UNIVERSITY - NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

UNOLS
FLEET IMPROVEMENT
COMMITTEE

MEETING REPORT

July 19-20, 1993
Oregon State University LaSells Stewart Center
Corvallis, Oregon

MEETING REPORT
UNOLS
FLEET IMPROVEMENT COMMITTEE

19-20 JULY 1993
OREGON STATE UNIVERSITY
CORVALLIS, OREGON

The UNOLS Fleet Improvement Committee met at the LaSells Stewart Center on the Oregon State University Campus, Corvallis, Oregon, 19-20 July 1993. The meeting was called to order at 0900 by FIC Chair, Marcus Langseth. The agenda is enclosed as Appendix I.

ATTENDEES

FIC MEMBERS

Marcus Langseth, Chair
Peter Betzer
Teresa Chereskin
Eric Firing
Ken Johnson
Charlie Miller
Tom Royer
Joe Coburn, RVOC (Ex officio)

PARTICIPANTS

Jack Bash, UNOLS
Pat Dennis, JOI/ONR
Annette DeSilva, UNOLS
Rich Findley, RVTEC (Visitor)
Marty Mulhern, NOAA

APPENDIXES

I. FIC Agenda
II. Science Mission Requirements for the ARV
III. Coastal Workshop Executive Summary
IV. Fleet Improvement Plan Outline

GREETINGS and MEETING LOGISTICS. Charlie Miller welcomed us to Corvallis and provided the logistical plans for the meeting. Marcus outlined the schedule and set objectives for the meeting.

APPROVAL OF MINUTES. The minutes of the 28-29 April FIC meeting in Seattle, WA, were approved as written.

UNOLS COUNCIL REPORT (JULY MEETING). Jack Bash provided a brief review of the UNOLS Council meeting that had been held in Newport, Oregon on 15-16 July. Jack reported that the DESSC and the ALVIN Group had been very successful in attracting proposal pressure for use of ALVIN and that ALVIN should have a very full year operating in the Pacific in 1994.

Garry Brass has written a letter to NOAA Administrator, Jim Baker suggesting the concern about the NOAA funded ship, K-O-K at Hawaii and the possibility of it becoming a UNOLS ship. This sparked considerable discussion in both the Council and FIC meeting. The Council is very concerned that a well planned solution be sought for the replacement of Moana Wave and that this vessel will serve the best interests of SOEST and the entire UNOLS community.

Jack discussed the Council's dialogue concerning the responsibilities and liabilities of Chief Scientists aboard ship. The legal realities may cause a realignment of shipboard tasks which could have ramifications on crew size and the crew/science mix.

The Council discussed the Federal Agencies' response to the Blue Ribbon Panel suggestion. It would appear the Agencies are not ready to convene such a panel at this time.

Don Heinrichs reported that Dolly was working with DOD on a memorandum of understanding that would permit the UNOLS fleet to use a black box to remove the dither from GPS. A classified clearance would be needed for the programing of this box but the box itself would be unclassified.

Jack also reported that the Council will recommend to the membership the inclusion of Harbor Branch's ship RV SEA DIVER to the UNOLS fleet as per that institution's request. The Council has requested that HBOI provide information of the funding status, past, present and future for this ship.

Finally, the Council tasked the FIC to produce Science Mission Requirements (SMR) for a large, shallow draft Coastal Research Vessel and that Don Wright was requested to give the UNOLS members a summary of the Coastal Workshop Report at the UNOLS Annual Meeting 1 October '93.

AGENCY REPORTS.

Office of Naval Research (ONR) - Pat Dennis reported on ONR matters. Pat announced that Fred Saalfeld has been named Deputy Chief of Naval Research. He reviewed the ONR ship funding indicating that 1994 would be a lean year with only about $2M going for ship support as apposed to the over $7M in 1993. Pat reported that the last NRL ship, BARTLETT, was going out of commission and that $1M in NRL/ONR money would be available for charter in 1994.

Pat reported that AGOR-24 was under construction at Halter Marine and should be delivered in 1996. Funds for AGOR-25 are expected and construction on this ship should start in early 1994 with a completion date of 1997. A Navy version of the TAG-60 is also in the 1994 budget.

During the shipbuilding discussion it was reported by Ken Johnson that the MBARI SWATH was under construction at SWATH Ocean in San Diego. The ship will be 120' LOA with a 50' beam.

National Science Foundation (NSF) - No NSF representative attended the FIC so Jack Bash provide a brief overview on the NSF funding picture as presented by Don Heinrichs at the UNOLS Council meeting in Newport, OR. Don had reported that the NSF was expecting a budget increase of about 6 to 8% for 1994, however, this would equate to level funding in ship operations.

National Oceanic and Atmospheric Administration (NOAA) - Captain Martin Mulhern provided the report to the FIC for NOAA. A steady funding picture is expected for NOAA in 1994. Marty reported that the Fleet Modernization Program received $33.2M in FY92, $30M in FY93 and for FY94, $23.1M has been approved by the House with the Senate yet to provide their number. At these funding levels, by the end of FY1994 the NOAA Ship DELAWARE II, a fisheries vessel, will undergo a major Repair-To-Extend (RTE) its life. There will be a conversion of a former Navy T-AGOS vessel for oceanographic mooring support, and ALBATROSS IV and TOWNSEND CROMWELL will undergo extended repairs. Both routine and critical maintenance costs now are included in the Fleet Modernization Program budget. Preliminary studies of modern ship systems are being performed. Other activities include a development of an economic model to compare government and contractor ownership and/or operation, and designs for conversion of Navy T-AGOS vessels for NOAA survey use, for the RTE of OCEANOGRAPHER, and for replacement of NOAA's fisheries vessel, JOHN N. COBB.

AGOR 26 is formally planned for construction in the 1995/96 time frame. The option for this construction expires at the end of FY 1996.

NOAA has developed a NOAA-wide Strategic Plan for 1995-2005, which projects a requirement for the Fleet Modernization Program to bring NOAA's days-at-sea up to 6,240.

Marty provided the FIC with a list of engineering projects that were underway for the NOAA ships. These included: Night scopes for all ships; five GPS P-Code decoders (2 are now purchased); Differential GPS for all ships; High speed computer modems; Upgraded computer systems; Shipboard Automated Maintenance Management program (SAMM); Vibration and oil analysis systems; and Electronic chart systems. In addition, NOAA is establishing an electronic bulletin board for posting schedules and has funded a waste management study for their ships.

MISCELLANEOUS ITEMS:

RVOC - It was reported by Joe Coburn that the RVOC will be holding their annual meeting 26-28 October in Galveston, Texas hosted by TAMU.

RVTEC - Rich Findley attended the FIC meeting and provided a summary of where RVTEC is going and some of the items on their agenda. Rich reported that RVTEC will have their annual meeting at Scripps on 20-21 September. The committee has formed three sub-committees: Equipment and technician data base; Technician sharing and cross training; and New instrumentation. They are inviting both Eric Firing and Teri Chereskin for a work session on ADCP. They are planning another work session on SeaNet, inviting Ellen Kappel to speak and a third work session on CTDs is scheduled. Rich and the RVTEC have been getting involved with data acquisition standards and data distribution. Rich has coined the acronym UDEF for UNOLS Data Exchange Format. A subcommittee of Eric Firing, Teri Chereskin and Rich Findley was formed to prepare a report that would address data handling and management for the Fleet Update Plan.

DESSC - It was reported that ALVIN may soon be certified for a depth capability of 4500 meters. A condition of this authorization will most likely require that all motor controller containers be replaced. DESSC has recommended that ALVIN engineering dives receive the same priority as a science dive and not be used as the give-away dives for heavy weather or equipment failures. In another action, DESSC is seeking ways to develop block funding for ALVIN. One avenue being pursued is through a congressional appropriations add-on to the NOAA/NURP budget.

KNORR Conversion to an ALVIN Support Ship - ATLANTIS II is scheduled for retirement when AGOR-25 is built. WHOI is planning to convert KNORR to a submersible support ship at that time replacing AII. The timing for this conversion is based on several factors: the overhaul cycle of ALVIN, the date of sale for AII and the health of KNORR's 1994-95 operating schedule. Under what is being called plan A, KNORR will go into a conversion period in late 1995 or early 1996. If events dictate, however, this could be advanced 6 months to a year starting the conversion in 1994 as plan B. The FIC and DESSC are forming a joint sub-committee to address the community's interest with the conversion. This committee will have its first meeting on 22 September at WHOI. The sub-committee will consist of two DESSC members (P.Fox & K.Von Damm), two FIC members (K.Johnson, Chair & P.Betzer) and two outside members (F.Spiess & F.Lutz). Glosten Associates are under an ONR contract to develop the preliminary plans for this conversion.

SCICEX- '93 - UNOLS has been involved in the coordination of a science plan for operations aboard a nuclear submarine under the ice in the Arctic. The sub, SSN PARGO, is a Sturgeon class submarine that will take five scientists on a 42 day mission under the ice. They expect to have 19 days in the Arctic and plan 15 surface stations. The US Navy seems anxious to make this trip a success for science. Future trips are possible. Congress has appropriated $3M for this cruise. Any further work would also need funding outside the current science budgets.

USCG Icebreaker - The US Coast Guard is reported to have let the contract for the construction of their new icebreaker. This ship appears to be on track and should be ready for operations by 1997. Garry Brass has written the Coast Guard about UNOLS concern that this ship is not planned to be build under CASPPR regulations.

Arctic Research Ship Preliminary Design Study.

Tom Royer provided the update on the Arctic Research Vessel. Glosten Associates have been revising and modifying the ship's plans. This includes the reduction in length to 331' with the beam remaining at 90'. A ducted nozzle propeller with a variable pitch has been selected. Direct drive diesel engines are planned with 14,000 to 16,000 shp. Model testing has been contracted with HSVA which is expected to take place in August or September of this year. A "free and open" bidding process is being sought for determining the construction yard.

The committee spent several hours reviewing the latest Science Mission Requirements (SMR) for this ship. A draft of these SMRs is included as Appendix II.

Coastal Oceanography Workshop

Don Wright brought the committee up to date on the Coastal Oceanography Workshop that was held in Williamsburg, VA, 22-24 February '93. Don reported that 75 scientists and federal agency persons attended the workshop. The meeting started with a plenary session providing an overview of coastal marine science and a perspective of the multidisciplinary aspect of this science. The group was then broken down into four sub-groups to conduct workshops on synoptic observations; high resolution time series; interdisciplinary studies and information management and communications. These groups reported their deliberations to the entire gathering then again broke into working groups. This time the groups were to discuss large research ships; small research ships; aircraft, satellites, moorings and fixed platforms, and instrumentation. This second set of working groups then presented their discussions to the entire group. This process created a stimulating array of ideas and needs for the coastal community. A highlight of their recommendations follows:

- More effective data transmission.
- Higher resolution data collection capability.
- Increased ability to operate inshore in heavy weather.
- Increased ability for simultaneous sampling.
- Aircraft, satellites must be used in coordinated programs along with vessels.
- Vessels that can accommodate groups of 20 or more scientists.
- Interdisciplinary ships should be able to work in shallow water (< 7 m).
- Sets of routine data must be acquired from all vessels.

- Enhanced communication/data transfer links.
- Regional pools of shared equipment.
- Access to larger vessels by multidisciplinary teams.
- Ability to service very dense station spacing.
- Quick-response vessels needed to service moorings.
- Ability to support multiple wires from anchored vessel.
- Ability to maintain 3-point mooring for prolonged periods.

Meeting these needs will require a mix of large ships, more specialized smaller ships, non-ship platforms such as aircraft, satellites, buoys, and fixed platforms, and field and shipboard instrumentation.

During this workshop three small ship designs were presented as examples. These included a shallow water ship, a catamaran and a SWATH ship. One issue that was of concern to all participants of the small ship group was the operating cost of these ships. The number of $3000/day was bantered around as a goal, however, this appears to be extremely optimistic and probably not realistic. The study will not refer to an operating daily rate but will stress the need for inexpensive platforms.

An inventory of Coastal Facilities is to be completed as part of this effort but may not be ready in time for the publication of the report.

The report for this workshop is well underway and should be completed by fall. A final meeting of the workshop steering committee will meet later this summer to work out the report details. A draft Executive Summary has been circulating for comment and is included as Appendix III. This summary will be the substance of a paper to be delivered at MTS '93 in Long Beach, CA, this September and will be published in the MTS Proceedings. An article for EOS is planned.

The FIC was tasked by the UNOLS Council to produce Science Mission Requirements (SMR) for a Large Shallow Draft Coastal Research Vessel. Don will head up a subcommittee to develop this SMR.

OTHER BUSINESS

AGU Booth - UNOLS is planning a booth at the fall AGU meeting in San Francisco 6-10 December. The plan is to man the booth with UNOLS Committee members so that each Committee is represented. Literature, graphics, charts, pictures and videos will be needed to describe the UNOLS activities. Marcus suggested that the FIC portion of the booth include a poster or posters depicting the new ARV design, the AGOR design and the OCEANUS class mid-life-refit before and after drawings. Tom Royer was tasked to acquire the ARV design; Jack Bash the AGOR design and Joe Coburn and Jack the drawings for OCEANUS class refit.

UPDATE OF THE FLEET IMPROVEMENT PLAN.

Mark led the discussion for the remainder of the meeting on updating the Fleet Improvement Plan. He provided the committee with a revised outline for the development of the plan which is included as Appendix IV. The outline provides the scope of the plan and provides tasking for the various parts.

A study titled "UNOLS Fleet Operating Costs and Trends" was distributed by Mark before the meeting. This study looked at the cost of operating the UNOLS fleet through the period of 1985 to 1992. By applying a 4% inflation factor Mark was able to show that the fleet operating costs have not changed significantly over this eight year period. The only dips in cost were during those years that KNORR and MELVILLE were going through conversion.

Charlie Miller presented an essay on the "Trends in Biological Oceanographic Field Work" which should provide the basis for the biological section of the plan. Mark will update the Background section. Eric, Teri and Rich were tasked to write a section on data handling. Other assignments in the Recommendations section of Fleet Size and Composition were: Large Coastal Vessels, Peter; Flip/Semi-submersible science platforms, Don; SWATHS, MBARI & WHOI, Ken; Jack-up rigs, Don. Teri was tasked with writing up the Methods for Monitoring/Forecasting ship needs and Eric, Geographic Distribution.

Drafts were to be passed around on OMNET so that a near final draft of the entire document would be ready for the next meeting. This meeting is planned for L-DEO, Palisades on 14-15 October 1993.

The meeting was adjourned at 1400 hrs.

APPENDIX I

TENTATIVE AGENDA

UNOLS Fleet Improvement Committee
July 19-20
Oregon State University
Corvallis, Oregon

Convene Monday July 19 at 9:00 am

1. **Greetings and meeting logistics** - Miller and Langseth

2. **Approval of minutes of April 28, 29 meeting and agenda** - Mark Langseth

3. **UNOLS Council report (July meeting)** - Jack Bash/Brass

4. **Agency Reports**

    ONR - Keith Kaulum
    NSF - Dick West
    NOAA - Martin Mulhern

5. **Miscellaneous items**- Mark Langseth

    SOONS update (Arctic Science 93)
    Joint FIC/DESSC ad hoc Committee for KNORR Conversion
    Update on Coast Guard plans

6. **Arctic Research Ship Preliminary Design Study** - Tom Royer

    Review of revised SMR
    Status of design study

7. **Coastal Oceanography Workshop (the real story)**- Don Wright

8. **Other business**

9. **Update of the Fleet Improvement Plan** - Mark Langseth

    (The main pupose of this meeting will be to complete a first draft of the update. Please bring any text you have prepared and/or background material to the meeting.)
    - Review of Outline.
    - Meeting of subgroups to write and edit material for update.
    - Reconvene at the end of the day to determine status of report.

APPENDIX II

Institute of Marine Science

UNIVERSITY OF ALASKA FAIRBANKS

Fairbanks, Alaska 99775-1080

MEMORANDUM

To: ARV Subcommittee

From: T. Royer

Date 6 August 1993

Subject: Revised SMR

The final version of the SMR is attached. I am sending via mail because of potential formatting problems. While not all of your suggestions are included, I did not ignore them. Many will be considered in the next level of design. I consulted with Dirk Kristensen on some of the comments especially on the ice capability. Comments from the Fleet Improvement Committee are also incorporated.

The meeting that we had scheduled for September has been postponed until the model test results are completed, probably late October or early November.

ARCTIC RESEARCH VESSEL
SCIENTIFIC MISSION REQUIREMENTS

August 1993

Prepared by the Arctic Research Vessel (ARV) Subcommittee

and

Approved by the University National Laboratory System (UNOLS)
Fleet Improvement Committee (FIC)

ARV Subcommittee:

K. Aagaard, University of Washington
V. Alexander, University of Alaska Fairbanks
W. Davis, U.S. Coast Guard
E. Dieter, National Science Foundation
R. Dinsmore, Woods Hole Oceanographic Institution
R. Elsner, University of Alaska Fairbanks
M. Langseth, Columbia University
T. Royer (Chair), University of Alaska Fairbanks
S. Smith, Brookhaven National Laboratory
A. Sutherland, National Science Foundation

ARCTIC RESEARCH VESSEL
SCIENTIFIC MISSION REQUIREMENTS

August 1993

SIZE

- The size ultimately is determined by the requirements. However, it is intended that this be a high endurance, Class I, ship that has significant ice capability. Draft restrictions will be determined by the propulsion and seakeeping requirements. The vessel will be no larger than necessary to perform its identified mission.

ENDURANCE

- An endurance of 90 days is required based on two science cruises in the Arctic between resupplying. For the purposes of this specification, a 90-day endurance is defined as 45 days at full power. The estimate of required full power days is intended to allow the vessel to actually operate for 90 days in varying ice conditions. Full power days are based on installed propulsion power defined as 90% of the maximum continuous horsepower rating for the propulsion diesels plus the power associated with the average hotel load. Quantities of all other consumables (provisions, stores, spares, potable water, lube oil, aviation fuel, snow-mobile fuel, etc.) are to be based on 90 days between reprovision stops.

ICE CAPABILITY

- The mission profile of the vessel emphasizes operations in ice, dictating that the hull form be optimized around ice transiting performance. The ship shall be able to:
  - operate continuously in first year ice,
  - have limited operations in multi-year ice, and
  - transit 7-foot ridges by ramming.

  Continuous operation is defined as maintaining a minimum speed of 3 kts in 3.5 to 4.0 feet of consolidated level ice. Limited operation is defined as controlled ramming, where necessary, and avoidance of heavy ice features wherever practical.

- The vessel is to be capable of independent, short-term, short-distance entries into the Central Arctic Basin (multi-year ice) from July through September and of operations over the arctic offshore shelf from July through December. The vessel is to be capable of a broader range of Arctic operations, when escorted by a vessel having an ice classification of A4 or greater.

- The required operating range of the vessel is within the operating areas and seasons described for ice class A3 in the American Bureau of Shipping's guide to ice classification or to those of Det Norske Veritas Icebreaker Polar 10 classification.

- The vessel must meet the requirements of the proposed new Canadian Arctic Shipping Pollution Prevention Regulations (CASPPR), specifically Canadian Arctic Class 2 (CAC-2). Included in these regulations are requirements for double bottoms and/or cofferdams between shell plating and all tanks containing polluting liquids.

- The vessel is to have excellent maneuvering characteristics in ice to enhance science operations. In this respect, maneuvering characteristics similar to those of the latest generation of modern icebreakers, such as the Swedish *Oden*, are required. Optimum maneuverability is to be achieved through hull design, high performance rudders, and a rapid heeling system.

- Ice capability is to be enhanced by the installation of a hull lubrication system and a rapid heeling system. A key feature of the vessel's design is propulsion efficiency for high thrust, low speed ice operations. High efficiency is required to meet the endurance requirements.

- The ship must be able to withstand being beset in ice. The design operating temperature range is -45° to +35°C.

ACCOMMODATIONS

- Thirty-five scientific personnel with no more than two per stateroom.

- Twenty-four to twenty-six crew berths with fourteen being single staterooms.

- Provide a science library lounge with conference room capability through the use of a folding bulkhead.

- Provide a science office with a chart table.

- Provide for a general ship's office.

- Provide a mud room with washer and dryer on the main deck.

- Provide a properly outfitted exercise room.

- All public spaces should be for common use, that is, no segregation of scientists and crew.

SPEED

- Speed requirements in open water: 14 kts cruising; 10 kts sustainable through Sea State 5. Speed control to plus/minus 0.2 kts in the 2-7 kt range and plus/minus 0.1 in the 0-2 kt range.

- Speed requirements in ice: 3 knots in 3.5-ft thick level first-year ice.

- Fuel economy requires efficient cruising at approximately 12 kts @ 50% power in S.S. 2.

SEAKEEPING

- Maintain underway science operations with the following speeds in the following sea states:
  - 10 kts through S.S. 5
  - 8 kts through S.S. 6
  - 6 kts through S.S. 7
- Emphasis is to be on accelerations in vessel coordinates, deck wetness, and slamming. Motion displacements are secondary. The vessel features are to be designed to minimize the effect of spray icing.

STATION KEEPING

- The ship must be able to maneuver in ice leads and maintain station in ice to deploy instruments over the side or stern. In open seas, it must maintain station and work in sea states through S.S. 6. Emphasis on ice operations will limit high performance station keeping, but vessel should have thrusters or equivalent maneuvering devices to maintain stations at best heading in 25 kt winds and one kt current. Thrusters should be installed with due regard to sonar and echo sounding requirements. The method used for deploying instruments in ice over the side or stern is to create a lee with the vessel. This means that the vessel must have the ability to "crab" sideways. Both sides of the vessel must be visible from the bridge. This implies enclosed bridge wings.

DECK WORKING AREA

- The vessel's working decks should have a stern working area of 3000 sq ft minimum with about 1000 sq ft enclosed (minimum of 10-ft clearance overhead) for weather protection, contiguous waist-level work area along one side 8 x 100 ft minimum to allow piston coring, and an arrangement of deck equipment and cranes to permit core lengths to 100 ft. The deck loading should withstand up to 1500 lb./sq ft and an aggregate total of 100 tons. There should be removable bulwarks at selected locations and the dry main working deck should not be more than 7 to 10 ft above the waterline. There should be a clear foredeck area to accommodate specialized towers and booms extending beyond bow wave. All working decks should be accessible to power, water, air and data and voice communication ports. Two heated "Baltic" rooms are to be provided. The starboard side, midship Baltic room shall be approximately 500 ft^2 and shall have a watertight exterior door having minimum clearances of 14 ft width and 18 ft height. The second Baltic room shall be located forward and to port. This forward room shall provide access to the ice surface for personnel, snow-mobiles, and other light equipment. Both Baltic rooms shall be provided with winches/booms and deck drains. Additionally, a means, other than by crane, shall be provided for personnel access to the ice surface from the aft working deck. This could be a portable gangway suitable of being rigged on either side of the vessel. Deck hatches should be hydraulically actuated and dogged. Space for incubators should be provided near the isotope van. Considerations should be made to minimize ice build-up on superstructure and hull during severe icing conditions. All weather decks should be either heated or be provided with deck surfaces such as wood to allow for sure footing during freezing conditions. Exterior decks should be cambered to provide for proper drainage. One inch flush bolt downs, on a 2 x 2 ft grid are to be installed on all working decks and hold decks.

CRANES

- A suite of modern cranes should be provided to carry out the following:
  - reach working deck areas and off-load vans and heavy equipment up to 20,000 lb;
  - articulate to work close to deck and water/ice surface;
  - handle overside loads at sea up to 5000 lb 30 ft from the side and up to 10,000 lb closer to the side;
  - usable as overside cable fairleads for towing at sea;
  - be rated for manned egress onto the ice surface.

There should be articulated cranes on both corners of the aft working deck for over-side work. These cranes should be arranged so that they can work in tandem and overlap. An articulated crane suitable for loading science equipment, vans and stores shall be placed on the foredeck.

WINCHES

- There must be oceanographic winch systems providing fine control (0.5 m/min), load compensation, constant tensioning, and constant parameter following. There must be cable with multiple conductors and wire monitoring systems with inputs to laboratory panels and shipboard recording systems. Winch controls should be both local and remote. There will be the ability to string two wires at the same time at all overside handling locations.
- Permanently installed general purpose winches should include:
  - two hydrographic-type winches capable of handling 30,000 ft of wire rope electromechanical cable having diameters from 1/4" to 3/8".
  - One traction winch capable of servicing two drums with up to 30,000 ft of 9/16" wire /synthetic fiber rope; and 30,000 ft of 0.68 electromechanical cable or fiberoptics cable. The cable should be capable of transmitting up to 10 KVA.
  - Additional special purpose winches will be installed temporarily at various locations along the working decks. Winch sizes will range up to 30 tons (140 ft^2) and have power demands up to 300 hp.
  - Two capstans must be located on the aft working deck.

- All winches should be located below decks to limit their exposure to weather.
- There must be the capability for winch installation on the bow working deck.

OVERSIDE HANDLING

- Various frames and other handling gear must be provided to accommodate wire, cable, and free launched arrays, one of which should have a safe working load of 30,000 lb. They must be matched to work with winch and crane locations but capable of being relocated as necessary.
- There should be a stern A-frame with a 20-ft minimum horizontal, 25-ft vertical clearance; 12 ft inboard and outboard reaches.
- A heated staging and sampling area with overhead rail and 15 ft clearance must be provided at an optimum overside working area.
- There must be the capability to perform overside handling operations along the forward and aft working decks.
- Sheltered control stations should be used to give operator protection, provide communications, and operations monitoring. They should be located to provide maximum visibility of overside work.
- A hydraulically actuated "hydro-boom" shall be installed in the overhead of the midship Baltic room. This boom shall be capable of extending approximately 13 ft over the side of the vessel and shall have a lifting capacity of 7.5 tons. A larger, extendible, 20-ton capacity hydro-boom shall be located above the wet lab. This hydro-boom must be designed to handle heavy coring equipment up to 100 ft in length. Both hydro-booms shall be fully controllable from either an enclosed winch control station or via tethered controls from the side working deck. Both hydro-booms shall be capable of being served by the hydro winches.

TOWING

- The ship should be capable of towing scientific packages up to 10,000 lb horizontal tension at 6 kts and 25,000 lb at 2.5 kts. The ship should create a relatively ice-free path aft, and thus be capable of towing scientific packages in ice-covered seas and of protecting those packages while towing.

LABORATORIES

- There should be approximately 4000 sq ft of laboratory space including:
  - Main lab area (2000 ft^2) flexible for frequent subdivision providing smaller specialized labs;
  - Analytical lab (300 $ft.^2$) with no exterior bulkheads and stable temperature control and wet lab (300 ft^2), both located contiguous to sampling areas;
  - Electronics/computer lab and associated user space (600 ft^2);

- Biology lab (300 ft^2);
- Meteorology lab (300 ft^2);

- Two climate controlled chambers (150 ft^2) capable of maintaining set temperatures within 2°C (one chamber suitable for primary productivity measurements);
  - Freezer space (150 ft^2) @ -18°C plus/minus 2°C.
- Labs should be located so that none serve as general passageways. Access between labs should be convenient with wide doors and passageways.
- Labs should be fabricated using uncontaminated and "clean" materials and designed to be maintained as such. Furnishings, HVAC, doors, hatches, cable runs and fitting should be planned for maximum lab cleanliness.
- Fume hoods shouldbe installed permanently in the main lab and analytical lab. Wet lab shall have provision for temporary installation of fume hoods.
- A dive locker to UNOLS standards with air handling equipment should be provided.
- Lighting in labs must be per UNOLS standards.
- Space must be provided for ten 20-gallon aquariums or incubation tanks.
- There must be a clean seawater supply with a small lab nearby. This seawater system should be insulated.
- There should be an anteroom to the constant temperature lab.
- Cabinetry shall be high grade laboratory quality, including flexible installation through the use of unistruts on bulkheads, overheads and decks.
- Unistruts should be located in bench knee holes. Threaded inserts should be on all non-chemical bench tops.
- The heating, ventilation, and air conditioning (HVAC) should be appropriate for laboratories, vans and other science spaces served. Laboratories must maintain temperature of 60 to 75°F, 50% relative humidity and 9 to 11 air exchanges per hour. Ventilation noise levels should be low in the labs and staterooms. Filtered air to be provided to analytical lab. Labs to be furnished with 110v and 220v AC electrical power with about 10-v amperes per square foot of lab deck area. Total estimated laboratory power demand is 100 KVA, of which 15 KVA is to be uninterrupted clean power. Each lab area is to have uninterrupted clean power on a separate circuit. Uncontaminated sea water supply should be provided to most laboratories, vans and several key deck areas. Compressed air supply must be clean and oil free.
- All labs, except those spaces associated with the clean seawater supply, transducer wells, and meteorology lab are to be on the main deck.

- Labs on the main deck are to have direct access to a wide (minimum 8 ft) longitudinal passageway terminating at the aft working deck.

- A dark room (75 ft^2) should be installed.

- Two locations are required for the meteorological equipment; one well forward of the mast for the IMET installation and one on top of the wheelhouse.

- A staging area should be provided with an aft facing door. This is to be suitable for housing ROVs, SeaMark, and others.

- There must be provisions for handling biological collections and their preservations with formalin and other toxic chemicals. Heating, ventilation, and isolation from ship's interior are all required. A wide, deep sink and adjacent counter in the aft staging bay could serve this purpose.

- Public heads are to be provided in the vicinity of the labs.

- All accesses to labs from the working deck are to have removable or dropdown sills. The central passageway between the labs is to access the aft working deck area.

- There must be a HAZMAT storage area on the main deck.

- There must be an explosives locker (1500 cu ft).

- A gravimeter room of about 40 sq ft should be provided near the center of motion of the ship.

VANS

- The ship should be able to carry up to four standardized 8 ft x 20 ft portable deck vans which may serve as laboratory, storage, or other specialized uses. There must be hook-up provisions for power, HVAC, fresh water, uncontaminated seawater, compressed air, drains, communications, data and shipboard monitoring systems. Vans must have heated water and sewage lines. Vans should have direct access to ship interior but located in wave sheltered spaces. Arrangements should allow two vans to be linked together. Vans should be capable of withstanding Arctic climate. The isotope van should have direct access from the labs.

- There must be the capability to carry additional, portable non-standard vans (200 sq ft) on super structure and working decks. Supporting connections should be provided at several locations around the ship including the foredeck.

WORKBOATS

- There must be at least one 21-ft inflatable (or semi-rigid) boat located for ease of launching and recovery. A 20-ft Norwegian style ice boat should be included.

- Space should be provided for a 25 to 30 ft workboat as optional equipment in place of a van.

HELICOPTER

- Facilities including hanger for the carrying, landing, fueling, and general servicing of a small helicopter such as an MBB BO 105, shall be provided. This will require a tank for storage of 12,000 gallons of aviation fuel and an associated pump room. The pilot and mechanic are to be considered as part of the science complement. Space should be provided for the storage of two of these helicopters.

SCIENCE STORAGE

- Provide 20,000 cu ft of scientific storage accessible to labs by interior and weatherdeck hatches and elevators. Half the provided space is to include suitable shelving, racks, and tie-downs; the remainder is to be open hold space. The open hold shall be equipped with heavy duty hold-downs on 2 ft centers.

ACOUSTICAL SYSTEMS

- The ship is to be as acoustically quiet as practicable Design target is underway multibeam and conventional echo sounding through Sea State 5 and acoustical dynamic positioning through Sea State 5. The hull should be designed to minimize "bubble sweepdown." Any transducer windows should be flush so as to not entrain bubbles. All acoustic equipment provided shall be selected, located, and installed to minimize noise, vibration, and interference with other acoustical systems.

- There should be a total of three pressurized voids for placement of transducers. The forward void should have four 20-inch wells for two 12 kHz transducers and two spares. The aft void should have three 20-inch wells for one 12 kHz and two spare transducers. There should be a large pressurized sea chest (4 ft x 8 ft) located at an optimum acoustic location for at sea installation and servicing of transponders and transducers. This optimum void should contain the 3.5 kHz array (12 or 16 transducers), two Acoustic Doppler Current Profiling (ADCP) transducers and two spare 20-inch wells.

- A state-of-the-art multibeam echo sounder bathymetric survey system should be installed.

- There should be a state-of-the-art Acoustic Doppler Current Profiling (ADCP) system with two hull-mounted transducers for redundancy.

- There must be space in the machinery room for two air compressors capable of generating 1000 scfm at 2500 psi for single channel seismic work.

- A dual axis Doppler speed log should be installed.

NAVIGATION

- Global Positioning System (GPS) with attitude sensor capability and appropriate interfaces to data systems and ship control processors must be provided.
- Radar suitable for navigation in ice must be provided.

INTERNAL COMMUNICATIONS

- There should be an internal communication system providing high quality voice communications throughout all science spaces and working areas.
- Data transmissions, monitoring, and recording systems must be available throughout science spaces including vans and key working areas.
- There should be closed circuit television monitoring of working areas.
- Monitors for all ship control, environmental parameters, science and overside equipment performance to be available in selected science spaces.

EXTERNAL COMMUNICATIONS

- Reliable voice channel must be established for continuous communications to shore stations (including home laboratories), other ships, boats and aircraft. External communications should include satellite, VHF, and UHF. Particular attention should be paid to the problems of access to communication satellites at high latitudes and placement of antenna.
- There should be the capability for facsimile communications to transmit high speed graphics and hard copy text on regular schedules.
- The ship should be capable of high speed data communications (via satellite) links to shore labs and other ships on a continuous basis.

SATELLITE MONITORING

- The ship should carry transponding and receiving equipment including antenna to interrogate and receive satellite read-outs of environmental remote sensing data.

DISCHARGE

- All discharges must be on the port side with their holding tanks capable of holding for a minimum of 24 hours. Overboard discharges must meet all international and state requirements.

SHIP CONTROL

- There must be maximum visibility of deck work areas during science operations especially during deployment and retrieval of equipment. This could be supplemented with television monitors as well as direct, unobstructed stern visibility. Portable hand-held units may also be used at various after deck locations during overside equipment handling.

- The functions, communications, and layout of the ship control stations should be carefully designed to enhance the interaction of ship and science operations. For example, ship course, speed, attitude, and positioning will often be integrated with scientific operations assisted by computer control from a laboratory or working deck area.

- Conning ability must be provided aloft with heat and an enclosed access.

REGULATORY STANDARDS

- This vessel shall be inspected and certified by the USCG as an oceanographic research vessel per 46 CFR Subchapter U and shall meet all of the associated regulatory requirements.

- This vessel shall meet the requirements of the proposed revision to the Canadian Arctic Shipping Pollution Prevention (CASPPR) regulations as a Canadian Arctic Class 2 (CAC-2) vessel.

- This vessel shall be classed by either ABS as an A3 Icebreaker or by DNV as an Icebreaker Polar Class 10 vessel.

- Arrangements and outfit are to meet UNOLS standards where applicable.

- USCG Certificate of Inspection, USCG approved Stability, ABS or DNV Classification, Loadline, U. S. Tonnage, International Tonnage and Panama Canal Tonnage and all other appropriate documentation are to be provided for the vessel. In addition, all documents required for outfit items, such as lifting gear, are to be provided.

APPENDIX III

DRAFT

THE FUTURE VESSEL AND FACILITY NEEDS OF COASTAL MARINE SCIENCE

UNOLS COASTAL OCEANOGRAPHY SUBCOMMITTEE

and 75 Workshop Participants

ABSTRACT

In 1991, the Fleet Improvement Committee (FIC) of UNOLS established a subcommittee to review the needs by coastal marine scientists for vessels and related field research facilities. A workshop was held in Williamsburg, Virginia in February 1993 to address questions concerning coastal research requirements and the facilities for meeting those requirements. Research needs by coastal scientists include the ability to make synoptic observations, to obtain accurate and often prolonged time series measurements, to conduct multidisciplinary studies, and to manage and communicate information effectively. The mix of facilities required to meet these needs varies regionally but includes large ships, small ships and boats, aircraft, satellites, moorings, fixed platforms, and specialized field and shipboard instrumentation.

BACKGROUND

Research activities in the coastal ocean, defined here as embracing estuaries and the entire continental margin, have increased measurably in recent years and are expected to increase dramatically over the coming decade. The National Science Foundation has recently initiated interdisciplinary research programs in coastal oceanography such as: Land-Margin Ecosystem Research (LMER), Global Ocean Ecosystems Dynamics (GLOBEC), and, with joint support from ONR and NOAA, Coastal Ocean Processes (CoOP). In addition to the NSF programs, recent NOAA initiatives include a major Coastal Ocean Program (COP) while the Ecological Research Division of the Department of Energy is supporting interdisciplinary studies of the Dynamics of Continental Margins. Significant shifts in emphasis within the Office of Naval Research toward coastal marine science have recently been announced (7). Additional coastal research activities are in progress or planned by EPA, USGS, MMS, NASA, and the U.S. Army Corps of Engineers. A science plan outlining some broad coastal marine science objectives has been prepared by the CoOP steering committee (2). A similar science plan entitled Land-Ocean Interactions in the Coastal Zone (LOICZ) has been prepared by European scientists under the auspices of IGBP (4).

Recent workshops and related reports have focused, appropriately, on science questions and interdisciplinary program planning (1,2,3,5). Implicit in these discussions and documents is the assumption that sophisticated - and intrinsically expensive - research platforms and other facilities will exist to enable the research objectives to be met. Included are research platforms of various sorts: ships, small boats, aircraft, semi-permanent moorings, and specialized facilities such as the research pier maintained by the U.S. Army Corps of Engineers at Duck, North Carolina.

In February 1993, a UNOLS-sponsored workshop was held in Williamsburg, Virginia. The purpose of the workshop was: to consider national needs for field research facilities and infrastructure in support of coastal and estuarine marine science. Table 1 lists the working groups and participants. What follows is a summary of the outcome of that workshop.

COASTAL RESEARCH REQUIREMENTS

The specific activities of coastal ocean field research can be broadly grouped into four basic categories: (1) synoptic observations; (2) time series measurements; (3) interdisciplinary studies; and (4) information management and communication.

Synoptic Observations

Synoptic observations are critical to understanding spatial (as opposed to temporal) variability. In the coastal ocean where spatial gradients are steep, synoptic data approximating nearly instantaneous "snapshots" of an entire region are particularly important and are also essential to deciphering time series data. Although remotely-sensed aircraft and satellite data provide the bulk of synoptic data, important roles are also played by rapid sampling from ships and by moored arrays of instruments.

Capabilities for the transmission of data from satellites and moorings to vessels in real time is in need of improvement as are techniques for more rapid, high resolution data collection. Limitations also exist at present with respect to our ability to operate inshore in heavy weather and to carry out simultaneous sampling in support of interdisciplinary studies. Synoptic observations, like other research needs, require more medium sized vessels with shallow drafts but capable of carrying large scientific parties.

Time Series Measurements

Coastal ocean processes vary on time scales ranging from seconds to millennia. Time series studies are required to enable us to understand the forcing functions for many phenomena including changes in productivity and climate. Continuous measurements at specific points are needed to capture short lived events, and multiple samples in a burst mode are needed to deal with both spatial and long-term temporal variability. Expanded time series observations are needed to verify a host of predictive models. To date, time series studies have tended to rely most heavily on various kinds of moorings; this is likely to continue. Large ships are needed to support the deployment of moorings which, in the coastal ocean, usually need to be fairly closely spaced. These moorings are commonly large and contain numerous sensor packages. In addition to a need for large vessels for setting moorings, there is an ongoing need through the duration of a deployment, for smaller, quick response vessels that can service moorings. Improved ability to telemeter data from moorings to shore or vessels would also greatly improve the value of the data and reduce data loss.

Interdisciplinary Studies

Coastal ocean studies in recent years have become increasingly interdisciplinary in the sense that they involve paradigms, ideas, and field efforts that embrace more than one oceanographic discipline. Interdisciplinary studies are needed to address some of the most compelling coastal research questions including those pertaining to: sources of materials entering the coastal ocean; the processes responsible for biogeochemical cycling and transformation; the health of the coastal ocean with respect to nutrient enrichment; the role of the coastal ocean in global change; and the societal uses of the coastal ocean.

By necessity, interdisciplinary field teams are normally larger than those involved in single-discipline investigations. Interdisciplinary research also necessitates the observation, often at the same time, of multiple parameters using a diversity of instrumentation. Accordingly, vessels must be able to accommodate parties of 16 to 20 scientists, permit simultaneous use of multiple wires, and operate in depths of 7 meters or less.

Information Management and Communication

The expected explosion of data on coastal ocean processes will benefit scientists only insofar as the data are effectively analyzed, managed and communicated. New technology is now making it easier to acquire, store, analyze, manipulate, and exchange coastal data. However, there still exists a need to develop an infrastructure to support information management needs of coastal marine scientists.

Among the specific requirements for information management are: distributed management systems; centers for data synthesis and storage; standardized shipboard protocols to be used on all UNOLS vessels for certain types of data; standard arrays of certain sensors on all UNOLS vessels; improved communication links among vessels, buoys, platforms, satellites, and shore facilities.

SUMMARY OF MAJOR NEEDS

From the foregoing considerations, we may highlight the following list of needs that coastal oceanographic facilities must aim to accommodate.

- More effective data transmission.
- Higher resolution data collection capability.
- Increased ability to operate inshore in heavy weather.
- Increased ability for simultaneous sampling.
- Aircraft, satellites must be used in coordinated program along with vessels.
- Vessels that can accommodate groups of 20 or more scientists.
- Interdisciplinary ships should be able to work in shallow water (< 7 m).
- Sets of routine data must be acquired from all vessels.
- Enhanced communication/data transfer links.
- Regional pools of shared equipment.
- Access to larger vessels by multidisciplinary teams.
- Ability to service very dense station spacing.
- Quick-response vessels needed to service moorings.
- Ability to support multiple wires from anchored vessel.
- Ability to maintain 3-point mooring for prolonged periods.

Meeting these needs will require a mix of large ships, more specialized smaller ships, non-ship platforms such as aircraft, satellites, buoys, and fixed platforms, and field and shipboard instrumentation.

THE ROLE OF LARGE SHIPS

There are important regional differences that influence the use of research vessels in the coastal zone. For example, the West coast of the United States, including Hawaii, has deep water almost directly adjacent to the coast which means that large and intermediate research vessels cover essentially everything up to (and in some cases into) the estuaries. In the Arctic Region ice represents a substantial operational problem that dictates use of an ice capable vessel. At the present time an arctic research vessel is being designed and will probably be constructed in the next several years. The science and operational requirements for this vessel have pushed the current design to greater than 300 feet. It should be capable of studying U.S., Canadian, Soviet and Scandinavian shelves. Both the Gulf and East Coasts have broad shallow continental shelves that present special challenges for sea going assets. The Great Lakes operating conditions are similar to those of the New England coast. If we use 10 meters as a cut off depth for inshore work by large and intermediate research vessels, there is a substantial amount of shelf area that will have to be studied using shallow draft vessels and/or other facilities.

The large (> 250 ft) vessels in the UNOLS fleet are capable of carrying out interdisciplinary studies of the coastal zone to water depths as shallow as 7 meters. The special characteristics that make the large blue water assets suitable platforms for coastal research include: (1) an ability to accommodate large scientific parties (25 or more); (2) large deck/storage space; (3) considerable laboratory space; (4) capability of handling large arrays; (5) ability to carry specialized vans (isotope/trace metal/organic); and (6) reasonable stability. At the present time, all but one of the large research vessels is recently refurbished or new. In addition, by 1997/98 it is likely that three more large vessels will have been added to the fleet. Although they cannot carry as many scientists and are also more limited in terms of laboratory space, deck space and storage capacity there are six intermediate vessels (ENDEAVOR, COLUMBUS ISELIN, MOANA WAVE, NEW HORIZON, OCEANUS, and WECOMA) that are also capable of working as far shoreward as the 7 meter isobath.

The science mission requirements of future large vessels capable of meeting the needs of coastal marine scientists should include the following: (1) large capacity for scientists, science activities, gear and equipment storage; (2) shallow draught; (3) good sea-keeping ability in storms; (4) improved precision station keeping capabilities; (5) support for multi-wire operations; (6) capability to launch AUVs, ROVs, inshore launches, and moorings; (7) more effective shallow water sampling techniques; (8) reduced endurance requirements; and (9) enhanced ship to shore communications.

THE ROLE OF SMALL RESEARCH VESSELS

The high cost of large ships combined with their general inability to operate close inshore, particularly over shallow shelves, dictates that coastal oceanographers will continue to have need of smaller vessels. Smaller vessels have the advantage of being shallower draft, having greater maneuverability, generally being able to respond more quickly to event-dependent opportunities, and being less expensive. Because small vessels have limited range and endurance, it was recognized by the working group that it is important to maintain a fleet of regionally-dedicated vessels. The mission requirements vary from region to region as will vessel designs.

Included in the "small vessels" category are day boats for short trips in protected waters (typically less than 80 ft in length) and "small expedition vessels" ranging from 80 to 130 feet in length. The latter are emphasized here. The working group felt that future generations of such vessels should be designed with the aims of (a) keeping the daily cost in the neighborhood of $3,000 or less, (b) accommodating parties of 12 to 20 scientists; (c) having endurances and ranges of one to three weeks and approximately 1200 miles; (d) having drafts under 4 meters (except in Alaska); and (e) possessing underway sea-keeping at sea state 5 to 6.

General scientific capabilities expected of all future vessels in the "small expeditionary" class include: (a) multiple wire deployment; (b) three point moorings and dynamic positioning; (c) mooring deployments of up to 5,000 lbs; (d) support for high resolution bathymetry and side scan; (e) underway flow-through sampling capability; (f) ADCP, sea-soar, and coring capabilities; (g) best available communication systems;

and (h) high quality data acquisition. Three distinct vessel designs considered to provide these capabilities were: (a) a SWATH design; (b) a catamaran; and (c) a shallow-draft, flat bottom design.

THE ROLE OF NON-SHIP OBSERVING PLATFORMS

Given the rigorous requirements for synoptic observations with high spatial resolution and for prolonged time series measurements at many locations, ships alone cannot serve the full spectrum of needs of coastal oceanographers. Complementary and essential are other types of research platforms including aircraft, satellites, moorings, and fixed platforms. Without such platforms it would be impossible to obtain truly synoptic data or very long-term time series. These platforms also facilitate the acquisition of data during extreme storm events when most vessels are ineffective.

Existing satellites are able to provide estimates of AVHRR sea surface temperature at four hour intervals with a "footprint" of 1.4 km, surface winds twice a day, and optical imagery at resolutions under 2 km. Satellites to be launched in the near future (one to five years) include: SeaWiFS in late 1993, which will provide 1 km resolution LAC of ocean color with a two-day repeat orbit(6); ADEOS in 1995, which will have the NSCAT scatterometer with 25 km footprint resolution; and the follow-on Geosat altimetric mission, with a 17-day exact repeat orbit and approximately 40 cm vertical accuracy in sea surface height; the Geosat also provides local winds. SeaWiFS will provide information on biogenic activity and its variability within a dynamic coastal domain. EOS-Color will succeed SeaWiFS in 1998, which is also the year of first launch for the EOS platforms. The Canadian RADARSAT mission will be launched in 1995, and will provide synthetic aperture radar imagery of primarily arctic but all coastal regions; these data will provide high resolution (order of 20 m) imagery of surface current patterns, roughness, and wind stress.

Airborne platforms including airplanes, blimps, and remotely piloted vehicles (RPVs) are likely to play much more important roles in coastal oceanography than is the case for deep sea oceanography. This is attributable in part to the fact that, on average, coastal waters tend to be cloudier than the deep sea, thereby inhibiting satellite-borne infrared and visible sensors, and in part to the need for much higher resolution to resolve small-scale spatial gradients. Blimps provide the special advantage of being able to sample with extremely high spatial resolutions owing to the slow speeds of these vehicles. Remotely-piloted vehicles will, in future, offer increased utility for coastal applications; they can fly at elevations as low as 5 meters above the surface carrying payloads of 200 kg.

Currently-available surface platforms include moored and drifting buoys, piers, and hovercraft type vehicles. Moored and drifting buoys have been used extensively by the oceanographic community. Noteworthy is the "spar" buoy. Its open and stable structure with enormous power capacity allows the design of integrated aerosol, gas, and heat flux profile data bases in the atmosphere, and subsurface biology and chemistry sampling. The aging FLIP is a specialized platform that continues to be needed. Piers represent a platform for long term monitoring of temperature, salinity, and tides, for long term seasonal and climatological monitoring. Their usefulness in studying the short term processes acting in coastal ocean science remains uncertain.

FIELD AND SHIPBOARD INSTRUMENTATION

Effective data collection at sea requires appropriate matching of new generation of seagoing instrumentation and sophisticated platforms to support the instrumentation. Among critical issues that must be considered are costs, calibration facilities, security of moored instruments, standardization of data collection protocols, and training and availability of seagoing technicians to operate aboard research vessels.

All oceanographic vessels should continually monitor a suite of navigational, meteorological, and hydrographic parameters while at sea. These observations should be user accessible in real time, available at the end of the cruise, and archived. Parameters include: time, date, position, depth, ship speed and heading, wind speed and direction, air temperature, humidity, barometric pressure and PAR, seawater temperature and conductivity. All UNOLS vessels should have high-speed data connection to Internet.

A large variety of important scientific equipment (too expensive for an individual user) should be available on a shared-use basis from regional equipment pools. Examples include: ROV, SEASOAR, OSCR, CODAR, MET-SPAR Buoy, Sidescan Sonar. This equipment requires maintenance and technical assistance for its operation. Regional or national shore-based facilities will eventually be required to support an increasingly complex fleet of ships and oceanographic equipment.

SUMMARY OF RECOMMENDATIONS

Based on the workshop discussions, the following summary of general recommendations for future action is offered. More specific recommendations as to vessel design and related matters must await the drafting of more formal mission requirements.

- Large ships should be available to coastal scientists.
- A new generation of shallow-draft vessels is needed.
- A new generation of coastal (approximately 30 m) vessels is needed.
- Coastal vessels need increased sea-keeping ability.
- Vessels must be able to support multi-wire operations.
- Ability to launch AUVs, ROVs and moorings must be increased.
- Flow-through sampling should be facilitated.
- Vessels must be capable of 3-point anchoring at depths less than 100 m.
- Communication links to shore for data transfer must be improved.
- The coastal community should be educated on new platforms and instruments.

- Better algorithms for analysis of satellite data should be developed.
- Better shore-based data acquisition systems should be developed.
- Regional or national pools of shared expensive equipment should be established.
- Regional or national shore-based facilities for instrument calibrations, technician training, and computer applications should be established.

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TABLE 1. COASTAL VESSEL AND FACILITIES WORKING GROUPS

Day 1 : Research Needs

A1 Synoptic Observations	*A2 Time Series Observations*	*A3 Interdisciplinary Studies*	*A4 Information Management*
L.Atkinson (Chr.)	C.N.K.Mooers (Chr.)	C.Wirick (Chr.)	F.Grassle (Chr.)
J.Grassle (Rap.)	C.Flagg (Rap.)	C.Nittrouer (Rap.)	J.Paul (Rap.)
K.Kaulum	G. Geernaert	G.Taghon	R.Lai
N.Marcus	D. Jay	R. Jahnke	J.Costlow
E. Durbin	E.Urban	R.Pittenger	M.Langseth
L.Jendro	J.Olney	A.Devol	L.Duguay
T.Moore	D.Dieter	L. Sanford	J.Acker
W.Ahrmsbrack	C.Mason	T.Church	M.Prince
D.Atwood	M.Scranton	P.Biscaye	F.Bohlen
R.Geyer	C.Sancetta	D.Boesch	M.Mulhern
M.Dagg	J.Brubaker	C.Simenstad	D.Wright
J.Van Leer	T.Royer	P.Betzer	M.Patterson
R.Dinsmore	R.Sternberg	R.Lambert	C.Dybas
M.Eschelman	W.Boicourt	C.Yentsch	M.Scott
R.West	C.Olsen	R.Jones	
B.McGregor	P.Donaghay		
J.Hain			

Day 2 : Facilities

B1 Large Ships	*B2 Aircraft Satellites,etc.*	*B3 Small Ships and boats*	*B4 Field Instrumentation*
P. Betzer (Chr.)	G.Geernaert (Chr.)	E.Durbin (Chr.)	R.Sternberg (Chr.)
R. Jahnke (Rap.)	J.Acker (Rap.)	R. Geyer (Rap.)	M.Patterson (Rap.)
K.Kaulum	T.Moore	N.Marcus	J.Grassle
L.Jendro	J.Costlow	M.Prince	E.Urban
C.Nittrouer	C.Mason	C.Simenstad	A.Devol
M.Langseth	P.Biscaye	J.Olney	M.Scranton
D.Dieter	D.Atwood	L.Sanford	C.Sancetta
D.Boesch	C.Mooers	G.Taghon	J.Brubaker
M.Dagg	C.Wirick	W.Ahrmsbrack	P.Donaghay
T.Royer	W.Boicourt	L.Duguay	F.Bohlen
M.Mulhern	J.Hain	R.Geyer	C.Flagg
M.Eschelman	G.Saunders	J.Van Leer	B.Butman
R.Pittenger	R.Lambert	R.West	R.Lai
C.Yentsch	B.McGregor	S.Kuehl	D.Wright
R.Dinsmore	T.Church	C.Olsen	D.Jay
		R.Jones	

APPENDIX IV

Outline for UNOLS Fleet Improvement Plan Update 1993

August 93 draft

I. Forward to the 1993 update

II. Background

- A.Fleet Improvement Committee
- B. Purpose and objectives of the update
- C. The UNOLS Fleet
- D Utilization and cost trends
- E. Trends in berthing

III. Future trends in Oceanography and Faciliity Needs

- A. Coastal Oceanography
- B. Scientific Programs and Support Requirements in the Arctic
- C. Trends in Chemical Oceanographic Research
- D. Trends in Biological Oceanographic Field Work
- E. Current Trends in tMarine Geoscience
- F. Physical Oceanography

IV Trends and issues regarding the UNOLS Fleet

- A. Funding the UNOLS Fleet
- B. Estimates of Future Operating Costs
- C.Innovative Funding for New Ships
- D. Improving the U.S. Research Fleet through interagency cooperation
- E. Impact of technology on the need for seagoing technologies
- F. Current Large Oceanographic Programs and the need for ships over the next 5-10 years.
- G. Regional distribution of the UNOLS Fleet
- H. Modes of operation of Research Vessels: Operation by UNOLS Institutions vs. Long-term, Third Party leasing Arrangements.
- I. Special platforms

V. Recommendations:

- A. Arctic Reseach Facilities
  - 1) Arctic Research Vessel
  - 2) Coast Guard's Polar Research Vessel
  - 3) Nuclear Research Submarines
- B. Monitoring future ship needs