for research with the availability of existing and planned Coast Guard icebreakers. Reports of the Polar Research Board of the National Academy of Sciences, the U.S. Arctic Research Commission, and the Interagency Arctic Research Policy Committee justify an additional vessel on the basis of (1) the increasing (although not quantified) needs for research in the Arctic and (2) the observation that the United States does not possess a vessel dedicated to Arctic research. These reports do not balance the increased needs for icebreakers to support research with the decreased needs for icebreakers

[5]For example, the Coast Guard told us that if its other icebreakers were unexpectedly unavailable, it would send the Healy to resupply McMurdo Station, Antarctica.

[6]The Coast Guard has arranged with the Canadian government to have the Canadian Coast Guard provide support for resupplying the Thule Air Force Base. However, the Coast Guard must be prepared to resume this duty on 1 year's notice. In the meantime, this arrangement makes an icebreaker available for about 60 days per year, potentially for assignment to research missions.

to support defense missions. Nor do the reports state why existing and planned Coast Guard icebreakers, whose missions include supporting Arctic research, cannot meet these needs. Finally, the reports do not consider where the additional funding for research will be obtained to fully employ a five-icebreaker fleet.

To address these shortcomings, NSF requested that the National Research Council, which is affiliated with the National Academy of Sciences, examine the scientific community's needs for icebreaker support and hov they can best be met. Neither the NSF program manager nor the study's director is certain whether the study will attempt to quantify the needs fo icebreakers to support research in the Arctic. Planning for the study bega in November 1994, and the final results are expected in the summer of 1995.

The potential for underutilizing existing and planned Coast Guard icebreakers has led that agency to oppose the construction of the proposed vessel. Both the actual use of Coast Guard vessels for research in the Arctic over the past 4 years and the projected use in 1995 and 1996 are lower than estimated in the 1990 study. Coast Guard records for 1994 show 83 days of icebreaker use for the Arctic research of NSF and others, compared with the 143 days of use projected for NSF's research in the 199(PIRS. Furthermore, no use of Coast Guard vessels for research in the Arcti region is scheduled, or likely, for 1995. Prospects for a scientific mission i 1996 are not good, according to Coast Guard and NSF officials, because of funding constraints.

Coast Guard's Shortcomings Not Compelling Justification for Vessel, Given Recent Improvements

Many in the Arctic scientific community justify the acquisition of the proposed vessel on the grounds that the Coast Guard, because it has multiple missions, does not possess the desire, skills, or facilities to provide adequate support for Arctic science. However, this justification is not convincing, given improvements in the Coast Guard's commitment an ability to support research in the region.

Some Arctic scientists assert that the Coast Guard values its other missions over supporting science. As a result, say these scientists, the Coast Guard lacks the desire to ensure the successful completion of scientific cruises to the Arctic. For example, supporting the U.S. military i a significant and traditional Coast Guard mission. The Coast Guard's adherence to this mission may result in approaches and goals on cruises that differ from those of the scientists on board. For instance, the strict

chain of command on Coast Guard vessels has made communication between the chief scientist and the Captain of the vessel cumbersome, limiting flexibility in the accomplishment of research. Scientists, on the other hand, are generally not accustomed to seeking authorization for minor changes in the conduct of research projects.

In recent years, the Coast Guard has placed greater emphasis on its role in supporting science. This increased priority is evidenced by an agreement between the Coast Guard and NSF on support for polar research, Coast Guard directives concerning such research, and a decline in the military mission for the Coast Guard's icebreaker fleet. The Coast Guard's operating authority includes supporting oceanographic research as a Coast Guard mission. In addition, in 1987, the Coast Guard pledged in an agreement with NSF to maintain trained personnel and icebreakers with adequate facilities to support polar research. Also, following an unsuccessful and contentious scientific cruise in 1991, high-ranking Coast Guard officials, including the Commandant, issued several directives stressing the importance of supporting Arctic science as a Coast Guard mission. Finally, Coast Guard officials in the Division of Ice Operations observed that the scientific mission has taken on added importance for the Coast Guard icebreaker fleet as emphasis on the military mission for these vessels has declined. Arctic scientists who participated in scientific cruises aboard Coast Guard icebreakers have noted significant improvements in the willingness of Coast Guard personnel to work with and support scientists.

However, many Arctic scientists have maintained that Coast Guard personnel lack the skills necessary to adequately support research in the Arctic. Furthermore, some of the scientists believe that acquiring the proposed vessel would allow them to employ a crew that is highly skilled in supporting research. Scientists also point to Coast Guard rotation policies that prevent personnel from acquiring and maintaining skills in planning scientific cruises, navigating and maneuvering in ice, and maintaining and operating scientific equipment, such as oceanographic winches.

The Coast Guard recognizes these shortcomings and has taken steps to address them. First, to represent the needs of scientists before the Coast Guard, the agency created a position for a liaison with the civilian scientific community at the icebreakers' home port of Seattle, Washington. This representation includes ensuring that scientists' needs are met when the vessels are prepared for scientific cruises. Second, the Coast Guard

arranged with the Canadian Coast Guard for an informal officer exchange/training program to improve the officers' skills and began sending new officers on trips aboard the icebreakers to familiarize them with icebreaker operations. In addition, the liaison has arranged training for Coast Guard technicians with equipment manufacturers on the proper use of scientific equipment found aboard the icebreakers.

Some Arctic scientists believe that the two currently operating Coast Guard icebreakers are unreliable and lack necessary scientific facilities. The scientists cite mechanical failures that have hindered or prevented the completion of research projects. Scientists also cite poor laboratory facilities and research equipment as limiting research opportunities.

The Coast Guard has taken steps to enhance the reliability of its two icebreakers and boost their basic scientific capabilities. First, the Coast Guard strengthened and rebuilt the faulty propeller hubs on the icebreakers to improve their reliability.[7] From 1987 to 1992, the two icebreakers underwent the Polar Science Upgrade Project to improve the scientific capabilities of both vessels. This project upgraded laboratory spaces, oceanographic instrumentation, and communication equipment and provided new oceanographic and trawling winches. These upgrades improved the vessels' ability to support Arctic research. In addition, beginning in the spring of 1995, the Coast Guard plans to conduct midlife refits of its two existing icebreakers as part of the Reliability Improvement Project, which is designed to correct original design flaws and replace deteriorated and outdated equipment, although it will not result in further significant upgrades of scientific equipment and facilities.

In addition to improving its two existing icebreakers, the Coast Guard is acquiring another icebreaker with significant research support capabilities. The Healy was justified and designed, in part, to support polar research. Coast Guard officials told us that the Healy will be used primarily as an Arctic research vessel. Compared with the two existing Coast Guard icebreakers, this icebreaker will provide significantly improved facilities for supporting science. Although the Healy was justified largely as a research vessel, the Coast Guard requires that it be capable of supporting other Coast Guard missions, namely, annually breaking the channels to allow the resupply of Thule Air Force Base,

[7]Despite the Coast Guard's efforts to redesign the propeller hubs, a propeller failed during a research trip to the north pole over the summer of 1994. This breakdown contributed to the failure to complete one of the research projects planned for that trip. The Coast Guard noted that such failures are not uncommon when propellers are operating in the high Arctic in heavy ice.

Greenland,[8] and McMurdo Station, Antarctica. Accordingly, the Healy was designed with greater icebreaking and seakeeping capabilities than the vessel proposed by NSF.[9]

The Arctic scientific community is largely dissatisfied with the design compromises the Coast Guard made to the Healy. As a result, some scientists believe that the vessel's overall design does not adequately reflect the scientific community's needs and suggestions for changing the vessel's design. The scientists point to factors such as an outdated hull design, poor fuel efficiency (high costs), and an inefficient deck layout resulting from the engines' placement as areas that the scientists had rejected. The Coast Guard maintains that the hull's design is not outdated and that, while it may not be the most efficient icebreaking design, it is necessary to ensure the Healy's open-ocean transit capability. The Coast Guard conferred with leading Arctic scientists when designing the scientific facilities for the Healy through a survey and during several meetings. Some of the scientists' suggestions were incorporated into the vessel's design. For example, the arrangement of laboratory spaces was changed, and hatch sizes were increased to accommodate scientific equipment. However, the scientific community was not consulted on the vessel's basic design. According to Coast Guard officials, the procurement of the Healy involved the use of performance-based specifications that were defined in consultation with the user community. The officials said that the shipbuilder relied heavily on consultants who had designed and built the majority of the world's icebreakers.

Conclusions

NSF and the Arctic scientific community have not demonstrated that the proposed vessel is needed. The most recent (1990) quantified assessment of national icebreaker requirements did not support a need for the proposed vessel. Reports identified by NSF as justifying the acquisition of the proposed vessel cite only increasing research needs and the lack of a dedicated research icebreaker without quantifying those needs and explaining why the current arrangement with the Coast Guard is inadequate. NSF recognizes the deficiencies in its justification for the proposed vessel, as evidenced by its recently contracting with the National Research Council, affiliated with the National Academy of Sciences, to study the need for icebreakers to support polar research. Furthermore, the

[8]The Coast Guard has arranged with the Canadian Coast Guard to perform this task in return for the United States' agreeing to help protect Canadian shipping interests in the western Arctic.

[9]Seakeeping refers to the stability and motion of a vessel traveling across open, and potentially rough, stretches of ocean. This quality is important for the Healy because of the requirement that it be capable of steaming to Antarctica—a roughly 35-day open-ocean passage from Seattle, Washington.

Coast Guard improved its responsiveness to the needs of the scientific community, enhanced the capabilities of existing vessels, and is building a vessel whose primary mission is to support Arctic research. Further cooperation between the Coast Guard and the scientific community should facilitate more cost-effective research and the achievement of other national goals in the Arctic region.

Agency Comments and Our Evaluation

NSF provided written comments on a draft of this report. (See app. III for NSF's comments and our evaluation of them.) NSF had three general comments: (1) the agency does not agree with our conclusion that NSF and the scientific community have not demonstrated the need for the proposed vessel; (2) the agency believes that final judgment on the need for a dedicated Arctic research vessel should be deferred until the National Academy of Sciences has completed its study of this issue; and (3) the agency recognizes that interagency communication must be improved.

We disagree with NSF's assessment that adequate need for the proposed vessel has been demonstrated. In our view, though scientific needs are important, fiscal constraints and the capacity of existing and planned icebreakers with scientific capability have not been taken into account when justifying an Arctic research vessel. We agree with NSF that the National Academy of Sciences' study is important. We note that our report is not, nor does it purport to be, the final judgment on the acquisition of an Arctic research vessel. We also support NSF's efforts to improve interagency cooperation in order to increase the effective use of resources for Arctic research.

We discussed a draft of this report with Department of Transportation officials, who generally agreed with our findings and conclusions. On the basis of NSF's comments and our discussion with Transportation officials, we have made changes to our report, where appropriate.

In examining the justification for the proposed vessel, we reviewed the Arctic Research Policy Act, as amended, and other relevant laws, regulations, and publications. We also reviewed the 1984 and 1990 Polar Icebreaker Requirements studies; relevant congressional testimony; correspondence from and for NSF and the Coast Guard; Coast Guard policies and procedures; design reports for the proposed Arctic research vessel and the planned Coast Guard icebreaker Healy; and data on the use of icebreakers. We interviewed officials from the Coast Guard, NSF, the

U.S. Geological Survey, and the U.S. Navy's Naval Sea Systems Command and Office of Naval Research. We also interviewed officials from the University of Alaska and other universities and research institutions. Finally, we interviewed officials from the Arctic Research Commission, the University National Oceanographic Laboratory System, and the Polar Research Board of the National Academy of Sciences. Appendix II contains a more detailed discussion of our objectives, scope, and methodology. We conducted our review between June and December 1994 in accordance with generally accepted government auditing standards.

We will send copies of this report to the Director, National Science Foundation; the Secretary of Transportation; the Commandant of the Coast Guard; the Director, Office of Management and Budget; and other interested parties. We will also make copies available to others on request.

If you have any questions or need additional information, please contact me at (202) 512-3841. Major contributors to this report are listed in appendix IV.

Sincerely yours,

Victor S. Rezendes
Director, Energy and
Science Issues

Contents

Abbreviations

FOFCC	Federal Oceanographic Fleet Coordinating Committee
GAO	General Accounting Office
NAS	National Academy of Sciences
NSF	National Science Foundation
OMB	Office of Management and Budget
PIRS	1990 Polar Icebreaker Requirements Study
UNOLS	University National Oceanographic Laboratory System

NSF's Lease-Buy Analysis for the Proposed Vessel

The Ranking Minority Member, Subcommittee on VA, HUD, and Independent Agencies, Senate Committee on Appropriations, asked us to examine the National Science Foundation's (NSF) analysis of options for buying and leasing the proposed Arctic research vessel.[10] We found that NSF's analysis closely follows the Office of Management and Budget's (OMB) guidelines and shows buying as the best option. However, because the analysis is necessarily preliminary, NSF plans to solicit both purchase and lease proposals, should it proceed in acquiring the proposed vessel.

As required by OMB Circular A-94, NSF compared the cost to the federal government of two different methods of financing the proposed vessel: (1) full purchase of the vessel and (2) long-term leasing from a private builder/operator, covering its 20-year expected life.[11] This analysis, which took into account both construction and operating costs, found that the federal government would have the least cost if it purchased the proposed vessel. However, because the design phase is preliminary, the cost estimates represent only rough approximations of the proposed vessel's costs. Moreover, in order to compare the expected costs of leasing and buying, NSF needed to make several simplifying assumptions.[12]

While NSF's analysis conforms reasonably well to the OMB guidelines for lease-purchase comparisons, the analysis is based on preliminary cost estimates and relies on a variety of assumptions for which alternative hypotheses might be reasonable as well. In addition, assumptions also needed to be made for key variables, such as private sector borrowing costs on maritime loans. Moreover, because of the difficulty of determining a unique methodology for analyzing more complex forms of financing, such as a lease with an option to buy, or some cost sharing that might be offered by the state of Alaska, NSF's analysis does not include all relevant options.

[10]We reviewed the methodology NSF used to compare the relative costs of the proposed vessel under the buy and lease options. However, we did not independently verify or validate the cost estimates NSF used in its analysis. Appendix II contains additional details on our scope and methodology.

[11]Two other financing methods that have been considered but were not included in NSF's cost analys are (1) a lease with an option to buy and (2) the procurement of the vessel with cost sharing by the state of Alaska. NSF officials told us that these additional financing methods could be structured in many different ways—for example, different years in which the buy could be exercised in the lease with an option to buy, or a variety of ways that the state could share the costs of the vessel—and thu a straightforward methodology for comparing these financing options was not clear.

[12]These assumptions include, for example, that the building and basic operating costs of the vessel a the same under both the lease and the buy scenarios and that if the vessel is leased, the private secto firm finances all of the building costs through debt and none through raising equity.

The cost advantage of government purchase over long-term leasing of the vessel is related to two factors. First, under a lease arrangement, the costs of private sector financing—which are higher than the government's borrowing costs—are passed on to the federal government in lease payments, thereby increasing the vessel's financing costs over what they would be under outright government purchase.[13] Second, NSF assumed that the cost of building the vessel is the same under both the buy and the lease scenarios, but that under the lease arrangement, an additional profit accrues to the lessor for services related to its retained ownership of the vessel. Under the base-case analysis, roughly half of the cost advantage of purchasing over leasing is related to the gap in federal and private sector borrowing costs, and the remainder is related to the assumption of an additional profit stream to the lessor.

NSF's base-case estimates use a 5.8-percent government borrowing rate because that was the federal Treasury rate on 20-year bonds (a time horizon equal to the expected life of the vessel) as of early 1994. The cost of private sector capital was assumed to be 8.5 percent.[14] In this case, NSF found the advantage of purchase over lease to be $55.7 million in present-value terms. NSF also looked at the sensitivity of the advantage of purchase over lease by using alternative interest rates for both the government and private sector borrowing costs. Throughout these analyses, government purchase was favored over leasing, but the range by which purchase was advantageous ranged from $22.9 million to $99.6 million, each in terms of present value.[15]

[13]Because a shipbuilder/lessor will have a long-term lease arrangement for the vessel with the federal government, it may be able to obtain private sector borrowing at a rate not much higher than the federal Treasury rate. Moreover, if some degree of construction or ownership risk is transferred to the shipbuilder/lessor and managed efficiently, the effective economic cost of the lease to the government could fall below that of outright purchase—even though private sector borrowing is more expensive than public sector borrowing. While OMB's guidelines are sufficient for budgetary purposes, the difficulty of valuing risk and of valuing it under different sharing arrangements between the government and private entities, makes the economic evaluation of lease-buy analyses less certain.

[14]Both of these rates are as of early 1994. NSF officials told us that they assumed the private sector borrowing costs to be the prime rate plus 200 basis points. Although the prime rate has risen considerably since NSF did this analysis, the government borrowing cost has risen as well. Since the important conclusions derive largely from the relationship of these two rates, the basic conclusion of the analysis should generally not change as interest rates rise or fall.

[15]While NSF's analysis uses three alternative private-sector interest rates, its final results for the lease/purchase cost comparison were based only on the midpoint of these rates. At the same time, NS used a range of government borrowing rates (3.8 to 7.8 percent) in producing its final results. The numbers presented here are based on the full range of private sector interest rates NSF examined (7.5 to 9.5 percent). As a result, the range by which purchasing the proposed vessel was advantageous to the government was broader.

NSF's decision to delay choosing a method of financing the proposed vessel until after bids are solicited from shipbuilders for any of several financing options is appropriate. After bids are solicited, NSF will need to perform a financial analysis similar to the one it has performed, but it will then have the advantage of performing such an analysis on more detailed data derived from the bid solicitation.

Objectives, Scope, and Methodology

To determine whether the proposed vessel has been justified, we reviewe the Arctic Research Policy Act, as amended; other relevant laws and regulations; findings and recommendations of the Arctic Research Commission and the Interagency Arctic Research Policy Committee; the University National Oceanographic Laboratory System (UNOLS) Fleet Improvement Plan Update; and several other publications. We also reviewed the 1984 and 1990 Polar Icebreaker Requirements studies; relevant congressional testimony; correspondence from and for NSF, the Coast Guard, and UNOLS; Coast Guard policies, procedures, and Arctic research cruise reports; design reports for the proposed Arctic Research Vessel and the planned Coast Guard icebreaker Healy; and icebreaker usage and research cost data. We also obtained written statements from NSF and the Coast Guard on the appropriateness of agencies other than th Coast Guard acquiring and operating icebreakers.

In addition, we interviewed officials at Coast Guard headquarters in Washington, D.C.; Seattle, Washington; and Alameda, California. We also interviewed NSF officials from the Office of Polar Programs, Oceanographic Centers and Facilities Section, Budget Division, and officials from the U.S. Geological Survey, the U.S. Navy's Naval Sea Systems Command, and Office of Naval Research.

We interviewed officials from the University of Alaska, the University of Washington, Texas A&M University, the Lamont Dougherty Earth Observatory, and companies that conduct Arctic research. In addition, we interviewed officials from the Arctic Research Commission, the Universit National Oceanographic Laboratory System, and the Polar Research Boar of the National Academy of Sciences.

In order to evaluate NSF's analyses of leasing versus buying the proposed vessel, we reviewed OMB Circular A-94 and NSF's own analysis of the lease-buy option. We did not independently verify and validate the cost data that NSF used in the analyses, but rather, given NSF's cost estimates fo building and operating the vessel, we reviewed the methodology NSF used to compare the costs of leasing with the costs of buying. In addition, we talked with OMB officials.

Comments From the National Science Foundation

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

OFFICE OF THE
DEPUTY DIRECTOR

February 17, 1995

Mr. Victor S. Rezendes
Director, Energy and Science Issues
Resources, Community, and Economic Development Division
General Accounting Office
Washington, DC 20548

Dear Mr. Rezendes:

This letter and enclosures are the response of the National Science Foundation to the proposed report entitled *National Science Foundation: Need for Additional Icebreaking Research Vessel Not Demonstrated* (GAO/RCED-95-77). With respect to the examination of our analysis of the costs and benefits associated with various acquisition strategies for an Arctic research vessel, we are pleased to note that Appendix I of your report states that NSF's analysis closely follows Office of Management and Budget (OMB) guidelines. The report also states that NSF's decision to delay choosing a method of financing from a range of financing options until after bids are solicited from shipbuilders is appropriate.

See p. 9.

We disagree with the report's conclusion regarding the need for a new vessel to be used for Arctic research as expressed in the proposed title of the report, as well as with the assessment of a number of factors leading to that conclusion. We continue to believe that scientific merit and need should drive the discussion about the appropriate ocean-going platform for the conduct of research. In our view, a scientifically outfitted research vessel has superior capabilities to icebreakers designed for other purposes. Our concerns are stated in enclosures accompanying this letter.

Arctic ocean science research has been identified as warranting the highest priority by the Arctic Research Commission and the Interagency Arctic Research Policy Committee, which I chair. The National Academy of Sciences currently is conducting a review and evaluation of the scientific requirements for an Arctic research vessel in the context of national research needs in the Arctic Ocean regions. The report of this review is expected late in 1995. We expect that all issues of concern for national planning by NSF, the U.S. Coast Guard, and other federal agencies will be addressed in this study. While many previous reviews have substantiated the need for a vessel, we believe that final judgments regarding the need for a dedicated Arctic research vessel should be deferred until that study is complete.

See p. 9.

See p. 10.

We recognize that interagency communication must be improved, and we are committed to strengthening our partnerships with other agencies. In doing so, we will continue our efforts improving the way that we actively cooperate in Federal government efforts to serve the nation. We therefore intend to renew efforts to develop effective means for coordination among agencies like NSF and the U.S. Coast Guard and the scientific community in order to facilitate more cost-effective planning and achievement of research and other national goals in the Arctic region.

Sincerely,

Neal Lane

Neal Lane
Director

Enclosures

Enclosure 1

General Comments Regarding the GAO Report on a Proposed Arctic Research Vessel

Analysis of Acquisition Strategies

In language accompanying the FY 1994 appropriation for the National Science Foundation, Congress called for "a report from the General Accounting Office on the costs and benefits associated with various acquisition strategies including lease, purchase, debt financing and other mechanisms which could be pursued by the NSF or its institutional operator." This charge is addressed in Appendix I of the report. We are pleased to note that the report found that NSF's analysis closely follows Office of Management and Budget (OMB) guidelines and that NSF's decision to delay choosing a method of financing from a range of financing options until after bids are solicited from shipbuilders is appropriate.

GAO Analysis of the Demonstration of Need for a Dedicated Arctic Research Vessel

Arctic oceans research is necessary to provide a sound basis for developing national and international policy on Arctic resources and for understanding the role of the Arctic region in global environmental change. The Arctic Ocean is a unique environment, characterized by a deep, permanently ice-covered central ocean basin surrounded by seasonally ice-covered shelves and marginal seas. The Arctic Ocean and adjacent seas play a key role in global climate systems and are very sensitive to environmental change. The vast continental shelves of the Arctic marginal seas have enormous impacts on the biology, chemistry, and physics of the ocean. The Arctic shelves contain some of the richest commercial fisheries in the world as well as large populations of birds and marine mammals. The full extent of the natural resources of the Arctic is poorly known, because the Arctic Ocean is critically undersampled.

The most severe limitation to accomplishing the research is limited access to the ice-covered Arctic Ocean and seasonally ice-covered marginal areas. Although the U.S. Coast Guard has allowed its icebreakers to be used for research purposes, the United States has no dedicated Arctic research vessel. In an extensive series of studies and reports, Arctic research scientists have repeatedly stated that the absence of a properly configured vessel that can conduct research at times dictated by scientific needs has seriously inhibited the advancement of our understandings of this critical environment. A research vessel providing all-season access to the Arctic region is essential for many proposed studies and is an indispensable component of a modern and efficient academic research fleet required to maintain U.S. leadership in polar sciences.

See comment 1.

The needs, priorities and capabilities required for an Arctic research vessel have been examined in National Academy of Sciences studies in 1982, 1989, and 1991 and in the University-National Oceanographic Laboratory System (UNOLS) academic fleet requirement studies of 1990 and 1995. In several reports, the U.S. Arctic Research Commission emphasizes the need for an Arctic research vessel. Long-range science plans developed by both the Directorate for Geosciences and

Office of Polar Programs at NSF have identified an Arctic research vessel as a facilities priority. An expanded list of studies and recommendations by national advisory groups is attached (Enclosure 2). This list demonstrates the comprehensive endorsement and involvement of the research community with the NSF planning process. We are unaware of any comparable studies addressing U.S. Coast Guard military icebreaker programs.

See comment 2.

We believe the report misinterprets the roles of the U.S. Coast Guard and the National Science Foundation with respect to the acquisition and operation of research vessels for use in Arctic settings. The National Science Foundation Act of 1950 (42 USC δ1861 et seq.) gives NSF broad authority to support scientific activities and to acquire and lease or loan "real and personal property of all kinds." Under that authority, NSF has acquired research vessels and provided funding to NSF awardees for research vessels. An example of this exercise of authority was the recent support for chartering of the *Nathaniel B. Palmer*, a research vessel with ice-breaking capability dedicated to Antarctic research.

See comment 3.

We believe that substitution of the term "icebreaker" for "Arctic research vessel" in the report's title and throughout the text of the report may have lead to incorrect conclusions. The report appears to imply that any ship capable of breaking through ice can be considered a research vessel and that any time when an icebreaker is not being used for some other purpose, it is available for research. Neither conclusion is justified, however. In order to conduct the broad range of scientific inquiries identified by leading Arctic scientists, a vessel must have adequate instruments, equipment, and performance capabilities. To simply cut through ice to get to a research site is inadequate if the vessel is unable to serve as a platform for the planned scientific research. The report noted that scientists were dissatisfied with the design and projected operating costs of the Coast Guard's proposed new icebreaker, the *Michael A. Healy*, but the report discusses that proposed vessel and the existing Coast Guard icebreakers as if they were equally acceptable research platforms to a vessel designed expressly for the conduct of Arctic research.

See comment 4.

The inability of scientists to be able to schedule their work with any kind of certainty seriously inhibits the conduct of many important projects. Some scientists have planned research that can be accomplished whenever Coast Guard vessels are available, but many important projects require that vessels be available at specific times. These kinds of projects often fail to proceed beyond the early planning stages because uncertainty about the availability of an adequate research vessel makes them too risky. The lower-than-expected number of days that Coast Guard icebreakers were used for research in recent years and their limited expected scientific use in 1995 and 1996 does not reflect a reduced need as is implied in the report. With a dedicated vessel, scientists and NSF staff could make plans and allocate funds for specific projects with much greater certainty.

See comment 5.

Taken together, the design limitations of the current and planned Coast Guard icebreakers and the difficulty of the Coast Guard to provide vessels for scientific research on a scheduled basis for research provide strong evidence of the need for a research vessel dedicated to Arctic research. The benefits of having a comparable vessel in the oceans surrounding Antarctica are becoming apparent as the results of studies conducted during its initial voyages are published. Inadequately configured icebreakers that may or may not be available when needed cannot serve a comparable role in support of Arctic research.

Enclosure 1, Page 2

See comment 6.

We believe the most relevant study for assessing the needs and requirements for an Arctic research vessel is the 1993 revision of the *U.S. Arctic Research Plan*. This plan, which was mandated by the Arctic Research and Policy Act, recognizes the need for both Coast Guard icebreakers and an Arctic research vessel. Section 4 of that plan indicates that Coast Guard icebreakers serve a role in support of Arctic research, but the plan also describes a need for a ship specifically designed for the conduct of Arctic oceanographic research. The two Coast Guard icebreakers currently operating are general-purpose icebreakers and were designed primarily to support military operations. Because of their configuration, age, and the ever-present potential for diversion to non-scientific missions, the existing Coast Guard icebreakers do not meet the needs stated in the plan for a dedicated Arctic research vessel. The vessel currently planned for construction by the Coast Guard is not well designed to serve as a dedicated, year-round Arctic research vessel. What the Arctic Research Plan implicitly recognizes is that some science missions, particularly those in the central Arctic, will require two ships with ice-breaking capabilities for safety reasons. One of these would be the more powerful Coast Guard icebreaker and the other would be the Arctic research vessel. For research conducted in less-dangerous Arctic waters, however, the Arctic research vessel would be the ship of choice.

The Utility of the Current National Academy of Sciences Study

See comment 7.

We agree that careful consideration of current scientific needs and resources is warranted. As part of our ongoing planning process, the National Academy of Sciences is conducting a review and evaluation of the scientific requirements for an Arctic research vessel in the context of national research needs in the Arctic Ocean regions. The NAS study, which is being jointly conducted by the Ocean Studies Board and Polar Research Board, includes a reassessment of past studies, a comprehensive analysis of all Arctic facilities and their roles in meeting science requirements, and recommendations for national planning and coordination. The structure and timeframe of the review calls for an interim report to NSF in August 1995, with a final report available by October 1995. This study will provide a current assessment of science needs, the roles of NSF and other agencies, the resources available and needed for research programs, including evaluations of their operating costs, and management options. We believe that all issues of concern for national planning by NSF, the U.S. Coast Guard, and other federal agencies will be addressed in this study. We believe that final judgments regarding the need for a dedicated Arctic research vessel should be deferred until that study is complete and its results are published.

Enclosure 3

Discussion of Specific Statements in the GAO Report Regarding the Arctic Research Vessel

- " A 1990 interagency study of national polar icebreaker requirements, the most recent such study, did not call for the construction of the proposed vessel."

  Response: The 1990 "Polar Icebreaker Requirements" report was based on a 1988 Federal Oceanographic Fleet Coordination Council (FOFCC) report. The focus was specifically on the U.S. Coast Guard, because funds for an additional icebreaker were included in the 1990 Defense Appropriations Act.

  The most recent report on Federal Oceanographic Fleet requirements was published in August 1990 by FOFCC. The report identifies requirements for 395 days per year for an Arctic research vessel from NSF, NOAA, ONR and the Naval Oceanographic Office. U.S. Coast Guard icebreaker requirements for the Arctic are 167 days from NOAA, NSF, ONR, USGS, USCG and the Naval Oceanographic Office. The NSF requirements are for 180 days of Arctic research vessel time and 30 days of USCG icebreaker time in an average year.

  The 1990 FOFCC report included the recommendation for NSF to construct a vessel capable of supporting oceanographic research in the Arctic.

See comment 8.

- "The potential for underutilization of existing and planned Coast Guard icebreakers has led that agency to oppose the construction of the proposal vessel".

  Response: The US Coast Guard participated as member of the Arctic research vessel design study. Coast Guard officials have not indicated to NSF management in any formal manner, either through direct communication or during discussions of the Interagency Arctic Research Policy committee, their opposition to the acquisition of the Arctic research vessel

See comment 9.

- "The Coast Guard has taken steps to enhance the reliability of its two icebreakers...."

  Response: In addition to the 1991 and 1994 breakdowns, both of the Polar-class icebreakers had major propulsion and shaft problems during the 1995 Antarctic deployment in ice conditions less severe than a central Arctic basin deployment.

See comment 10.

1

See comment 11.

See comment 12.

- "The Coast Guard conferred with leading Arctic scientists when designing the science facilities for the *Healy* through a survey and during several meetings.... The science community was not consulted on the vessel's basic design.... They point to factors such as outdated hull design, poor fuel efficiency (high costs), and an inefficient deck layout... as areas where their suggestions were rejected".

  Response: Consultation with the science community by the Coast Guard was minimal, with only two or three *ad hoc* meetings. The science community was not consulted on the basic design, and major comments and concerns regarding the scientific spaces and requirements appear to have been ignored. It is our understanding the *Healy* design does not meet the minimum scientific requirements specified for the Arctic research vessel.

In summary, NSF believes that the GAO report conclusion that "while these criticisms had merit, they are not convincing, given recent improvements in the Coast Guard's commitment and capability to support research in the region" dismisses a set of serious issues that should be resolved prior to the construction of a new military icebreaker by the U.S. Coast Guard.

The following are GAO's comments on the National Science Foundation's letter dated February 17, 1995, in addition to the comments discussed on page 9 of this report.

1. We have reviewed many relevant studies, including those written by the Interagency Arctic Research Policy Committee, the Arctic Research Commission, the Polar Research Board, the University National Oceanographic Laboratory System, and NSF. As we note on pages 4-5 in the report, these studies do not take into consideration the two existing and one planned icebreaker—each of which possesses some research support capabilities. In fact, the planned Coast Guard vessel Healy was partially justified as a research vessel. In addition, according to the Coast Guard, the Healy will serve primarily as an Arctic research vessel. The observation that the United States does not possess a dedicated Arctic research vessel is insufficient justification for spending $120 million to construct the proposed vessel, as well as committing substantial funds to operate and maintain it. NSF also needs to consider fiscal constraints and the availability of existing and planned U.S. Coast Guard icebreakers in assessing icebreaker needs.

2. We disagree with NSF's statement that "the report misinterprets the roles of the U.S. Coast Guard and the National Science Foundation with respect to the acquisition and operation of research vessels for use in Arctic settings." We do not dispute NSF's authority to acquire or lease icebreakers. In our view, the issue is not whether NSF has the authority to acquire the proposed vessel but whether NSF has demonstrated the need for an additional icebreaker.

3. The proposed vessel is an icebreaker. Special consideration was given to the proposed vessel's icebreaking capabilities. For example, the icebreaking requirements for the proposed vessel were increased twice between 1990 and 1994. Our report does not imply that any ship capable of breaking through ice can be considered a research vessel. However, we do state that the two existing Coast Guard icebreakers and the planned vessel Healy, while capable of breaking ice, also have been upgraded or were specifically designed to support research. We agree that none of the three Coast Guard vessels represent the ideal research platform.

We disagree with NSF's view that we discuss the proposed vessel and the existing Coast Guard icebreakers as if they were equal research platforms. On page 7, we state that equipment and other facilities necessary to support science have been added and improved. The largely successful

1994 scientific mission to the Arctic confirms that the existing Coast Guard vessels are capable of supporting the accomplishment of a significant body of Arctic research.

4. We disagree that we imply a reduced need for scientific research in the Arctic. Rather, on page 5 we state that funding constraints have contributed to underutilization of existing Coast Guard vessels.

5. As we note on pages 4-5, neither the design of the Healy nor the availability of Coast Guard vessels are explicitly put forth, with supporting analysis, in the various studies NSF cites in this letter as supporting acquisition of the proposed vessel.

6. The 1993 U.S. Arctic Research Plan mentions the Coast Guard role of supporting Arctic research and describes an Arctic research vessel (the proposed vessel) but does not demonstrate a need for the vessel. NSF states in its comments that the planned vessel Healy is not suited for year-round dedicated research. However, the Coast Guard has stated its intent to make the Healy available for Arctic research 144 days a year. We also note that, according to the 1990 Polar Icebreaker Requirements Study, NSF approved the design of the Healy as a member of the Polar Icebreaker Users Council (an interagency group of icebreaker users that includes NSF). With three Coast Guard icebreakers available, it should be easier to schedule two vessels for central Arctic missions. Again, while it might be ideal to have a dedicated vessel available for research in the less hazardous Arctic waters, the acquisition (about $120 million), maintenance, and operations costs (at least $34,000 per day)—coupled with the costs of maintaining underutilized Coast Guard icebreakers in a state of readiness—raise doubts as to the net benefit to the nation of acquiring the proposed vessel.

7. While it appears that NSF has concluded that the proposed vessel is justified, NSF also states that final judgment should be withheld pending the National Academy of Science's (NAS) study. We believe that our report points to significant issues that must be addressed before any final judgment is made. The report does identify weaknesses in the justifications found in previous studies and will, in our opinion, help to guide the current NAS effort. Accordingly, we are encouraged that the NAS study commissioned by NSF will include an assessment of the roles of NSF and other agencies and the resources available to support Arctic research programs, including evaluations of their operating costs and management options.

8. The 1990 Federal Oceanographic Fleet Coordinating Committee (FOFCC) report that NSF cites is not a study of national icebreaker requirements, of which research is a significant part, as is the 1990 PIRS study we refer to in this report. While NSF criticizes the 1990 Polar Icebreaker Requirements Study (PIRS), NSF, as well as the Departments of Transportation and Defense and OMB, developed that report. The 1990 PIRS study points to a broader scope of national needs and research community needs and not specifically to the Coast Guard vessel. We found the quantitative assessment of icebreaker needs in the 1990 PIRS study persuasive while the 1990 FOFCC study focuses on fleet requirements for a variety of vessel types.

9. Coast Guard officials told us that the agency is opposed to the acquisition of the proposed vessel because of funding constraints that would likely lead to underutilization of existing and planned Coast Guard vessels.

10. We do not dispute the fact that the Coast Guard icebreakers have experienced reliability problems. As we note on page 7, the Coast Guard is continuing efforts to improve the reliability of its two existing icebreakers.

11. As we note on pages 7-8, the Coast Guard surveyed the scientific community and held meetings that included officials from NSF and UNOLS. Although the Healy will primarily be used to support Arctic research, it is a multipurpose vessel. So while significant scientific capabilities were designed into the vessel, it is not surprising that it does not meet every scientific requirement laid out by the scientific community for the proposed vessel.

12. We agree that the ability of Coast Guard icebreakers to support Arctic science is a serious issue and the report treats them as such. Referring to the Healy as a military icebreaker is misleading given the multiple missions for which the vessel was designed and the research for which the Coast Guard states the Healy will be used. The Coast Guard stated that the funding for the Healy is in place, the contract for construction of the Healy has been let, and assembly of component parts has begun in several locations. As noted on page 8, the Coast Guard solicited, and, in some cases, implemented input from the scientific community.

Major Contributors to This Report

Resources, Community, and Economic Development Division, Washington, D.C.	Robin M. Nazzaro, Assistant Director Larkin K. Jennings, Evaluator-in-Charge Jonathan M. Kusmik, Adviser Amy D. Abramowitz, Senior Economist
Office of General Counsel	Mindi G. Weisenbloom, Senior Attorney

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APPENDIX X

UNIVERSITY - NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

Office of the Unols Chair
Moss Landing Marine Laboratories
PO Box 450
Moss Landing, CA 95039-0450

408 755 8657 tel
408 753 2826 fax
johnson@mlml.calstate.edu

February 2, 1995

Dr. Paul L. Stoffa
Committee on the Arctic Research Vessel
Ocean Studies Board
National Research Council
2101 Constitution Ave.
Washington, DC 20418

Dear Dr. Stoffa,

I am writing in reply to your letter of December 20, 1994, requesting the opinion of the UNOLS Council on the proposed Arctic Research Vessel (ARV). The UNOLS views on the ARV are outlined below. I would be pleased to attend your initial meeting in Washington, DC to discuss these issues further.

Let me begin by stating that it is the desire of the UNOLS Council to bring to the science community a level of access to the Arctic Ocean which approaches that available at lower latitudes in vessels of the UNOLS Fleet. Currently, the Arctic Ocean is not perceived to be readily accessible to the science community without herculean efforts by individual scientists. The key to providing this access will be new ice capable research vessels that are dedicated to Arctic Ocean research and which are operated under a model similar to that of the UNOLS Fleet.

UNOLS has had a long term involvement in this issue. Following a request from Bob Correll (then Assistant Director of Ocean Sciences at NSF) on November 20, 1987 to the UNOLS Council, the Fleet Improvement Committee (FIC) of UNOLS began consideration of the design of an ice capable research vessel. During the 6 years that the FIC has considered the ARV, at least 5 reports (see attached list) have been issued. The proposed design has changed dramatically in response to community input at national meetings and through extensive mail review and committee work by scientists, marine architects and ship operators. In particular, the community repeatedly focused on the need to operate in the multi-year ice found in waters of the Central Arctic Basin. This mission required a much more ice capable vessel than we had originally envisioned. As a result of this input, the Science Mission Requirements were finalized and approved by the UNOLS Council and a preliminary design study was undertaken by Glosten Associates and published in 1994. This design study included model tests of the proposed hull form in ice covered test tanks and excellent results have been obtained.

I'll continue by addressing your bulleted questions in order:

First, the current status of the UNOLS fleet. As the result of an extensive modernization and building program, the 27 vessels of the UNOLS fleet stand as the finest and most capable research fleet in the world. The eleven general purpose Class I, II and III vessels (all > 150' LOA) are all built

expressly for research. Most of these ships are either less than 10 years of age, or they have recently undergone extensive mid-life refits. Two significant additions to the fleet are planned. These are the AGOR 23 class (Thomas Thompson, 274') vessels Roger Revelle (AGOR 24) and Atlantis (AGOR 25). Both are under construction and scheduled to be delivered in 1996 and 1997, respectively. The oldest ship in the fleet, RV Atlantis II is scheduled to be retired in 1996 and replaced by the RV Knorr as a Deep Submergence Support Vessel. The US Navy has announced their intention to eliminate support for the RV Moana Wave as the new AGOR's come on line.

The current funding and ship usage situation for the fleet is similar to that of the past few years. That is, we have an excess capacity of one to one and half ships relative to requests from funded scientists for ship usage and dollars available for operations. For example, operation of the fleet is projected to cost $49.9M for 1995, while only $46M was available in 1994. As a result, UNOLS has generally laid up one ship each year. Because of demand for large ships in multi-disciplinary programs, recent layups have impacted the intermediate (Class III) ships most severely. I should stress that this excess capacity is viewed by many as healthy, since it gives us the ability to refit vessels and meet surge requirements without affecting long-term science operations.

However, we expect to see this budget discrepancy become more serious as the new AGOR's come on line at the end of the decade. My best hope to resolve this problem is to direct other federal users of research vessels into the UNOLS fleet. For example, as the Navy has phased out their own AGOR's, operated by the Military Sealift Command, ship users from the Naval Research Laboratory system have moved onto UNOLS vessels. This has produced very satisfactory results, including a net savings for the Federal Government. There are a number of other Federal Agencies, performing substantial amounts of ocean research. These agencies could benefit both through dollar savings, identified in GAO studies, and access to a modern, superbly equipped fleet, by using UNOLS assets. Such a transition is also essential because the cost of operating the fleet has slowly become nearly 75% supported by NSF. The ecologists have a maxim - diversity equals stability.

Your second question concerned UNOLS support for the ARV Science Mission Requirements. The UNOLS position on the ARV is summarized in the 1995 Fleet Improvement Plan (FIP), which has been approved by the Council at its September 1994 meeting. The following quote is from the 1995 FIP: *"FIC recommends that the Arctic Research Vessel be the highest priority acquisition for oceanographic research. The FIC strongly supports the addition of the ARV to the UNOLS fleet and recommends that it be operated by a UNOLS institution. The FIC and UNOLS take the position that the Arctic Research Vessel should be built only if sufficient funds are available for its construction, operation and science missions."* The Science Mission requirements for the ARV design were approved by the UNOLS Council in 1993 and they are reprinted in the 1995 FIP. The SMR's represent a consensus of the Council that was reached after extensive consultation with the Arctic research community.

Your third question regarded how the ARV will be funded. UNOLS has reiterated its position that this ship cannot be operated without additional funds for fleet operations. This point has been made in the 1995 FIP. A related recommendation of the FIC is that Federal agencies funding oceanographic research make realistic projections of ship needs over the next 5 years, and possible levels of support. The 1995 FIP looks at the crystal ball from the other end - what levels of support will be needed to maintain various sizes of UNOLS fleet, with or without the ARV.

I have discussed this issue with representatives of various agencies to assess whether or not there is a realistic hope that the needed funds will become available. While there are no hard answers, I am satisfied that the funds could be made available without unduly impacting existing oceanographic

assets.

The fourth question concerns potential impacts on the UNOLS Fleet if the ARV is constructed, particularly if no additional funds are for ship operations are provided. Again, it is the express policy of UNOLS, stated in the 1995 FIP that operating funds for the ARV should represent substantially new sources of funding to the fleet. However, there is no mechanism in place to protect the existing fleet assets if a funding shortfall develops. Annual operational costs for the ARV are estimated to be in the area of $6M pa. If the ARV were added without additional support, up to three large vessels would have to be laid up permanently. Substantial savings are obtained only by removing a vessel from the fleet. This is clearly an unacceptable situation for the UNOLS fleet. In particular, it would mean that many scientists working at lower latitudes would not have access to the ocean.

Your fifth point concerned the question of whether the ARV will operate as a part of the UNOLS fleet. We would expect that the ARV would be a part of the fleet and the FIP expressly states that it should be operated by a UNOLS institution. There are considerable advantages to operation within UNOLS and cooperative scheduling. Efficient use of this vessel, from both the science and program management side, will require that it be scheduled in concert with other vessels in the fleet. In addition, there are often substantial subsidies for fleet operations provided by most vessel operators.

Finally, has UNOLS considered alternate platforms? We have considered a variety of alternatives. UNOLS has sponsored the SOONS (Scientific Opportunities on Nuclear Submarines) study and the recent Workshop on Using a Nuclear Submarine as a Research Vessel. UNOLS representatives served on the design team for the RV Palmer. They have sailed on ice breakers of foreign nations and they have investigated the possibility of leasing or buying foreign ice breaking vessels. They have worked on US Coast Guard vessels and found them inadequate as currently operated. Drifting ice islands, helicopters and aircraft have been considered.

These platforms can satisfy research niches, but major interdisciplinary research efforts cannot be launched from them. Coring, net tows, large water sampling equipment and large moorings are a few examples of the operations which can be efficiently performed only from a ship. The versatility of a well equipped, ice breaking vessel that is purpose designed for research makes it the only platform that can begin to meet all of the community needs.

I hope these responses to your questions will assist you in your deliberations. Forgive me for their length. If I can be of further help, please do not hesitate to contact me.

Sincerely yours,

Ken Johnson

Kenneth S. Johnson
UNOLS Chair

cc J Bash, UNOLS
C Mooers FIC
D Heinrichs, NSF
C Sullivan, NSF

UNOLS Reports Related to the ARV

UNOLS Fleet Improvement Committee (1988) Arctic science requirements for ice-worthy research vessels, 21 pp.

UNOLS Fleet Improvement Committee (1989) Scientific mission for an intermediate ice-capable research vessel, 17 pp.

The Glosten Associates (1991) Concept design of an Arctic Research Vessel.

UNOLS Fleet Improvement Committee (1993) Scientific mission requirements for an ice-capable research vessel.

UNOLS Fleet Improvement Committee (1994) Arctic Research Vessel preliminary design report.

APPENDIX XI

U.S. Department of Transportation
United States Coast Guard

Commandant
United States Coast Guard

2100 Second St. S.W.
Washington, DC 20593-0001
Staff Symbol: (G-NIO)
Phone: (202) 267-1456

1600
JUN 30 1995

Dr. Christopher N.K. Mooers
Professor and Director
Ocean Pollution Research Center
4600 Rickenbacker Causeway
Miami, Florida 33149-1098

Dear Dr. Mooers:

Thank you for your letter of June 7, 1995 which addressed the issue of an "Icebreaker Users Advisory Group". During the last UNOLS council meeting in Monterey the council recommended that a permanent Advisory Group be established vice an "ad hoc" group which has been used in the past. As I stated at the council meeting, I concur with that recommendation and would like to see the formation of an Advisory Group as soon as possible. I believe it is in the best interests of all concerned that such an Advisory Group be established.

In your letter you asked for my input on the "terms of reference" for the Advisory Group. The following represents my views on the appropriate size, membership, support, and scope of work for the Advisory Group.

The group should be kept relatively small, 10 to 15 members, with the majority of members being designated by UNOLS. I would expect the group to have representatives from the Fleet Improvement, Research Vessel Technical Enhancement, and Research Vessel Operators subcommittees of UNOLS. In addition, there should also be representatives from the National Science Foundation, Office of Naval Research, Geological Survey, and Coast Guard. Once the size and membership of the Advisory Group is established I would expect the UNOLS council chairman to designate UNOLS representatives, in writing, and be responsible for ensuring subsequent vacancies are filled.

The Advisory Group should represent a broad spectrum of Polar science disciplines such as ice studies, oceanography, geology, and biology. I believe recent, or near recent, experience aboard U.S. or foreign icebreakers should be a prerequisite, however, members should have permanent association or extremely close ties with science organizations having strong interests in Polar research.

I do not believe the Advisory Group should be limited to issues concerning the construction of HEALY. I have two other icebreakers too. Therefore, I would expect the Advisory Group to play an integral role in providing assistance, guidance, advice

on a broad range of topics concerning Coast Guard icebreakers. Members should expect to deal with a variety of issues including outfitting, staffing standards, scheduling, training, funding and design, modifications, and future operations.

The UNOLS council should understand that the Ice Operations Division cannot expend funds for member's travel or per diem for meetings. Consequently, formal meetings should be held in conjunction with established UNOLS council meetings. I would hope, however, that Advisory Group members would have the flexibility to respond to issues informally as the need arises. Documentation of the issue and correspondence would be provided to the UNOLS council at the next formal meeting.

I hope I have provided you with enough information to help define the Advisory Group. If I can be of any further assistance or you require additional information, please call me at the above number.

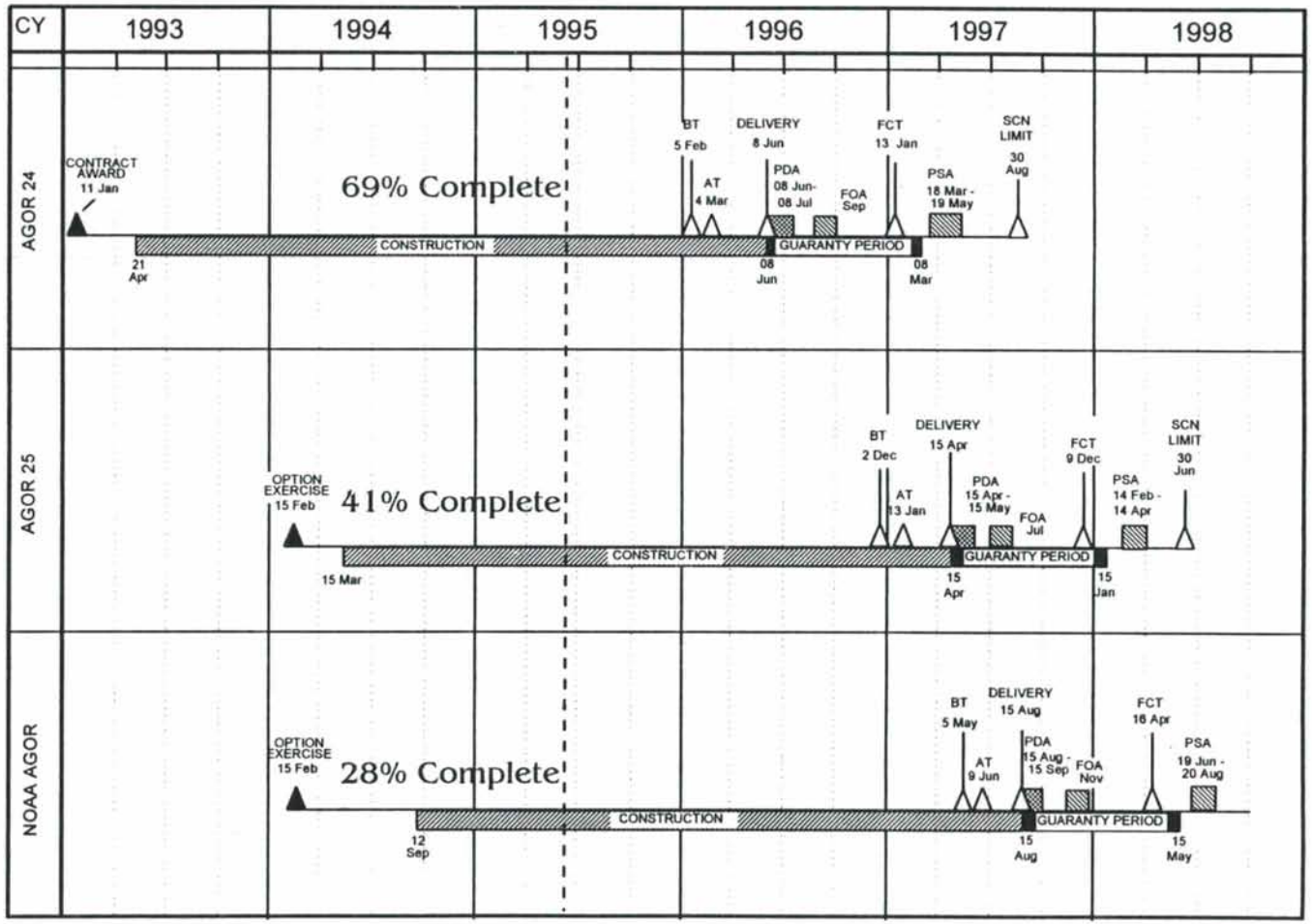
Sincerely,

R. A. ROOTH
Commander, U.S. Coast Guard
Acting Chief, Ice Operations Division
By direction of the Commandant

Copy: Dr. Kenneth Johnson, UNOLS Chair
Mr. Jack Bash, UNOLS Secretary

APPENDIX XII

AGOR PROGRAM SCHEDULE



APPENDIX XIII

DRAFT

Summary of Van Design Information for UNOLS FIC
14 July 1995

Information summarized by Suzanne Strom based on input from:
UNOLS RVOC
UNOLS RVTEC
Jack Bash
Peter Betzer
Ken Robertson (NERC)
Tony Thomas (Thomas International)

INTRODUCTION

Scientists have been using vans for years to work at sea. There are a multitude of reasons why vans are valuable to sea-going scientists, with economy, efficiency, security, and compactness being just a few. The oceanographic community is committed to using vans at sea. This paper provides an overview of van design considerations for those desiring to develop this facility for their own use. As with ships, no one design can satisfy all requirements. Similarly, some designs have proven more successful than others. This paper is not intended to design 'a' van but to review van designs, illuminating their pros and cons.

Vans used for individual ships can afford to be designed with specialized equipment and tailored for that ship. Vans that are intended for world-ranging ships or the international community need to have a more generic design. As with ships, design features tend to be compromises between cost and sophistication. Simple, inexpensive designs may well suffice for single-purpose vans planned for single ship use. Significantly more thought and planning is necessary to design multi-purpose or multiple ship use vans, with international use demanding the most severe design considerations. As sophistication increases, so will cost. What follows is a summary of features available in van design. Pros and cons are discussed where appropriate. This information is intended to review existing van design and to guide future van construction.

1. Overall design.

A 20' length is the industry design standard and may facilitate shipping of the van. This size may be too large for use on the intermediate size class vessels. Some vessels have an 01 deck overhang which necessitates use of a 7' high van rather than the more standard 8' - 9'.

No one likes the idea of stacking vans while they are in use, but stackability for shipping to distant ports should be considered. Thus the frame should be of strong steel and the top should be reinforced. All exterior fittings should be recessed and there should be no exterior projections which could make the van awkward to stack or prone to damage during fork lifting, etc. Vans could be constructed with interior bolt-downs so that exterior mounted AC units could be secured and the van be made self-contained for shipping.

Fork lift slots in the van's bottom frame and lifting points for crane operation are important to allow loading options depending on port and facilities.

All construction materials, including hardware, windows, doors, plywood, paints, etc. should be marine grade. To reduce the possibility of standing in water or getting splashed by waves, exterior penetrations should be mounted as high as possible. Penetrations on the top will generally leak no matter what the sealing precautions.

A floor drain is essential. At the least, one should be able to hook up a length of hose so that material will drain over the side of the ship. It may be desirable to hook the drain up to the ship's wastewater system. Depending on the proposed use of the van, the drain should have a shut-off valve and should drain to an isolated container (e.g. 55 gallon drum) for containment of hazardous materials.

2. Access/escape.

Doors for people: inward opening doors are not recommended They could lead to people being trapped in the van or squashed behind the door by waves. Sliding doors (WT) were suggested but would surely be a maintenance issue over time.

Doors for loading/unloading: double doors for loading and unloading large pieces of equipment should be considered. These could close over an interior, demountable bulkhead. Power, water and other connections could come out through this bulkhead and thus would not protrude from the van during shipping.

Windows: a window or windows improves the working environment and could be seen as a safety feature (emergency lighting during day, view of the deck). Conversely, windows take up valuable interior bulkhead area. Perhaps a window in the door should be recommended as a minimum.

Escape hatches: more than one. Given the variety of configurations the van might end up in while on various ships, it seems like two wall hatches and one hatch on top might not be excessive, while bearing in mind the potential for top hatch leaks. Top escape hatches should be located at a corner so as not to compromise the strength of the van top.

Ladder: undoubtedly someone will want to use the space on top of the van and a ladder will be mounted. This should be detachable for shipping. It should not be mounted next to a window (someone climbing the ladder could fall through the window - I saw this happen) or over an escape hatch.

3. Heating/cooling/ventilation.

Active air replenishment is recommended and the incoming air may need to be filtered. Air-cooled heat pumps for heating and cooling are more reliable and convenient than water-cooled pumps. Given that vans are unlikely to be stacked while in use, the AC unit could be mounted on the top, then unbolted for shipping with a patch placed over the spot where the AC unit would normally go. Again, leakage could be a problem. The bulkheads should be insulated.

4. Power.

An uninterruptible power supply is desirable but may be impractical to maintain for the van alone. There could be a dedicated circuit in the van for attachment to the ship's UPS system.

The primary power supply should be compatible with the UNOLS fleet. The consensus seems to be 480VAC 3 phase with outlets inside the van for stepping down to 220v 3 phase and perhaps 110v 1 phase. There was some uncertainty as to amperage. If the van is to be used on foreign research vessels flexibility as to voltages, frequencies, connectors and wiring conventions could be built in, significantly increasing van cost.

In general the electrical system design should be carefully thought out and designed with built-in flexibility, i.e. the internal electrical system should be readily reconfigurable. This is probably not compatible with imbedding the system in the bulkheads. The van may need to provide for its own conditioned power. Both male and female external connections may need to be provided. Transformers, circuit breakers, distribution panels and adequate grounding need special consideration.

5. Other van - ship connections.

Water: there should be fresh and perhaps salt water hook-ups will likely be necessary.

Communications: a link to the ship's communication system (phones, intercoms) and alarm system was recommended (again, what type?) such that anyone

working in the van can be contacted by ship's personnel and vice versa. An additional penetration for cables to data loggers, antennae, etc. may be useful. Connection to gas and compressed air may be required.

6. Emergency.

Emergency lighting is desirable but, again, may be impractical to maintain. Several flashlights mounted in convenient locations were suggested by several to be a realistic solution. The van should be equipped with a smoke detector and fire extinguisher(s). Tony Thomas recommends a 'panic button' mounted near the door which will interrupt power to the van.

7. In al Outfitting.

istrut fittings are a good thing. The van should be well-lit and easy to clean, suggesting use of linoleum and similar materials.

APPENDIX XIV

U.S. Department of Transportation

United States Coast Guard

Commandant
United States Coast Guard

2100 Second St. S.W.
Washington, DC 20593-0001
Staff Symbol: (G-NIO)
Phone: (202) 267-1453

12 July 1995
1600

Dr. Christopher N. K. Mooers
Chairman, UNOLS Fleet Improvement Committee
University of Miami
Rosensteil School of Marine and Atmospheric Science
Oceam Pollution Research Center, MSC 132
4600 Rickenbacker Causeway
Miami Fl 33149-1098

Dear Dr. Mooers:

Thank you for your invitation to attend the 20 July Fleet Improvement Committee Meeting in Seward. Unfortunately, I will be unable to send a representative due to travel budget constraints. I have, however, enclosed the latest information on the USCGC HEALY project for your use in bringing all concerned up to date.

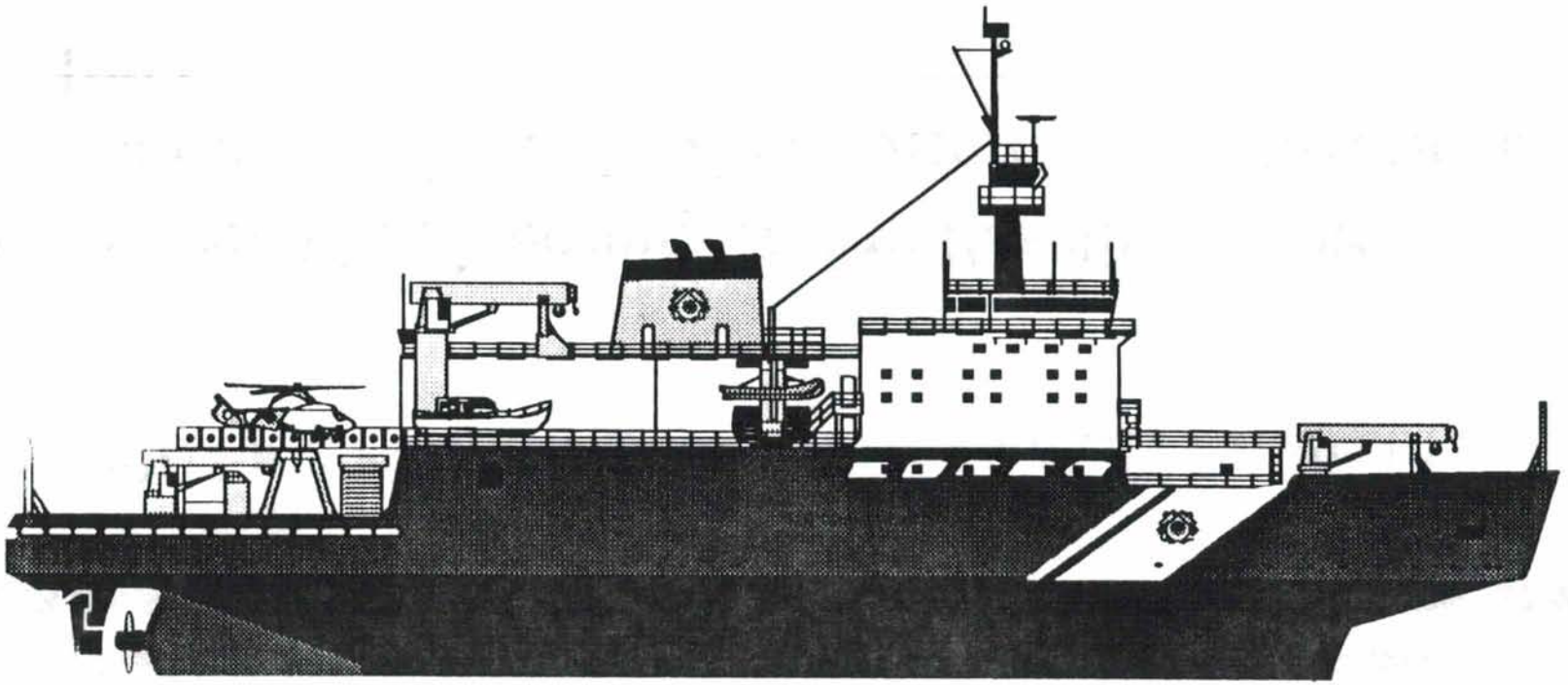
Again, my regrets. The benefits derived by Coast Guard attendance at UNOLS meetings are numerous, I have requested an increase in my office travel budget to ensure our attendance at future meetings. Please contact LCDR Steve Wheeler of this office with any questions or comments regarding the enclosed material. He can be reached at the above listed address and phone number; FAX (202) 267-4425 or via the INTERNET at: "lcdr_s_wheeler/g-nio@cgsmtp.comdt.uscg.mil". I look forward to working with you in the future.

Sincerely,

ALAN SUMMY
Captain, U.S. Coast Guard
Chief, Ice Operations Division
By direction of the Commandant

Copy: Dr. Kenneth Johnson, UNOLS Chair
Mr. Jack Bash, UNOLS Secretary

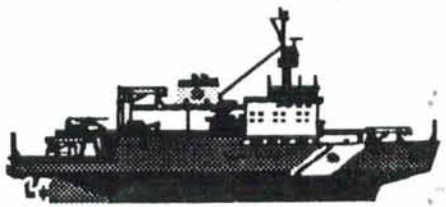
POLAR ICEBREAKER
USCGC HEALY (WAGB 20)



July 1995

POLAR ICEBREAKER - WAGB 20
Background

- 1990 DOD Funding - Joint Navy / CG Program
- Awarded Engineering Design Baseline (EDB) Contracts to Two Previous Offerors - 10 November 1992
- Exercised Option for Detail Design and Construction - 15 July 1993



POLAR ICEBREAKER - WAGB 20
Contract Information

Contractor:	Avondale Industries, Inc. New Orleans, LA
Detailed Design/Construction	
Awarded:	15 July 1993
Award Amount:	$186.1M Target/$36.0M Profit
Contract Type:	FPIF
Share Ratio:	70/30

Contract Includes a Logistics Incentive Award Fee of $750K and a Weight Control Award Fee of $850K.

POLAR ICEBREAKER - WAGB 20

420' WAGB Ship Characteristics

HEALY

Length *(Overall)*	420'
Beam *(Extreme)*	82'
Draft *(Full Load)*	29' (Max)
Displacement *(Full Load)*	16,385 Tons
Shaft Horse Power	30,000 SHP
Icebreaking	4.5FT at 3 KT
Crew Size	75 Military
	50 Scientists

POLAR ICEBREAKER - WAGB 20
Responded to Science Needs

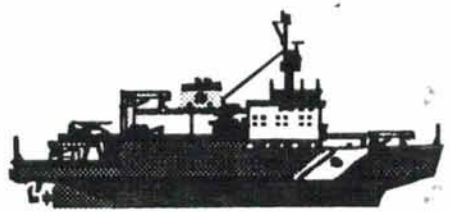
- Included a Bottom Mapping Sonar
- Rearranged Existing Science Spaces
- Added a Dry Assembly Room
- Increased Area for Climate Controlled Work
- Added Transducer Wells

POLAR ICEBREAKER - WAGB 20

Schedule

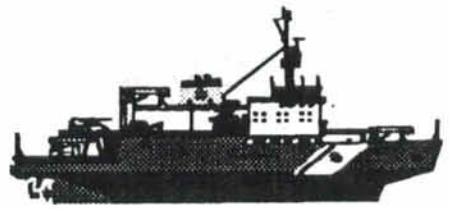
Award	10 November 1992
Contract Baseline Presentation	February 1996
Start Construction	March 1996
Keel	September 1996
Launching	July 1997
Delivery	June 1998*
End of Navy Responsibility/Funding	January 2000

* The Only Contractually Binding Date



POLAR ICEBREAKER - WAGB 20
Program Risk

- Schedule (Moderate)
- Technical (Low)
- Cost (Moderate)



POLAR ICEBREAKER - WAGB 20

Action Items

- No Outstanding Major Issues
- Complete and Issue Contract Mods
- Assist Contractor to Modify Program Baseline
- Complete Machinery Plant Control Monitoring System Hardware & Software Design
- Complete Main Engine In-Plant Testing
- Evaluate Weight Incentive

POLAR ICEBREAKER - WAGB 20

Summary

- Design is Essentially Complete
- Delivery of June 1998 Aggressive
  - Minimum Government Changes
  - Shipbuilder Excels at Production

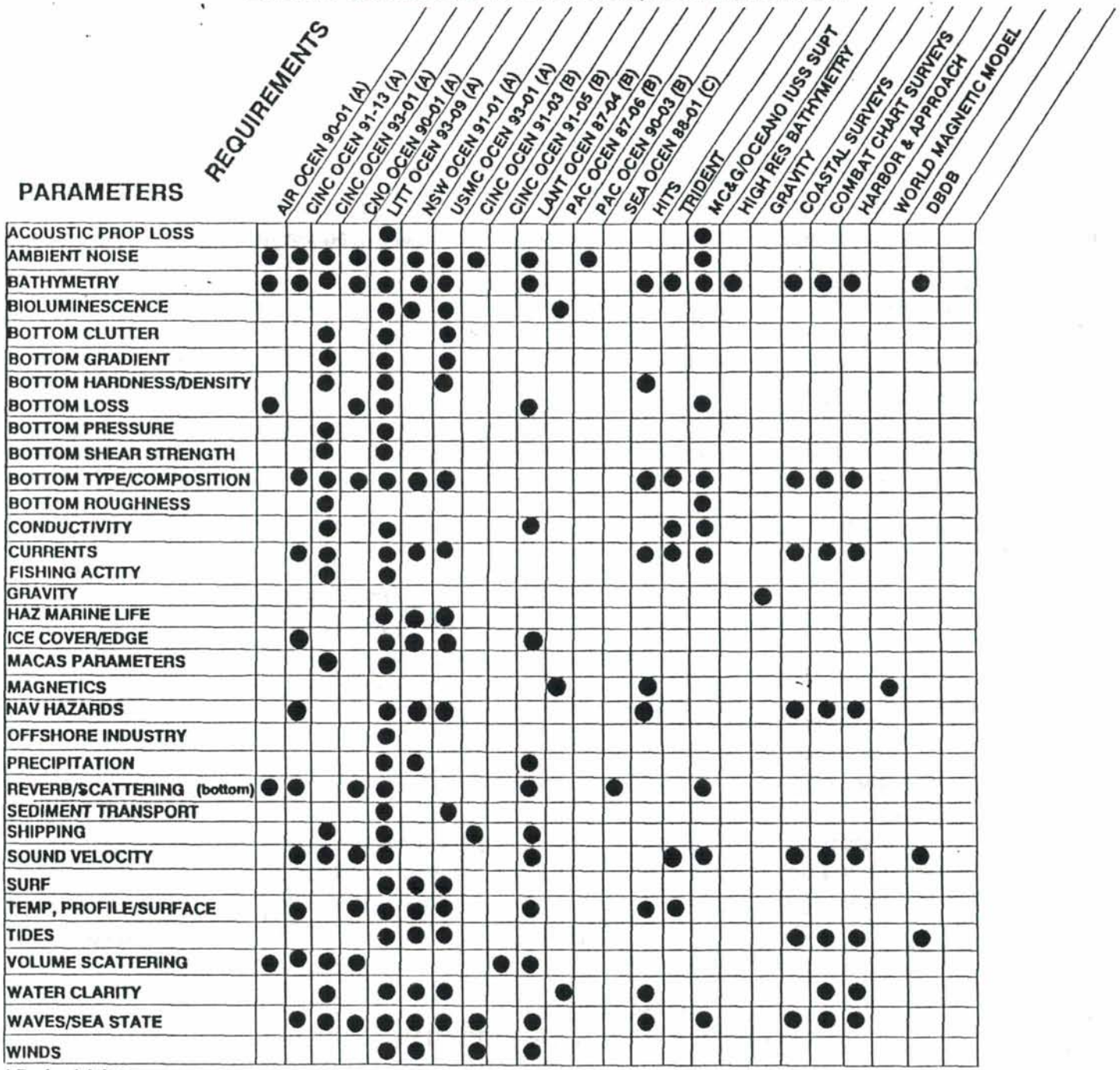
APPENDIX XV

13 July 1995

DATA COLLECTION REQUIREMENTS
NEAR-CONUS

REQUIREMENT	LOCATION	DATA PARAMATERS
Training / Exercise Areas	Onslow Bay, NC Corpus Christi, TX Tanner Bank, SOCAL	High-resolution bathymetry Bottom characteristics Currents Water clarity CTD / XBT Navhazards Sea state
HITS	Kittery, ME (new) Pearl Harbor E (deep) zone Kings Bay / Charleston " Long Island " Norfolk "	See matrix, attached
TRIDENT / Peacekeeper	E. Coast	See matrix, attached
Submarine support - USACOM	Selected areas along E. Coast and GOMEX Seaward of 30-fm curve	High-resolution bathymetry, 1:50,000 scale Géoacoustic data, if available, including Transmission Loss Volume scattering strength Surface and bottom backscatter Sound velocity profile High and low frequency bottom loss
Submarine MC&G Support	Caribbean Sea Selected areas in E. Pacific	High resolution multibeam bathymetry Gravity (limited)

DATA COLLECTION REQUIREMENTS *



* Revised Jul 95

APPENDIX XVI

University of Miami

From: Prof. Chris Mooers, UNOLS/FIC Chair

To: UNOLS FIC

Subj: White Paper on UNOLS Regional Research Vessel Consortia

Date: 30 June 1995

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1. Enclosed is the draft of subject white paper, commissioned by the UNOLS Council.

2. Please read and critique it in advance of our July meeting, so that we can discuss it thoroughly, and revise it accordingly at that time. (If you care to send me comments in advance, I will make a fresh draft before we meet.)

3. The next step will be to circulate it to the UNOLS Council for comment in advance of the September meeting.

cc: Dr. Donald Heinrichs, NSF

Dr. James Andrews, ONR

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DRAFT

White Paper on UNOLS Regional Research Vessel Consortia

Chris Mooers, FIC Chair

29 JUN 95

Background. Recently, UNOLS has suddenly entered an era of rapid change: downsizing, realignment, no-growth funding levels at NSF, etc. In the same era, US Navy has decommissioned its research vessels and NOAA may be following suit. Furthermore, the character of ocean science is changing with polarization into global and coastal ocean science, with new satellite and other autonomous observing systems, with an enlarged research populace, and with the emergence of computer modeling.

This is an era when the concept of shared resources (ships, instrumentation, marine technicians, etc.) may have new meaning and urgency, especially with needs for expensive technology and more competitive research funding. The shared resource approach is timely with the trend for the scientific user-base being evermore dispersed institutionally and the rise of non-ship-operating institutions.

There may also be new opportunities in regional ocean science and coastal ocean science, especially if improved, coordinated efforts can be engendered and maintained. On the regional and coastal scales, research vessel inventories need to encompass a

spectrum of vessel sizes and types.

Historically, the UNOLS community has seen regional consortia develop, mainly in association with efforts to acquire a new research vessel. None of the present consortia (see Appendix) can be said to be fully functional. Remarkably, a 1972 (!) UNOLS study outlined the need and potential for regional consortia for coastal ocean research; the concepts articulated then seem very relevant today.

Vision. Now is the time to cultivate a new stage of development for the existing (and largely moribund) regional consortia. They should be based on well-rationalized geographical domains and cover the full spectrum of research vessels. Their major attributes would include:

1. One or more ship-operating institutions involved as principals
2. One or more academic institutions involved as principals
3. A non-exclusionary nature by offering associate membership to non-ship-operating regional institutions.
4. A level of 'jointness' associated with the ship operations; e.g.,
   - regional scheduling
   - pooling of instrumentation
   - pooling of marine techs
   - coordinating shore support (i.e., maintenance and repair)

- long range planning of vessel and facility requirements, design, upgrading, equipage, training, regional telemetered data, data processing, etc.
- proposal preparation

5. Regional faculty (user) oversight
6. Regional management (administrative) coordination
7. A focus on intermediate and small R/Vs; however, large R/V's, specialized platforms, and other facilities could be included

Note: Items 1 to 6 are considered necessary conditions; large R/Vs may need their own mega-consortia.

New management mechanisms need to be evolved and codified. For example, past consortia may have remained embryonic because member institutional commitment was lacking. A system of membership dues (to defray costs of meetings, etc.) might make the difference. (It may be best for UNOLS to propose a template for consortia.) Clearly, there must be a balance between the needed management controls of ship-operating institutions and the oversight required by the regional community of scientists served.

Another need is for NSF, ONR, NOAA, and other agencies to provide moral support of regional consortia, which needs to be backed with financial inducements.

Plan-of-Action. Several steps need to be taken. First, the UNOLS Council needs to endorse this regional consortia concept, and modify it as necessary. Second, UNOLS needs to create guidelines for the formation and operation of consortia. Third, agency moral and financial support must be obtained. Fourth, one or more consortia should be encouraged to "step out" with revitalization. Fifth, their progress should be monitored, the guidelines modified, and the overall UNOLS community should be kept informed of progress and problems.

DRAFT

APPENDIX

Existing Regional Consortia

NAME	MEMBERS	STATUS	COMMENTS
NECOR	WHOI URI LDEO		
MARCO	ODU VIMS U. Delaware U. Maryland Rutgers U.	starting up	
"North Carolina"	Duke U. NCSU UNC etc.		
SECOR	TAMU UT (Austin) RSMAS	MOU '87	revitalization under review
NORCOR	U. Washington OSU U. Alaska		
CENCAL	MLML NPS UCSC UCSB USC	"operates" Point Sur	
SOCAL	SIO		
LUMCON	Louisiana Association of Independent Colleges & Universities		

APPENDIX XVII

UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

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

17 July 1995

Dr. Donald Heinrichs
NSF/OCFS
4201 Wilson Blvd., Rm. 725
Arlington, VA 22230

Dear Don,

As you know the Charter for the Fleet Improvement Committee (FIC) tasks this committee to "improve the capability and effectiveness of individual ships and to assure that the number, mix and overall capability of ships in the UNOLS fleet match the science requirements of academic oceanography in the U.S." In fulfilling this tasking the FIC has maintained an updated Fleet Improvement Plan, has developed mission requirement statements for various ship classes, has historically been active in providing review for new construction and has studied mid-life conversions for Intermediate and Cape Class ships. Missing in these activities has been the review of individual proposals for major refits.

At our January FIC meeting in St. Petersburg, the Committee set a tasking goal of being involved in the mid-life reviews for NEW HORIZON, CAPE HATTERAS and POINT SUR. Through this letter we are requesting that NSF include the FIC in the review process for these ship refits as well as other institutional/consortium proposals that are seeking new or refit ships for the UNOLS fleet.

In the current funding environment it seems obvious that more coordination is needed on a regional basis for ship design and refit. This is particularly the case for vessels designed to operate in the coastal zones. FIC is a proponent for the concept of consortia and will strive to coordinate its activities on a regional basis using consortia where they exist and to encourage regional cooperation where they do not. For any reviews we would consider the regional use of a ship as primary consideration and would endeavor to draw in regional members for such reviews.

Sincerely,

Christopher N.K. Mooers, Chair
Fleet Improvement Committee

cc: R. West
E. Dieter

P O Box 392
Saunderstown, RI 02874

Phone: (401) 792-6825
FAX: (401)792-6486

APPENDIX XVIII

UNIVERSITY-NATIONAL OCEANOGRAPHIC
LABORATORY SYSTEM

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

March 31, 1995

Dr. Larry P. Atkinson
Center for Coastal Physical Oceanography
Old Dominion University
Norfolk, VA 23529

Dear Larry,

Thank you for your presentation to the Fleet Improvement Committee (FIC) on the MARCO consortium's planning process to develop a coastal vessel. Planning for a new generation of coastal vessels is a priority of UNOLS. The FIC is conducting a national assessment of Coastal Zone Research Vessel needs and designs. One of the specific recommendations of the 1995 UNOLS Fleet Improvement Plan is, "that Scientific Mission Requirements be established and a conceptual design study be carried out for a shallow-water, high capability, multidisciplinary coastal research vessel, together with a study of the applicability of current assets to developing coastal programs." This need is particularly acute on the east coast where the Ridgely Warfield has been retired and the Cape Henlopen, which is operating with a schedule of nearly 200 days per year, is also approaching retirement. It is, therefore, entirely appropriate that you move forward in your endeavor to plan for a coastal zone research vessel.

As you move ahead with the planning process, we urge you to follow the process adopted by UNOLS. The UNOLS process is predicated on community involvement. UNOLS vessels enjoy their great success because of our efforts to involve the community in the entire process from ship design to maintenance, operations and scheduling. As a result of such involvement, the science community strongly supports the operations of the UNOLS fleet.

The UNOLS ship design process centers around preparation of a set of Science Mission Requirements for the vessel. These SMR's drive the vessel design. Preparation of the SMR's for UNOLS designs is a task of the FIC, a group of experts with experience in most phases of shipboard science. We suggest that you involve the FIC in the design study. Prof. Don Wright of VIMS, who serves on the FIC, might be a good choice to represent FIC. One of the important issues that we have identified, after the SMR's are prepared, is the need for a community input. In the case of a coastal vessel, this would most likely be a regional workshop.

One of the strengths of UNOLS is the ability to coordinate existing assets and to ensure that they are available to the entire oceanographic community. As you finalize the Science Mission Requirements and proceed through the conceptual design you should critically assess how the existing vessels of the UNOLS Fleet can meet the requirements that are identified. If particular aspects of the SMR's can be met by existing vessels, this should be recognized and synergistic relationships

P.O. Box 392
Saunderstown, RI 02874

Phone: (401) 792-6825
FAX: (401)792-6486

developed where possible with other vessels in the fleet.

A key to this synergism, and efficient operation of the fleet, is the development of regional consortia. We would like to commend you for the regional approach that MARCO has adopted for this planning process.

Best of luck in your planning.

Sincerely yours,

Kenneth S. Johnson
UNOLS Chair

Chris Mooers
Fleet Improvement Committee Chair

UNIVERSITY-NATIONAL OCEANOGRAPHIC
LABORATORY SYSTEM

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

January 20, 1995

Dr. Otis Brown
Rosensteil School of Marine and Atmospheric Sciences
University of Miami
4600 Rickenbacker Causeway
Miami, FL 33149-1098

Dear Otis,

It came to my attention at the January 12, 1995 meeting of the UNOLS Fleet Improvement Committee that RSMAS is considering the construction of a coastal vessel for work in southern Florida waters as a replacement for the Calanus. In recent years, UNOLS, through its Fleet Improvement Committee (FIC), has acquired extensive experience in the process that leads to a research vessel design. The Fleet Improvement Committee is currently involved with a national assessment of Coastal Zone Research Vessel needs and designs. They are, therefore, quite familiar with many of the challenges that you will face. Although the vessel that you are considering may not operate in the UNOLS fleet, I believe that coordination of your efforts with the FIC would be in the best interests of RSMAS and the oceanographic community. This may be as simple as keeping the FIC aware of your efforts. In addtion, as you proceed with your efforts, I would urge you to consider following a design process similar to that used by UNOLS.

The UNOLS process is predicated on community involvement. UNOLS vessels enjoy their great success because of our efforts to involve the community in the entire process from ship design to maintenance, operations and scheduling. As a result of such involvement, the science community strongly supports the operations of the UNOLS fleet. Without this support, we would not have the strength of the UNOLS research fleet that is in operation today.

The UNOLS ship design process centers around preparation of a set of Science Mission Requirements for the vessel. These SMR's drive the vessel design. Preparation of the SMR's for UNOLS designs is a task of the FIC, a group of experts with experience in most phases of shipboard science. One of the important issues that we have identified, after the SMR's are prepared, is the need for a community input. In the case of a coastal vessel, this would most likely be a regional workshop. I would, therefore, encourage you to consider involving potential users of your proposed vessel, who are from outside institutions, in the planning process. This will be to your benefit in the long run, especially if the vessel is ever operated as a regional facility for users from outside of RSMAS.

Following the workshop and finalization of the SMR's, a preliminary design is developed with qualified marine architects. Comments on the design are sought again from the user community. With this input a final design is produced and construction begins. Periodic reviews by the committee that developed the SMR's are used to identify and

P.O. Box 392
Saunderstown, RI 02874

Phone: (401) 792-6825
FAX: (401)792-6486

resolve problems that arise during construction.

If you believe that UNOLS can be of assistance to you as you plan your vessel, please do not hesitate to consult with us. Best of luck with your endeavor.

Sincerely yours,

Kenneth S. Johnson
UNOLS Chair

CC C. Mooers, FIC Chair
J. Bash, Executive Secretary

APPENDIX XIX

For distribution to UNOLS Fleet Improvement Committee at 20-21 July 95 meeting

Last month, the College of Geosciences and Maritime Studies of Texas A&M University (TAMU) reached agreement in principal with the Rosenstiel School of Marine and Atmospheric Sciences of the University of Miami (UM) for a joint marine operations program. TAMU and UM believe the combined strengths at both institutions can create an efficient use of existing facilities leading to enhanced multidisciplinary research on regional to global scales.

The key aspects of the TAMU-UM Joint Marine Operations Program are:

1) Ship Ops: our intermediate class vessels would be jointly operated, while the smaller vessels and the Texas Maritime Training vessel *Texas Clipper* would be operated out of our respective institutions. Staging capability would be maintained at both Miami and Galveston. For next year 1996, TAMU-UM are working toward the joint operation of *Gyre*, with a subsequent evaluation of both *Gyre* and *Iselin* to determine which ship should be operated by TAMU-UM until replacement vessel(s) might be obtained.

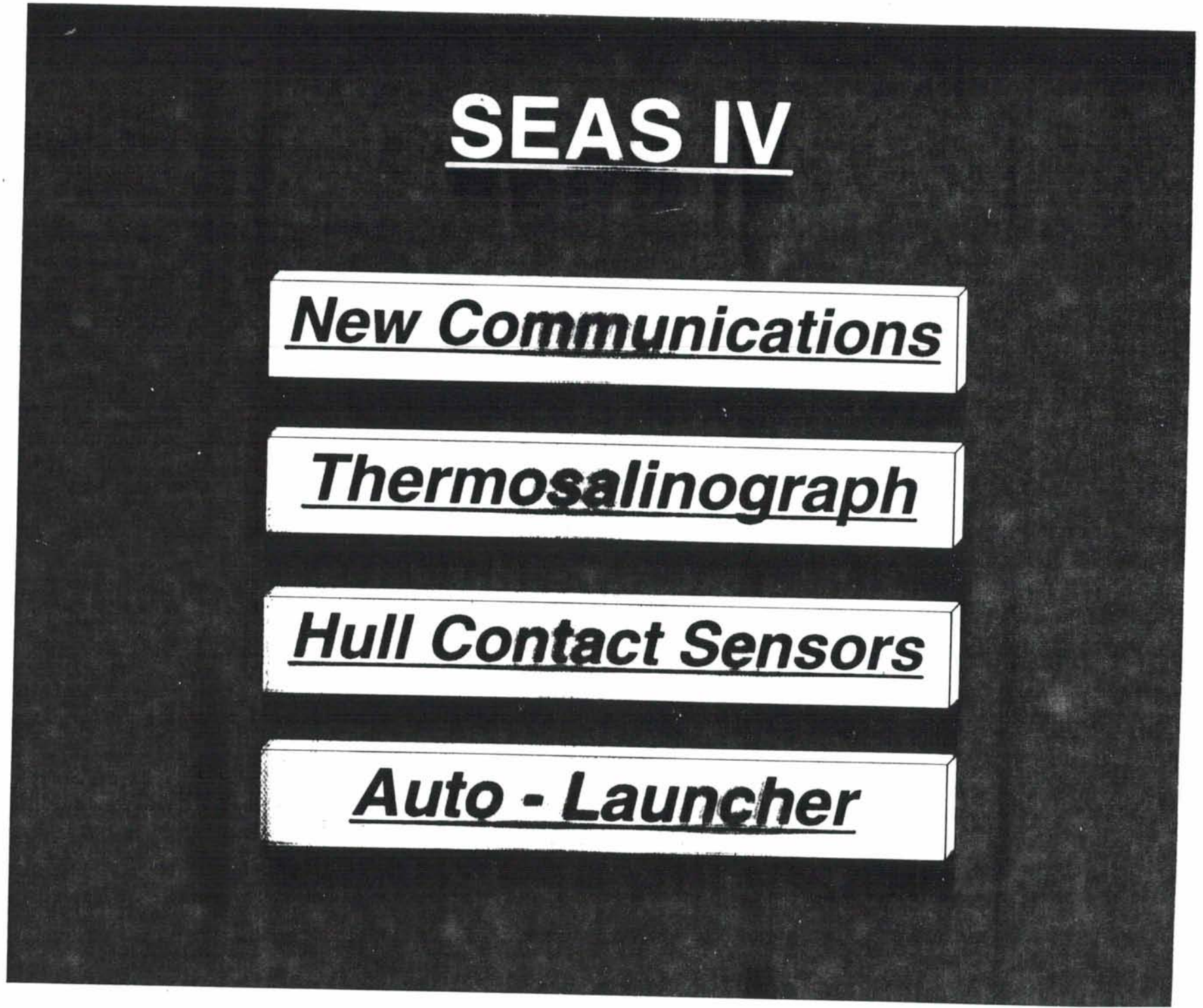
2) Techs and Equipment: these will be jointly scheduled and shared to best advantage of the combined program, taking advantage of complimentary specialties.

3) Proposals: annual proposals to NSF for a) Ship Ops; b) Shipboard Scientific Equipment; c) Technicians; d) Oceanographic Instrumentation, would be a joint submittal from TAMU and UM, with separate budgets and indirect costs for each institution.

4) Organizational Structure: guidance and future planning will be the responsibility of the Science Advisory Committee, to be made up of representatives from the administration, marine departments, academic departments, and the marine technology groups of both institutions.

APPENDIX XX

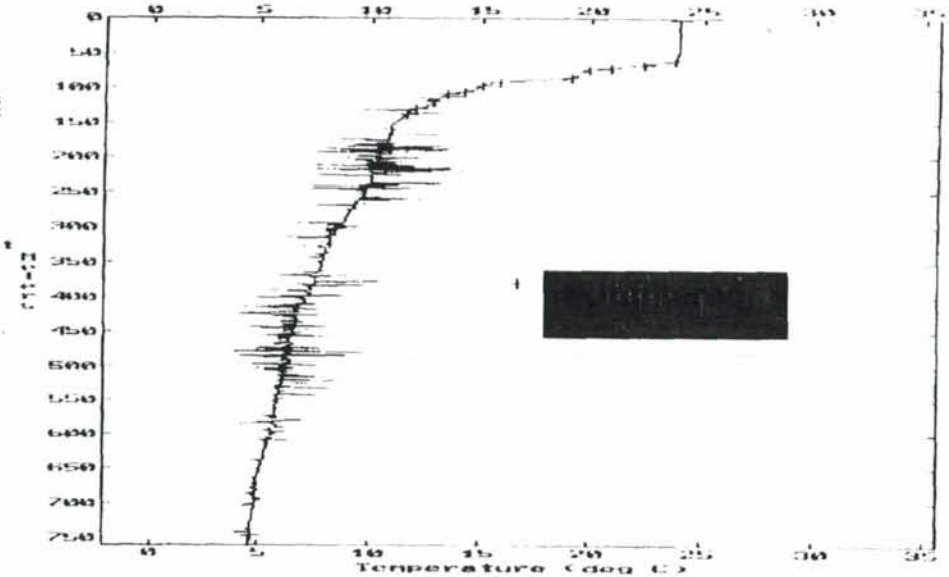
	GOES	STD-C	STD-C/SEAS
Hardware	$5 K		$4 K
Transmission $	"Free"	$4.50	$.12-.56
Time	1 Min./3 Hr.		Unlimited
Coverage	Atl.+Pac.	Atl.+Pac.	Global
Setup	Difficult		None
Volume	1 K-Byte Buffer		No Limit
Transmission	One Way		Two Way
Growth	Small		Large


SEAS IV
New Communications
Thermosalinograph
Hull Contact Sensors
Auto - Launcher

NOAA
National
Ocean
Service

Drop 018
Latitude: 06 16.0 S
Longitude: 14 34.0 E
Probe T-07
Date 92/09/17
Time 03:11 GMT
Bottom depth: 3500 m
Cruise Cruise ID
Bucket Temp: 23.7 C

Use mouse or arrows
and Enter to zoom plot
Hit p, P, or Alt-P
to print or Esc key
to continue



NOAA
National
Ocean
Service

Drop 018
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Probe T-07
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Bottom depth: 3500 m
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Bucket Temp: 23.7 C

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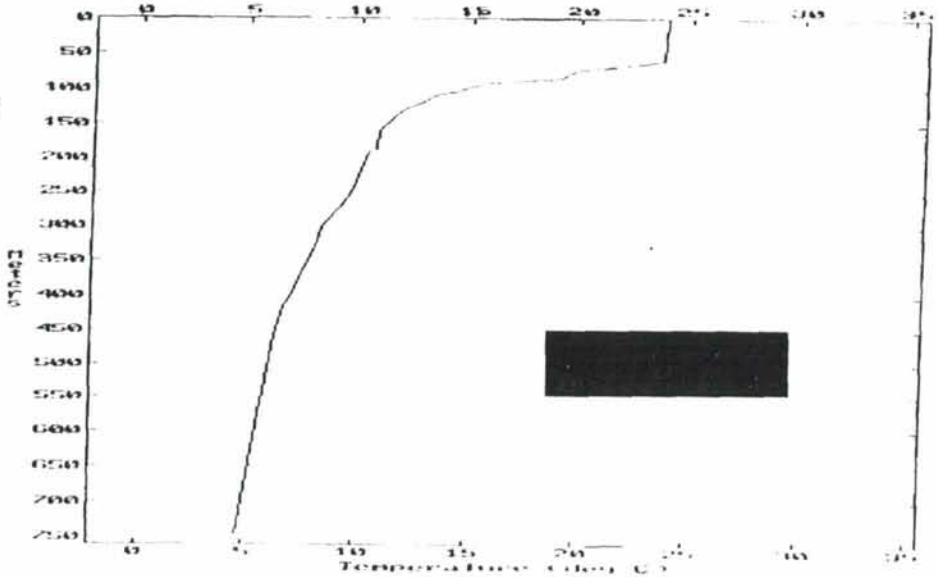
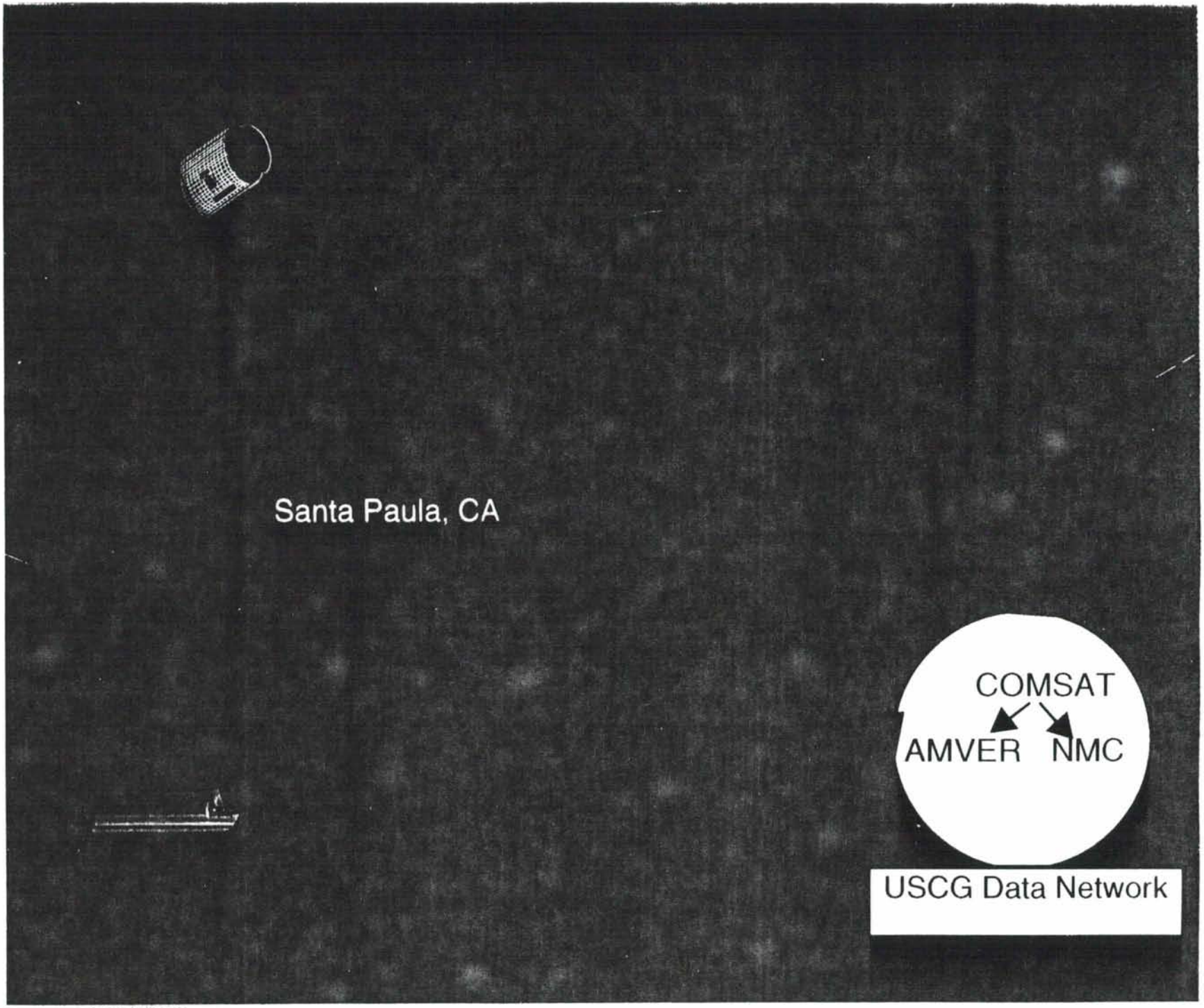
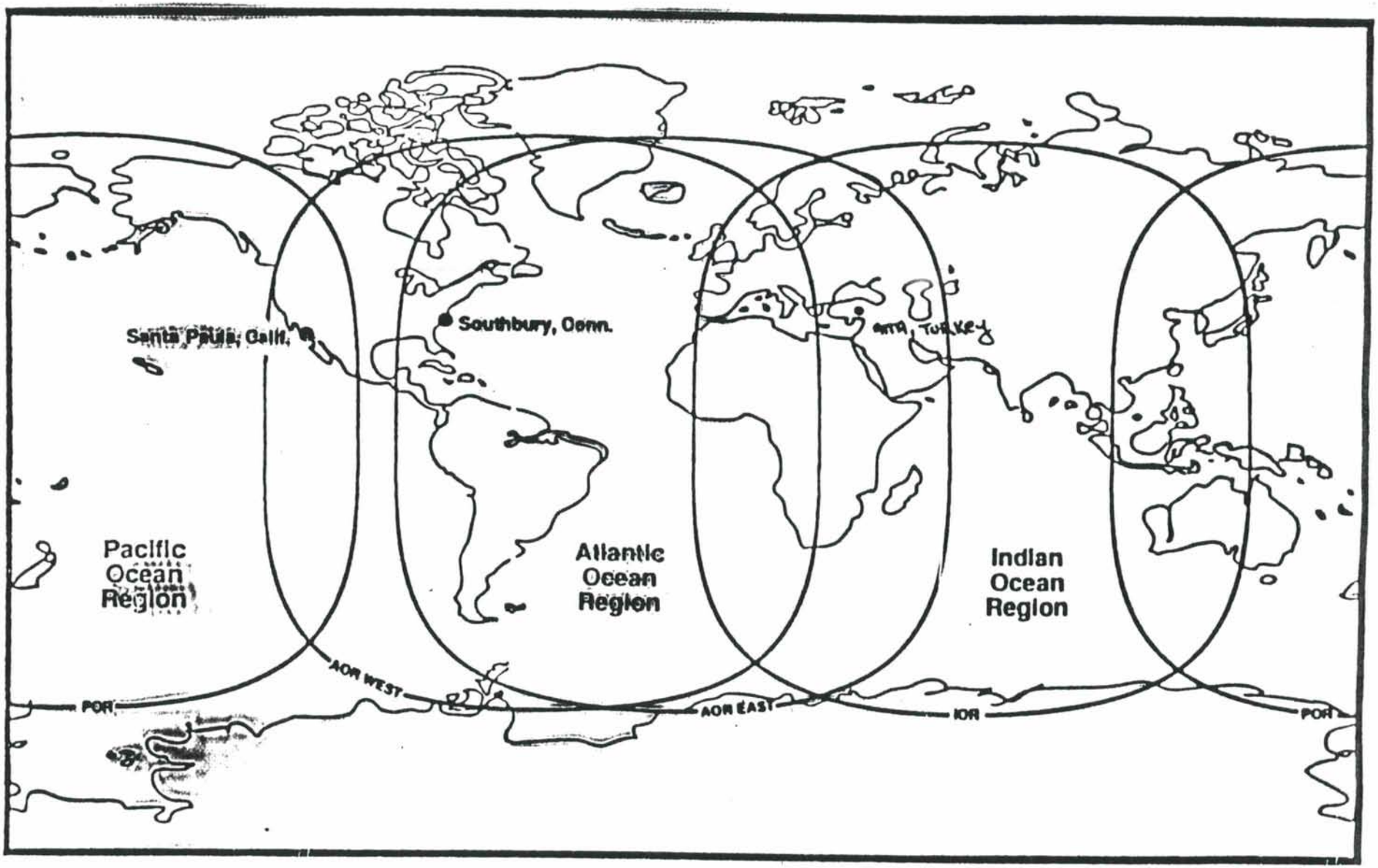


SEAS REQUIREMENTS

- Standard "C" on Bridge
- Connection to PC
- Permission from Ship for SEAS

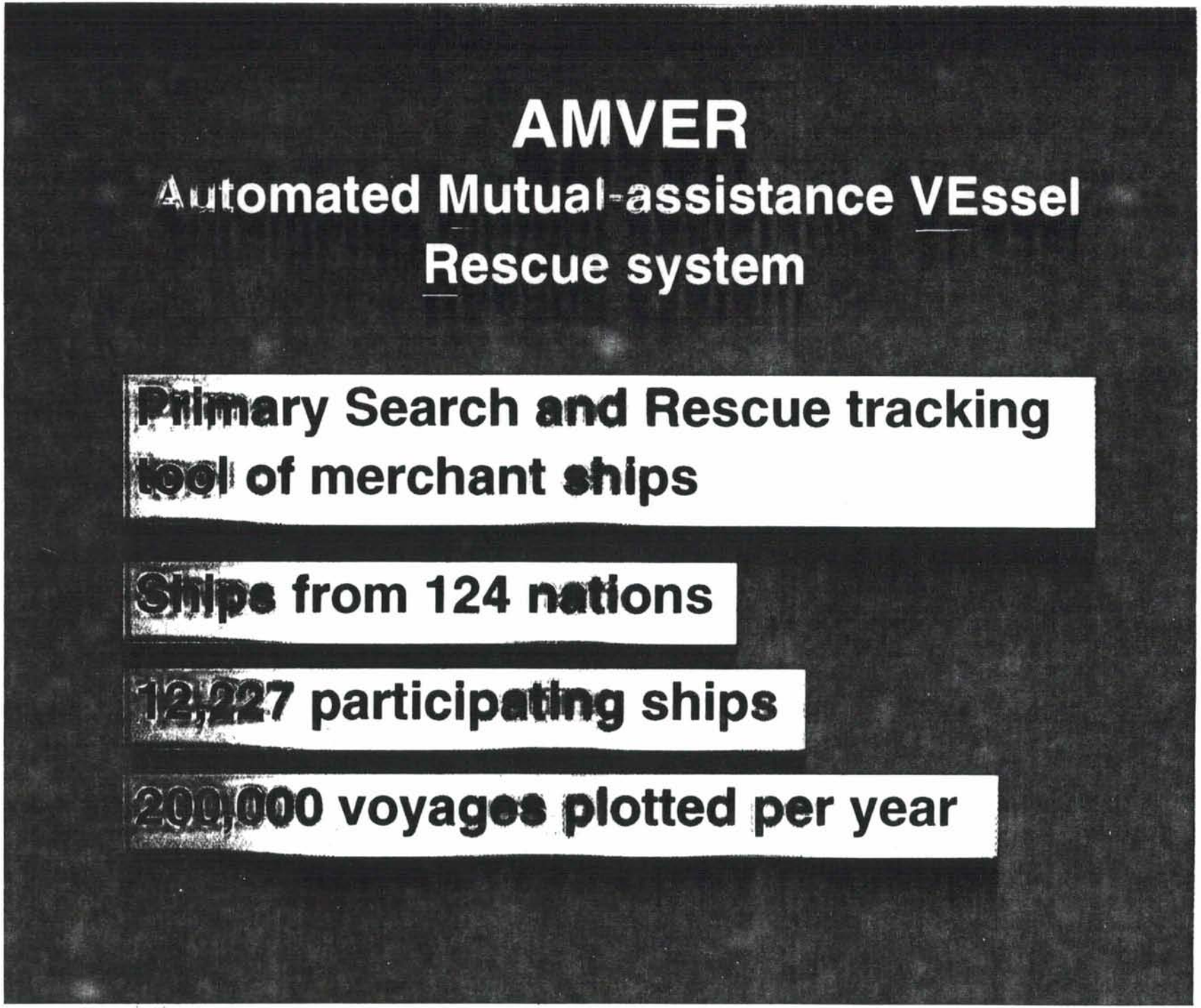

Santa Paula, CA
COMSAT
AMVER
NMC
USCG Data Network

FOUR OCEAN REGION COVERAGE



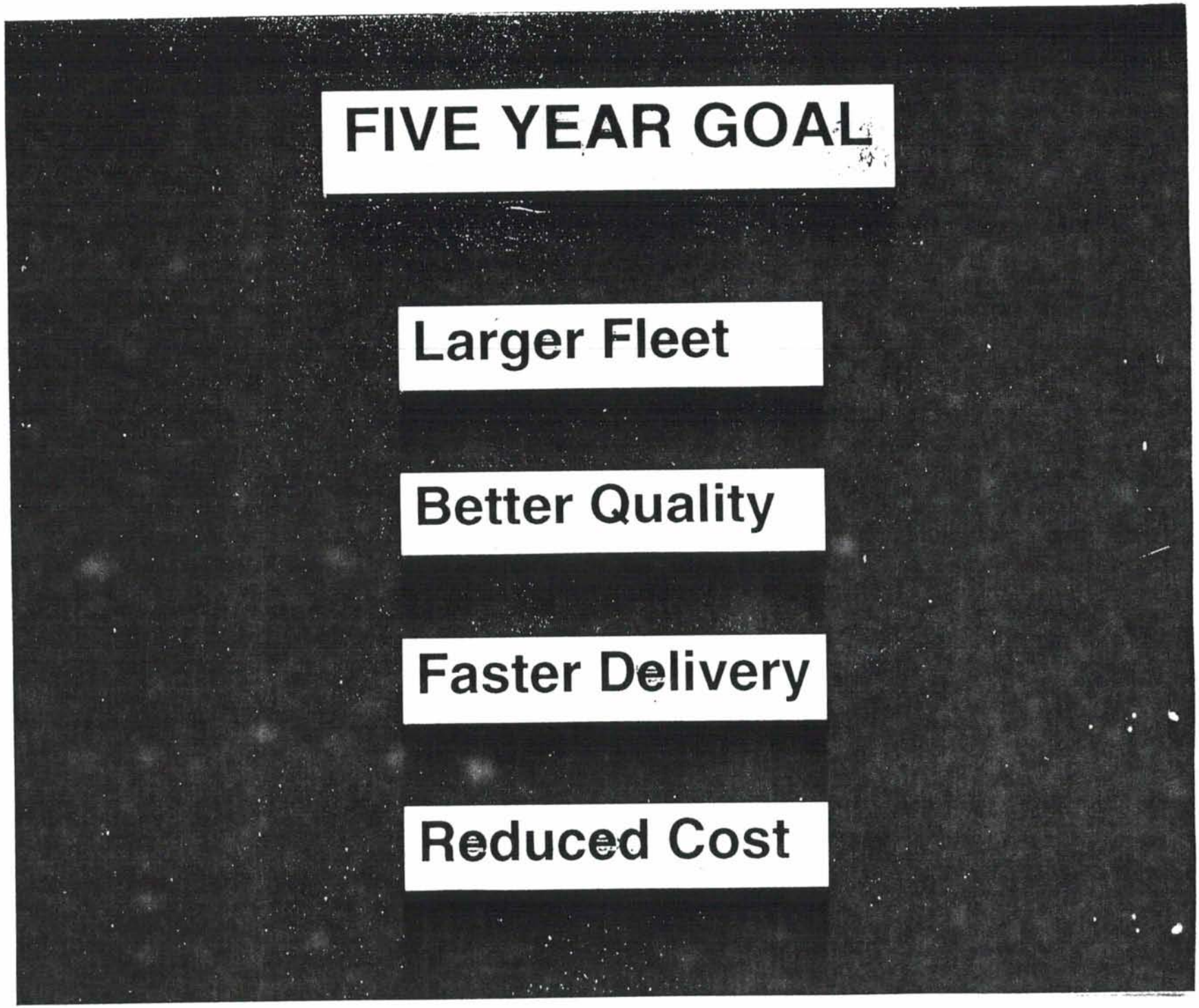
Improve Cost - Efficiency Through Joint Venture

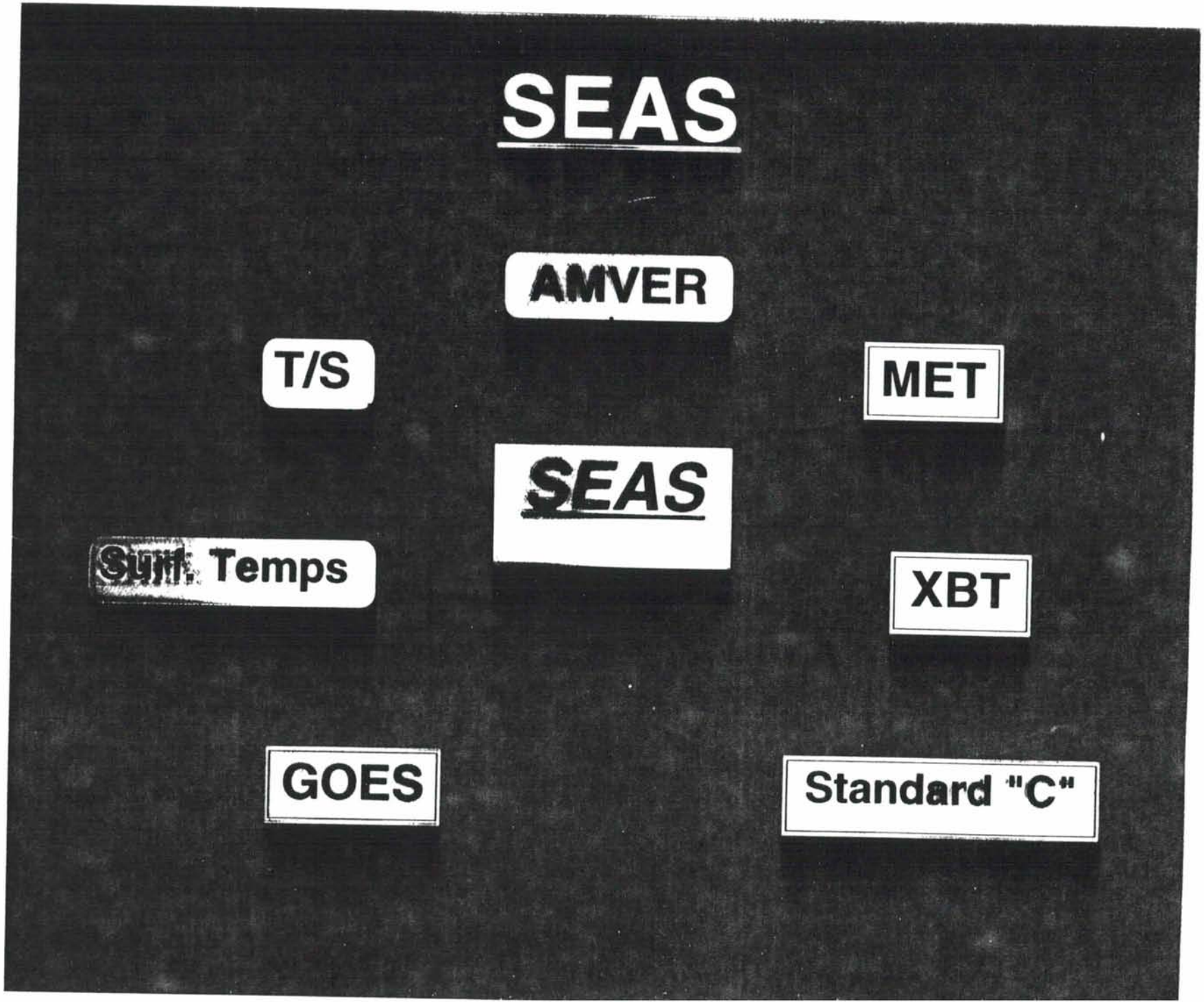
- Standard "C" as a Basis
- Compressed Message Software = Lower Transmission Costs
- Integrate Environmental Reports with AMVER Reporting
- COMSAT - USCG Cooperative Ground Segment Portion


AMVER
Automated Mutual-assistance VEssel
Rescue system
Primary Search and Rescue tracking tool of merchant ships
Ships from 124 nations
12,227 participating ships
200,000 voyages plotted per year

SEAS IV

- Increased QC
- Modular Design
- AMVER
- TRACKOBS
- Updated Menus


FIVE YEAR GOAL
Larger Fleet
Better Quality
Faster Delivery
Reduced Cost


SEAS
AMVER
T/S
MET
SEAS
Surf. Temps
XBT
GOES
Standard "C"

APPENDIX XXI

FIC Coastal (NRL)

DEPARTMENT OF THE NAVY
NAVAL RESEARCH LABORATORY
4555 OVERLOOK AVE SW
WASHINGTON DC 20375-5320

IN REPLY REFER TO

Ser 7000/129
20 June 95

Dr. Christopher N.K. Mooers
Rosenstiel School of Marine and Atmospheric Science
Ocean Pollution Research Center, MSC 132
4600 Rickenbacker Causeway
Miami FL 33149-1098

Dear Dr. Mooers,

In reply to your letter of 25 May, I am happy to provide you information on the Naval Research Laboratory's plans in littoral/coastal ocean research. In response to the Navy shift to the littoral, NRL programs in littoral/coastal oceanography and meteorology have grown to greater than half of our total program. The coastal research program encompasses several related disciplines in oceanography, marine geology, underwater acoustics, meteorology and remote sensing.

Our research in littoral/coastal oceanography has three major thrusts. The first is to understand the physical, optical and biological processes in shallow and semi-enclosed seas, and the exchange processes between these areas and the deep ocean in order to develop predictive models for these areas. We are also interested in understanding and characterizing the geology and geophysics of the near shore and shelf region and its temporal/spacial evolution. Finally, we are performing research on acoustics propagation and scattering on the shelf and semi-enclosed seas. The field research for these programs is conducted primarily along the East and Gulf coasts of the United States, with additional work being done along the West coast and overseas.

The annual platform use is currently 200 ship days and 225 aircraft hours spread over the disciplines listed above. This platform use is expected to be maintained through the time frame of interest to you but will vary depending on the amount of funding available to conduct research.

With ONR's fleet plan and NSF's refit of their ships I find the state of the UNOL's RV's generally excellent. One wish I have is that UNOL's would provide greater emphasis/incentive to use the larger vessels and associated technology, e.g. with ROV's/AUV's in littoral/coastal research. This would encourage not only interdisciplinary research but also major coastal efforts requiring this scale of vessel.

I deeply appreciate this opportunity to comment on the UNOL's fleet. I am extremely interested in maintaining a healthy and robust research fleet for the U.S. ocean sciences community. These are required assets if the U.S. is to remain at the forefront of the field. I hope this "first-cut" helps the FIC in developing its report and I look forward to seeing the "draft."

Sincerely,

Eric O. Hartwig

FIC/Coastal (MMS

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
WASHINGTON, D.C. 20240

JUL 12 1995

Professor Christopher N.K. Mooers
Rosentiel School of Marine and
Atmospheric Science
Ocean Pollution Research Center,
MSC 132
4600 Rickenbacker Causeway
Miami, Florida 33149-1098

Dear Professor Mooers:

This is in response to your letter of May 25, 1995, soliciting input to the UNOLS Fleet Improvement Committee for long range planning for coastal ocean research vessels.

The Minerals Management Service (MMS) is a member of the Federal Oceanographic Fleet Coordination Council (FOFCC). The members of the FOFCC include many federal agencies that operate and use research and survey vessels. You may already be aware that the coordination board of the FOFCC meets regularly to identify agency needs, to exchange and monitor Fleet schedules, and to integrate ship utilization. The board publishes a Fleet status report which includes: (1) an overall Fleet capability and assessment; (2) an overview of post usage; and (3) a summary of future requirements.

The current issue of the Fleet report is in preparation and will be published in late 1995. Each agency has submitted its updated information to the coordination board. You can obtain a lot of "first cut" information on future Fleet requirements by contacting board co-chairmen: Dr. Pat Dennis and Capt. R.T. Schnoor at (202) 653-1295.

I am enclosing information (Attachment 1) which describes general themes within the Environmental Studies Program (ESP). Because the ESP is designed to be flexible and responsive to changing OCS program needs, it is difficult to provide specific information regarding time frames and funding levels, and major field experiments, etc. Additionally, because we contract our research requirements out, the vessel requirements are met by the contractor and the planning horizon is typically one to five years rather than five to ten years.

As indicated in the attachment, our geographic areas of interest will focus on the Gulf of Mexico OCS Region, Southern California OCS Region, and the Beaufort Sea and Cook Inlet areas of the Alaska OCS Region. We have no "major" field experiments planned at this time. However, we plan to have several smaller integrated field studies in the areas mentioned above.

If you need further information, please call me at (703) 787-1726 or call Dr. Ron Lai at (703) 787-1714.

Sincerely,

Kenneth W. Turgeon
Chief, Environmental Study Branch
Minerals Management Service

Attachment 1

Minerals Management Service
FY 1996 Science Priorities for the Environmental Studies Program

Prepared May 5, 1994

Management Needs

The DOI/Minerals Management Service (MMS) Environmental Studies Program (ESP) conducts a wide variety of studies designed to improve knowledge on fundamental physical, chemical and biological processes, ecosystem functioning and inventorying of living marine resources to provide information for management decisions regarding activities associated with management of offshore gas and oil and mineral resources. The priority research described in the following paragraphs is essential to current and planned decisionmaking for offshore leasing, exploration, development and production in the outer continental shelf areas of the United States.

Research Priorities

Fate and Transport of Marine Pollutants

An integrated program designed to provide an understanding of the dynamic processes of the ocean and the features that control the motion of coastal and oceanic waters of the continental shelf is carried out through physical oceanography field programs which are integrated with modeling efforts for oil spill risk analysis. Major efforts will take place in the northern Gulf of Mexico (from Texas to Florida), off the coast of southern California (Southern California Bight), and the Arctic Alaska (Beaufort and Chukchi Seas). Research must continue to develop and refine bioindicators for petroleum in the marine environment in important marine species and elucidation of physical, chemical and biochemical transformation processes for petroleum hydrocarbons. New studies must be initiated to assess potential impacts of OCS related sulfur emissions in the Breton Wilderness Area of Louisiana.

Marine Ecosystems

Major efforts must continue in the Gulf of Mexico to characterize distribution and abundance and particular habitat use for marine mammals and sea turtles with an emphasis on protected species. Additional studies of marine ecosystem processes and function on the northeast Gulf of Mexico continental shelf must be carried out to provide information for decisions related to OCS operations. Additional studies of benthic communities of the northern Gulf of Mexico continental slope, including chemosynthetic communities, will be conducted as offshore industry interest emphasis shifts to deeper water. In addition, studies to document migration, distribution and abundance of whales and selected other species of marine mammals must continue in the Beaufort and Chukchi Seas. Monitoring of seabird colonies to provide a basis for assessing change must occur annually in Alaska.

Long-term monitoring studies are currently underway in the Santa Barbara Channel area which integrate priorities to assess change resulting from OCS activities and carry out research to enhance our understanding of natural variability and the ocean processes that control change. Additional long-term monitoring efforts must be continued in areas of oil and gas development in the central and western Gulf of Mexico. Monitoring the health of coral based communities of the East and West Flower Garden Banks in the Gulf of Mexico will continue as a partnership effort between the MMS and the NOAA Marine Sanctuary Program.

Socioeconomics

Studies of community level impacts, recreation and tourism impacts, fiscal and employment effects, and analysis of other social, political and economic factors related to OCS oil and gas industry activities in southern California are needed. Socioeconomic baseline information in the mature oil development areas of the Gulf of Mexico must be collected and applications must be developed for development in areas of the country that do not have a history of oil development. In Alaska, potential impacts on native Alaskan culture and related subsistence issues will be studied in the context of offshore oil and gas development activities.

Partnerships

The MMS Environmental Studies Program emphasizes partnerships with States and their universities through MMS Coastal Marine Institutes which have been established in Louisiana and Alaska. A third CMI will be operational in California by FY 1996. A unique aspect of the CMI is the requirement for one to one matching of Federal funds by the recipient to carry out research which supports the most important OCS oil and gas information needs of the MMS and the State. In addition to the CMI's, the MMS utilizes cooperative agreements with other States and universities to accomplish specific projects. MMS also works closely with other Federal agencies using interagency agreements and memoranda of understanding. We are currently working with NBS to establish a basic memorandum of understanding and anticipate developing annual interagency agreements which will specify marine biology projects to be carried out by NBS in support of the MMS OCS program. MMS also has entered into interagency agreements with the Office of Naval Research, NOAA, and DOE (for example) to fund and/or carry out mission related science objectives. Additionally, MMS has enters into partnerships with private sector organizations such as the Marine Spill Response Corporation (MSRC) to meet mutually agreed upon science objectives.

Budget

The FY 1996 budget required to accomplish these priorities is approximately $20 million. The projected MMS budget will be approximately $14 million.

FIC/Coastal (NSF)

From: mreeve@nsf.gov
Date: Wed, 12 Jul 95 11:25:09 EST
To: cmooers@rsmas.miami.edu, dheinric@nsf.gov
Subject: Coastal Plans and FIC

Chris - this is in response to your letter to me requesting information on long-range planning for coastal ocean research vessels for FIC.

I have been out of town on extensive travel recently. So I have only recently had a chance to look at your letter asking for coastal ocean research vessels long range planning comments.

I discussed this briefly with Don Heinrichs before he left on a trip. We both feel that, given the unusually high degree of uncertainty regarding funding both for NSF, and in particular other "coastal agencies", trying to provide the kind of detailed responses to your questions which you would undoubtedly prefer would only provide an appearance of precision which would be virtually useless.

The Division of Ocean Sciences has placed interdisciplinary coastal ocean process studies as its number one priority for increased funding in the non-strategic area (i.e. not Global Change) for several years. We have participated with other federal agencies in producing interagency planning documents, as well as community-based CoOP plans for well over five years. To date, very little of these efforts have borne fiscal fruit. At present our CoOP initiative is about $3M annually (including ship funds). In order for any major increase in coastal science funding to occur, it will clearly take a major push on the part of interests controlling the Congressional budget process. Your guess is as good as mine as to the likelihood of this occurring over the next seven years of budget balancing, but it is hard to be optimistic. Nevertheless, CoOP remains at the center of our "major research themes". Secondarily, there are the international (IGPB) Global Change theme of LOICZ and the new IOC International Coral Reef theme.

Interdisciplinary coastal studies call for either larger ships than UNOLS usually operates in the coastal zone, or perhaps smaller ships which are more specialized with state-of-the-art facilities, and operate as two-or-more ship teams. One could envisage a ship primarily designed for rapid site surveying using underway sampling techniques (physical, chemical and biological) and one primarily designed for process and experimental studies (mainly biological/chemical). Either way, a large multi-disciplinary field program could require 30 - 50 scientists at sea at the same time just as it does for JGOFS ocean field programs. The days when the "ideal" new coastal vessel would look like a Calanus or Bluefin are long gone, in my opinion.

Regarding geographical location, I believe coastal studies are much more likely to be conducted in U.S. coastal waters,because most justifications for coastal programs, particularly in an interagency context, will be in association with U.S. societal problems (fisheries, pollution, habitat, weather prediction etc.). The only major field experiment being talked about now is the desire of CoOP to mount a major study in the Great Lakes. GLOBEC has strong interest in a west coast program, but current problems within NOAA

mean that the Georges Bank field program cannot be sustained at its desired level over the next several years, and so a new start is not likely soon.

In summary, even in the best of circumstances, the NSF budget is not likely to do more than keep pace with inflation over the next few years. This, combined with the fact that great pressure is being placed on other "coastal agencies" to be drastically cut back, suggests less, rather than more funds available for coastal research.

APPENDIX XXII

DRAFT

UNOLS Goals and Objectives for Post-Cruise Assessment Reports

Chris Mooers, FIC Chair

14 JUN 95

GOALS

- To help ensure that the UNOLS Fleet functions to meet the needs of the ocean science community.

- To help ensure that the UNOLS Fleet meets the highest quality operational and safety standards of all research vessel operations in the U.S., preferably the world.

OBJECTIVES

- To provide for chief scientist evaluation of the adequacy of the UNOLS Fleet, including research vessel condition and operations, safety issues, marine technician support, shore support, standard shipboard equipment and scientific instrumentation, and data processing facilities.

- To provide a mechanism for improvement of the operation of the UNOLS fleet through continual feedback from chief scientists.

- To provide feedback to ship operators, marine technicians, the UNOLS membership, and the federal funding agencies on the effectiveness of the UNOLS Fleet.

- To provide accountability to the chief scientist community by engendering reports on follow-ups by ship operators.