A PLAN FOR IMPROVED CAPABILITY OF THE UNIVERSITY OCEANOGRAPHIC RESEARCH FLEET, JUNE 1986

SUMMARY

The purpose of the University-National Oceanographic Laboratory System is to provide for community-wide coordination and review of the utilization of available facilities and for access to those facilities. UNOLS assesses the current match of facilities to the needs of academic oceanographic programs and makes appropriate recommendations of priorities for replacing, modifying, or improving the numbers and mix of facilities for the community of users.

Ships of the University-National Oceanographic Laboratory System (UNOLS) comprise a twenty ship fleet operated by fifteen academic institutions. The "Fleet" considered here comprises seagoing ships over 100 feet in length. The operating institutions are autonomous, but scheduling and performance standards are coordinated by the group acting jointly.

Most of the basic research projects of the Federal oceanographic program are carried out by ships of this fleet. The ships are, therefore, primarily general purpose types with special capabilities in the basic sciences disciplines. Chief sponsors for UNOLS ships utilization are the National Science Foundation and the Office of Naval Research. However, to some extent oceanographic projects of most Federal agencies are included in UNOLS ship operations.

The need to plan for new, more capable research ships to conduct scientific programs at sea has become virtually self evident. Numerous studies have amply demonstrated that our ships, mostly constructed in the 1960's are becoming obsolete in their capability to support oceanography for the 1980's and 1990's. The 1984 Federal Oceanographic Fleet Study (FOFCC) reported that two of its major findings give cause for concern. These are:

- Within the next fifteen years over 70% of the Federal fleet will have become overage and obsolete.
- No Agency has an approved plan for the replacement of ships as they become obsolete.

It concluded that the issue of fleet replacement is a matter of urgency and is to be considered one of the priority matters resulting from the Federal Fleet Study.

Nowhere is this more apparent than in the UNOLS fleet where a total of seven large seagoing ships are present to serve the university community. Of these, most were constructed in the 1960's. The requirements now being posed by scientific investigations render these ships marginally capable.

A 1982 National Academy of Sciences study on the needs for academic research vessels examined the growing demands being placed upon these ships. It noted the following: Much scientific equipment, especially that going onto or into the bottom, has increased in weight, bulk and complexity, therefore requiring deployment from large, stable ships. Increasing complexity of electronic sensors and shipboard computers often result in an increase in the number of technicians who must go to sea, rather than a reduction in their number. The nature of new interdisciplinary ocean science research projects requires that several scientists from different disciplines be able to work on the same ship at the same time. This increases the demand for laboratory, storage and other work-ing spaces aboard ship. Large high performance overside handling arrangements and modern state-of-the-art shipboard laboratories will be needed to support major on-going ocean programs. In addition, a high quality working and living environment is essential in order to attract competent seagoing personnel.

In 1984, based on recommendations of its Advisory Council, UNOLS established a Committee charged with planning for the orderly replacement of the UNOLS Fleet.

That Committee is completing its work and the preparation of its report. Its goals are to: (1) Recommend the numbers and types of new ships and replacement dates; (2) Prepare a set of science mission requirements for the various classes of ships; and (3) Undertake representative conceptual designs.

The principal findings of this report are:

1. Many, if not most, of the existing large ships are not capable of meeting the requirements of on-going science at sea. In this regard they are mission obsolete. Their average age is 19 years, and by the mid-1990's, four of the seven ships over 200-ft. will have exceeded their generally recognized 30-year service life. Up to one-third of all existing ships are approaching obsolescence, both platform and mission.

2. New ships should have improved seakeeping and station keeping characteristics; and should have upgraded laboratory, overside handling, and scientific outfitting. Consequently, new ships inevitably will be larger than existing ships.

3. The numbers of future ships should not be significantly different from the existing fleet.

4. The mix of ships should be about evenly divided between the size classes, i.e., large ships, intermediate and small ships.

5. New and improved ships should be more economical to operate. Through the use of fuel efficient engines, unattended engine rooms with integrated machinery systems, newly developed anti-corrosive and fouling coatings, and other modern ship technologies, the costs of research ship operations will be reduced.

6. Several of the new ships should have, in addition to regular multi-disciplinary (general purpose) research capability, an enhanced capability - or option - for a particular discipline or field of work. These include multichannel seismic (MCS) geophysics; submersible and polar (or high latitude) research.

7. Necessary improvements in the UNOLS Fleet as defined above should start in the near term - 1986-1990. The existing fleet should be totally replaced by the year 2015.

The proposed new fleet is recommended to be eight large ships (200-300 ft LOA); six intermediate ships (150-200 ft); and six small ships (100-150 ft). Because they are older and are demonstrably incapable of meeting modern science requirements, priority attention has been focused on the larger ships.

Profile of Planned UNOLS Fleet

	Existing Fleet	Upgraded Fleet
Large Ships: Classes I & II (over 200 ft)		
General Purpose	5	4
MCS Capable	1	2
Ice Capable	0	1
Submersible Handling Capable	1	1
Intermediate Ships: Class III (150-199 ft)		
General Purpose	6	6
MG&G Ship	1	0
Small Ships: Class IV (100-149 ft)		
General Purpose	6	5
Ice Capable	0	1
TOTAL	20	20

In looking to new ships the first step has been to describe the science mission requirements to which the new ships will be expected to respond. In accomplishing this the UNOLS Committee took on a massive campaign of meetings, interviews and questionnaires in order to gain the views of the scientific community. The most overriding requirement upon which all oceanographers agreed was seakeeping, that is for a ship which will allow both overside and laboratory work to proceed in higher sea states than is now available. Other requirements include overside and deck handling arrangements to allow work in greater capacity and sizes than is now possible; larger and improved scientific laboratories; increased scientific complement (up to 35 scientific and technical personnel); reduced noise and vibration; greater speeds (up to 15 knots) and cruising range. Endurance should provide for cruising to any part of the world ocean and working there for 3-4 weeks before returning.

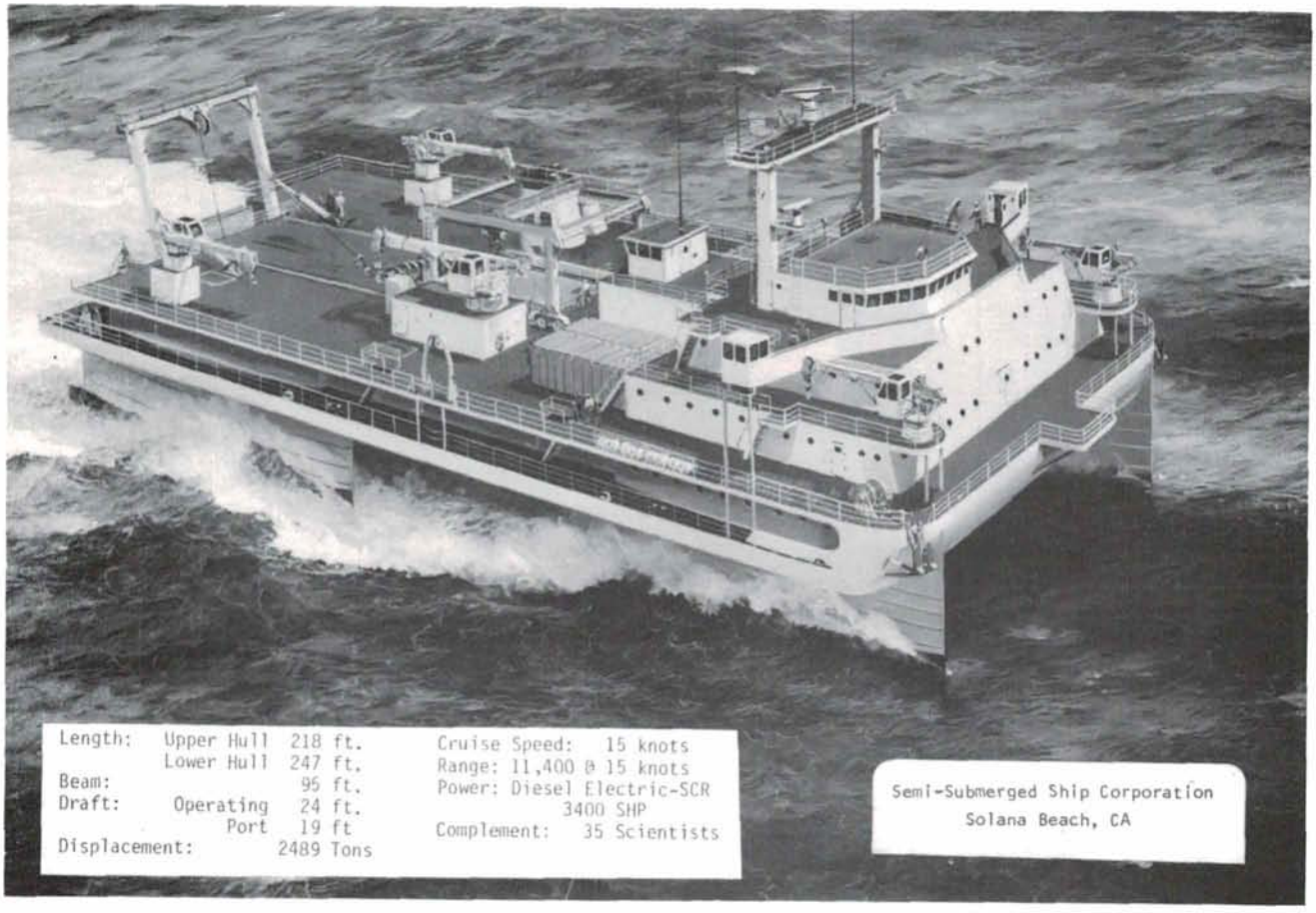
In describing new ships for the future, the UNOLS Committee sought innovative new designs with an emphasis on seakeeping. With support from the National Science Foundation and the Office of Naval Research, eight conceptual ship designs were undertaken for the purpose of fitting the science requirements into a real hull. The conceptual designs included two each of the following types of ships.

- **SWATH Ships.** The SWATH or semi-submerged ship is a relatively recent development in ship design. SWATH ships, in theory and performance, demonstrate a remarkably stable environment. Additionally, they have a platform configuration which is highly attractive for science and engineering operations at sea. It is time for the oceanographic community to take a hard look at what SWATH can offer.

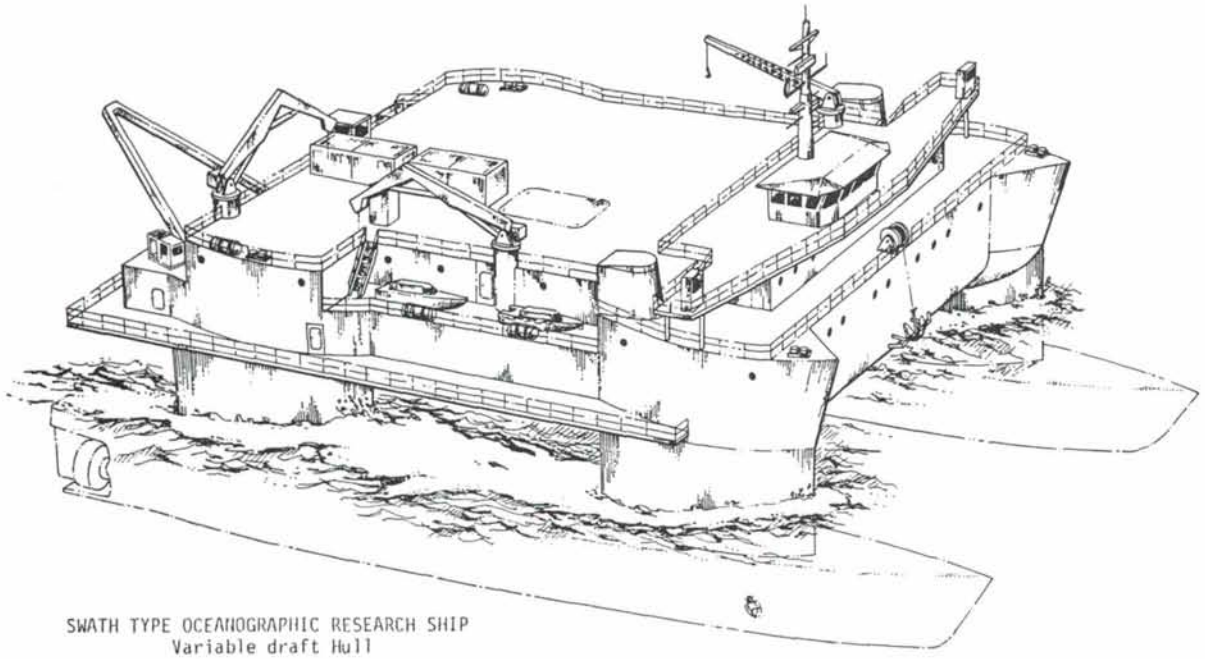
- **High Endurance Ships.** Ships 250-300 ft LOA are not now available in the UNOLS Fleet. They are intended to meet requirements for extended worldwide cruising including high latitudes with larger scientific parties and to permit both overside and laboratory work to proceed in higher sea states than is now possible.

- **Medium Endurance Ships.** Ships of a 200-250 ft size range are intended to have the highest capability commensurate with this size range. Although of similar size to existing ships, they should provide superior seakeeping, laboratory arrangements and overall ability to do science at sea than is presently available and at the same time be more economical in their operation.

- **Ships With Enhanced Geology & Geophysics Capability.** These are ships intended to have the same multi-discipline capability as the above ships, but in addition are to carry a configuration for multichannel seismic investigations. Such ships inevitably are larger than their corresponding general purpose type class.



Small Waterplane Twin Hull (SWATH) Ship. Note abundance of deck space and overside handling capability including center well.



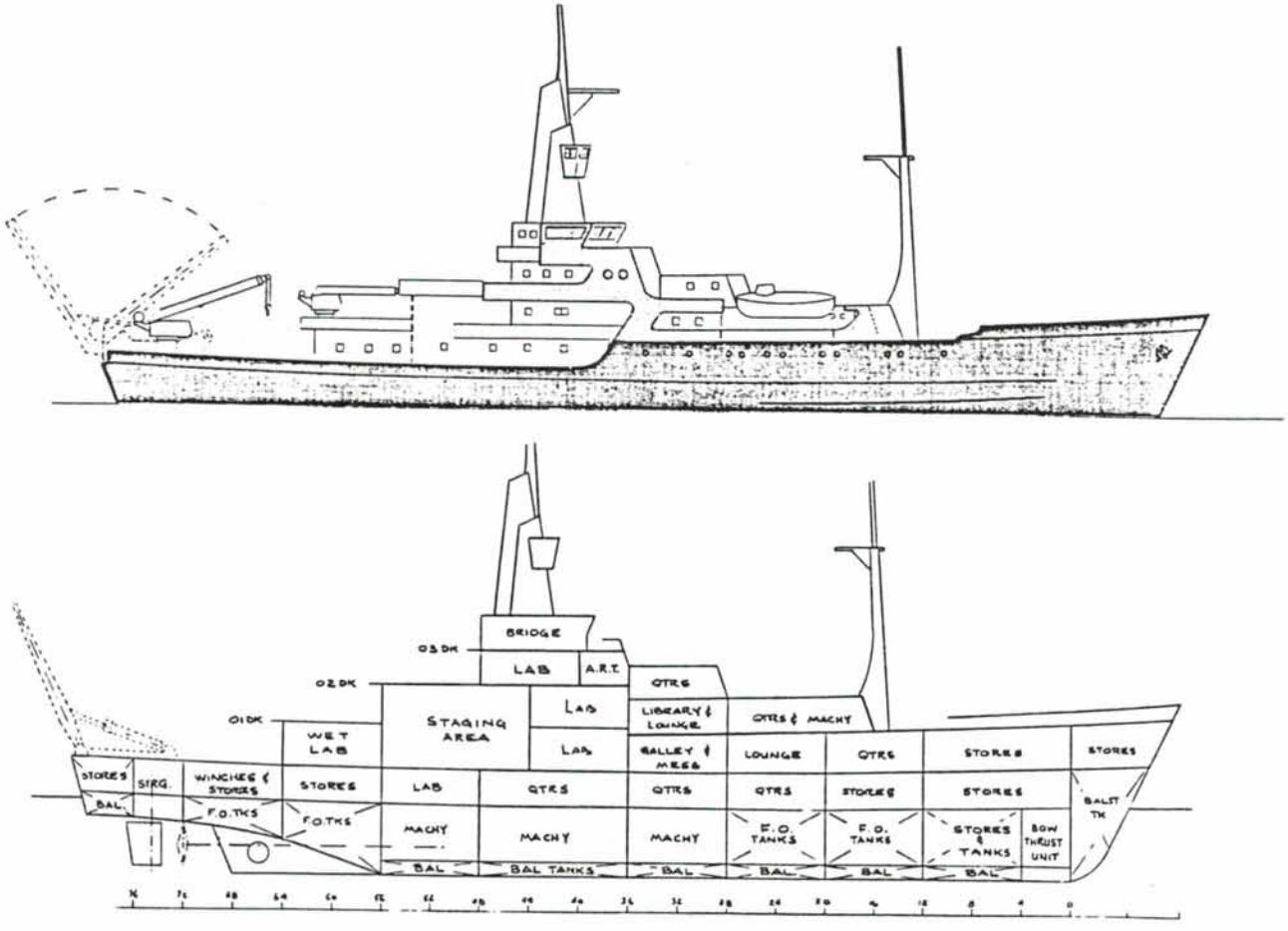
SWATH TYPE OCEANOGRAPHIC RESEARCH SHIP
Variable draft Hull

Length: Upper Hull 147 ft
Lower Hull 202 ft
Beam: 104 ft.
Draft: Operating 26 ft.
Transit 15 ft.
Displacement: 3220 L.Tons

Cruise Speed: Transit - 15 knots
Operating - 10 knots
Power: Diesel Electric 6000 SHP
Complement: 30 Scientists

Blue Sea McClure
Houston, Texas

SWATH with interior center well area. Variable draft allows ballasting working deck close to water. Transits in catamaran mode.

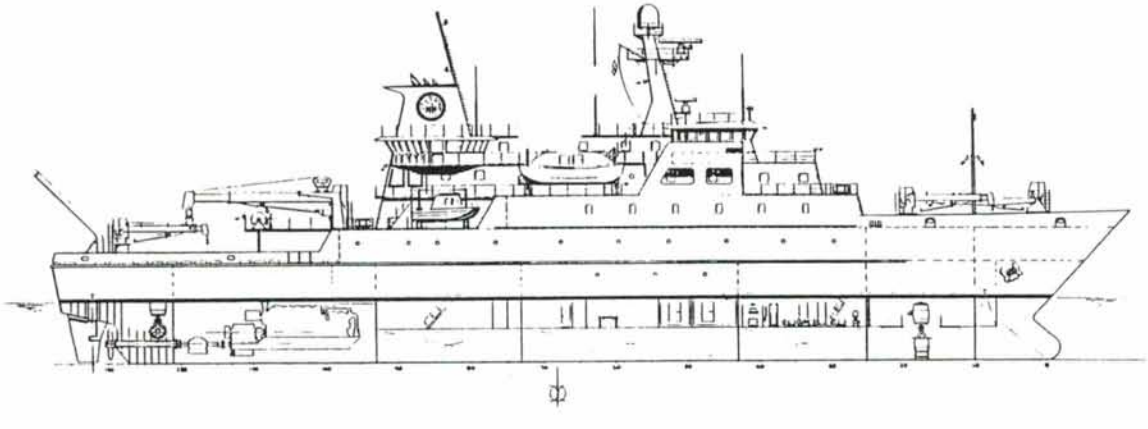


Length	275 LBP	310 LOA	Cruise Speed		16 Kts
Beam		68 Ft.	Range		12,000 mi. @ 16 Kts
Draft		21 Ft.	Power	(Diesel Elec. SCR)	6,300 SHP
Displacement		5,840 LT	Complement		35 Scientific

Large High Endurance R/V where primary attention has been given to seakeeping and deck working area.

WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASSACHUSETTS 02543
JONATHAN LEIBY
MARINE DEPARTMENT
TEL. 617 548-1400

DN [illegible]	NECOR - LARGE RES SHIP - PRELIMINARY ARRGT
APD SMS	
1/16"=1'-0"	10-5-85 DWG No. 8506-2



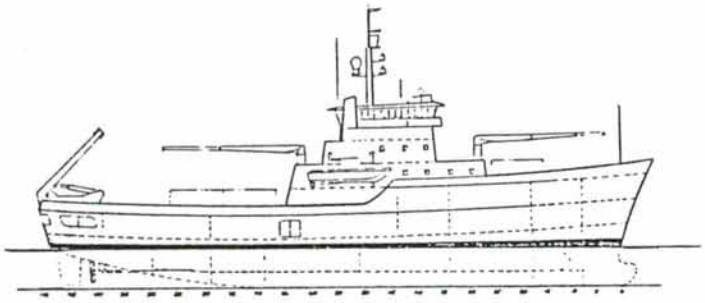
LARGE GENERAL PURPOSE OCEANOGRAPHIC RESEARCH SHIP

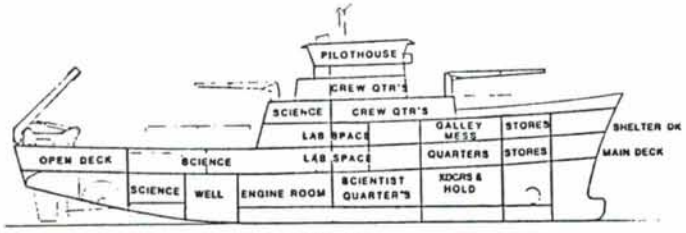
Length	273 LBP	300 LOA	Cruise Speed	14 knots
Beam		54 Ft.	Range	10,000 nm
Draft		18 Ft.	Power	4,000 SHP
Displ.		LT	Complement	33 Science

Large High Endurance R/V where emphasis is on laboratory and economy of operation.

ROONEY E. LAY & ASSOCIATES
NAVAL ARCHITECTS

OUTBOARD PROFILE
300'-0" x 54'-0" x 28'-0"
RESEARCH VESSEL





INBOARD PROFILE

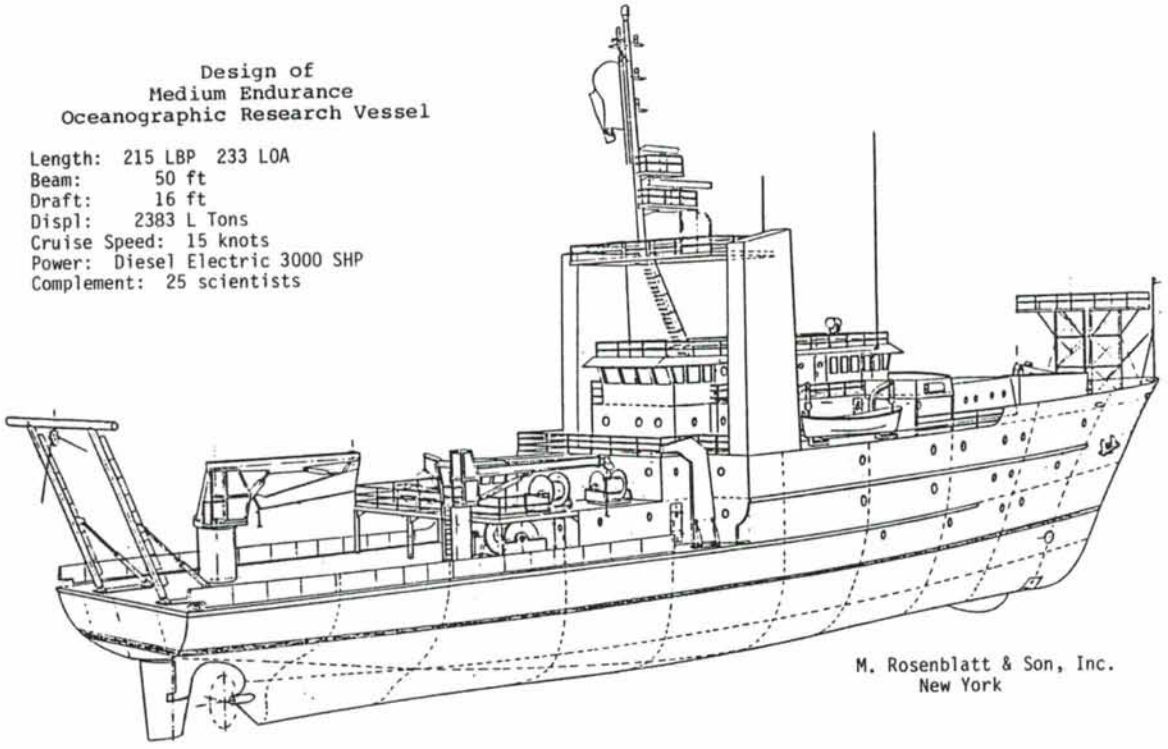
Length	212 LWL 228 LOA	Cruise Speed	14 knots
Beam	64 ft.	Range	10,500 nm
Draft	15 ft.	Power	3,000 SHP
Displ.	2,468 LT	Complement	25 Scientific

SCRIPPS INSTITUTION OF OCEANOGRAPHY
UNIVERSITIY OF CALIFORNIA, SAN DIEGO
212' LWL RESEACH VESSEL
DESIGN CONCEPT- ARRANGEMENTS
THE GLOSTEN ASSOCIATES, inc.
CA/BLH | NO SCALE | OCT 1895 | 8534-2 (1 of 2)

Medium Endurance R/V. Shelter deck design shows two working deck and interaction with laboratories. Wide beam permits a sizeable centerwell not ordinarily found on monohull.

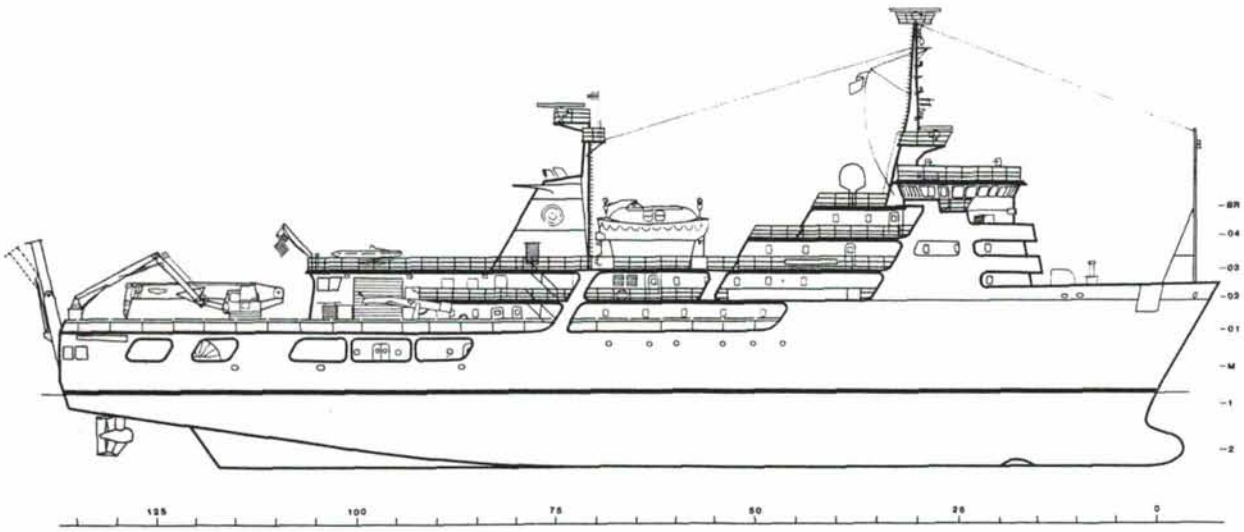
Design of
Medium Endurance
Oceanographic Research Vessel

Length: 215 LBP 233 LOA
Beam: 50 ft
Draft: 16 ft
Displ: 2383 L Tons
Cruise Speed: 15 knots
Power: Diesel Electric 3000 SHP
Complement: 25 scientists



M. Rosenblatt & Son, Inc.
New York

Medium Endurance R/V. Attention has been given to overside handling and economy of operation.

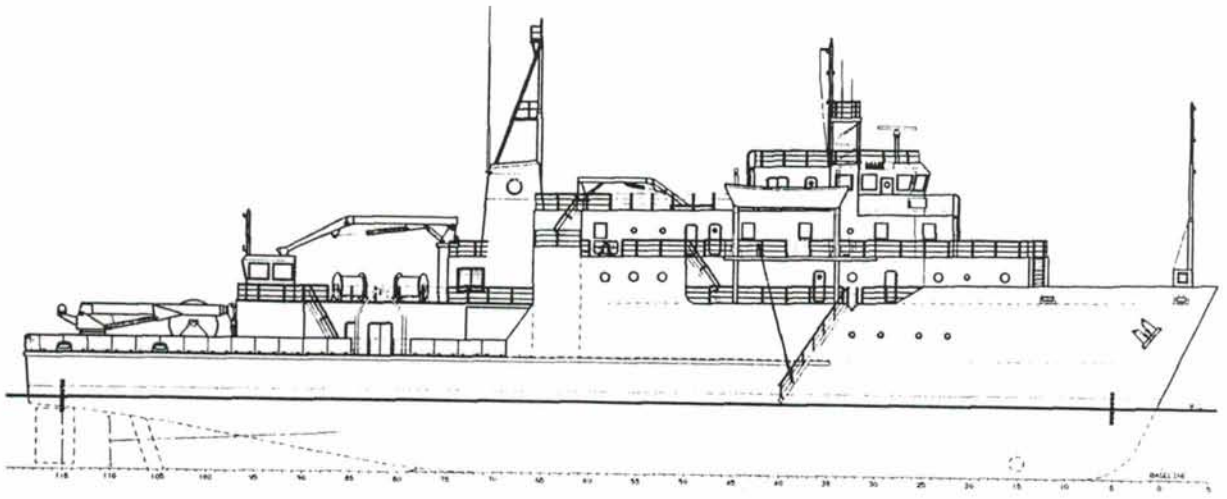


John Gilbert Associates

LARGE GENERAL PURPOSE RESEARCH AND GEOPHYSICAL SHIP

LOA:	291 Feet	Displacement:	4,997 L Tons
LBP:	275 Feet	Cruising Speed:	14.5 Knots
Beam:	58 Feet	Range:	24,000 N Miles
Draft:	19 Feet	Power:	5,000 SHP

High Endurance R/V with enhanced ecology and geophysics capability. MCS Streamer and air-guns are handled from lower deck. Upper deck is for general purpose activity.



GENERAL PURPOSE RESEARCH SHIP WITH GEOPHYSICS CAPABILITY

Length:	238 LBP 250 LOA	Power:	Diesel Elec. 3000 SHP
Beam:	52 ft	Cruise Speed:	14 knots
Draft:	15 ft	Range:	13,700 miles
Disp:	2,790 LT	Complement:	28 Scientists

MARINETTE MARINE CORPORATION
MARINETTE WISCONSIN

250 FT MEDIUM RESEARCH VESSEL

OUTBOARD PROFILE

Medium Endurance R/V with enhanced multichannel seismics capability. MCS and other outfitting share the same working area.

SUMMARY COMPARISON OF SCIENCE REQUIREMENTS FOR LARGE SHIPS

	HIGH ENDURANCE R/V (Monohull)	SWATH R/V	MEDIUM ENDURANCE R/V (Monohull)
SIZE RANGE	Class I (250-300 ft)	Class II (200-250 ft)	
ENDURANCE	Sixty Days: 30 days cruising; 30 days working. 15,000 miles total range at cruising	Fifty Days: 25 days cruising; 25 days working. 12,000 miles total range at cruising	
CRUISING SPEED	15 knots		14 knots
SEAKEEPING	15 knots through SS 4 13 knots through SS 5 8 knots through SS 6	15 knots through SS 6 10 knots through SS 7	14 knots through SS 4 12 knots through SS 5 8 knots through SS 6
STATION KEEPING	Dynamic Positioning at best heading: Wind Vel. 35 knots; Sea State 5; 3 knot current; ± 5° head; ± 150 ft maximum excursion		
PRECISION TRACKLINE	Maintain a precision trackline, including towing, at speeds as slow as 2 knots with maximum 45° heading deviation from the trackline in wind speed 35 knots; Sea State 5; 3 knot current. Speed control along track to be ± 0.1 knot; maximum lateral excursion 150 ft		
TOWING	Capable of towing large scientific packages up to 10,000 lbs tension at 6 knots, and 25,000 lbs tension at 2.5 knots into a sea state 5 and 3 knot current		
SCIENCE ACCOMMODATIONS	30-35 scientific personnel in two person staterooms. Expandable to 40 in portable berthing vans.		20-25 scientific personnel in two person staterooms. Expandable to 30 in portable berthing vans
DECK WORK AREA	3,000 sq ft with contiguous 12 x 50 ft area along side 100 tons disposable load	4,000 sq ft with 15 x 30 ft centerwell 100 tons disposable load	2,000 sq ft with contiguous 12 x 40 ft area along side 90 tons disposable load
LABORATORY AREA	4,000 sq. ft. plus 4 portable vans with inside access		3,000 sq ft plus 2 portable vans with inside access
SCIENCE STORAGE	20,000 cu. ft.		15,000 cu. ft.
ICE STRENGTHENING	ABS Class IB except ABS Class IAA when specified as ice capable	None	ABS Class IC
ACOUSTICAL SYSTEMS	All ships to carry precision echo sounding ("SEA BEAM"); 3.5 kHz and 12 kHz echo sounding; Doppler current profiling; bottom positioning to 6,000 m depth. Design underway - target is echo sounding at Sea State 4		
MULTI-CHANNEL SEISMICS	Selected vessels to carry seismic air compressors for 4,000 scfm at 2,500 psi; and a large array MCS system	Selected vessels to carry seismic air compressors for 3,000 scfm at 2,000 psi; and a large array MCS system	

June 1986

Implementing the plan should take into account a meld of motivating factors:

1. A replacement schedule which is realistic in terms of the national effort an economy. The effect of this would be to smooth the peaks of existing ship construction dates into a reasonably uniform number of replacements per year.

2. A priority of new construction based upon the material condition and scientific capability of existing ships.

3. A priority of new construction based upon the needs of ongoing science.

Fleet Improvement Plan Shown by 5-year Increments

Time Frame	LARGE (Over 200 ft.) Classes I & II	INTERMEDIATE (150-199 ft.) Class III	SMALL (100-149 ft.) Class IV
1986-1989	1 new 1 new (MCS capable) modernize two	---	---
1990-1994	1 new (ice capable) 1 new (MCS capable)	--- ---	1 new (ice capable)
1995-1999	---	2 new	1 new
2000-2004	1 new (sub-handling capable)	1 new	2 new
2005-2009	1 new	3 new	---
2010-2014	2 new	---	2 new
TOTAL	8	6	6

This plan will need continuing review and updating in order to keep up with changing times and requirements. In addition, selected designs might be further developed; and new concept designs started on smaller ships and innovative platforms. This calls upon UNOLS to provide for continuing efforts in the fleet replacement process.

UNOLS FLEET REPLACEMENT COMMITTEE

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