UNIVERSITY - NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

Summary of Concept Designs

June 1986

Compiled as Part of an
Overall Fleet Planning Study

UNOLS Fleet Replacement Committee
Woods Hole Oceanographic Institution
Woods Hole, Mass. 02543

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SUMMARY CONCEPTUAL DESIGNS

CONTENTS

* Replaces summary contained in December, 1985 edition

6/1/86

DESIGN COMPARISONS FOR HIGH ENDURANCE SHIPS

1/15/86

	SCIENCE MISSION REQUIREMENTS	NAVSEA AG(X)	J. LEIBY/WHOI	R. LAY ASSOC.	J. GILBERT ASSOC. G&G OPTION
Dimensions:					
Length Overall	n/a	327 ft	310 ft	300 ft	291 ft
Length B.P.	n/a	311 ft	275 ft	273 ft	275 ft
Beam, Max.	n/a	52 ft	68 ft	54 ft	58 ft
Draft, Full Load	n/a	17.7 ft	21 ft	18 ft	19 ft
Freeboard of Work Deck	7-10 ft	7 ft	9'-0"	9.5 ft	6/15 ft
Freeboard of Stern	7-10 ft	7 ft	12'-0"	9.5 ft	6/15 ft
Weights:					
Light Ship Displacement	n/a	2,911 L Tons	3,930 L Tons	1,900 L Tons	2,784 L Tons
Full Load Displacement	n/a	3,930 L Tons	5,840 L Tons	3,000 L Tons	4,997 L Tons
Fuel & Lube	n/a	779 L Tons	1,040 L Tons	unspec	1,176 L Tons
Science Mission Payload	n/a	454 L Tons	700 L Tons	unspec	455.3 L Tons
Design Margin	n/a	312 L Tons	720 L Tons	unspec	315.0 L Tons
Performance:					
Max Speed	unspec	19.3 Knots	18 Knots	unspec	16 Knots
Cruising Speed	15 Knots	15 Knots	15 Knots	14 Knots	14.5 Knots
Range of Cruising	12,000 miles	12,000 miles	12,000 miles	10,000 miles	24,000 miles
Endurance Days	60 days	53 days	60 days	60 days	120 days
Accommodations:					
Crew Size/Staterooms	unspec	25/14	26/26	22/16	16/10
Science Size/Staterooms	30-35/2 per rm	35/20	36/23	33/20	42/22
Machinery:					
Propulsion	unspec	Geared Diesel; 2x 6000 HP; twin screw	Diesel Elec; SCR Drive; twin screw	Geared Diesel; one 4,000 up; single screw	Diesel elec; SCR 3-2000KW;"Z" Drive 2 x 2500 HP
Shaft Horsepower	unspec	9,500 SHP	6080 SHP	4,000 SHP	5,000 SHP
Thrusters					
Bow, Type & HP	unspec	tunnel; 600 HP	360°; 1,000 HP	360° /800 HP	360°/750 HP
Stern, Type & HP	unspec	none	tunnel;1,000 HP	tunnel/800 HP	("Z" Drive)
Aux Elec. Power	unspec	3x1135 KW	1,500KW	3x850 KW	1-1000KW;1-650KW
Science Arrangements:					
Number of Labs	5	5	5	7	5
Total Lab Area	4,000 sq ft	4,162 sq ft	7,500 sq ft	5,593 sq ft	5,188 sq ft
Deck Working Area	3,000 sq ft	4,024 sq ft	7,500 sq ft	4,104 sq ft	11,677 sq ft
Science Storage Area	20,000 cu ft	1,979 sq ft	2,200 sq ft	3,876 sq ft	19,700 cu ft
Ice Strengthening:	ABS-B	ABS 1C	ABS Class 1B	unspec	ABS-B
Est. Construction Cost Excluding Science Outfit:	unspec	unspec	$32.8 M	unspec	$25-30 M

DESIGN COMPARISONS FOR MEDIUM ENDURANCE SHIPS

1/15/86

	SCIENCE MISSION REQUIREMENTS	(AGOR-3)	M. ROSENBLATT & SON, INC.	GLOSTEN ASSOC.	MARINETTE MARINE G&G OPTION
Dimensions:					
Length Overall	n/a	208 Ft	233 Ft	228 Ft	250 Ft
Length B. P.	n/a	196 Ft	215 Ft	212 Ft	238 Ft
Beam	n/a	37 Ft	50 Ft	64 Ft	52 Ft
Draft, Full Load	n/a	14 Ft 3 In	16 Ft	15.2 Ft	15 Ft
Freeboard at Work Deck	6-8 Ft	7 Ft 3 In	8 Ft	12/4 Ft	9 Ft+
at Stern	6-8 Ft	9 Ft	8 Ft	15/6 Ft	9 Ft
Weights:					
Light Ship Displacement	n/a	975 L Tons	1,440 L Tons	1,750 L Tons	1,902 L Tons
Full Load Displacement	n/a	1,350 L Tons	2,383 L Tons	2,469 L Tons	2,790 L Tons
Fuel & Lube	n/a	300 L Tons	527 L Tons	455 L Tons	654 L Tons
Science Mission Payload	n/a	unspec	unspec	242 L Tons	260 L Tons
Design Margin	n/a	None	208 L Tons	292 L Tons	204 L Tons
Performance:					
Max Speed	unspec	1.5 Knots	15.2 Knots	14.6 Knots	15 Knots
Cruising Speed	14 Knots	10 Knots	14 Knots	14 Knots	14 Knots
Range at Cruising	12,000 Miles	9,000 Miles	12,000 Miles	10,540 Miles	13,725 Miles
Endurance Days	50 Days	45 Days	50 Days	48 Days	50 Days
Accommodations:					
Crew Size/Staterooms	unspec	21/15	14/8	23/unspec	16/10
Science Size/Staterooms	20-25/2 per room	20/11	25/13	25/unspec	28/15
Machinery:					
Propulsion	unspec	Diesel electric; single screw	Diesel-electric; SCR 3x1050 KW; single screw	Diesel electric; SCR 6x650 HP; twin screw	Diesel-electric; SCR 2x1500 KW
Shaft Horsepower	unspec	1,000 SHP	3,000 SHP	3,000 SHP	2,955 SHP
Thrusters					
Bow, Type & HP	unspec	360° ; 150 HP	360° ; 750 HP	360° ; 720 HP	OMNI; 600 HP
Stern, Type & HP	unspec	None	Tunnel; 350 HP	360° ; 720 HP	None
Aux Elec. Power	unspec	500 KW	600 KW	350 KW	500 KW
Science Arrangements:					
Number of Labs	5	2	4	6	5
Total Lab Area	3,000 Sq Ft	1,170 Sq Ft	2,843 Sq Ft	4,056 Sq Ft	2,700 Sq Ft
Deck Working Area	2,000 Sq Ft	2,005 Sq Ft	3,548 Sq Ft	6,706 Sq Ft	2,960 Sq Ft
Science Storage Area	15,000 Cu Ft	520 Sq Ft	2,613 Sq Ft	2,830 Sq Ft	1,060 Sq Ft
Ice Strengthening:	ABS Class C	No	ABS Class C	unspec	ABS Class C
Est. Construction Cost Excluding Science Outfit:	n/a	$4.3 M (1963)	$16-25 M	$17-21 M	$30 M

1/20/86

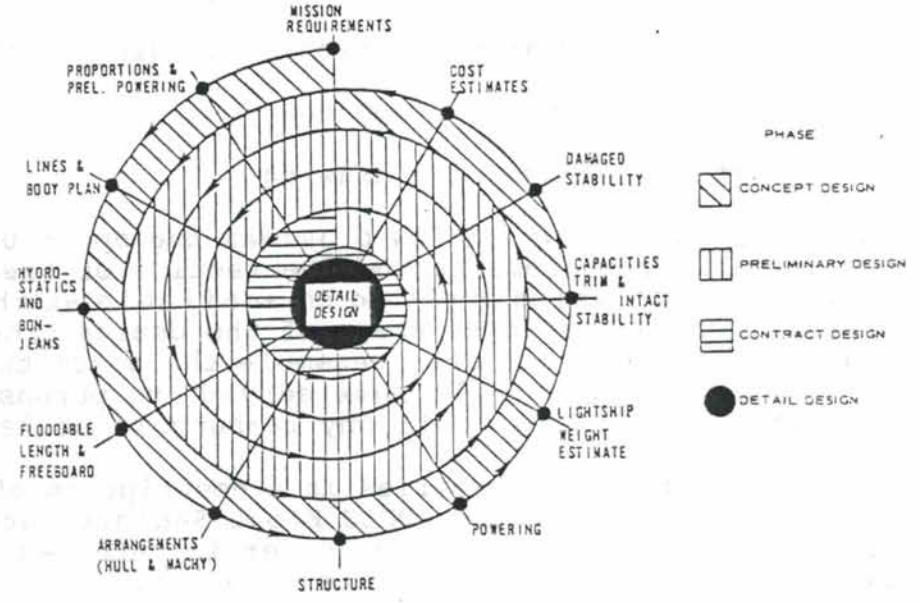
DESIGN COMPARISONS FOR LARGE SWATH SHIPS

	SCIENCE MISSION REQUIREMENTS	(AGOR-3)	M. ROSENBLATT & SON, INC.	GLOSTEN ASSOC.	MARINETTE MARINE G&G OPTION
Dimensions:					
Length Overall	n/a	208 Ft	233 Ft	228 Ft	250 Ft
Length B. P.	n/a	196 Ft	215 Ft	212 Ft	238 Ft
Beam	n/a	37 Ft	50 Ft	64 Ft	52 Ft
Draft, Full Load	n/a	14 Ft 3 In	16 Ft	15.2 Ft	15 Ft
Freeboard at Work Deck	6-8 Ft	7 Ft 3 In	8 Ft	12/4 Ft	9 Ft+
at Stern	6-8 Ft	9 Ft	8 Ft	15/6 Ft	9 Ft
Weights:					
Light Ship Displacement	n/a	975 L Tons	1,440 L Tons	1,750 L Tons	1,902 L Tons
Full Load Displacement	n/a	1,350 L Tons	2,383 L Tons	2,469 L Tons	2,790 L Tons
Fuel & Lube	n/a	300 L Tons	527 L Tons	455 L Tons	654 L Tons
Science Mission Payload	n/a	unspec	unspec	242 L Tons	260 L Tons
Design Margin	n/a	None	208 L Tons	292 L Tons	204 L Tons
Performance:					
Max Speed	unspec	1.5 Knots	15.2 Knots	14.6 Knots	15 Knots
Cruising Speed	14 Knots	10 Knots	14 Knots	14 Knots	14 Knots
Range at Cruising	12,000 Miles	9,000 Miles	12,000 Miles	10,540 Miles	13,725 Miles
Endurance Days	50 Days	45 Days	50 Days	48 Days	50 Days
Accommodations:					
Crew Size/Staterooms	unspec	21/15	14/8	23/unspec	16/10
Science Size/Staterooms	20-25/2 per room	20/11	25/13	25/unspec	28/15
Machinery:					
Propulsion	unspec	Diesel electric; single screw	Diesel-electric; SCR 3x1050 KW; single screw	Diesel electric; SCR 6x650 HP; twin screw	Diesel-electric; SCR 2x1500 KW
Shaft Horsepower	unspec	1,000 SHP	3,000 SHP	3,000 SHP	2,955 SHP
Thrusters					
Bow, Type & HP	unspec	360 ; 150 HP	360 ; 750 HP	360 ; 720 HP	OMNI; 600 HP
Stern, Type & HP	unspec	None	Tunnel; 350 HP	360 ; 720 HP	None
Aux Elec. Power	unspec	500 KW	600 KW	350 KW	500 KW
Science Arrangements:					
Number of Labs	5	2	4	6	5
Total Lab Area	3,000 Sq Ft	1,170 Sq Ft	2,843 Sq Ft	4,056 Sq Ft	2,700 Sq Ft
Deck Working Area	2,000 Sq Ft	2,005 Sq Ft	3,548 Sq Ft	6,706 Sq Ft	2,960 Sq Ft
Science Storage Area	15,000 Cu Ft	520 Sq Ft	2,613 Sq Ft	2,830 Sq Ft	1,060 Sq Ft
Ice Strengthening:	ABS Class C	No	ABS Class C	unspec	ABS Class C
Est. Construction Cost Excluding Science Outfit:	n/a	$4.3 M (1963)	$16-25 M	$17-21 M	$30 M

SUMMARY COMPILATION OF

RESEARCH VESSEL CONCEPTUAL DESIGN STUDIES

An important step in the planning process is the "conceptual design" of new ships to meet the intended requirements. Figure 1 shows the classic design spiral in which the outer loop of the spiral represents the Concept Design phase, the next loop the Preliminary Design phase, and the inner loops the Contract Design phase. Major steps in each phase are shown as radial lines. The sequence of the steps shown may vary with the individual design problem and with individual design practice.



From Ship Design and Construction, Society of Naval Architects and Marine Engineers, 1980

Figure 1

The conceptual design stage proposed here is the first step in translating the stated requirements for a ship into the actual design process. It is a technical and engineering effort by a qualified naval architect to develop a hull form, machinery system, and general arrangements which integrates the various scientific requirements, combining laboratory arrangements, deck handling, storage and ship control into a single shipboard system. Here the requirements of the regulatory agencies, principally Coast Guard and the American Bureau of Shipping are defined. From this the community of oceanographers can evaluate whether the ship thus described is what they really had in mind.

The scope of the conceptual design include:

- Technical description of the vessel design
- Discussion of the vessel design and its responsiveness to the scientific requirements and ship characteristics stated
- Summary of ship specifications
- General arrangements plans
- Inboard profile and outboard profile plans
- Scientific arrangement
- Machinery arrangement
- Operating characteristics, including costs
- Estimated construction cost
- Artist's conception drawing

The conceptual design review provides the opportunity for feedback into the requirements and the testing of the many comments and suggestions which ought to be available at this stage. It is doubtful whether the next stage of the design process, the preliminary design, will closely resemble the conceptual design. But the conceptual design will have served its purpose if it permits the next stage to start with any reasonable degree of confidence.

Each of the attached summaries is a description of the available conceptual designs in the UNOLS Fleet Replacement process. For more detailed information the reader is referred to the appropriate report which is available separately.

This edition supercedes the December 1985 version.

Conceptual Design of a 2500 Ton Oceanographic Research Ship

Conducted pursuant to the research ship requirements of the Northeast Consortium Research Fleet [NECOR] and the University National Oceanographic Laboratory System [UNOLS]

by

Woods Hole Oceanographic Institution

under a grant from the Penzance Foundation

FEBRUARY 1985

CONCEPTUAL DESIGN STUDY OF A LARGE GENERAL PURPOSE SWATH OCEANOGRAPHIC RESEARCH SHIP

Foreword

This Study has been undertaken as a part of the University-National Oceanographic Laboratory System (UNOLS) effort to develop plans for oceanographic research ships of the future. The need to plan for new, more capable research ships to conduct scientific programs at sea has become a matter of urgency. Numerous studies have amply demonstrated that by the 1990's our ships will be obsolete; some vessels are only marginally capable of supporting oceanography in the 1980's. In the Northeast Consortium Research Fleet (NECOR), two ships -- CONRAD and ATLANTIS II -- are over twenty years old. The situation is similar at the national level where three of the five major seagoing ships that serve the university community are of 1960's vintage.

The objective of this Study is to describe a large, general purpose oceanographic research vessel to meet science requirements for the next 10-20 years. The single most overriding requirement is that the ship provide the most stable environment possible to allow overside and laboratory work in greater capacity and in higher sea states than is now possible. Other general requirements include reliability, flexibility, cleanliness, and a ship that is vibration- and noise-free.

The SWATH or semi-submerged ship is a relatively recent development in ship design. Although patents employing it show up as early as 1905, it was not until 1972 that the Naval Electronics Laboratory constructed an 89-foot, 217-ton, prototype model. The principle of the SWATH ship is that submerged hulls do not follow surface wave motion; struts supporting an above water platform have a small cross section (waterplane), resulting in longer natural periods and reduced buoyancy force changes. The result is that 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.

This Study has been sponsored on behalf of NECOR and UNOLS by the Woods Hole Oceanographic Institution with funding by the Penzance Foundation.

DESIGN SPECIFICATIONS

for

2500-Ton SWATH Oceanographic Research Ship

Semi-Submerged Ship Corp.

TABLE 1. PHYSICAL VESSEL CHARACTERISTICS

Displacement	2489 LT
Length, Overall	247.4 ft
Length, Main Deck	218.4 ft
Beam, Overall	95 ft
Beam, Main Deck	95 ft
Draft, Full Load	24 ft
Draft, Full Load less 1/2 Fuel	19.3 ft
Strut Chord	84 ft
Strut Thickness (arc)	7.8 ft
Fore/Aft Strut Gap	50.4 ft
Lower Hull C.L. Spacing	77 ft
Air Gap	16 ft
Vertical Stiffness	49.9 LT/ft
Transverse GM	8.76 ft
Longitudinal GM	74.4 ft
Structural Material	Welded Steel up through 01 Deck, Aluminum Above 01 Deck.

TABLE 2. PERFORMANCE CHARACTERISTICS

Electric Power	925 x 4 KW (Caterpillar 3516 motor/gen)
Maximum Speed	16.5 Kts at 5027 SHP Intermittent
Continuous Speed	15.9 Kts at 4446 SHP Continuous
Cruise Speed	15.3 Kts at 3779 SHP (0.85 Continuous)
Transit Speed	15.0 Kts at 3400 SHP (0.765 Continuous)
Slow Speed	0.5 Kts +/- 0.1 Kt
Range	16,800 n mi at 12 Kts
	13,600 n mi at 14 Kts
	11,400 n mi at 15 Kts
	10,500 n mi at 15.3 Kts
	9,400 n mi at 15.9 Kts
Endurance	20 Days at 15 Kts (7200 n mi) + 20 Days on Station with 1500 HP for Mission Systems and Ship's Power, and a 15% Fuel Reserve
Propulsors	2 Kort Nozzles, 8.76 FT Rotor Diameter
Thrustors	White Gill, Model 32, 469 HP x 2
Ship Systems Load	120 KW (Average)
Dynamic Positioning	35 Kt Wind and 3 Kt Current
Normal Work Condition	S.S. 5 and S.S. 6
Limited Work Condition	S.S. 7

TABLE 3. TANK CAPACITIES

Fuel	480 LT (151,400 Gal)
Lube Oil	5 LT (1,580 Gal)
Fresh Water	60 LT (16,100 Gal)
Ballast, B1	141 LT
Ballast, B2	230 Lt
Ballast, B3	244 LT
Ballast, B4	277 LT

TABLE 5. PAYLOAD CHARACTERISTICS

A. FIXED PAYLOAD		
	Itinerant Payload	100 LT
	Pettibone Model 200 Crane	44 LT
	Pettibone Model 30 Crane x 2	22 LT
	Pettibone Model 20 Crane x 2	10 LT
	Stern A-Frame Crane	20 LT
	Stbd Side U-Frame Crane	5 LT
	Gantry Crane	5 LT
	Trawl Winch	17 LT
	Deep Tow Winch	17 LT
	Hydro Winch x 2	14 LT
	8' x 8' x 20' Van x 4	40 LT
	Laboratory Equipment	15 LT
	Wire for Winches	16 LT
	Misceilaneous	11 LT
	SUB TOTAL =	336 LT
B. VARIABLE PAYLOAD		
	Crew, Scientists, Effects	6.7 LT
	General Stores	2.6 LT
	Gasoline for Boats	0.6 LT
	Provisions and Personel Effects	23.4 LT
	Fresh Water	60.0 LT
	SUB TOTAL =	83.3 LT
C. TOTAL PAYLOAD	=	419.3 LT

GENERAL ARRANGEMENT

A SWATH is unusually versatile in regard to arrangements. This is attributable to the large expanses of deck in the cross structure made available by the wide separation of the lower hulls, and the nearly rectangular shape of the upper box or cross structure. The general arrangement of this vessel is designed as a four-deck level configuration where the lower deck is the main deck, the weather deck is at the 0-1 level, the master's and nine other state rooms are at the 0-2 level, and the bridge is located at the 0-3 level.

Accommodations

The accommodations provide for 60 persons. Forty eight are accommodated in 2-person staterooms (110 sq ft) located at the main deck level and the 0-2 level. Three are accommodated in 1-man executive staterooms (228 sq ft) at the main deck, 0-1 and 0-2 levels. Five 1-man scientist state rooms (141 sq ft) are located at the 0-2 level, and four 1-man state rooms (81 sq ft) are on the main deck.

All staterooms share a toilet and shower with another stateroom except for the three executive staterooms and nine 2-man staterooms which have their private toilet and shower. Also, each stateroom is equipped with a lavatory.

Laboratories

The main science laboratory, analytical lab, computer lab and user's area, the science office, space for four vans, the 1 1/2-level staging room, and the science lounge and library are located forward on the 0-1 level. The vans interface with the passage way aft of the main laboratory.

The Sea Beam room and electronics shop are located above the analytical lab on the 0-2 level.

The wet lab, hydro lab, scientific storage rooms, science shop, diving locker, and dark room are located on the main deck.

Machinery

The main engines and generators are located aft and to port of the center well on the main deck. The SCR room is on the starboard side. The auxiliary machinery, machine shop, and electrical shop are located aft of the main engines.

The D.C. drive motors and gear boxes are located in the lower hulls, and can be hoisted out through the aft struts and the aft machinery access hatches in the main deck.

The fuel, fire, salt water, fresh water, and ballast pumps are located in fore and aft pump rooms in each lower hull. The thrusters are mounted in thruster rooms in each lower hull, forward.

Facilities

The galley, general mess, lounge, laundry, sick bay, and exercise rooms are located forward on the main deck adjacent to the majority of the staterooms. Various storage areas, refigerators, and freezers are located on the main and O-1 decks.

Cranes and Winches

Two trawl winches are located amidships and starboard on the main deck. A large A-frame is located at the stern of the main deck for handling equipment from either the main deck or the O-1 deck.

A Pettibone Model 200 crane, the largest made by Pettibone and rated at 200,000 lbs is located on the O-1 level, amidships on the starboard side. Two Pettibone Model 30 cranes are located aft, one on each side. Also, two oceanographic winches are mounted just aft of the center well opening. The anchor winches are mounted at the forward corners of this deck, and a U-frame is mounted amidships on the starboard side to serve both the O-1 and main decks.

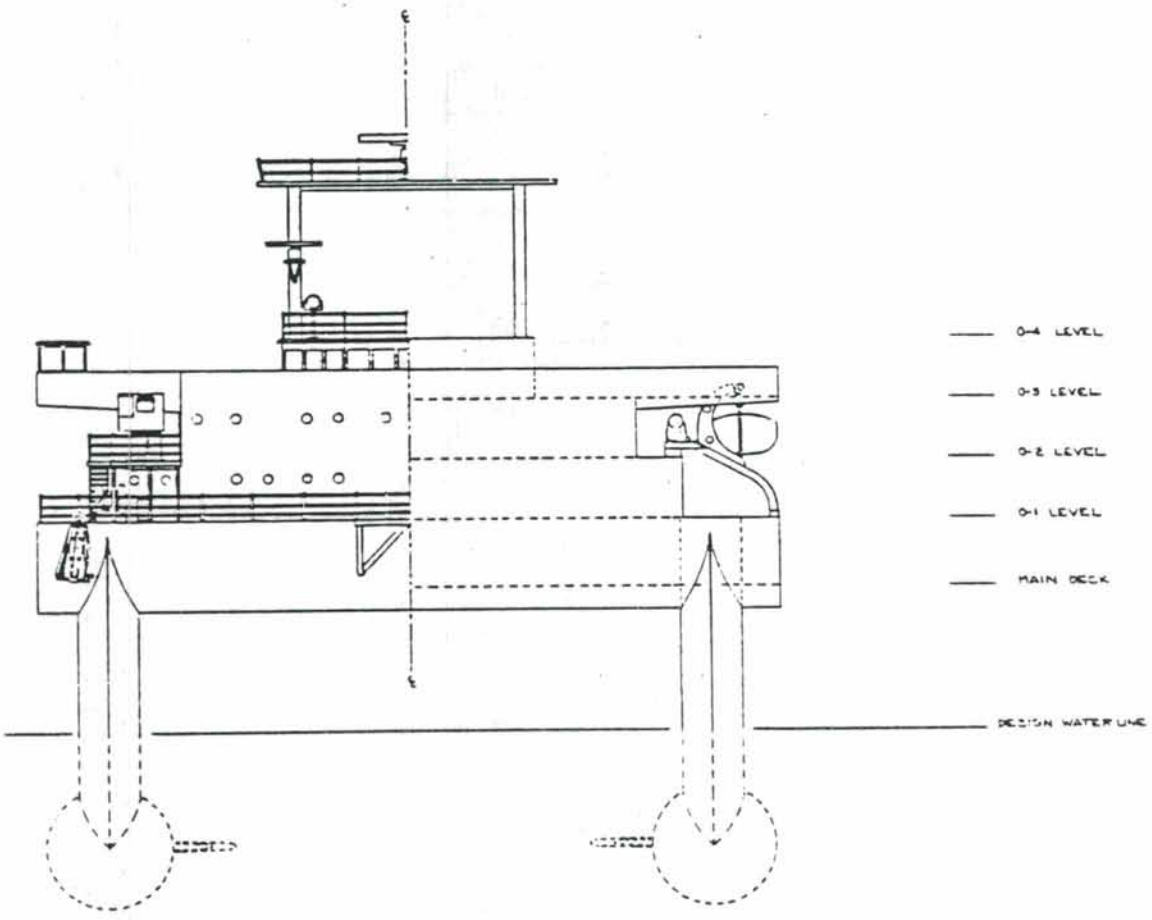
Two Pettibone Model 20 (or 30) cranes are mounted on the O-2 level forward, one on each side to serve the O-1 forward deck and working platform.

Ship Control

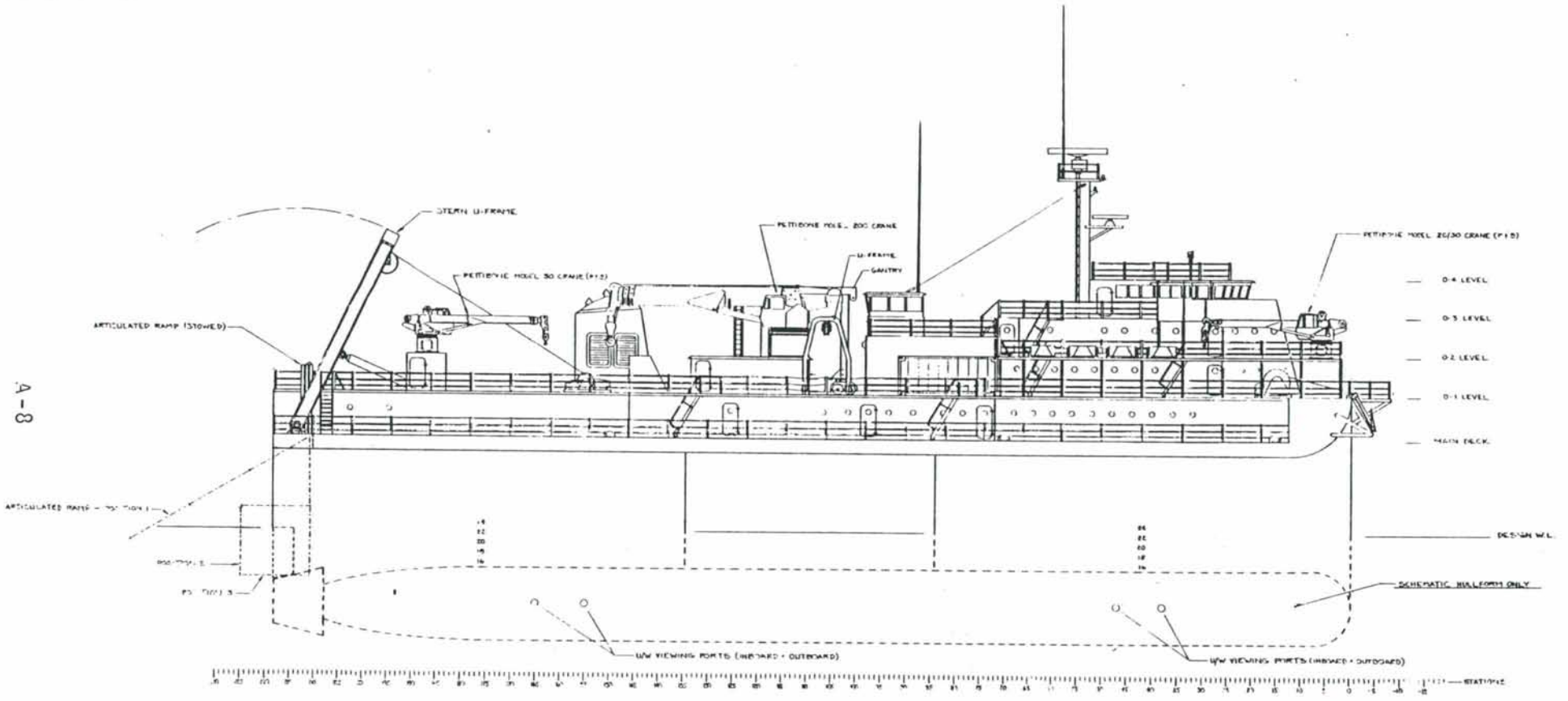
There are four control stations; one in the pilot house, one in each of two side-wing "doghouses", and one in the aft control room which is located midway between levels O-2 and O-3 above the staging room and overlooking the center well and the O-1 deck.

Fuel and Ballast Tanks

The fuel is located in two tanks, amidships in each lower hull. There are two sets of four ballast tanks, one set on each side. The B-1 tanks are in the bows of the lower hulls. The B-2 and B-3 tanks are respectively just ahead and just behind the fuel tanks in the midsection of the lower hulls, and the B-4 tanks are in the lower hulls just ahead of the drive motors, and extend upward into the aft struts.



APPROVED		SEMI-SUBMERGED SHIP CORPORATION	
APPROVED		617 LOMA LARGA DR., SOLANA BEACH, CA 92075	
CHECKED		TITLE	
PREPARED	12/10/84 WP	OCEANOGRAPHIC RESEARCH VESSEL	
PROJECT NUMBER	SSSCO-114	FRONT VIEW	
COGNIZANT CODE	600		
BY DIRECTION		SIZE H / SCALE / REV.	
		DRAWING NUMBER 114-C-601	SHEET 1 OF 6



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COGNIZANT CODE	600		
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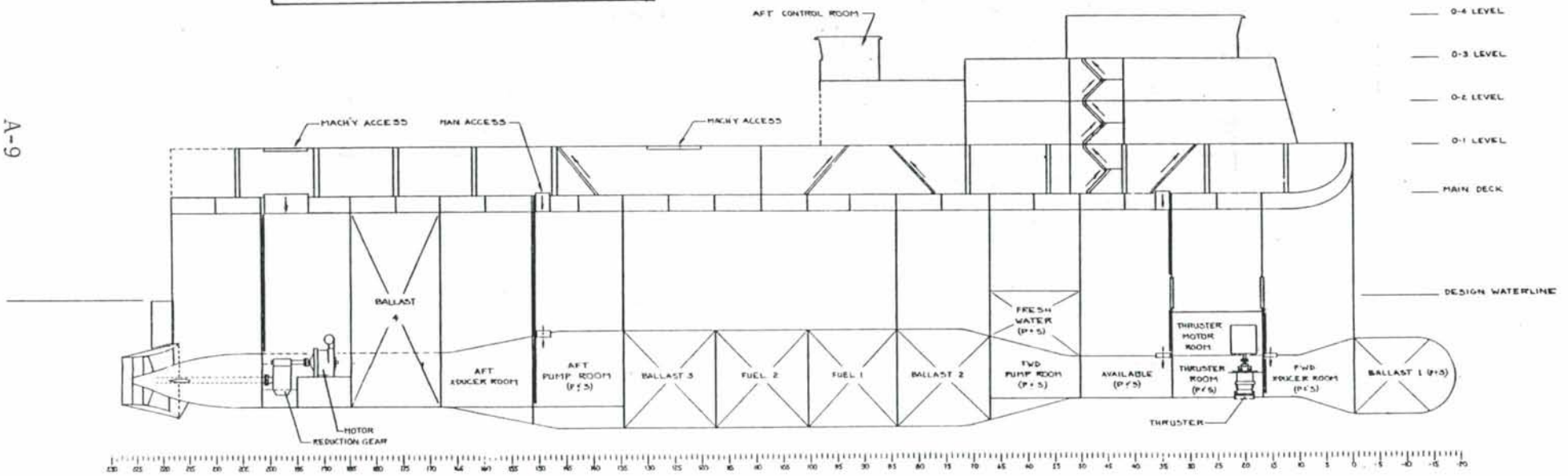
			DRAWING NUMBER 114-F-601 · SHEET 2 OF 6

NOTE: This plan shows the actual design shape of the lower hulls. This is proprietary to SSSCo. and should not be disclosed.



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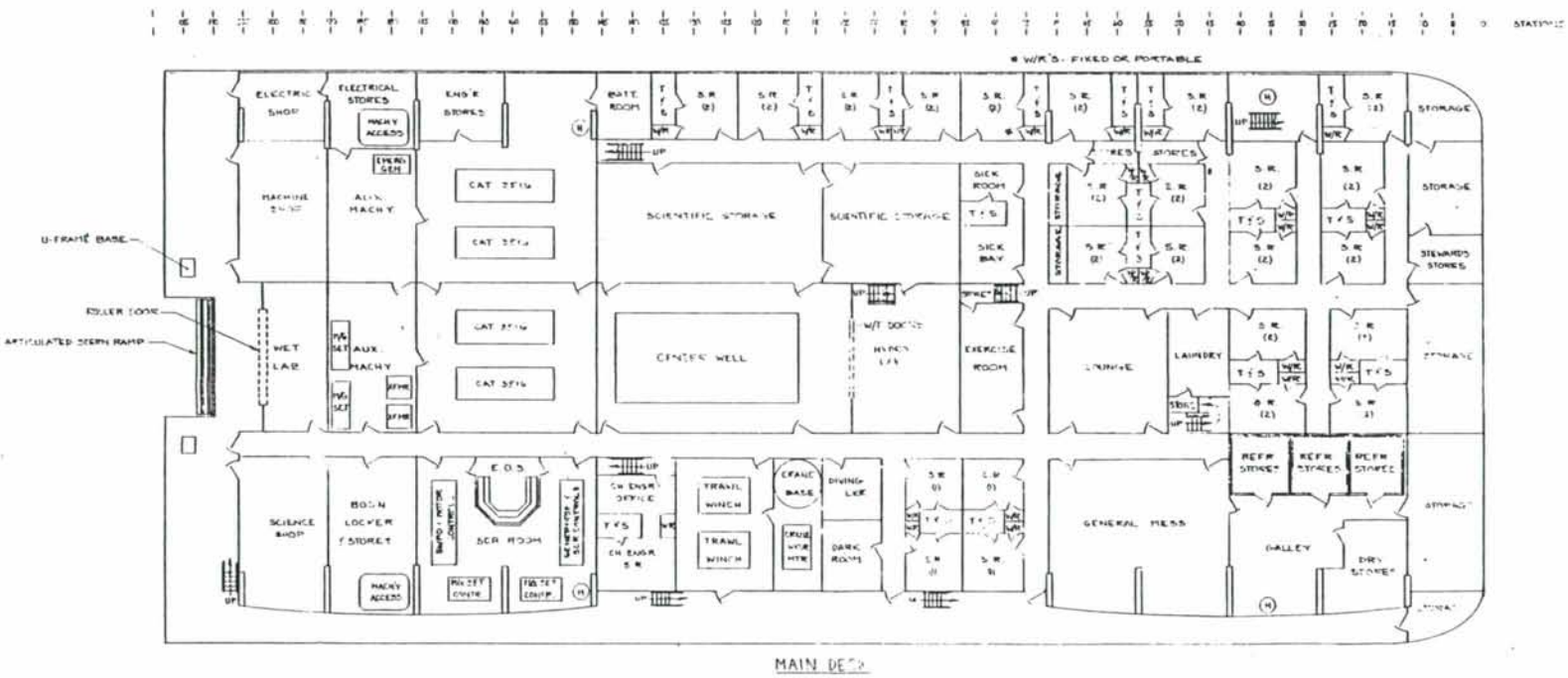

MAIN DECK

A-10

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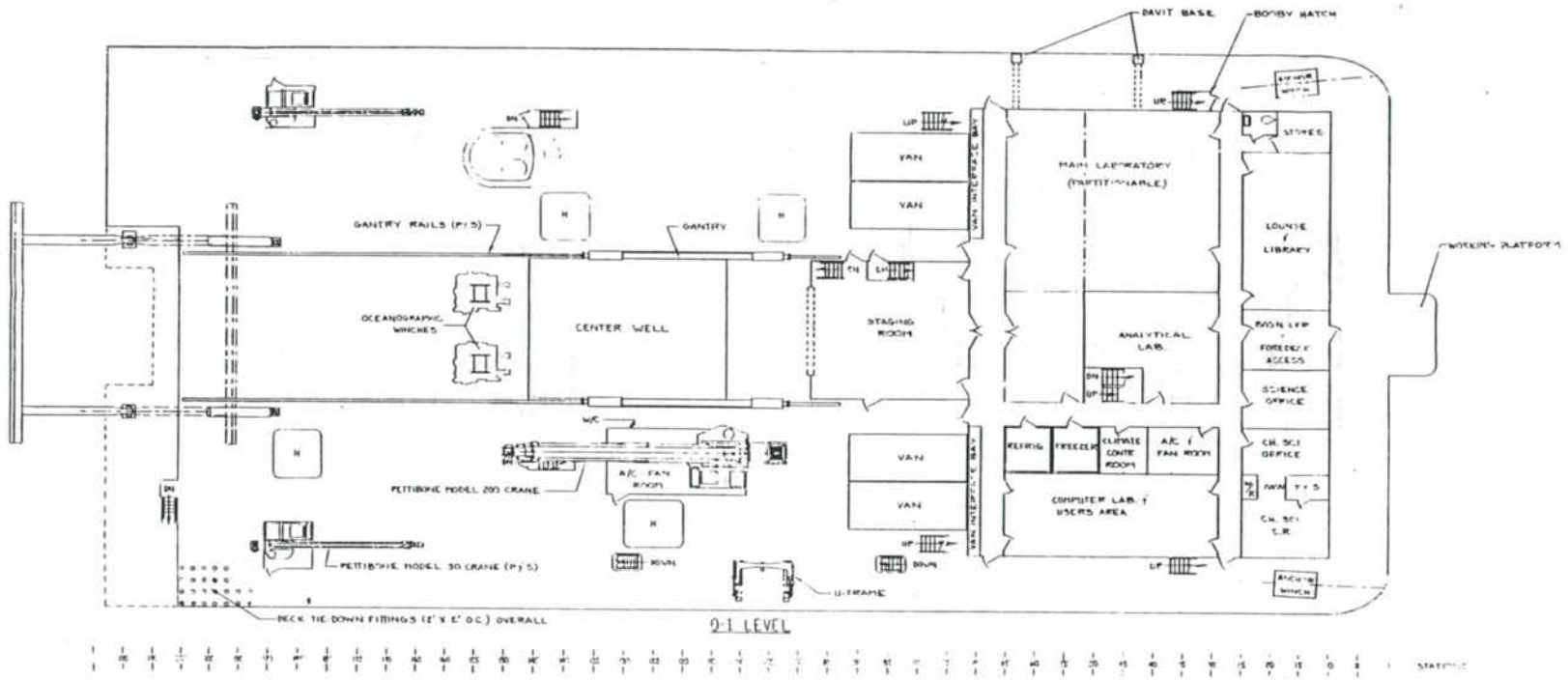

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APPROVED			
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PREPARED	12/10/84	NP	
PROJECT NUMBER	SSSCO-114		
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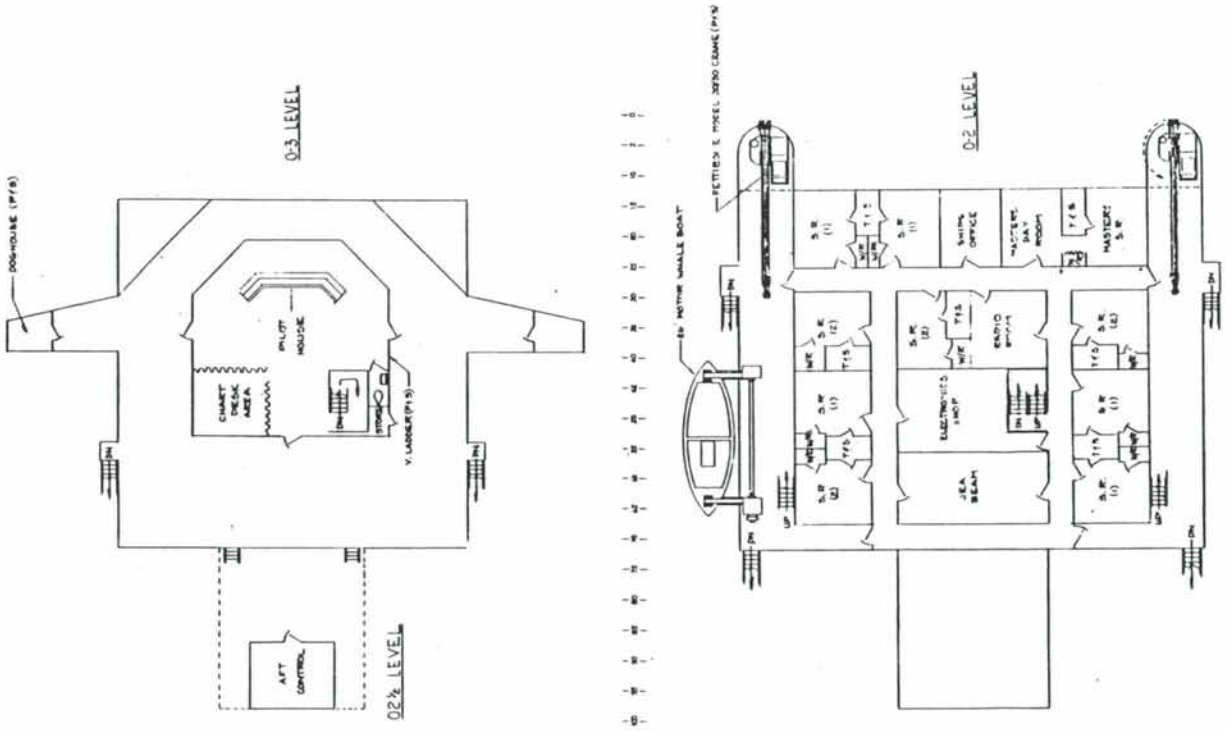

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APPROVED		
CHECKED	12/28/84	TGL
PREPARED	12/10/84	NP
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COGNIZANT CODE	600	
BY DIRECTION		

SEMI SUBMERGED SHIP CORPORATION
411 LOMA LARGA DR., SOLANA BEACH, CA 92075

TITLE
OCEANOGRAPHIC RESEARCH VESSEL
GENERAL ARRANGEMENT - 02 & 03 DECK

SIZE H	SCALE Sta. Space = 1'0"	REV.	
DRAWING NUMBER 114-C-601		SHEET 6 OF 6	

CONCEPTUAL DESIGN
OF A
SEMISUBMERGED OCEANOGRAPHIC
RESEARCH SHIP

PREPARED FOR

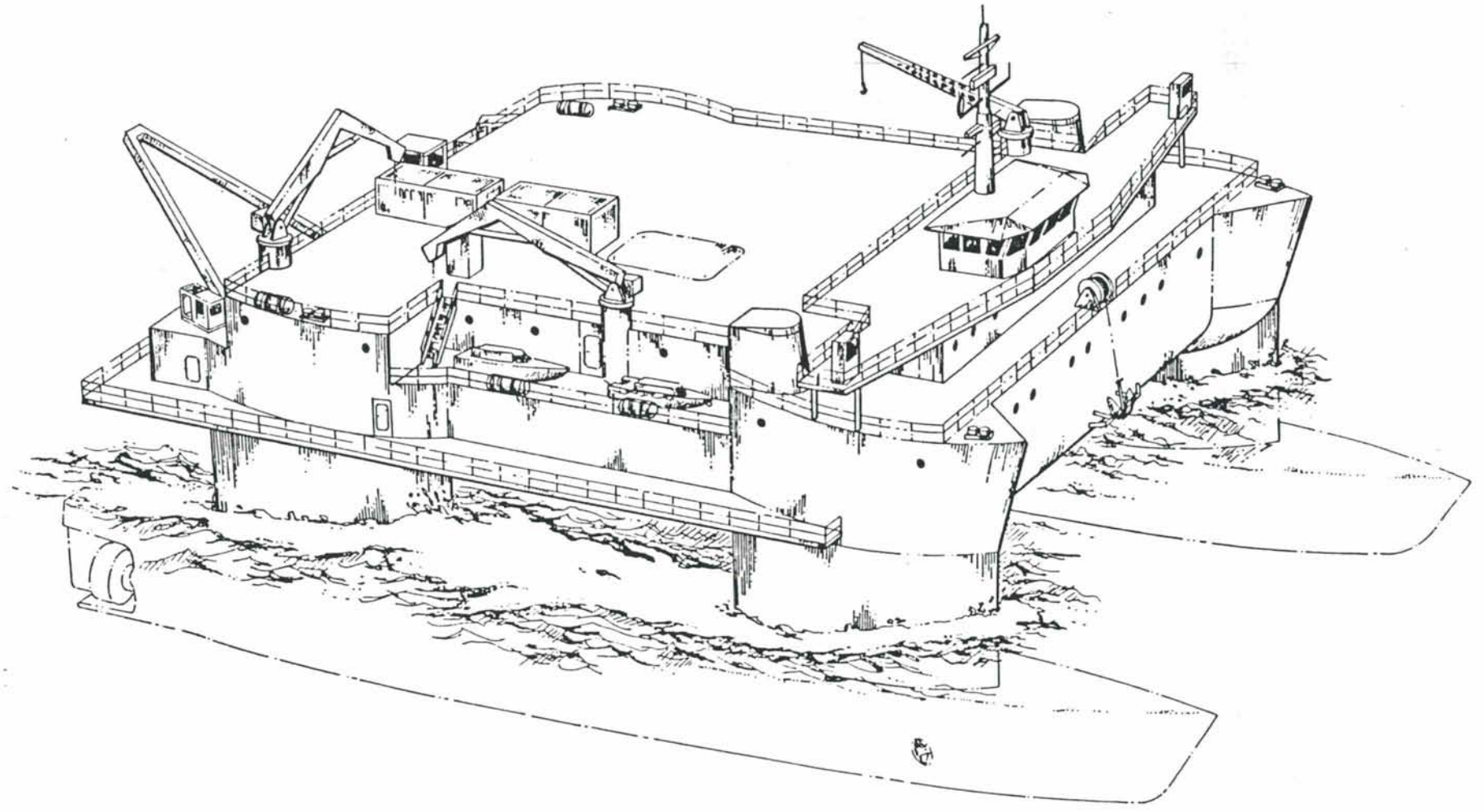
UNIVERSITY-NATIONAL OCEANOGRAPHIC
LABORATORY SYSTEM

WOODS HOLE, MASSACHUSETTS

BY

BLUE SEA MCCLURE
14300 CORNERSTONE VILLAGE DRIVE
SUITE 317
HOUSTON, TEXAS, 77014

APRIL 1985



ARTIST RENDITION OF
SEMISUBMERGED OCEANOGRAPHIC RESEARCH SHIP

PRINCIPAL PARTICULARS

GENERAL DESCRIPTION

Ship	Length, Overall	202 feet
	Beam, Overall	104 feet
	Height to Main (Weather) Deck	60 feet
	Draft, Transit, Full Load	15 feet 3 inches
	Draft, Storm	23 feet
	Draft, Normal Operating	26 feet
	Draft, Special Operating	33 feet 6 inches
Lower Hulls	Number	2
	Length Overall	202 feet
	Beam	27 feet 6 inches
	Depth (amidship)	16 feet 6 inches
	Transverse (center to center)	76 feet 6 inches
Columns	Number	4
	Length	45 feet
	Width	9 feet 3 inches
	Height	23 feet
	Longitudinal (center to center)	96 feet
	Transverse (center to center)	86 feet
	Form	Double Circular Arc
Upper Hull	Length (on centerline, including stern work area)	147 feet
	Width Overall (at midship)	86 feet
	Width Overall (Maximum)	95 feet 3 inches
	Depth	20 feet 6 inches
	Decks (full and partial)	4
	Moonpool	30 x 16 feet
	Helicopter Landing Area	50 feet diameter
	Main Pilot House	01 Level, Centerline

Displacement	Light Ship	1705 LT
	Transit Draft (15.25 feet)	2645 LT
	Storm Draft (23.0 feet)	3160 LT
	Normal Operating Draft (26.0 feet)	3220 LT
	Special Operaing Draft (33.5 feet)	3460 LT
Power	Main Diesel Generators (4)	4400 KW
	In-Port Service Generator	350 KW
	Ship Emergency Generator	100 KW
	Propulsion Motors (4)	6000 SHP
	Bow Thruster (1)	500 SHP
Speed	Max. Continuous Trial Conditions at 15.25 Feet Draft	16 knots
	Normal Transit at 15.25 Feet Draft	15 knots
	Max. Continuous at 26.0 Feet Draft	10 knots
Range	15 knots at 15.25 Feet Draft with 15% remaining reserve fuel	10,000 n. miles
Endurance	Stores and Supplies	60 days

Accommodations

Marine Crew:	
Captain	1
Chief Engineer	1
Mate	3
Assistant Engineer	2
Able Seamen	5
Oiler	3
Cook	2
Messmen	4
Corpsman	1
Radio Technician	1
Total Marine Crew	23

Scientific Crew:	
Chief Scientist	1
Party Chief	1
Assistant Party Chief	2
Technical	26
Total Scientific Crew	30

TOTAL COMPLEMENT 53

CONFIGURATION

The configuration of the conceptual Semisubmerged Oceanographic Research Ship is shown in the drawings in Section V(B). The descriptive terminology used on these drawings is appropriate for accurate functional identification as used by various regulatory bodies.

The ship has a maximum beam of 104 feet which encompasses the lower hulls and allows passage through the Panama Canal. The lower hulls have a width of 27 feet 6 inches and a depth at midship of 16 feet 6 inches. The 27 feet 6 inch width gives a clear space between the inboard sides of the lower hulls of 49 feet. There is no cross bracing between the hulls.

The ship is designed to have a transit draft of 15 feet 3 inches (approximately 1 foot 3 inch freeboard amidship) when fully loaded and with the ballast tanks empty. Under full load conditions the ship can be ballasted down to a normal operating draft of 26 feet. It may be operated at intermediate drafts as dictated by sea conditions. This feature is especially useful during transit to permit higher speeds and to save fuel by operating at the shallowest draft that is consistent with sea-kindliness requirements. To allow for ease of deploying and retrieving oceanographic equipment, the ship can be ballasted to a 33 feet 6 inch special operating draft. At this draft, the clearance from the water to the third deck work areas is 8 feet 6 inches.

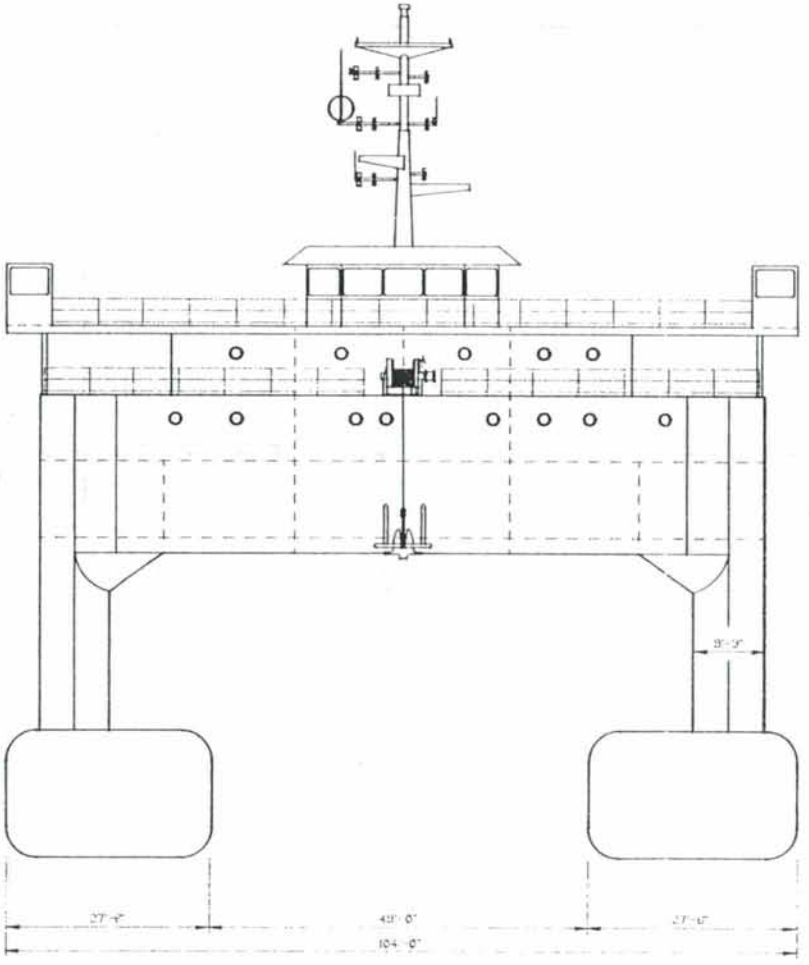
Four columns, two port and two starboard, provide support for the upper hull. Each column is 45 feet in length, 9 feet 3 inches in

width, and 23 feet high. The columns are offset outboard on the lower hulls. Man lifts will be located in each aft column to provide easy access to the lower hull machinery compartments.

The upper hull has three continuous decks: main (weather), second, and third reckoning from the top down. In the middle of the upper hull is a centerwell area that has approximately 1,500 square feet of enclosed deck space. The centerwell work area is comprised (at the third deck level) of a moonpool, with fore and aft work areas, and provides direct access to the main laboratory areas. There is adjacent access to all laboratories, stern and starboard side work areas, change room, storage rooms, and other scientific areas. The centerwell area is serviced by a 10-long-ton overhead traveling gantry crane for handling miscellaneous loads. The centerwell overhead is formed by the main deck structural closure and affords a clear height of 17 feet.

The third deck also contains an oceanographic work platform with an area in excess of 1,000 square feet located across the stern of the ship. Direct access is provided to the main and wet laboratories. The stern platform will provide space for various oceanographic equipment, and is serviced by a 20,000 lb. capacity A-Frame crane and a 20-ton articulated crane to provide flexibility for over-the-side operations and handling of equipment. On the starboard side, a 113 foot long work area is provided. This area is serviced by two 20-ton articulated cranes and has convenient access to the various laboratories. The remaining area of the third deck contains the main and auxiliary machinery areas for the ship.

The second deck contains quarters, storage spaces, and lounge and recreational facilities, as well as the galley and mess room. The second deck also incorporates an aft control room and center well control room with associated communication centers. The aft open deck at this level will carry the research winch and deep-tow winch.



TYPICAL SECTION OF LOWER HULLS AT MIDSHIP.

REV	DESCRIPTION	BOM APPROVAL DATE	BY
1	GENERAL REVISION	4/6/...	FES

EXAMINED	
B	SIGNATURE
DRAWN	FES
CHECKED	FES
ENGINEER	EJT
APPROVED	FES
DATE	2/87

UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

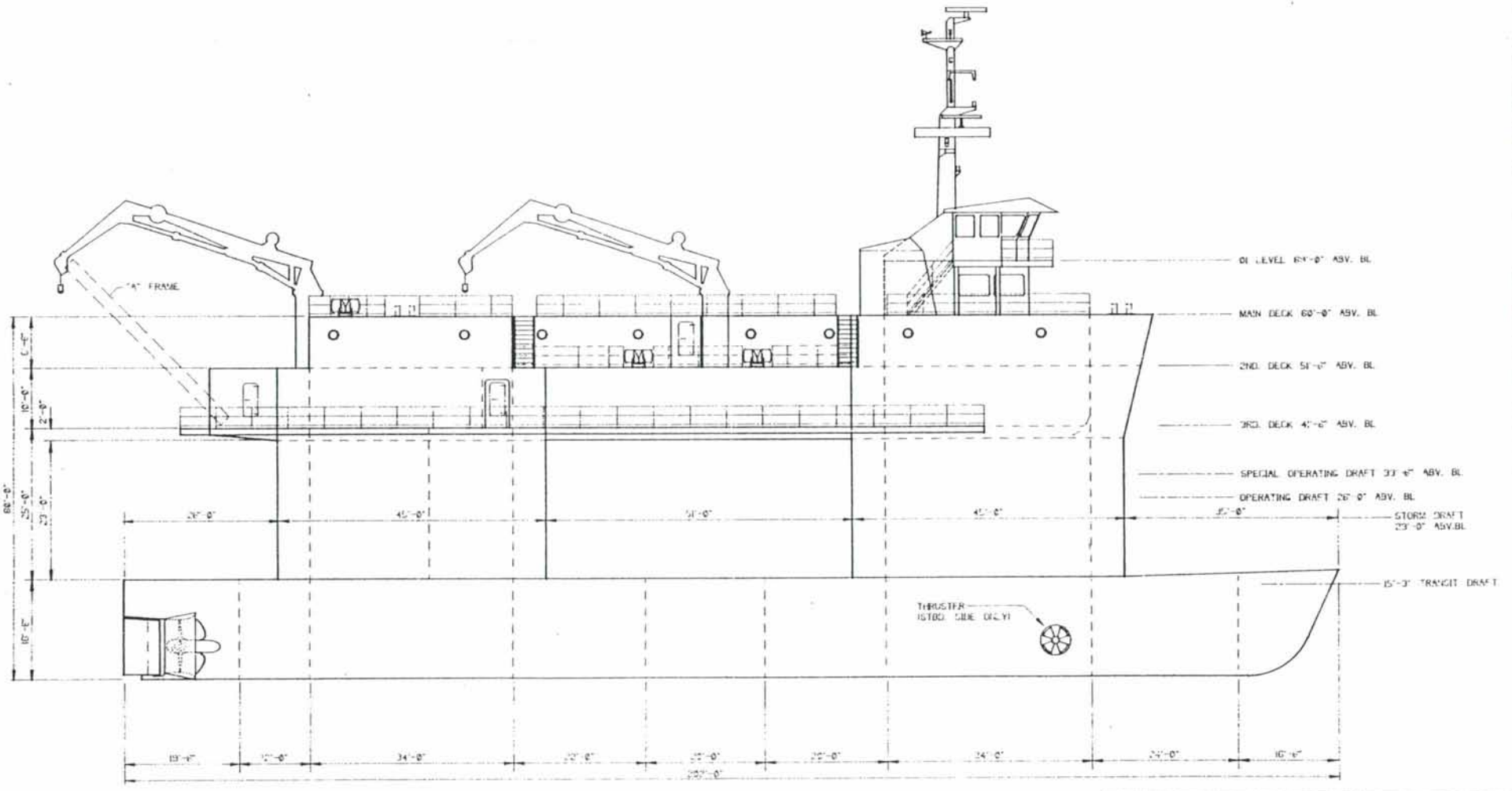
Blue Sea McClure

14900 LONGSTONE VILLAGE DR. SUITE 317
HOUSTON, TEXAS 77014

SEMISUBMERGED OCEANOGRAPHIC RESEARCH SHIP

GENERAL ARRANGEMENT
FORWARD END ELEVATION

SCALE	WT. GRT	PLAS NUMBER	SHEET 1 OF 1	REV
1/8"=1'-0"		B3C0-207		1



NOTE: BRIDGE WING ENVELOPES NOT SHOWN FOR CLARITY.

REV	DESCRIPTION	DATE	BY	APP'D
1	GENERAL REVISION	[illegible]	[illegible]	[illegible]

UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

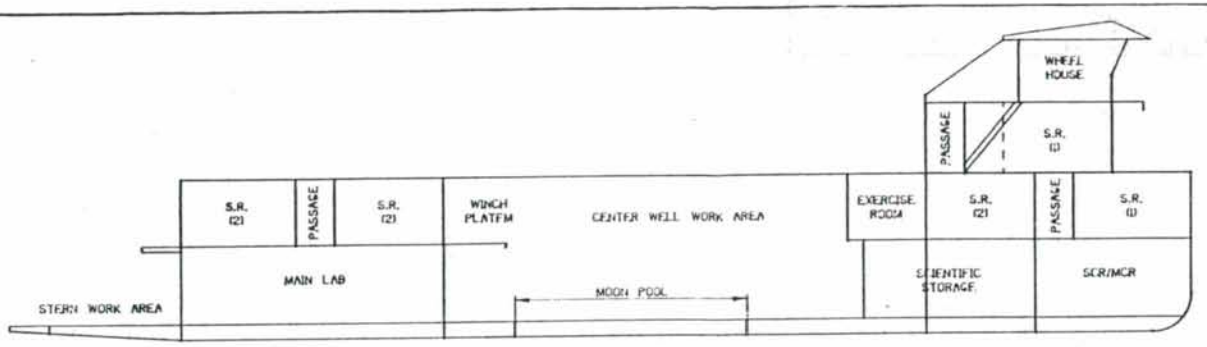
EXAMINED	
BY	SIGNATURE
DRAWN	E.E.E.
CHECKED	F.E.S.
ENGINEER	E.J.T.
APPROVED	F.E.S.
DATE	[illegible]

Blue Sea McClure
14300 CORNERSTONE VILLAGE DR. SUITE 317
HOUSTON, TEXAS. 77014

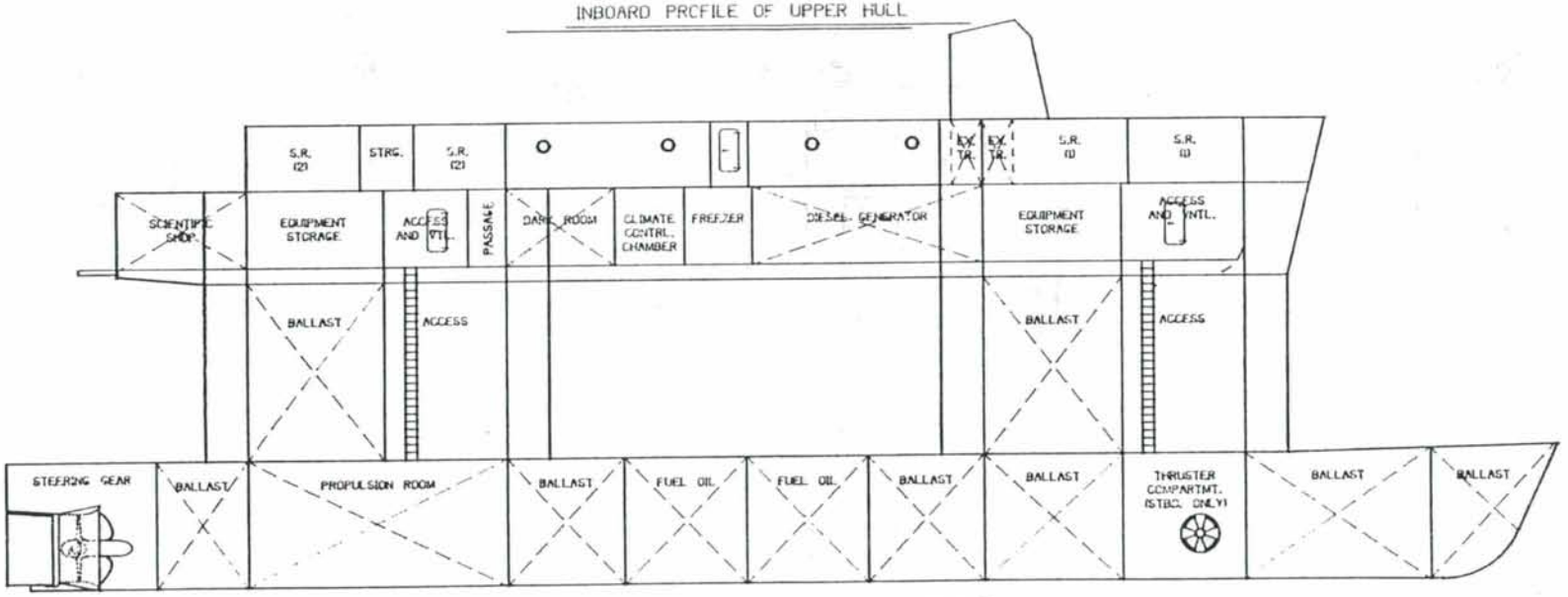
SEMISUBMERGED OCEANOGRAPHIC RESEARCH SHIP

GENERAL ARRANGEMENT
OUTBOARD PROFILE

SCALE	WT. CRP	PLAT NUMBER	SHEET OF	REV
[illegible]		[illegible]	[illegible]	



INBOARD PROFILE OF UPPER HULL



INBOARD PROFILE OF LOWER HULL AND COLUMNS

STBD. SHOWN

REV	DESCRIPTION	BOM APPROVAL DATE	BY	APP'D FOR CLASS DATE	BY	APP'D

EXAMINED	
BY	SIGNATURE
DRAWN	FFF
CHECKED	FFS
ENGINEER	EJT
APPROVED	FFS
DATE	8/85

UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

Blue Sea McClure

14300 CORNERSTONE VILLAGE DR. SUITE 307
HOUSTON, TEXAS, 77014

SEMISUBMERGED OCEANOGRAPHIC RESEARCH SHIP

GENERAL ARRANGEMENT
INBOARD PROFILE

SCALE	WT. GRP.	PLAN NUMBER	SHEET 1 OF 1	REV.
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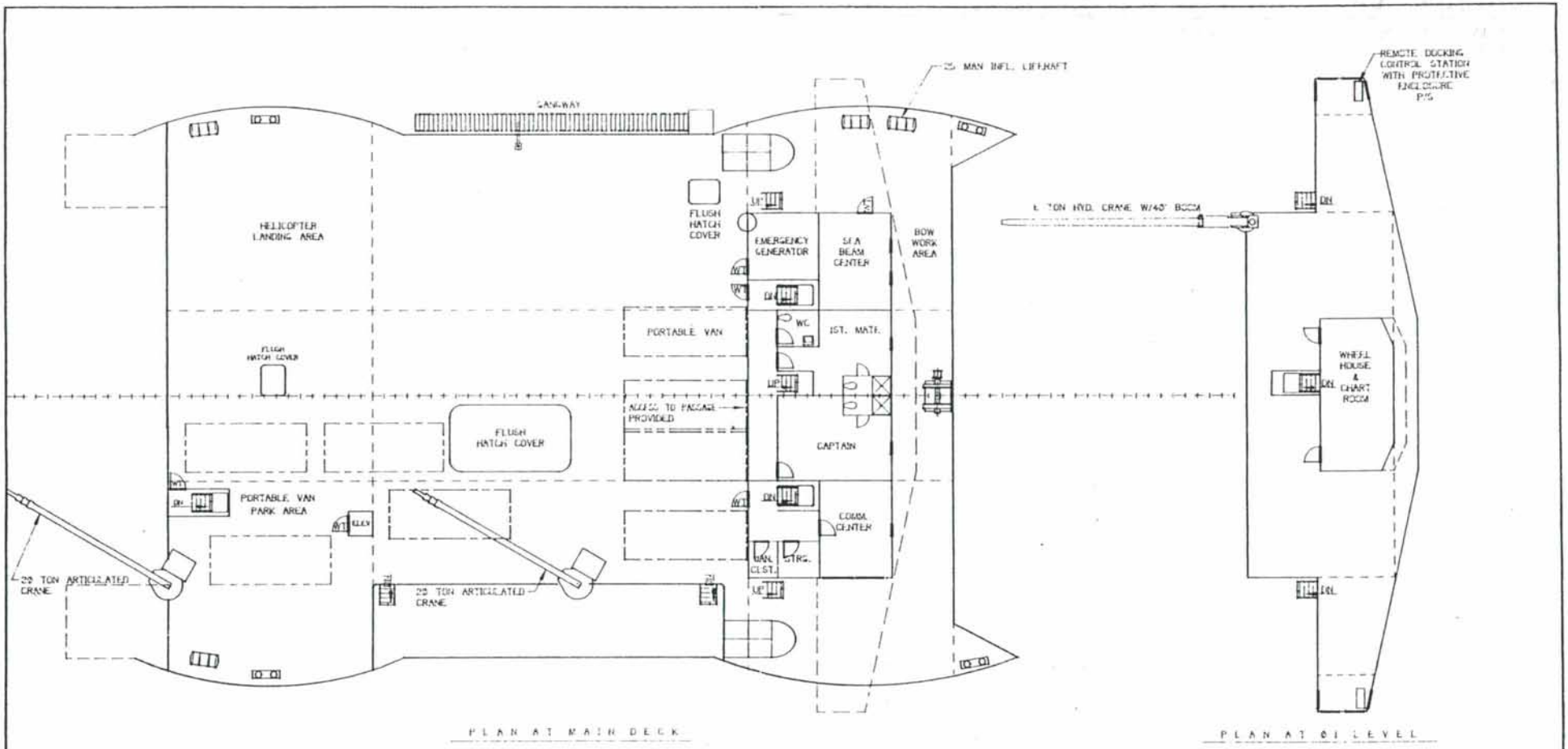

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1	GENERAL REVISION	4/93	FES		

EXAMINED BY	SIGNATURE
DRAWN	EEE
CHECKED	FES
ENGINEER	EJT
APPROVED	FES
DATE	7/85

UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

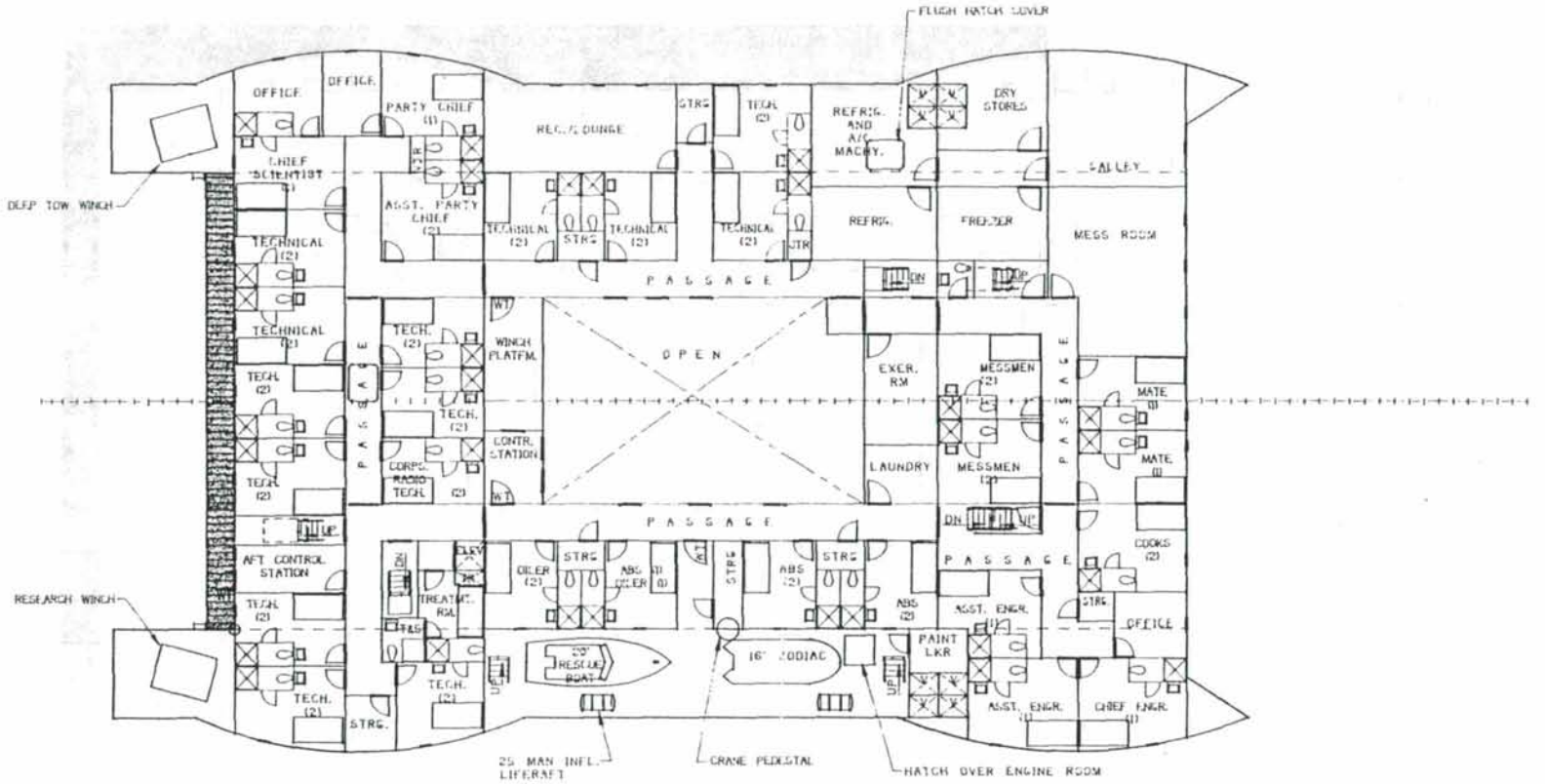
Blue Sea McClure

14900 CORNERSTONE VILLAGE DR. SUITE 307
HOUSTON, TEXAS, 77014

SEMISUBMERGED OCEANOGRAPHIC RESEARCH SHIP

GENERAL ARRANGEMENT
MAIN DECK AND 01 LEVEL

SCALE: INT. GRP. PLAN NUMBER SHEET 1 OF 1 REV



PLAN AT 2ND. DECK

NO.	DESCRIPTION	DRAWN APPROVED DATE	BY	JOB NO. / DRAWING NO. ADD.	DEV.
1	GENERAL REVISION	4/10	FFS		

EXAMINED	
BY	SIGNATURE
DRAWN	E.E.E.
CHECKED	F.F.S.
APPROVED	F.J.T.
APPROVED	F.F.S.
DATE	3/84

UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

Blue Sea McClure

14300 CORNERSTONE VILLAGE DR. SUITE 317
HOUSTON, TEXAS 77014

SEMISUBMERGED OCEANOGRAPHIC RESEARCH SHIP

GENERAL ARRANGEMENT
2ND. DECK

SCALE	WEIGHT (lbs)	DRAWING NUMBER	SHEET 1 OF 1	REV.
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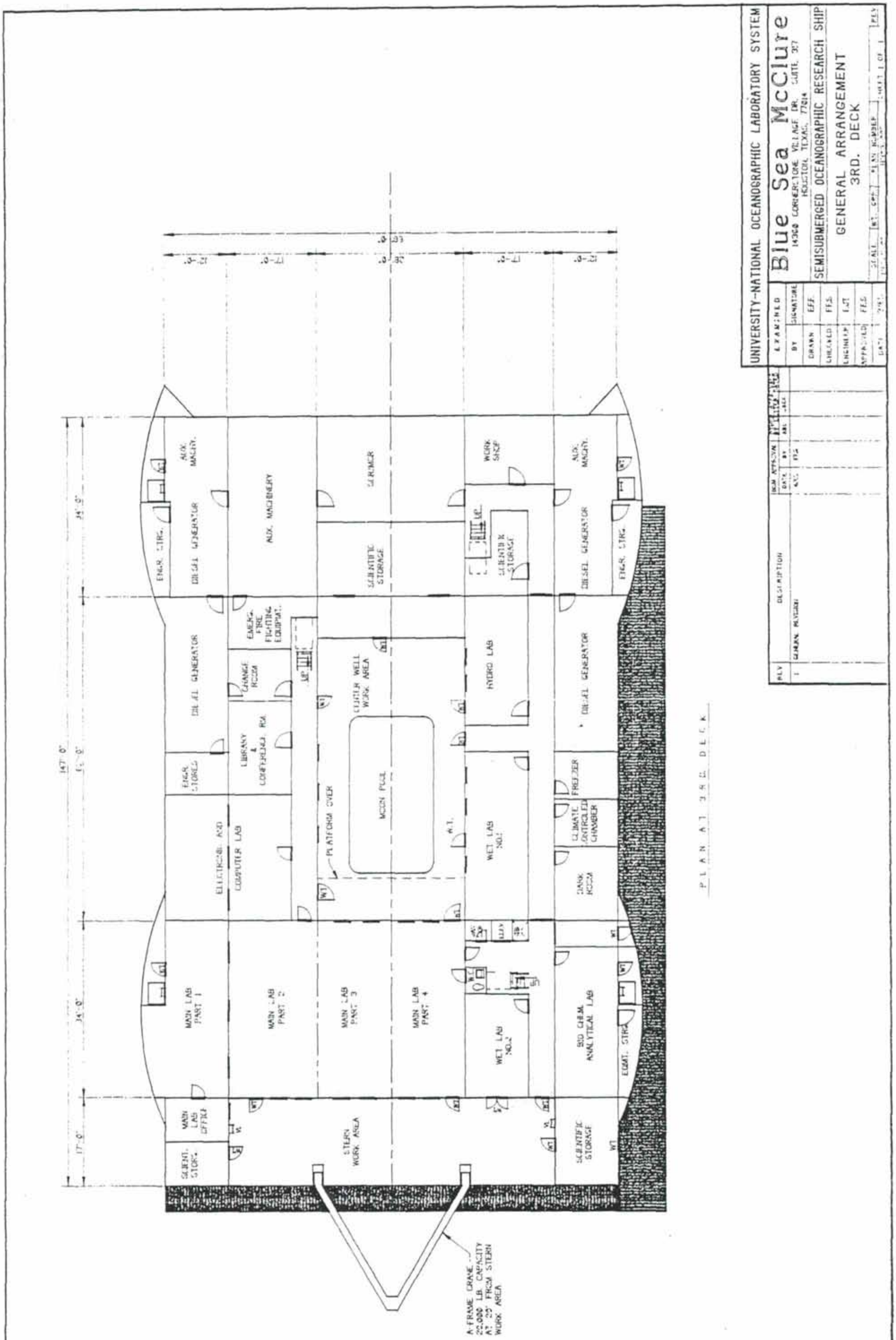

UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM
Blue Sea McClure
HOUSTON, TEXAS
SEMISUBMERGED OCEANOGRAPHIC RESEARCH SHIP
GENERAL ARRANGEMENT
3RD. DECK
PLAN AT 3RD DECK
147'-0"
34'-0"
17'-0"
AUX. MACHY.
DIESEL GENERATOR
EMER. STRG.
AUX. MACHINERY
SCIENTIFIC STORAGE
WORK SHOP
EMERG. FIRE FIGHTING EQUIPMT.
CHANGE ROOM
LIBRARY & CONFERENCE RM.
EMER. STORES
ELECTRONIC AND COMPUTER LAB
CENTER WELL WORK AREA
MOON POOL
PLATFORM OVER
HYDRO LAB
WET LAB NO.1
FREEZER
CLIMATE CONTROLLED CHAMBER
DARK ROOM
MAIN LAB PART 1
MAIN LAB PART 2
MAIN LAB PART 3
MAIN LAB PART 4
WET LAB NO.2
BIO CHEM. ANALYTICAL LAB
EQMT. STRG.
MAIN LAB OFFICE
SCIENT. STOR.
STERN WORK AREA
A-FRAME CRANE 20,000 LB. CAPACITY AT 25' FROM STERN WORK AREA

FEASIBILITY STUDY

AG(X)

DESIGN OF A LARGE OCEANOGRAPHIC RESEARCH SHIP

SWATH

NAVAL SEA SYSTEMS COMMAND

PRELIMINARY DESIGN DIVISION

AUGUST, 1985

NAVAL SEA SYSTEMS COMMAND

August 1985

AG(X) FEASIBILITY STUDY

SWATH DESIGN SUMMARY

SHIP CHARACTERISTICS - The general characteristics of the baseline SWATH AG(X) are given in Table 4.1. The inboard profile is presented in Figure 4.1. This profile is basically constant for all the variants investigated.

The variations of the baseline assessed the impact of reduced endurance, reduced transit speed, addition of airborne noise enclosures, no SURTASS capability, Navy vs. Coast Guard stability requirements, and the presence or absence of a centerwell. The results are summarized in Table 4.2.

OVERALL SHIP DESCRIPTION

General Arrangements Description - The general arrangements of all variants of the SWATH AG(X) are similar, with the exception of the centerwell variant. Arrangement drawings of the centerwell variant have not been developed. The arrangement sketches of the baseline are shown in Appendix F.

The SWATH AG(X) has most of its arrangeable space in the box and first level of deckhouse. The box contains the living spaces, messing spaces, and auxiliary machinery. The deckhouse contains the scientific laboratories and offices.

Scientific Spaces - The main deck is the scientific deck. The main laboratory is subdividable, convenient to both side and aft working decks and out of the flow of traffic. The wet lab and hydro lab are aft of the main lab. The labs that do not work with specimens, such as the computer lab and darkroom, are located forward of the main lab. The laboratory space breakdown, as received from UNOLS operators, is shown in Table 3.3.

Manning and Accommodations - A ship's complement of 25 men has been assumed based on USCG regulations and the design of the T-AG.

In addition, the TOR calls for a scientific complement of 35 Scientists, mixed men and women, housed in 15 double and five single staterooms. Further, there is one spare double stateroom.

The total number of staterooms is 27 doubles and 7 singles, of which one of the doubles is spare.

All staterooms are located on either the main deck or the second deck and all have a port hole.

The accommodation standards are based on recently constructed oceanographic research ships. Thus, the space allocation for habitability spaces is comparable to those found on other University National Oceanographic Laboratory System (UNOLS) designs. These accommodations exceed USN standards and are significantly less than Military Sealift Command (MSC) requirements.

Common messing facilities are provided for officers, crew and scientists.

TABLE 4.1 - SWATH BASELINE PRINCIPAL CHARACTERISTICS

DIMENSIONS (FEET)

Length Overall	332.8
Length on Waterline	246.0
Length Between Perpendiculars	246.0
Length of Lower Hull	332.8
Beam, Maximum	82.0
Beam, Waterline	78.0
Beam, Main Deck	82.0
Depth to Main Deck	47.2
Draft, Full Load	23.0
Air Gap, at F.P.	14.0
Air Gap, Amidships	10.0
Air Gap, at A.P.	14.0
Freeboard, Main Deck	24.0

PERFORMANCE

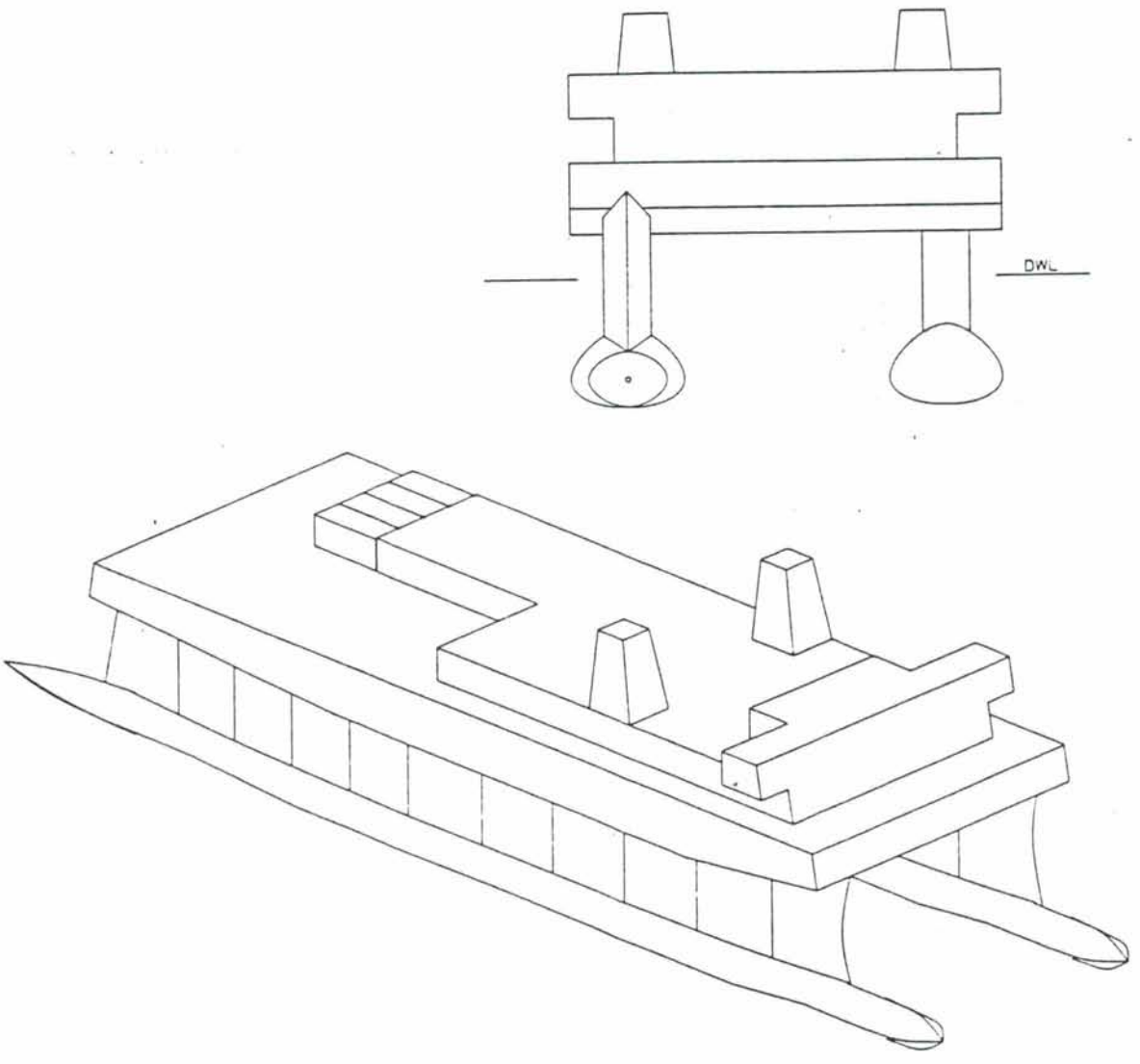
Sustained Speed, Free Route, (Kts)	17.7
Endurance Speed, (Kts)	15.0

MANNING

	Manning	Accommodations
Officers	5	5
Crew	20	20
Senior Scientists	2	2
Scientists	33	34

WEIGHT, LONG TONS

Displacement, Full Load	5037.5
Displacement, Light Ship	3552.2
Hull Structure	1783.9
Propulsion	286.1
Electric Plant	105.7
Communication and Control	24.3
Auxiliary Systems	518.8
Outfit and Furnishings	369.0
Armament	1.1
Margin	463.3



DEPARTMENT OF THE NAVY		WASHINGTON, D.C. 20362		
NAVAL SEA SYSTEMS COMMAND				
AG(X) SWATH				
SIZE	FSCM NO.	SHEET	NAVSEA DRAWING NO.	REV
-	53711			
SCALE				SH. OF

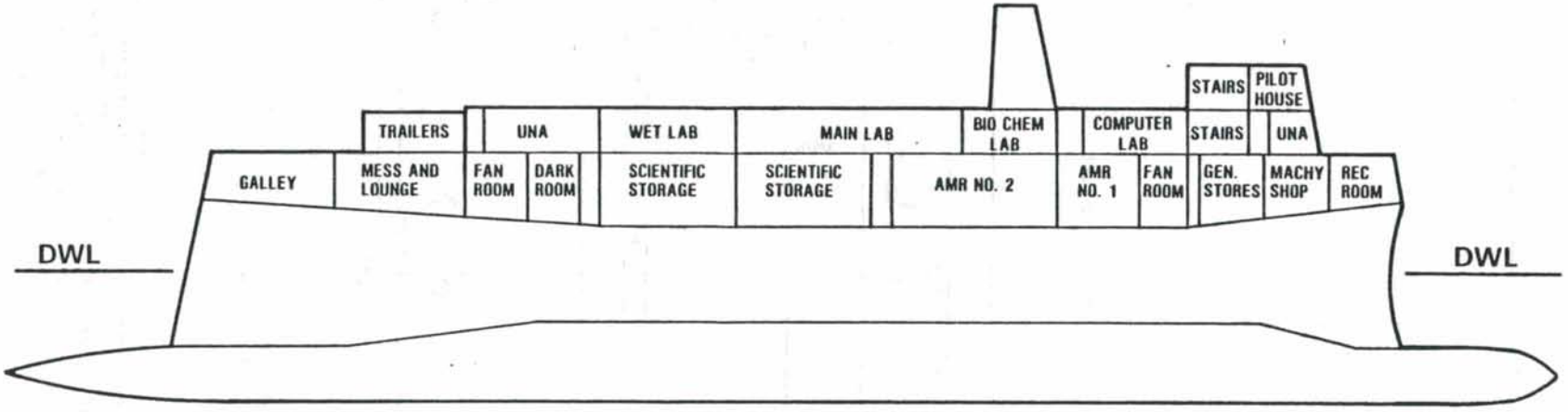
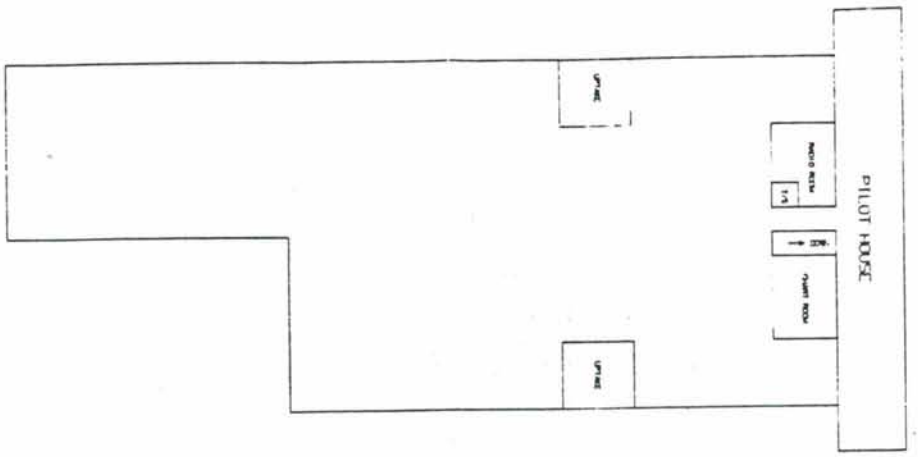
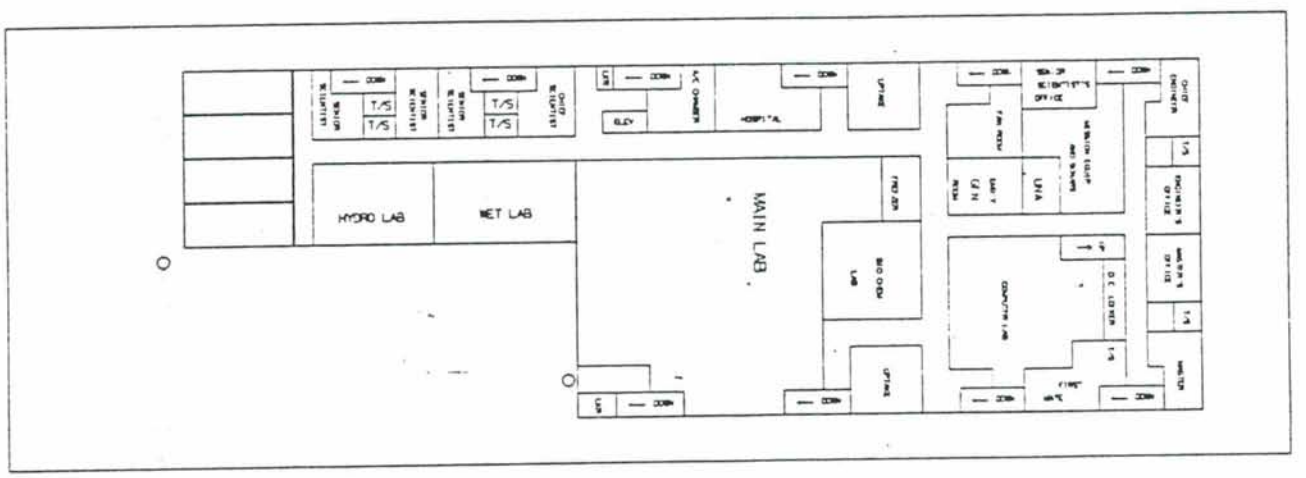


Figure 4.1. Baseline SWATH Inboard Profile

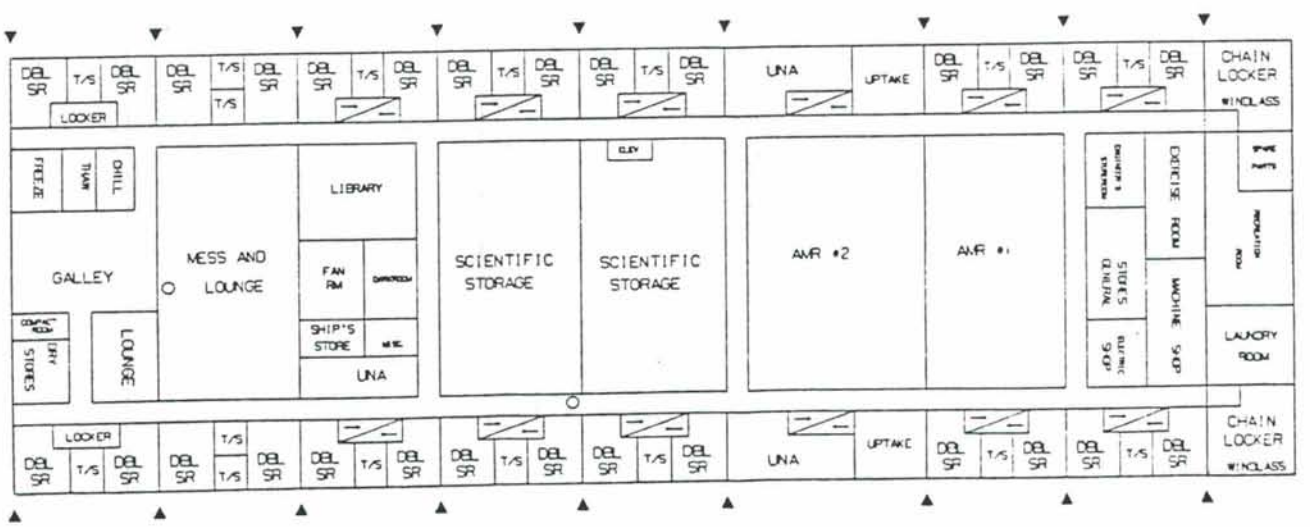


O
LEVEL

SWATH AG(X) General Arrangements. Scale: 1" = 32 ft.



MAIN
DECK



FIRST
DECK

TABLE 4.1 - SWATH BASELINE PRINCIPAL CHARACTERISTICS (Cont'd)

MISSION DECK SYSTEMS

1 Knuckle Boom Crane
1 Fixed Boom Crane
3 Winches
1 Stern A-Frame
1 Core Sampler A-Frame

PROPULSION PLANT

2 Caterpillar 3616, 6000 BHP
2 500 kW Electric Motors

ELECTRIC PLANT

4 Caterpillar 3416, 1100 kW each Ship Service Generators
1 Caterpillar 3406, 250 kW Emergency Generator

The SWATH AG(X) is of all steel construction. The structural design was the result of work performed at DTNSRDC. The resulting ship structure consists of three major components, all transversely framed: the lower hulls, the struts, and the box. The midship section structure is depicted in Figure 4.2.

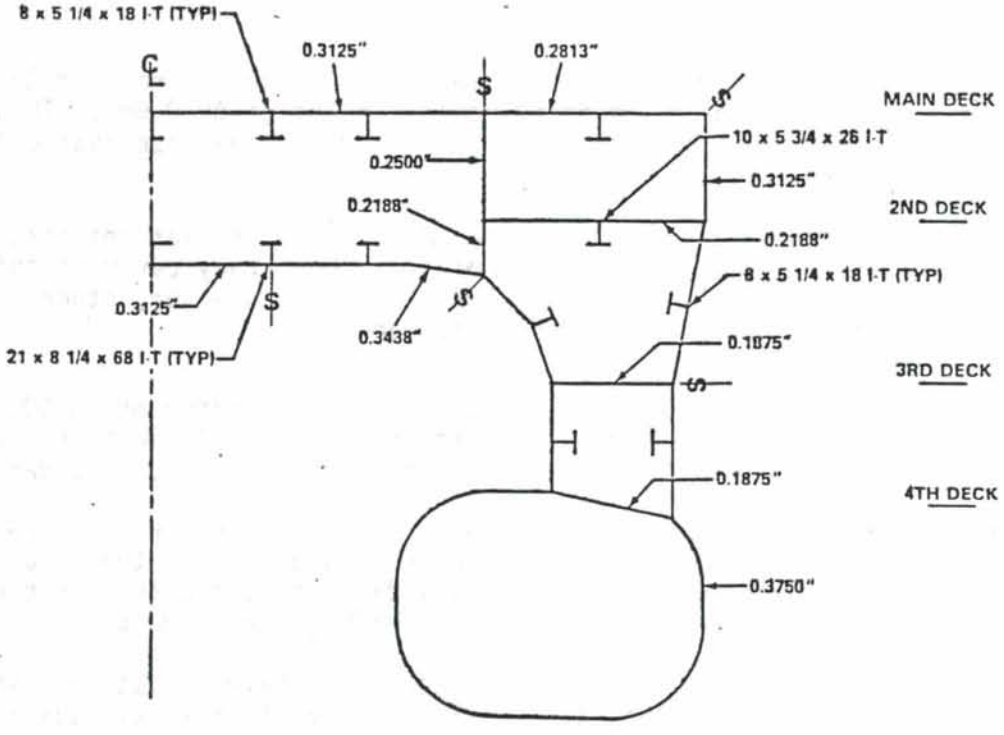


Figure 4.2. Midship Section of SWATH Structure

Plant Selection - The combined electric/mechanical propulsion plant was chosen as the baseline for the machinery plant feasibility investigations, based on the following advantages:

- o Ease of arrangement.
- o Operational Flexibility - both high-speed and low-speed loiter conditions are satisfied, with additional benefit of variable speed choice throughout the range of speeds.
- o Lower Noise Signature than the CODOD plant at loiter speeds.

For all variants, the propulsion plant consists of a twin screw combined mechanical/electrical drive system. For each shaft, a main propulsion diesel and loiter propulsion motor are coupled to a reverse reduction gear connected by shafting to the fixed pitch propeller. Power for both loiter motors is provided from a single Ship Service Diesel Generator (SSDG).

Two machinery options were developed to identify the impact of variation in the requirements. The same high speed/low speed machinery components are used for the SWATH and new construction monohull studies. These options are summarized below.

The high-speed propulsion plant consists of one 6000 BHP main propulsion diesel engine and one electric 650 BHP (500 kW) DC motor geared to each shaft. The DC motors are powered through a SCR system located in the AMR. This plant is incorporated in the baseline and in all the variants except the low-speed variant.

The low-speed variant propulsion plant replaces the main propulsion engines with 2125 BHP diesel engines in the same arrangement as the high-speed variant.

Baseline - The baseline transit speed diesels are Caterpillar 3616. These engines are high-power density engines rated at 6000 BHP. These are the only U.S. manufactured engines of this physical size available in this power range.

Low Transit Speed Variant - The low transit speed variant offers a wider range of choices of propulsion diesel. For study purposes this variant used two Fairbanks/Morse 3D38 1/8 engines; however, other diesels are available in this power range and size range.

Endurance Fuel Calculations - The TOR requires a range of "8,000 to 12,000 nautical miles at 15 knots, plus ten percent, or 7,500 to 9,500 nautical miles at 15 knots plus 29 days on station at zero speed, plus ten percent."

The different endurance fuel loads of the SWATH Baseline are shown in Table 4.3. Based on discussions with the working Group SCIB, the endurance value of 8500 nautical miles at 15 knots plus 29 days stationkeeping plus 10 percent was selected. All but two of the SWATH variants meet this endurance.

Since the low speed SWATH AG(X) does not have a sustained speed of 15 knots, its fuel load is based on 8,500 nm at 12.5 knots (sustained speed for this variant) plus 29 days on station, plus ten percent.

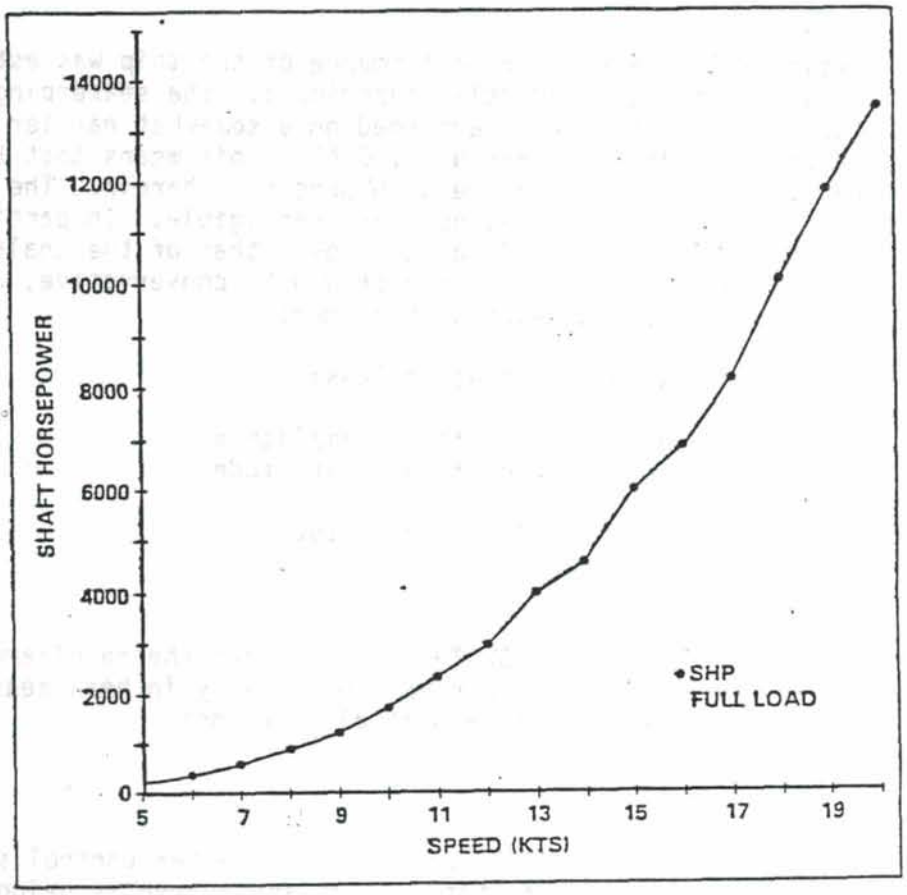


Figure 4.3. Speed/Power Curve AG(X) SWATH

Electric Plant (SWBS 300) - All SWATH AG(X) variants have the same electric plant because none of the variations significantly affect electric loads. The electric plant arrangement is shown in Appendix G. The AG(X) electric plant consists of three Caterpillar 3516 diesel generator sets rated for approximately 1135 kW each. For the purpose of this feasibility study, the manufacturer's commercial rating of 1135 kW has been used on the premise that the future uprating of the engine will result in an acceptable Navy rating of at least 1135 kW electrical output.

Hull Form - All versions of the SWATH AG(X) use the same basic hull form. Its dimensions were adjusted to give the desired displacement. The hull form was developed by Mr. G. Robert Lamb of DTNSRDC. The form is a simple single bulged type shape. The hull incorporates simple cylindrical and conic shapes to maximize producibility. The hull cross section is elliptical, with a ratio of major to minor axes of 1.4:1.

The struts are also simple in shape. They have no cant or taper. The strut axis is parallel to ship centerline.

Seakeeping - The seakeeping performance of the ship was estimated using established computer predictive techniques. The seakeeping analysis, like the stability analysis, was performed on a somewhat earlier version of the ship, which had a displacement of 4100 LT. This means that the ship that was analyzed is not exactly the ship presented herein. The effect of the differences on seakeeping are, however, negligible. In particular, the increase in displacement of the final ship over that of the analyzed ship means that the results presented herein should be conservative, as seakeeping generally improves with displacement.

The seakeeping criteria used were as follows:

Roll	8 degrees significant amplitude
Pitch	3 degrees significant amplitude
Acceleration at Bridge	0.4 G significant amplitude
Deck Wetness	30 per hour
Slamming	20 per hour

The seakeeping results show the SWATH AG(X) to meet the requirements with active control. The ship has 99 percent operability in head seas. The ship is fully operable in Sea State 6 at all headings.

Maneuvering - The SWATH AG(X) uses inclined after control surfaces for maneuvering. Model tests of this concept are currently being performed by DTNSRDC.

No bow or stern thrusters are included in the design. The 66 foot separation between the propeller shafts should give enough steering torque to permit dynamic positioning without using thrusters. This, however, will need to be evaluated with model tests in the next stage of design.

FEASIBILITY STUDY

AG(X)

Design of a Large Oceanographic Research Ship

MONOHULL

Naval Sea Systems Command

Preliminary Design Division

August, 1985

NAVAL SEA SYSTEMS COMMAND

AG(X) FEASIBILITY STUDY

NEW CONSTRUCTION MONOHULL DESIGN SUMMARY

SHIP CHARACTERISTICS - The baseline monohull design and associated trade-offs are summarized and compared in this section. Note that the trade-offs on the baseline designs are permutations of the baseline and not stand alone designs.

The characteristics of the baseline new construction monohull are given in Table 3.1. The inboard profile of the variant with no acoustic enclosures over the diesels is given in Figure 3.1. This profile is similar for all the variants investigated.

The variations of the baseline studied assessed the impact of reduced transit speed, no airborne noise enclosures and no SURTASS capability. The results are summarized in Table 3.2.

OVERALL SHIP DESCRIPTION

General Arrangements Description - The general arrangements of all variants are similar. The major exception is that the variant with no enclosures has a shorter machinery box because of the space savings from eliminating the enclosures. This translates into 11 feet shorter ship length between perpendiculars. The basic compartmentation arrangement is the same for all variants. The arrangement sketches are shown in Appendix A. The new construction monohull has its machinery box located midships with the working deck aft.

Scientific Spaces - The main deck is the scientific deck. Most of the laboratories are located on this deck. UNOLS had requested a centralized subdividable lab space so that the lab area could be reconfigured as required by different missions. The laboratory space breakdown, as received from UNOLS operators, is shown in Table 3.3.

Manning and Accommodations - A ship's complement of 25 men has been assumed based on USCG regulations and the design of the T-AG.
as follows:

The crew will be accommodated in 14 staterooms, of which 11 are doubles and 3 are singles. In addition, the TOR calls for a scientific complement of 35 scientists, mixed men and women. These are accommodated in 15 double and five single staterooms. The total number of staterooms is 27 doubles and 8 singles of which one of the doubles is a spare.

Ice Strengthening - Three recent Navy designs have been built to Class C ice strengthening; the T-AGOS 1, T-AO 187, and the ARS 50. Class IC is a more stringent requirement than Class C. It was specifically developed for operations in the Baltic Sea and is based on Finnish-Swedish Ice Navigation Rules. The relative differences between Class C and IC are difficult to quantify at this stage of design because the Class IC calculations require detailed data to determine the impacts on the ice related sub-systems. At this stage of design the relative differences between the two classifications are negligible.

TABLE 3.1. NEW CONSTRUCTION MONOHULL BASELINE PRINCIPAL CHARACTERISTICS

DIMENSIONS (FEET)

Length on Water Line	311.0
Beam on Water Line	52.0
Depth to Main Deck	24.0
Draft	17.7

PERFORMANCE

Sustained Speed (80% SHP)	19.3 kts

MANNING

Officers	10
Crew	15
Scientists	35

WEIGHT, LONG TONS

Displacement, Full Load	3929.9
Displacement, Light Ship	2918.6
Hull Structure	1681.5
Propulsion	210.0
Electric Plant	135.4
Communication and Control	22.5
Auxiliary Systems	316.7
Outfit and Furnishings	238.7
Armament	1.1
Margin	312.7

MISSION DECK SYSTEM

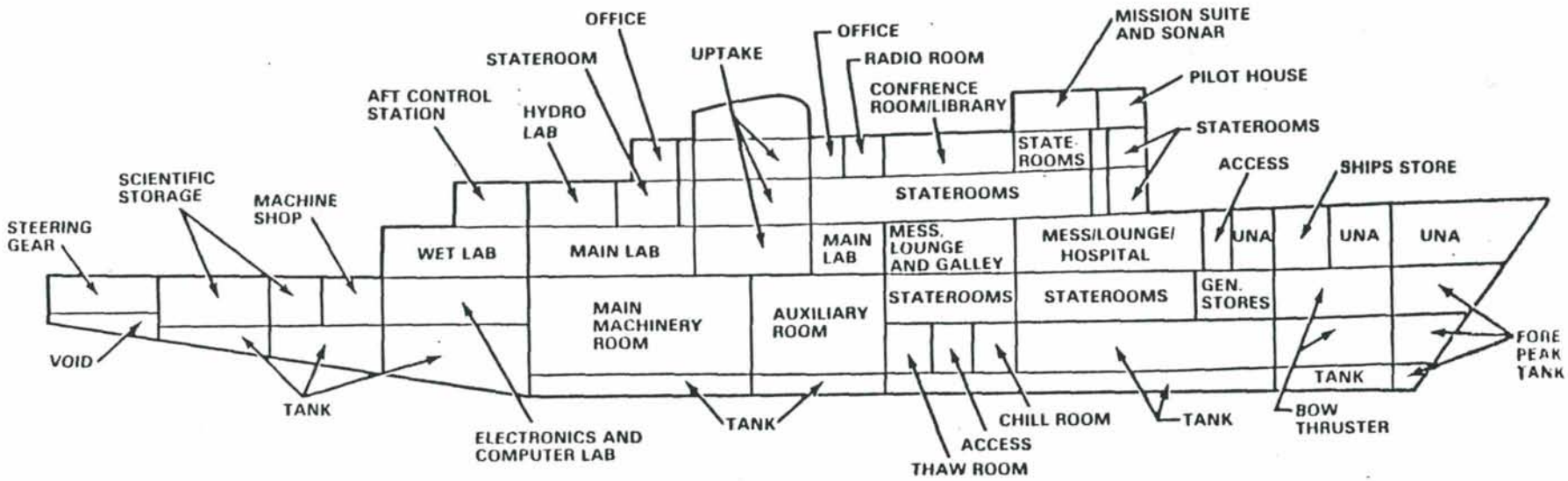
1 Knuckle Boom Crane
1 Fixed Boom Crane
3 Winches
1 Stern A-Frame
1 Core Sampler, A-Frame

PROPULSION PLANT

2 Caterpillar 3616, 6000 BHP
2 500 kW Loiter Motors

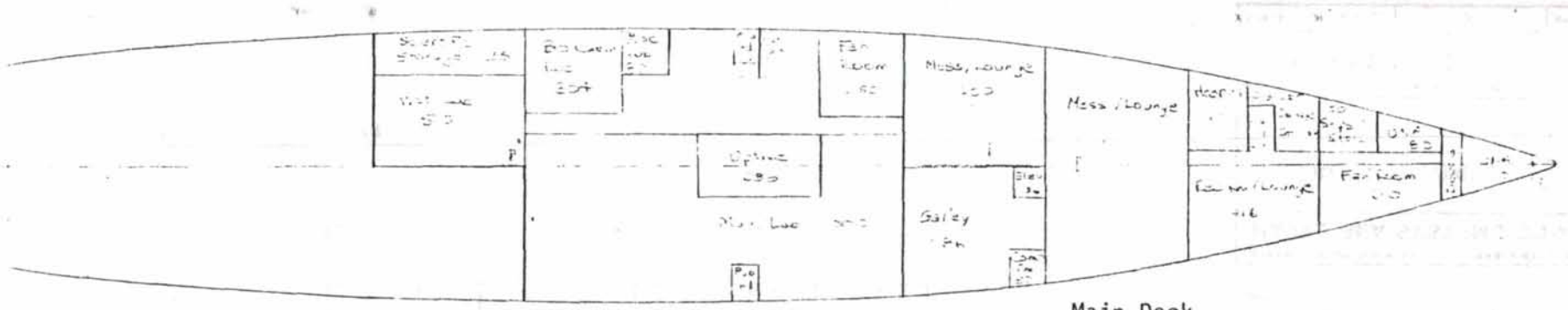
ELECTRIC PLANT

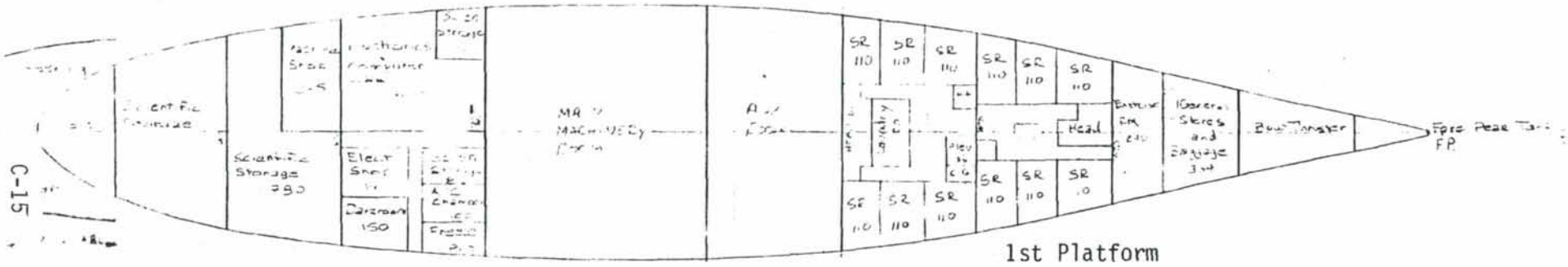
3 Caterpillar 3516, 1135 kW each
1 250 kW Emergency Diesel Generator
SCRs for Propulsion Motors



C-14

ENGINEER		DEPARTMENT OF THE NAVY WASHINGTON, D.C. 20362
SR. HEAD		NAVAL SEA SYSTEMS COMMAND
DIV. HEAD		
TASK GROUP MGR.		
GROUP DIR.		AG(X) MONOHULL
SHIP DES. MGR.		
SHIP DESIGN GROUP DIR.		
NAVSEA APPROVED DATE		
NAVSEA 05 APPROVED DATE	SIZE H	FSCM NO. 53711 / SHEET / NAVSEA DRAWING NO. / REV
PROJ. MGR. APPROVED DATE	SCALE 1/16" = 1'-0"	4/11/85 / SHL. OF

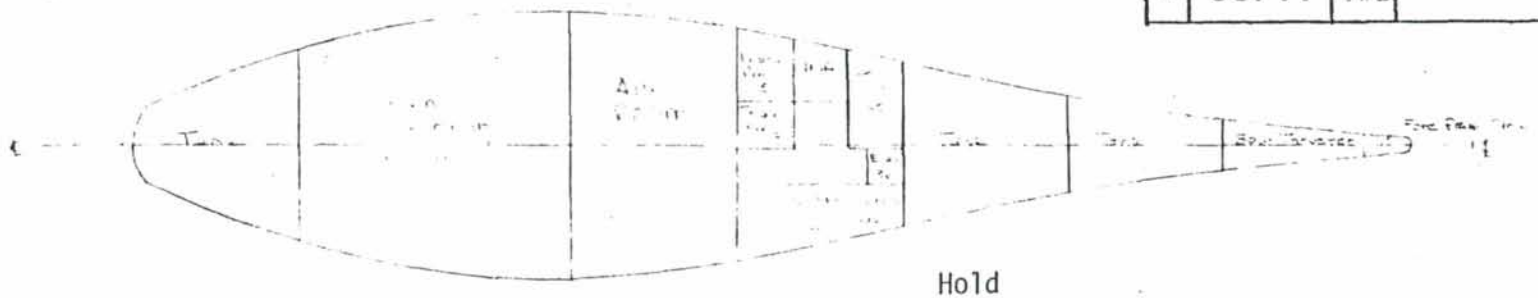


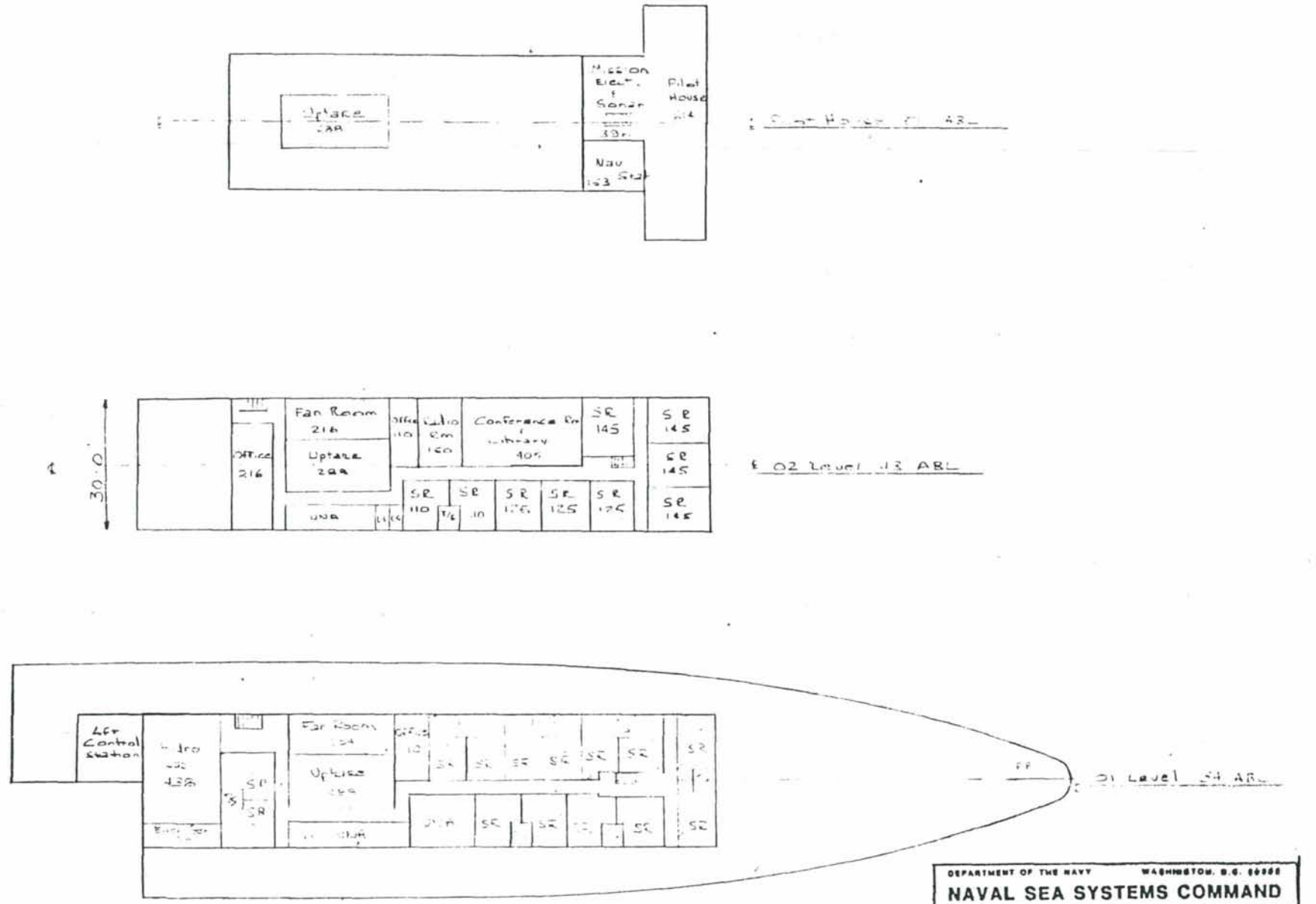


C-15

Scale: 1" = 32 ft. (approx)

DEPARTMENT OF THE NAVY — WASHINGTON, D.C. 20362				
NAVAL SEA SYSTEMS COMMAND				
AG(X) MONOHULL				
SIZE	FSCM NO.	DWGD	NAVSEA DRAWING NO.	REV
H	53711			





Scale: 1" = 32 ft.

DEPARTMENT OF THE NAVY — WASHINGTON, D.C. 20362				
NAVAL SEA SYSTEMS COMMAND				
AG(X) MONOHULL				
SIZE: H	FSCM NO.: 53711	SWBS: 400	NAVSEA DRAWING NO.:	REV
SCALE: 1" = 1'-0"		4/11 B5	SH. OF	

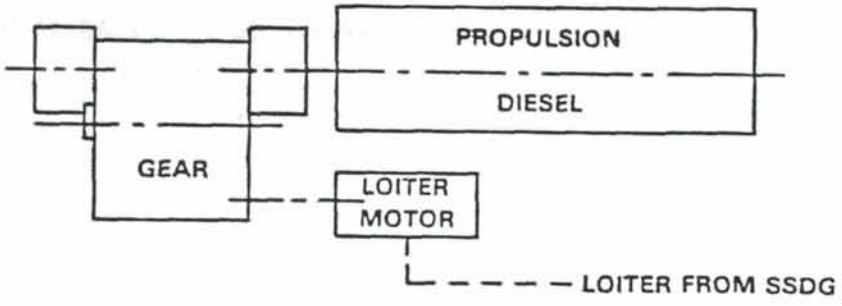
TABLE 3.3. SCIENTIFIC SPACE REQUIREMENTS

Main Lab	2000 ft^2
Hydro Lab	300
Wet Lab	400
Biochem Lab	300
Electronics/Computer Lab	600
Photo Lab	150
Climate Controlled Room	100
Freezer	80
Misc Lab Space	70
Total Lab Space	4000 ft^2
Scientific Stores	2000 ft^2
Total Enclosed Space	6000 ft^2
Van Storage	700 ft^2
Open Deck Working Area	2900 ft^2
Total Open Deck Area	3600 ft^2

Plant Selection - The combined electric/mechanical propulsion plant has been chosen as the baseline propulsion plant for use in the machinery plant feasibility investigations based on the following advantages:

- o Ease of arrangement.
- o Operational Flexibility - both transit speed and low speed tow (loiter) conditions are satisfied, with additional benefit of variable speed choice throughout the range of speeds.
- o Lower Noise Signature than the CODOD plant at loiter speed.

Two propulsion plants were developed comprising a trade-off on transit speed for both variants. The propulsion plant consists of a twin screw combined mechanical/electrical drive system. On each shaft, a main propulsion diesel and loiter propulsion motor are coupled to a reverse reduction gear connected by shafting to the fixed pitch propeller.



COMBINED ELECTRICAL/MECHANICAL DRIVE

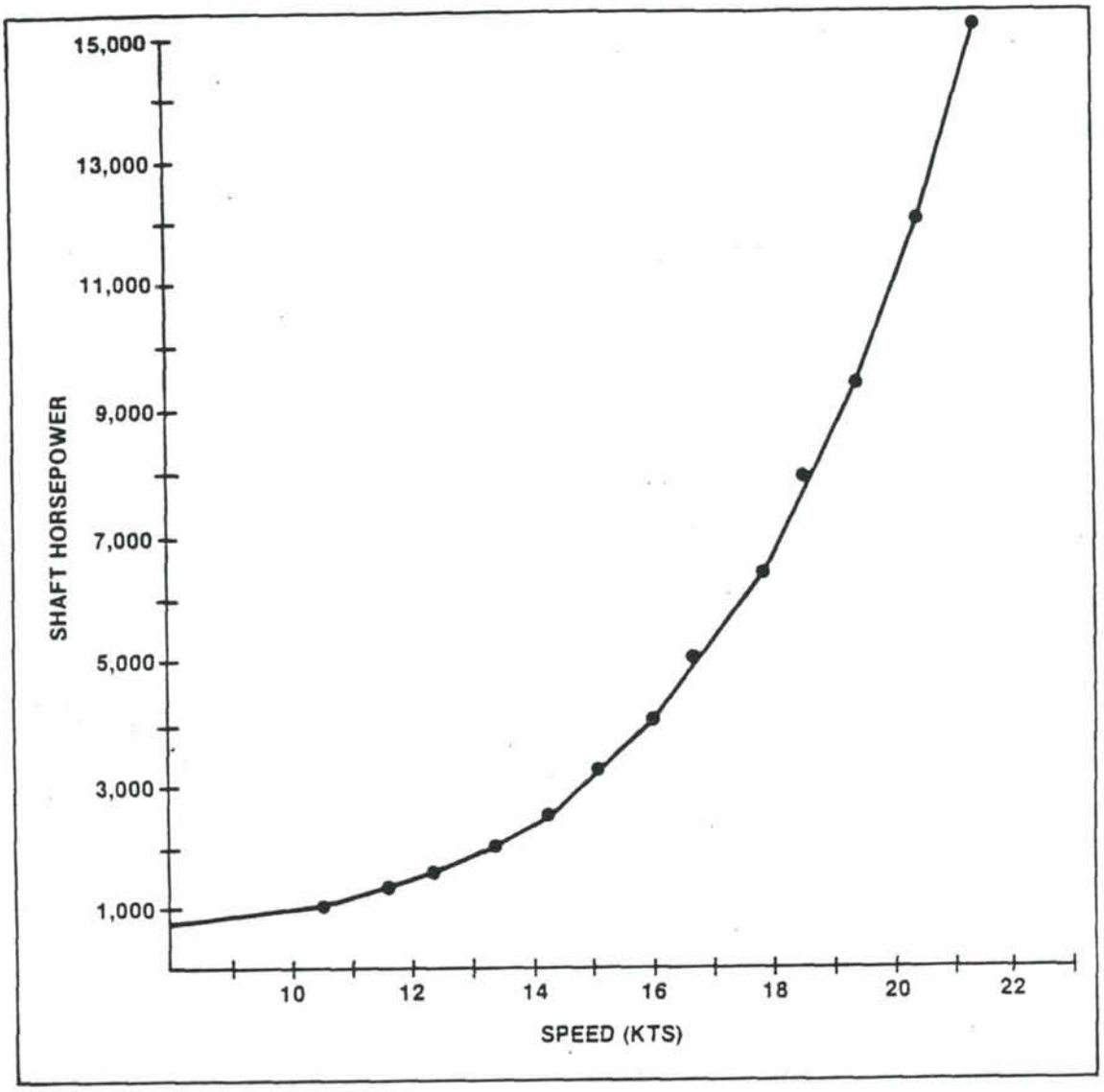


Figure 3.3. Speed/Power Curve for AG(X) Monohull

TABLE 3.5 MISSION DECK EQUIPMENT

QTY	ITEM	CAPACITY
1	A-Frame, Core Sampler	30,000 lb
1	Davit, Core Head Universal	30,000 lb
1	Davit, Core Sampler	2,100 lb
1	Core Sampler Shelf Assembly	
1	Core Sampler	
1	* Winch, Trawl-Core	40,000 ft 9/16 wire
1	* Winch	30,000 ft .68m cable
1	* Winch	30,000 ft 3/8 cable
1	A-Frame, Stern	30,000 lb
1	Crane, Fixed Boom	36,000 lb 60 ft outreach
1	Crane, Knuckle Boom	22,000 lb 40 ft outreach

* Remove with installation of SURTASS.

\# Applicable for all studies.

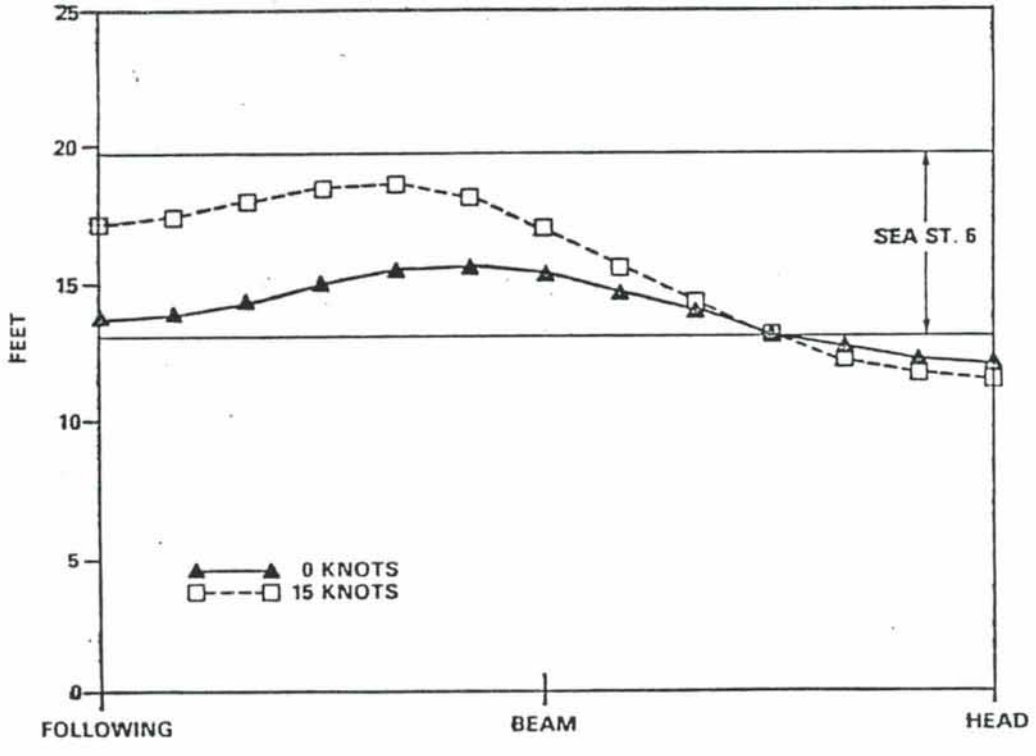


Figure 3.6. Limiting Significant Wave Height - New Construction Monohull Baseline

Maneuvering - The TOR requires a dynamic positioning system to maintain maneuverability and keep station within a 300 ft radius watch circle at best heading through SS5 with a 3 kt current. No maneuvering analysis was performed at this stage of design. However, the baseline and all variants have twin screws and a bow thruster as is typical of oceanographic ships. As discussed in Section 3.3.1, Radiated Noise, the bow thruster in the design is a 600 HP tunnel thruster. This type of thruster can degrade sonar performance through flow noise. The type of thruster and more detailed sizing will be studied in the next stage of design when model tests are performed.

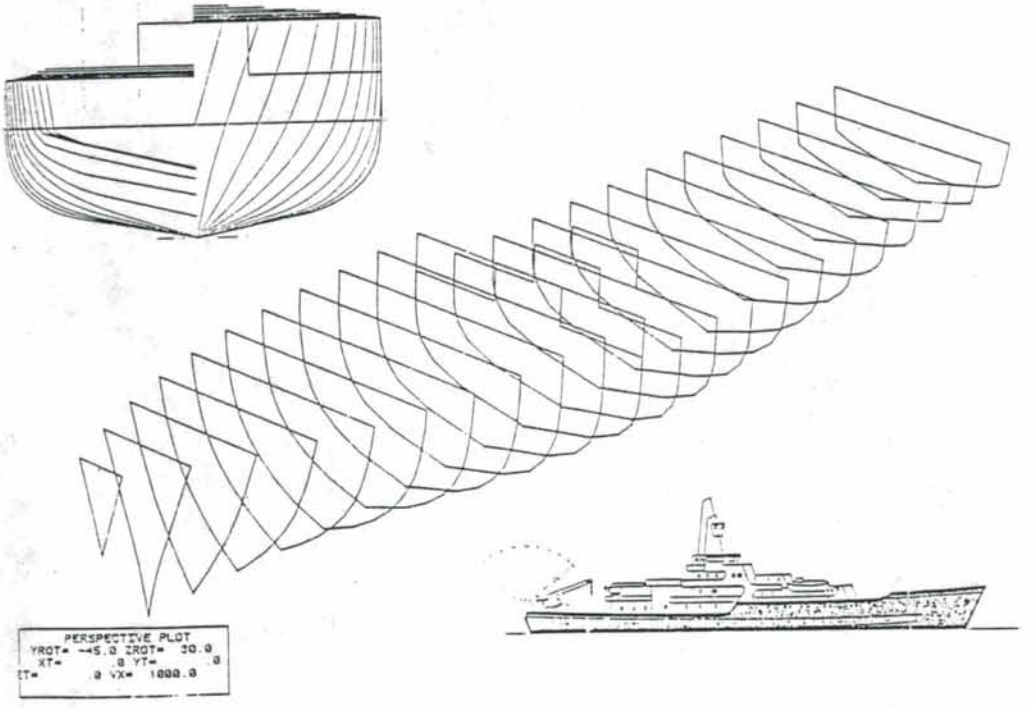
Summary

Conceptual Design

Of

LARGE HIGH ENDURANCE

OCEANOGRAPHIC RESEARCH SHIP

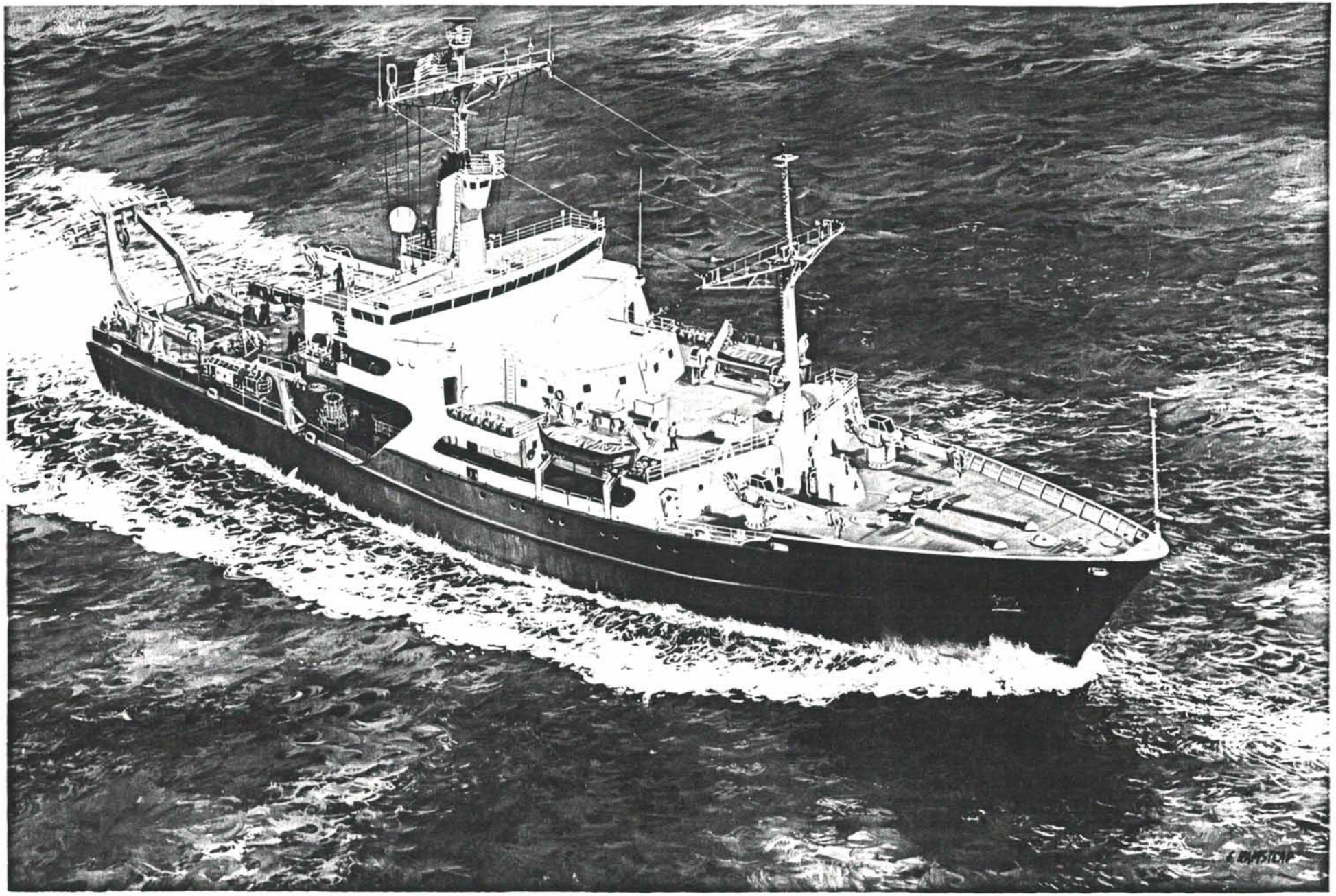


Design WO 8506
Dec. 1985

Jonathan Leiby
Staff Naval Architect
Woods Hole Oceanographic Institution

Chrys Chryssostomidis
Prof. of Naval Architecture
Massachusetts Institute of Technology

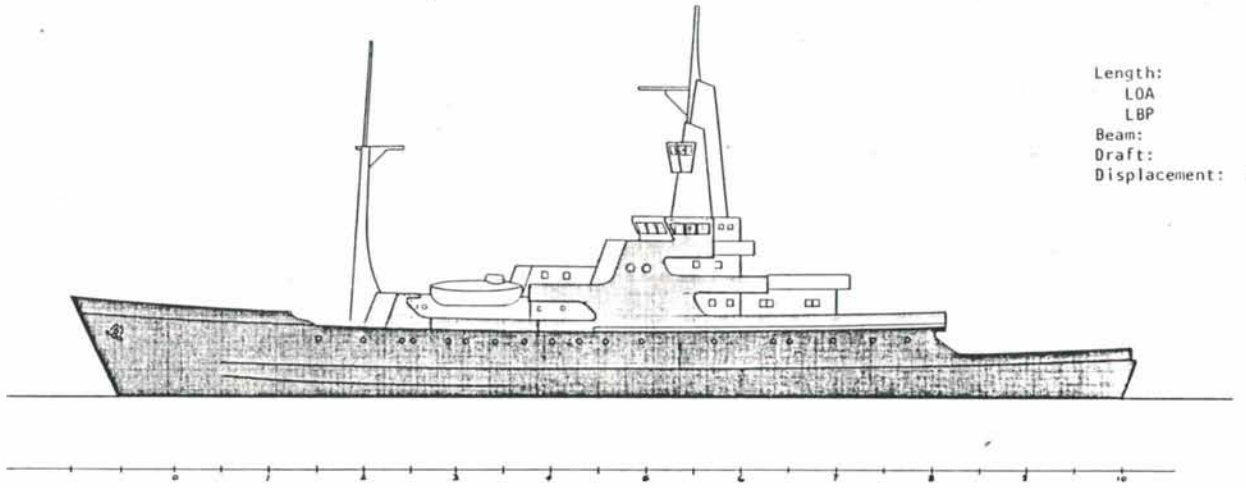
CONCEPTUAL DESIGN - LARGE HIGH ENDURANCE RESEARCH SHIP NECOR PROJ. WO 8506



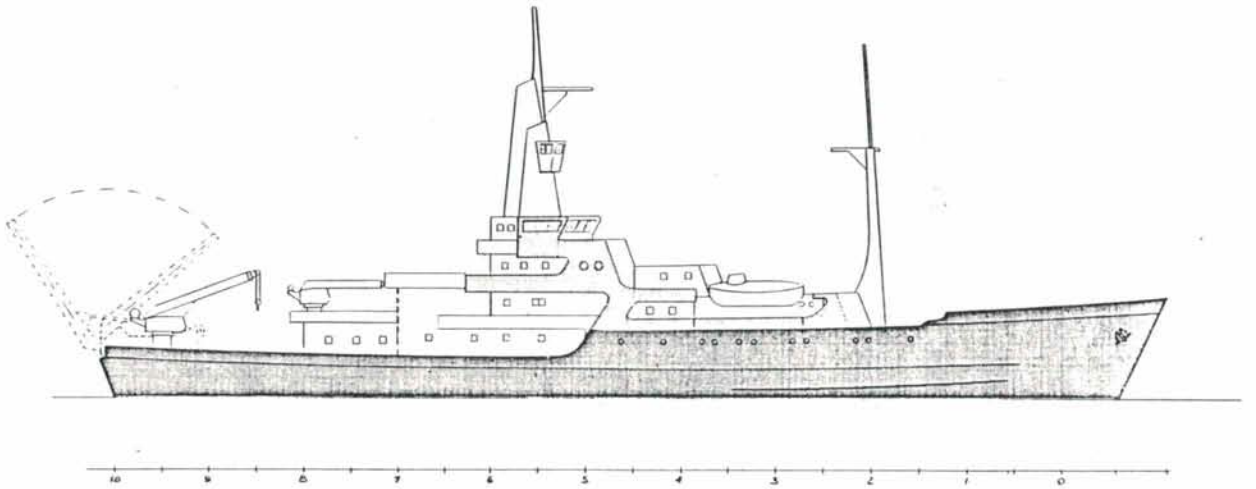
PRELIMINARY CHARACTERISTICS

LENGTH	275 L.B.P.	290 L.W.L.	310 L.O.A.	(84.0 M)
BEAM			68 Ft.	(20.8 M)
DEPTH			30 Ft.	(9.2 M)
DRAFT			21 Ft.	(6.4 M)
DISPLACEMENT			5840 Long Tons	
GROSS TONNAGE			1600 Gross Tonns	
MAX SPEED			18 Knots	
CRUISING SPEED			16 Knots	
ENDURANCE			60 Days	
RANGE		12,000 (20,000 Km) @ 16 Knots		
POWER (Diesel Electric SCR)		6800 SHP, 8000 total installed HP		
COMPLEMENT		35 Scientific, 26 Officers and Crew		

EQUIPMENT	SINGLE DRUM CORING WINCH TWO DRUM TRACTION WINCH HYDRO - ACOUSTIC WINCH (2) A - FRAME AT STERN (40 Ft) TRAWL CRANE (AFT QUARTER) MEDIUM CRANE HYDRO - BOOM AMIDSHIPS POWER AND DECK AREA FOR PORTABLE VAN LABS (8), GEOPHYSICAL SURVEY SYSTEM, HELIO PLATFORM, ETC. DYNAMIC POSITIONING SYSTEM MULTI-BEAM SOUNDING SYSTEM
STABILIZATION	ANTI-ROLL TANK PLUS ACTIVE FINS.



Length:		Cruise Speed:	15 Knots
LOA	310 Ft.	Range:	12,000 M
LBP	275 Ft.	Power:	6,800 SHP: 8,000 HP
Beam:	63 Ft.	Complement:	35 Scientific: 26 Officers and Crew
Draft:	21 Ft.		
Displacement:	5840 LTons		



APPROVALS			
FOR	ALT	NAME	DATE
OWNER			
USPHS			
ABS			
USCG			

WOODS HOLE
OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASSACHUSETTS 02543

JONATHAN LEIBY
MARINE DEPARTMENT
TEL. 617 548-1400

DN JL	NECOR - LARGE RES SHIP - PRELIMINARY PROFILE -	
APD WA		
1/4"=1'-0"	10-5-85	DWG No. 8506-1

SUMMARY OF THE DESIGN FOR A LARGE HIGH-ENDURANCE GENERAL PURPOSE OCEANOGRAPHIC RESEARCH SHIP

NECOR DESIGN WO 8506

GENERAL

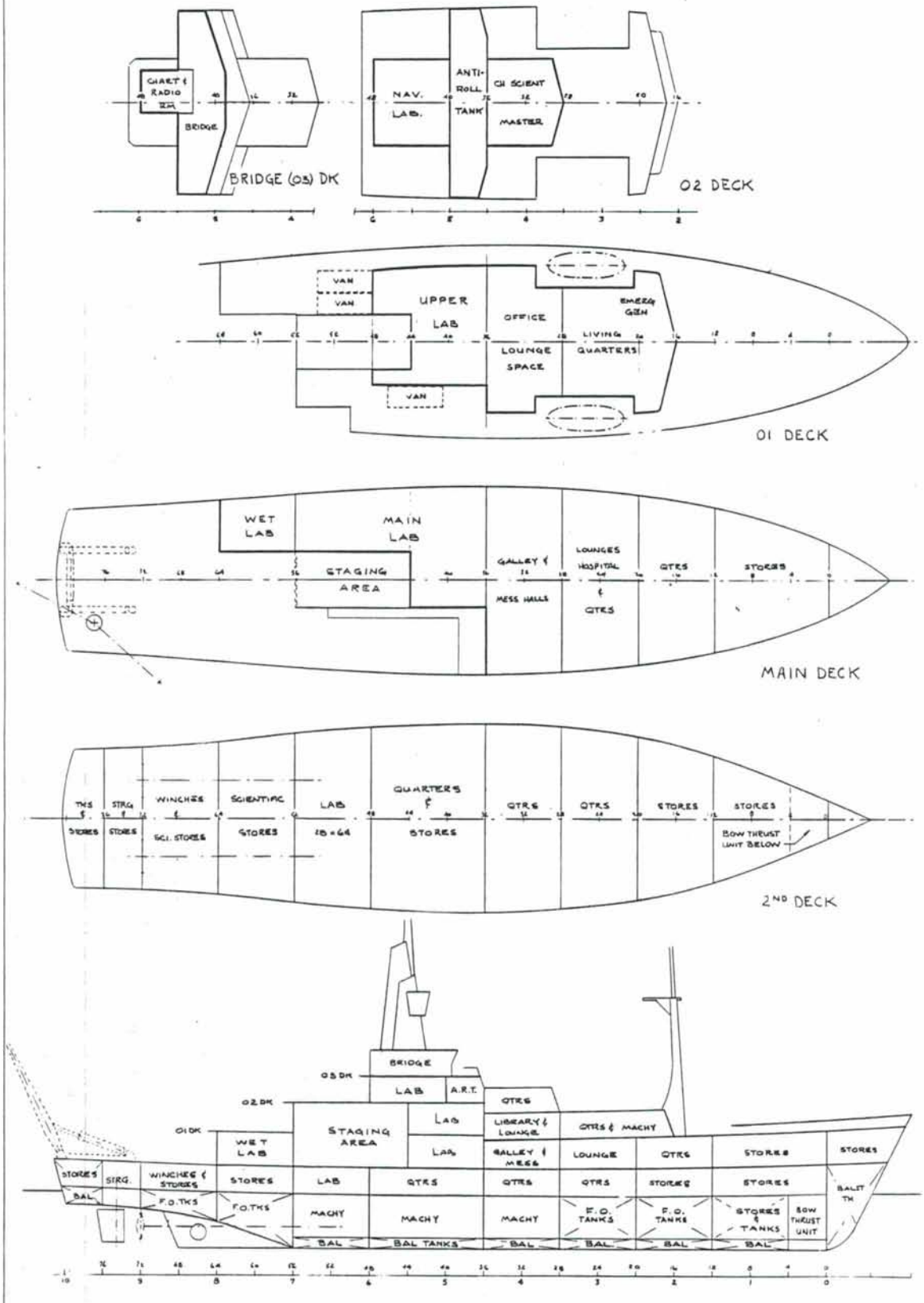
This design is for a large (approx. 300 ft.) oceanographic research ship where the highest priority has been given to improvement of the seakeeping qualities of the vessel in the earliest stages of design. The prime requirement is for a vessel capable of world wide research (except in close pack ice) with a greater capacity for scientific work in higher sea states than is now available in the academic fleet.

DESIGN PRIORITIES

1. Improved Seakeeping
2. High Reliability
3. High Endurance and Capacity
4. Arrangement for Optimum Scientific Operational Capability
5. Station Keeping in High Sea States
6. Relatively High Sea Speed

SEAKEEPING

Often primary attention to seakeeping has not been a major factor in the design of research vessels. Too often past designs have placed more stress on a high packing factor and 'unique' oceanographic features to the detriment of the basic seakeeping ability and motion reduction (and therefore personnel efficiency) of the vessel. Heretofore seakeeping qualities of a design were generally predicted by time consuming and expensive model testing made too late in the design procedure to allow significant changes. Recent developments in the theoretical evaluation of seakeeping response by computer have not only resulted in a quicker and cheaper method of predicting seakeeping performance but they have allowed one to make substantial changes in the hull form in the earliest stages of design in order to arrive more easily at an optimum seakeeping performance. In the present design this process was carried to the next logical step where the basic hull design originated from a



WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASSACHUSETTS 02543

JONATHAN LEIBY
MARINE DEPARTMENT
TEL. 617 548-1400

DN JL	NECOR - LARGE RES SHIP - PRELIMINARY ARRGT
APD GAB	
1/8" = 1'-0"	10-5-85 DWG No. 8506-2

SEAKEEPING (cont'd.)

computer-aided seakeeping program utilizing information on ship response to arrive at the optimum seakeeping performance. This work was undertaken through consultation with Professor C. Chryssostomides of M.I.T. A comparison of the seakeeping qualities of this design with the known responses of existing ships in the research fleet has been made.

In addition to concern with the design of the basic hull form motion reduction has been enhanced through a general arrangement which has been designed to place personnel living and working spaces in areas of minimum motion. Further motion reduction would be achieved by use of both anti-roll tanks and active anti-rolling fins.

RELIABILITY

Arrangement of the design purposely kept simple; spaces are grouped by function and the bridge is located near the center of scientific work spaces for optimum visual communication. Machinery, equipment and outfit selection made using a minimum of number and the simplest of components consistant with safety and efficiency.

ENDURANCE

Range

a. 12,000 miles at cruising speed of 16 knots /or
b. 15,000 miles at 15 knots with 28 days on station at equivalent 6 knots power.
c. Fuel for (average) 60 days operation or 45 days in Sea State 5.

Duration — Provisions storage for 60 to 80 days.

CAPACITY

Scientific Space

Laboratories 6,500 sq. ft. in 4 spaces
Stowage - 32,000 cu. ft.
Staging space - 1,000 sq. ft. covered space with 20 ft. clear height
Main deck aft working area - 5,000 sq.ft.
Vans - capacity for at least six 20 ft. portable vans
Scientific office
Library with conference capacity and working fireplace.

CAPACITY (cont'd.)	Accommodations	30 scientists and technicians, expansion capacity to 36 if all in two-person staterooms Two lounges plus library
Arrangement		Developed to include and improve upon best features and scientific mission capability of existing vessels and design studies: - Large open working deck aft and one (starboard) side to midship - Large high sheltered staging area between labs and open deck - Labs adjacent to main deck and/or with view of same - Bridge command center adjacent to labs with view of aft working area - Living quarters and working spaces in area of least motion - low and central - Food storager adjacenty to preparation area - All scientific outfitting to utilize bolt on equipment attachments - Layout and dimensions in even spacings and modular construction where possible
OTHER CHARACTERISTICS		
Station Keeping:		Maintain station and work in Sea States up to 5; limited work in Sea State 7. Dynamic positioning in depths to 6,000 m, 35-knot winds, and Sea State 5.
Speed:		18 knots trial speed, 16 knots cruising; sustainable in Sea State 5. Fine speed control throughout this range especially between 0 - 6 knots. (Feedback based on speed rather than rpm)
Ice Strengthening:		Ability to transit loose pack (5/10 cover). Not intended for icebreaking or close pack work. Protection against encounters with growlers and other glacial ice difficult to detect.

Deck Working Area:	Spacious fantail area - 5,000 sq. ft. with contiguous waist work area along one side. Provide for deck loading up to 1,500 lbs./sq.ft. and an aggregate total of 300 tons.
	Hold-downs (bolt fittings) on 2-ft. centers on all working and laboratory areas. Flexibility to accommodate large and heavy equipment. Removable bulwarks throughout.
	Useable clear foredeck area to accommodate specialized towers and booms extending beyond bow wave.
PROPULSION PLANT	Diesel-electric drive with variable speed A-C system to eliminate rectification problems. Use of reversible controllable direction and pitch propellers for fine ship and speed control.

SUMMARY CONCEPTUAL DESIGN

OF

LARGE OCEANOGRAPHIC RESEARCH VESSEL

Rodney E. Lay & Associates

October 1985

PARTICULARS:

Length, Overall	300'-0"
Length Between Perpendiculars	273'-0"
Beam, Overall	54'-0"
Draft	18'-0"
Range	10,000 N. Miles
Endurance	60 Days
Service Speed	14 Knots
Light Ship Displacement	1900 Long Tons
Full Load Displacement	3000 Long Tons

CLASSIFICATION:

American Bureau of Shipping:

- ✠ ACCU for Automatic and Remote Control of Propulsion Machinery
- ✠ A1 Hull Requirements
- ✠ AMS Machinery Requirements

Ice Strengthening - Class C

PROPULSION:

(1) Direct Diesel 4000 HP @ 900 RPM
(1) Auxiliary DC Motor, 800 HP, SCR Driven

GENERATORS:

(3) Diesel Generator Sets, 850 KW each
(1) Emergency Diesel Generator Set, 100 KW

THRUSTERS:

(1) Stern - Tunnel Type, 800 HP DC Motor, SCR
(1) Bow - 360°, 800 HP DC Motor, SCR

BERTHING ACCOMMODATIONS:

(22) Officers and Crew
(33) Scientific Personnel

SCIENTIFIC DECK MACHINERY:

(2) Hydrographic Winches
(1) Trawl Winch
(1) Crane, Tapered Boom, Electric Hydraulic, 10,000 lbs. @ 30 ft.
(1) Crane, Telescopic Boom, Electric Hydraulic, 20,000 lbs. @ 35 ft.
(2) Crane, Telescopic Boom, Electric Hydraulic, 20,000 lbs. @ 20 ft.
(1) Stern A-Frame, 10,000 lbs. @ 15 ft.
(2) Gallows Frames, 10,000 lbs. @ 6 ft.

ACOUSTICAL SYSTEMS:

Phased Array, Multibeam Precision Echo Sounding (Sea Beam)

DYNAMIC POSITIONING SYSTEM:

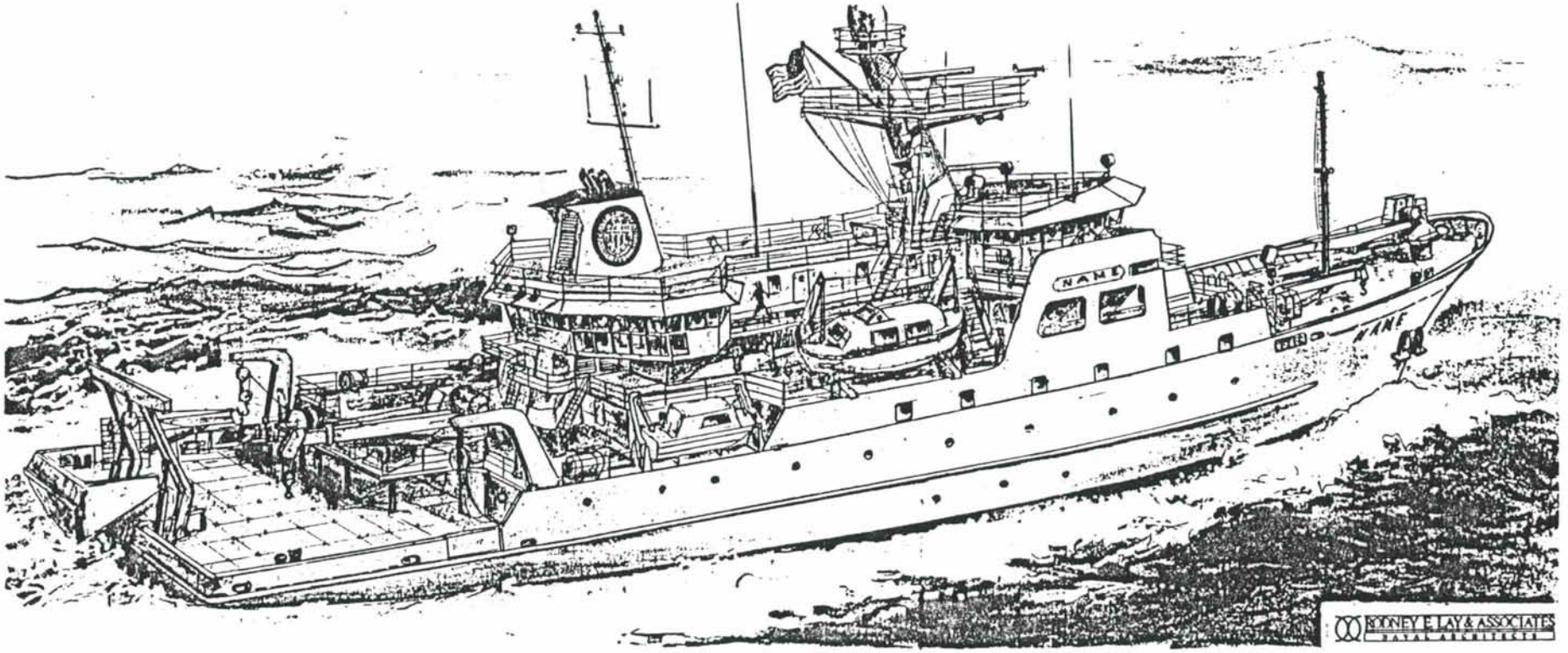
Absolute and Relative Positioning

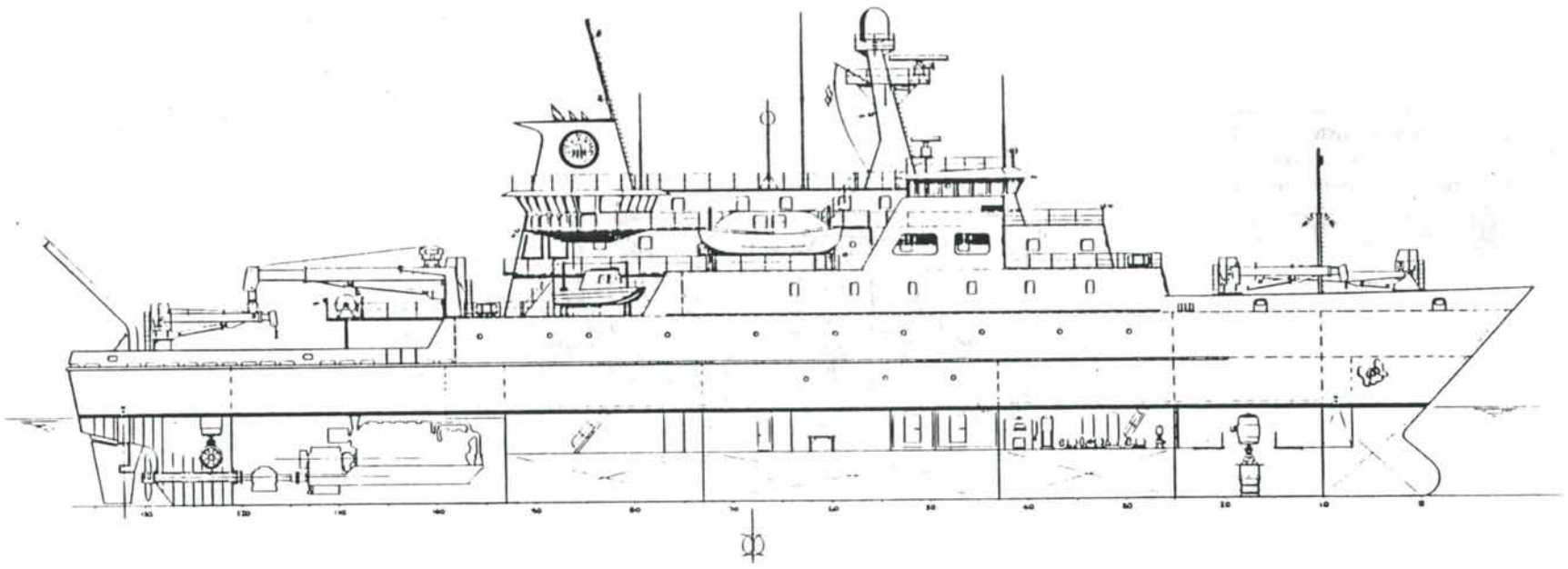
SCIENTIFIC LABORATORIES:

Main Laboratory	1,620 Sq. Ft.
Bio-Chem Laboratory	231 Sq. Ft.
Auxiliary Laboratory	429 Sq. Ft.
Wet Laboratory (Port)	495 Sq. Ft.
Wet Laboratory (Starboard)	528 Sq. Ft.
Scientific Workshop	446 Sq. Ft.
Plot and Remote Sensor Lab	256 Sq. Ft.
Computer-Electronics	1,588 Sq. Ft.

SCIENTIFIC STORAGE:

Hold (2nd Platform)	2,160 Sq. Ft.
Stores (1st Platform, Stbd.)	930 Sq. Ft.
Stores (1st Platform, Port)	544 Sq. Ft.
Climate Control Chamber	121 Sq. Ft.
Scientific Freezer	121 Sq. Ft.


NAME
NAME
RODNEY E. LAY & ASSOCIATES
NAVAL ARCHITECTS

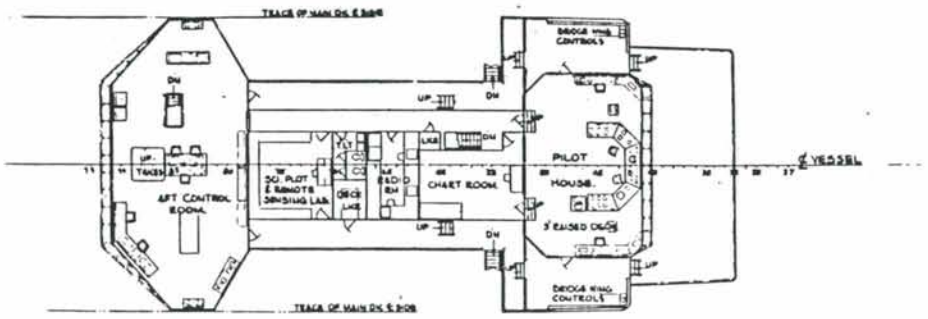


LARGE GENERAL PURPOSE OCEANOGRAPHIC RESEARCH SHIP

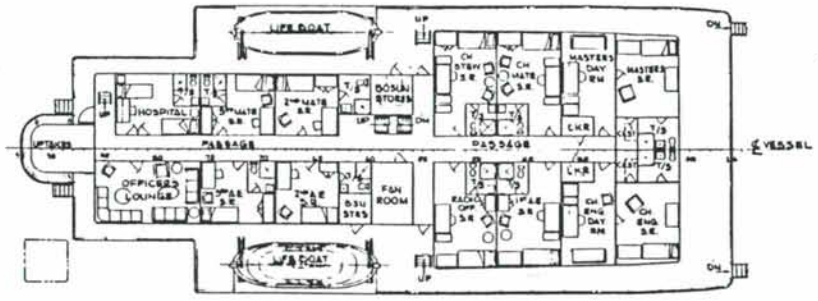
Length	273 LBP	300 LOA	Cruise Speed	14 knots
Beam		54 Ft.	Range	10,000 nm
Draft		18 Ft.	Power	4,000 SHP
Displ.		LT	Complement	33 Science

RODNEY E. LAY & ASSOCIATES
NAVAL ARCHITECTS

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



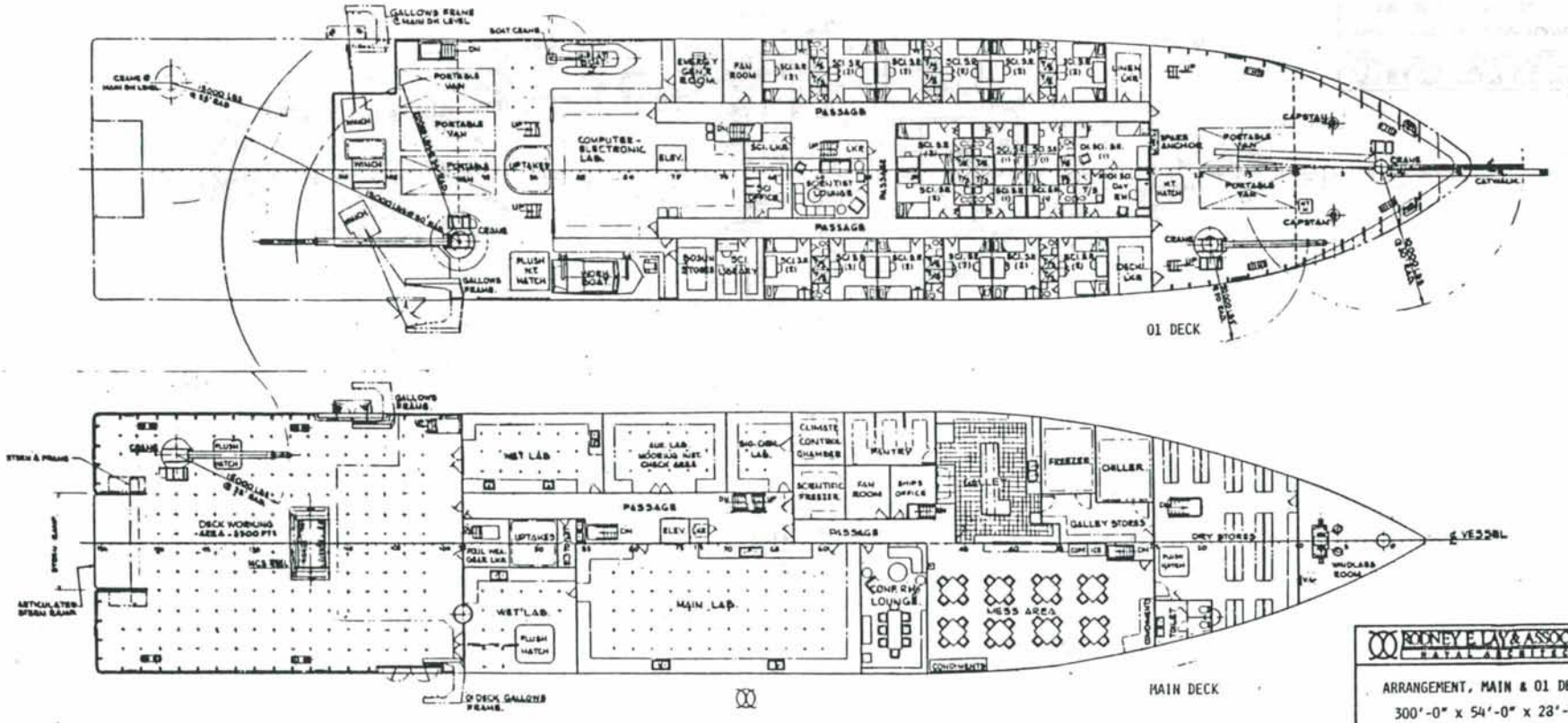
03 DECK



02 DECK

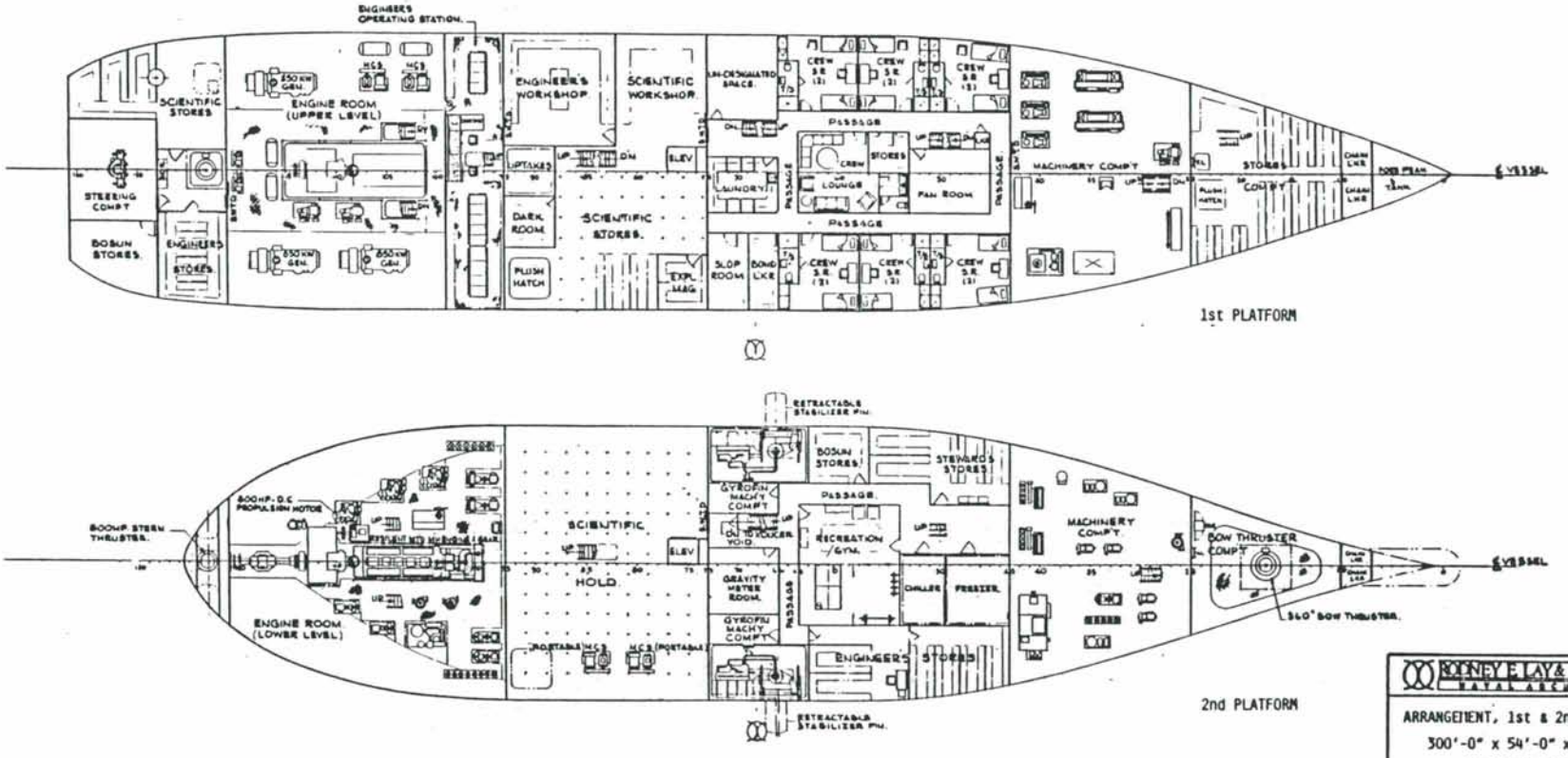
RODNEY E. LAY & ASSOCIATES
NAVAL ARCHITECTS

ARRANGEMENT, 02 & 03 DECKS
300'-0" x 54'-0" x 23'-0"
RESEARCH VESSEL



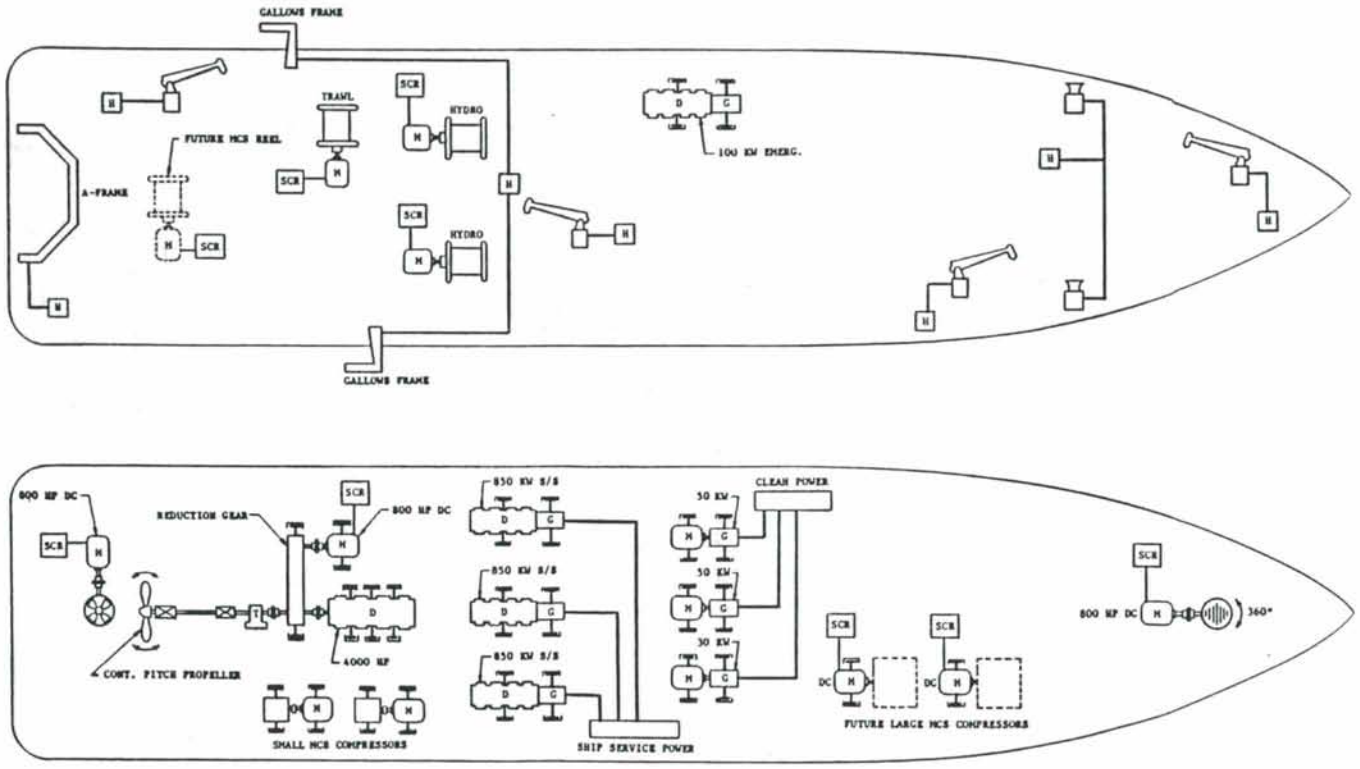
ROONEY E. JAY & ASSOCIATES
NAVAL ARCHITECTS

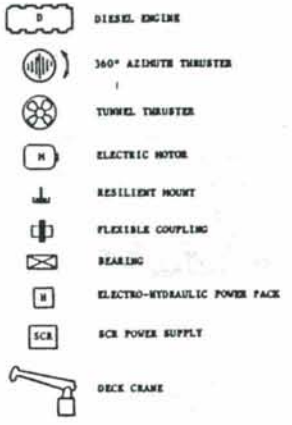
ARRANGEMENT, MAIN & 01 DECKS
300'-0" x 54'-0" x 23'-0"
RESEARCH VESSEL



ROONEY LAY & ASSOCIATES
NAVAL ARCHITECTS

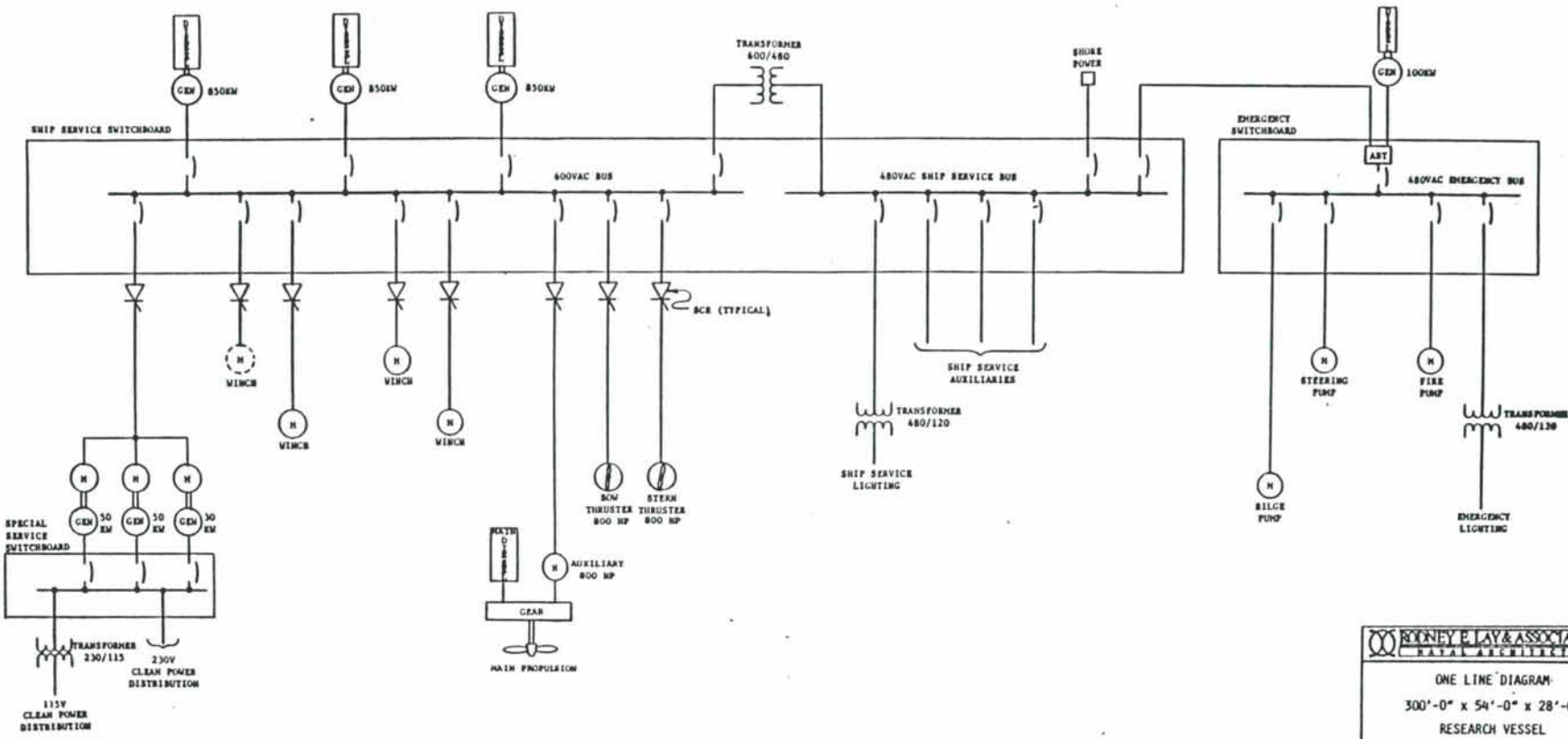
ARRANGEMENT, 1st & 2nd PLATFORM
300'-0" x 54'-0" x 28'-0"
RESEARCH VESSEL





RODNEY E. LAY & ASSOCIATES
NAVAL ARCHITECTS

CONCEPT POWER DIAGRAM
300'-0" x 54'-0" x 28'-0"
RESEARCH VESSEL



RODNEY E. LAY & ASSOCIATES
NAVAL ARCHITECTS

ONE LINE DIAGRAM
300'-0" x 54'-0" x 28'-0"
RESEARCH VESSEL

Conceptual Design of a "MG &G Friendly" Oceanographic Research Ship

Conducted pursuant to the research ship requirements of the Northeast Consortium Research Fleet [NECOR] and the University National Oceanographic Laboratory System [UNOLS]

by

Marinette Marine Corporation
Marinette, Wisconsin

Under the direction of Lamont-Doherty Geological Observatory of Columbia University

MAY 1985

Marinette Marine

GENERAL REQUIREMENTS

1. Intent

It is the intent of this specification to describe the features of a MG & G Friendly Research Vessel.

This world-ranging vessel shall be capable of fulfilling an effective marine geological and geophysical program using modern instrument systems and systems envisioned for future studies of the sea floor. It shall have maximum possible capability and flexibility in that it shall carry a team of 25 to 30 researchers to any area of the world oceans in reasonable comfort and also provide a stable platform and clean environment for technologically demanding surveys and measurements.

2. Characteristics

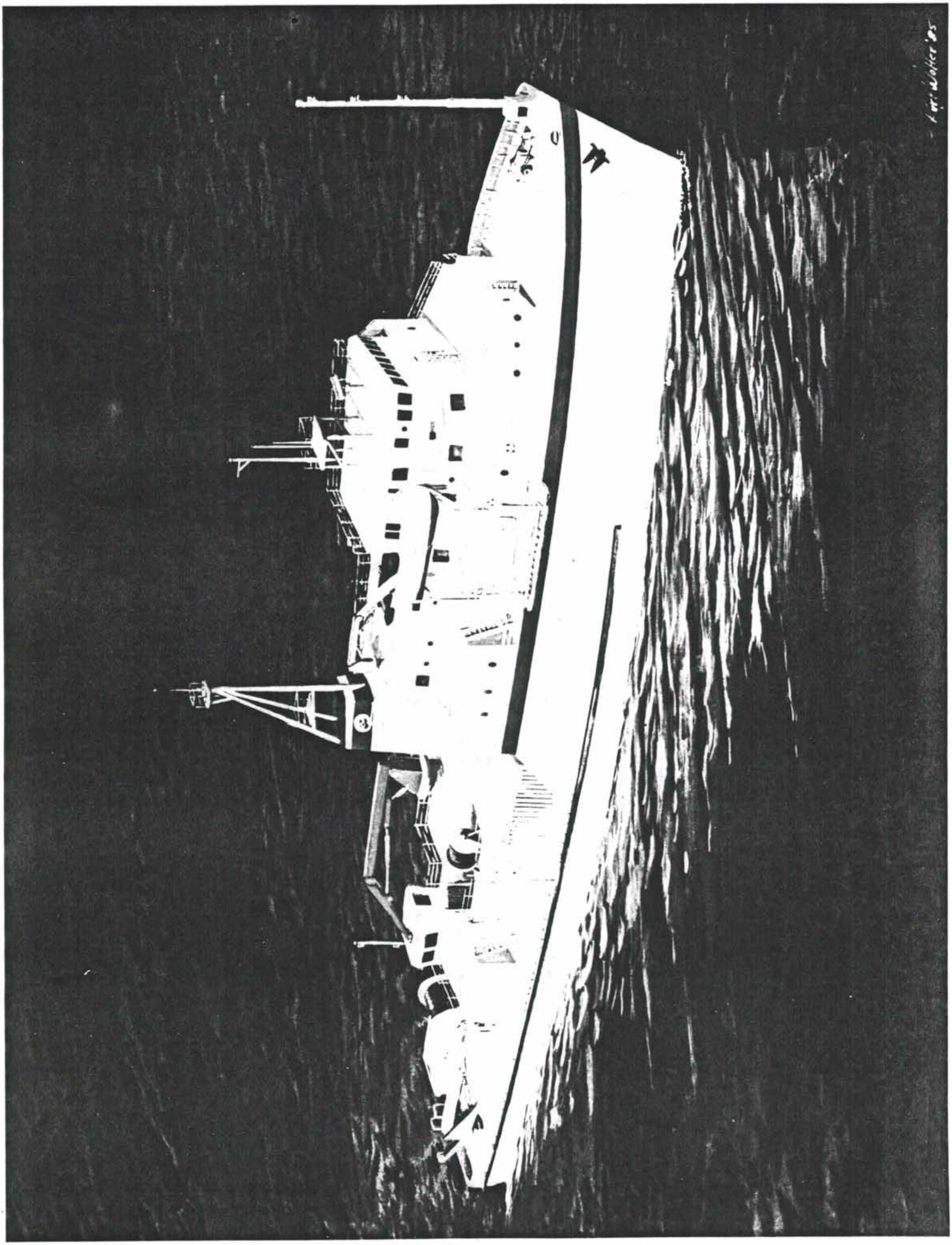
Principal characteristics are as follows:

Length (Overall)	250'-0"
Length (Between Perp.)	238'-0"
Breadth (Molded)	52'-0"
Depth (Molded to Main Deck)	23'-6"
Draft (DWL)	15'
Displacement (Full Load - Est)	2790 LT.
Propulsion:	
Type:	Diesel -Electric
B.H.P. (Est.) Installed	1500/shaft
Propeller	2 Fixed Pitch - 10' Diameter
Speed	14 knots
Tank Capacities:	
Fuel Oil	212,897 gallons
Potable Water	7,443 gallons
Ballast Water	80,867 gallons
Cable Fluid	883 gallons
Dirty Cable Fluid	883 gallons

3. Mission Statements

This research vessel shall be capable of cost-effectively performing multiple missions, fulfilling various oceanographic requirements. It shall have maximum flexibility in launching, towing, and recovering a variety of large and heavy equipment necessary for each mission. Missions shall be performed sufficiently utilizing laboratory spaces, state-of-the-art navigation, communications, sensors, computers and ship control equipment.

This vessel with its machinery and equipment shall be designed and constructed in accordance with the requirements of:



1. American Bureau of Shipping (A.B.S.) Rules for Building and Classifying Steel Vessels - 1984

2. United States Coast Guard (U.S.C.G.) rules and regulations for Oceanographic Vessels Sub-chapter U of 46 CFR.

3. Institute of Electrical and Electronic Engineers (IEEE) Standard No. 45

4. Safety of Life At Sea (SOLAS)

Multichannel Seismic, Borehole Re-entry, Submerged Vehicle Handling and Seabeam Mapping shall be the primary missions performed. Only equipment common to these mission systems or equipment difficult to transport shall be permanently installed.

The maximum number of days at sea for this vessel shall be 50.

This ship shall be capable of reaching any area of the world oceans from the nearest suitable port and be able to work in the area for a period of 4 to 5 weeks.

The required range of this vessel shall be 15,000 nautical miles at 14 knots maximum. This vessel shall perform at the following speeds:

14 knots in sea state 3
12 knots in sea state 4
8 knots in sea state 5

The ship shall also be able to maintain position within a few hundred meters of a sea floor target in sea states up to 6.

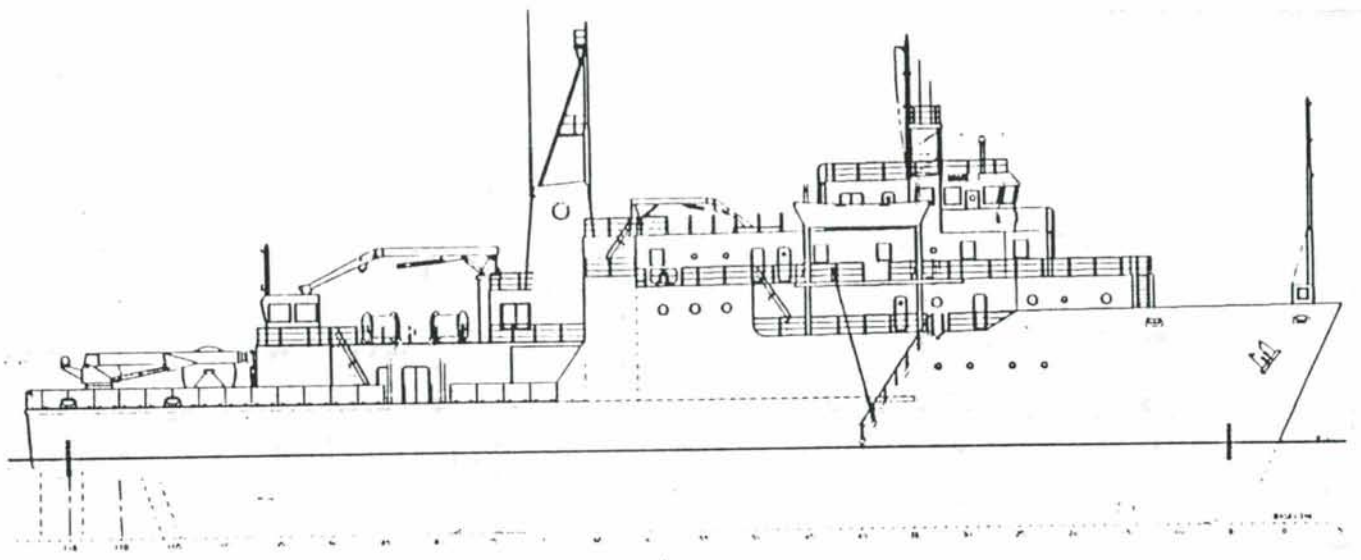
This vessel shall maintain a watch circle of 200m, and a heading of ±10° under a 20 knot wind in sea state 3 with a current of 1.5 knots.

4. Acoustic Requirements

The hull of this vessel shall be acoustically quiet so that swath mapping systems can be used at speeds up to 10 knots, and quiet conditions can be provided during Borehole Re-entry.

To reduce structureborne noise and attendant radiated noise transmitted from the Generator Room and the Compressor Room, the two propulsion diesel generators, one auxiliary diesel generator, three air compressors, auxiliary seawater pumps and A/C compressor/condensor shall have single low frequency isolation mounts. A damped deck treatment shall be applied to the deck of the Main Lab.

To provide adequate conditions for watchstanding, the noise level in the EOS shall not exceed 72 dBA.

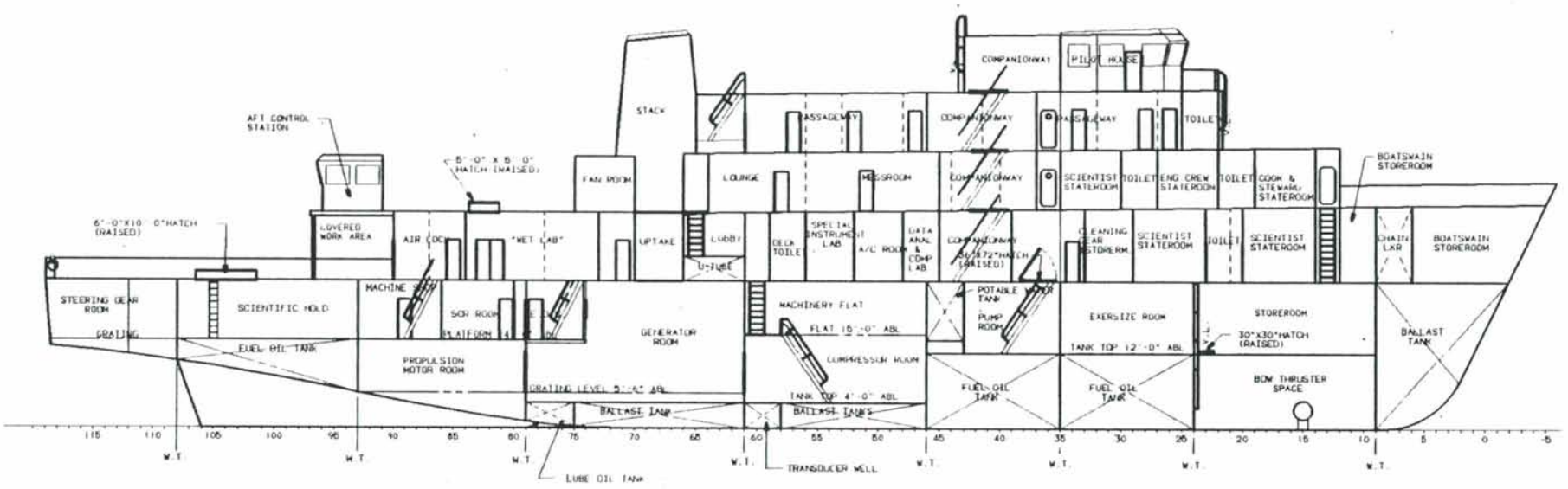


GENERAL PURPOSE RESEARCH SHIP
with GEOPHYSICS CAPABILITY

Length: 238 LBP 250 LOA
Beam: 52 ft
Draft: 15 ft.
Displ: 2790 LT
Cruise Speed: 14 knots
Power: Diesel Elec. 3000 SHP
Complement: 28 Scientists
Range: 1500 nm @ Cruise

MARINETTE MARINE CORPORATION

OUTBOARD PROFILE

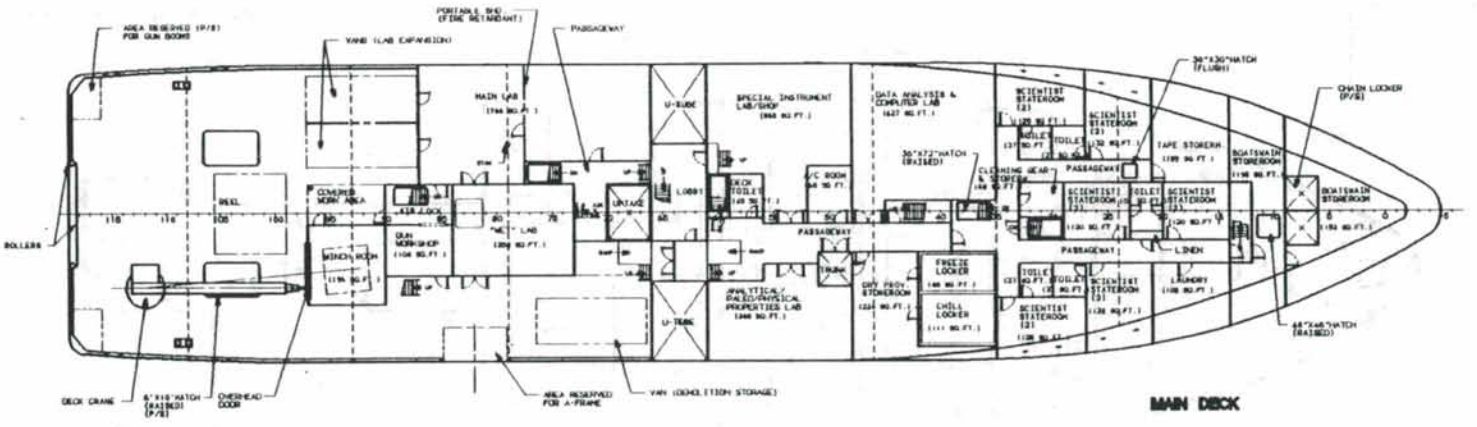


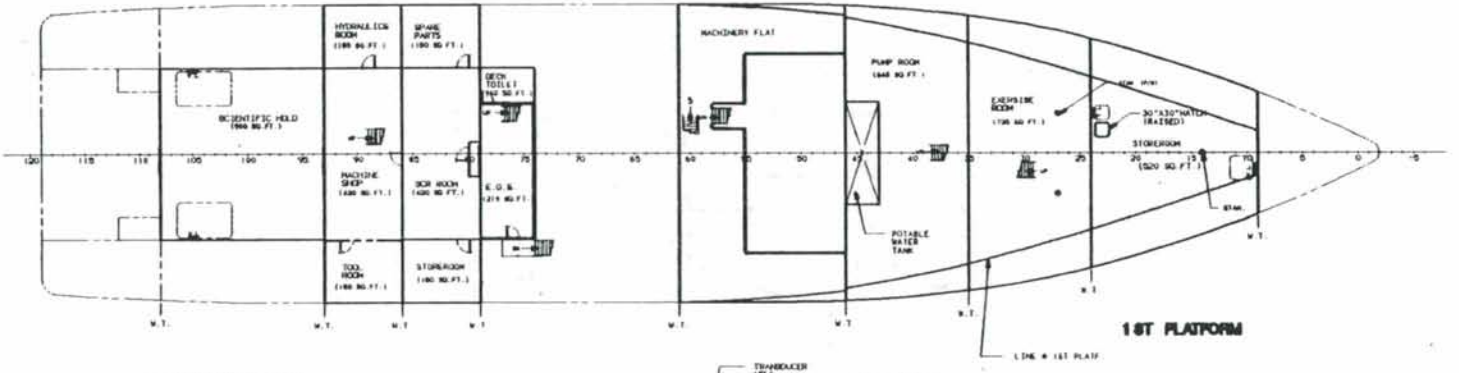
MARINETTE MARINE CORPORATION
MARINETTE WISCONSIN 54143

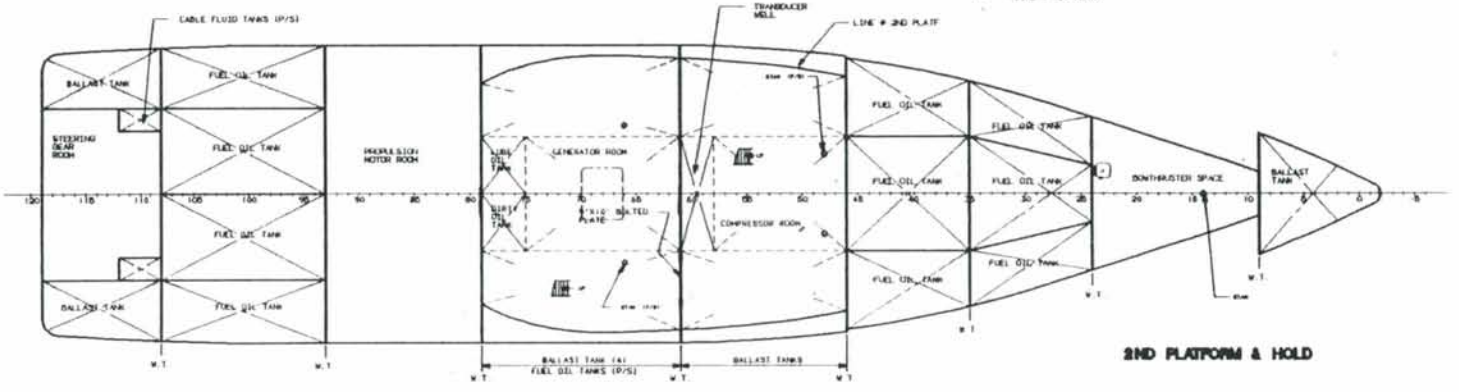
250 FT NECOR RESEARCH VESSEL

INBOARD PROFILE

APPD:
APPD:
CHKD: PWH
DRWN: CLB 3-22-85



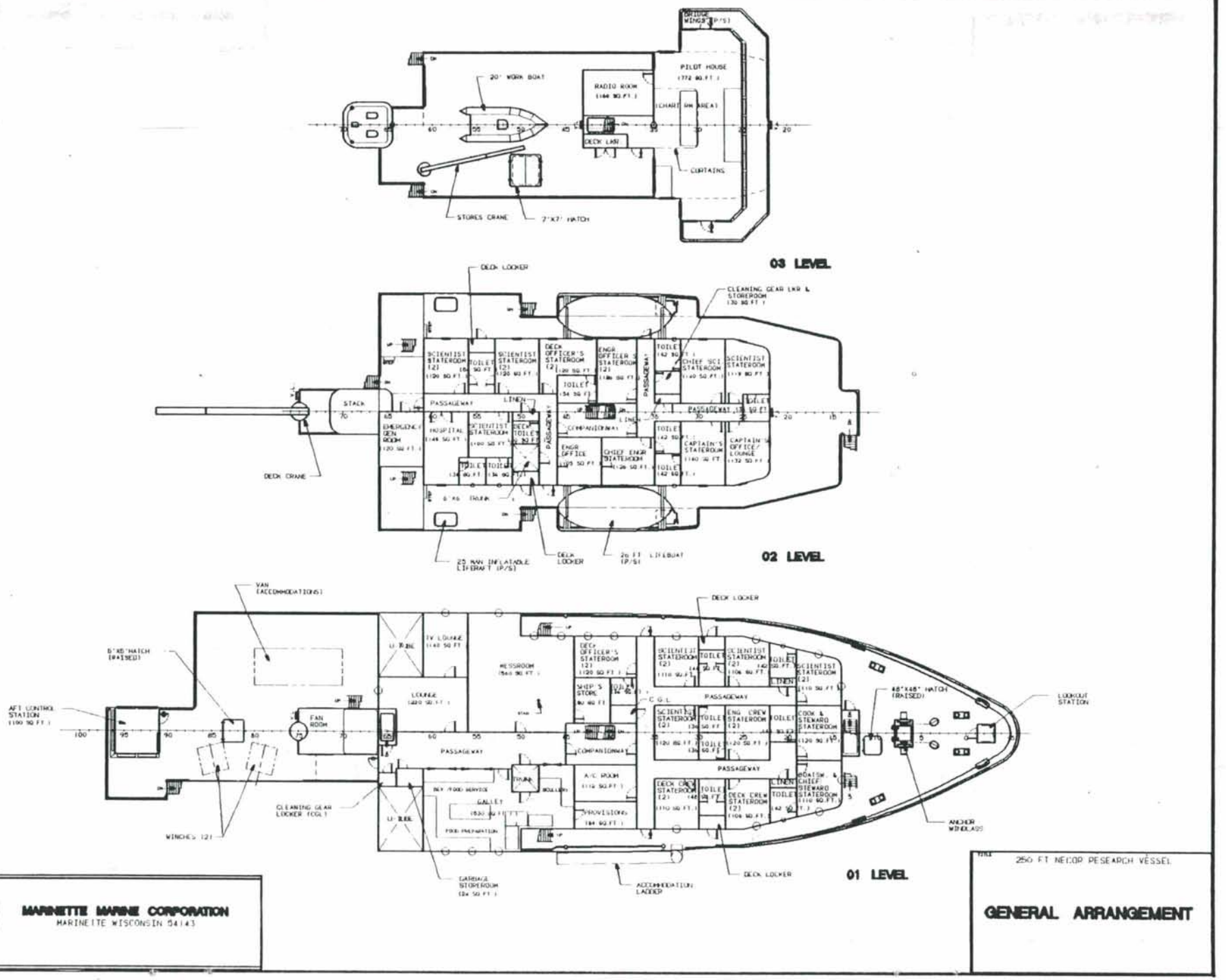


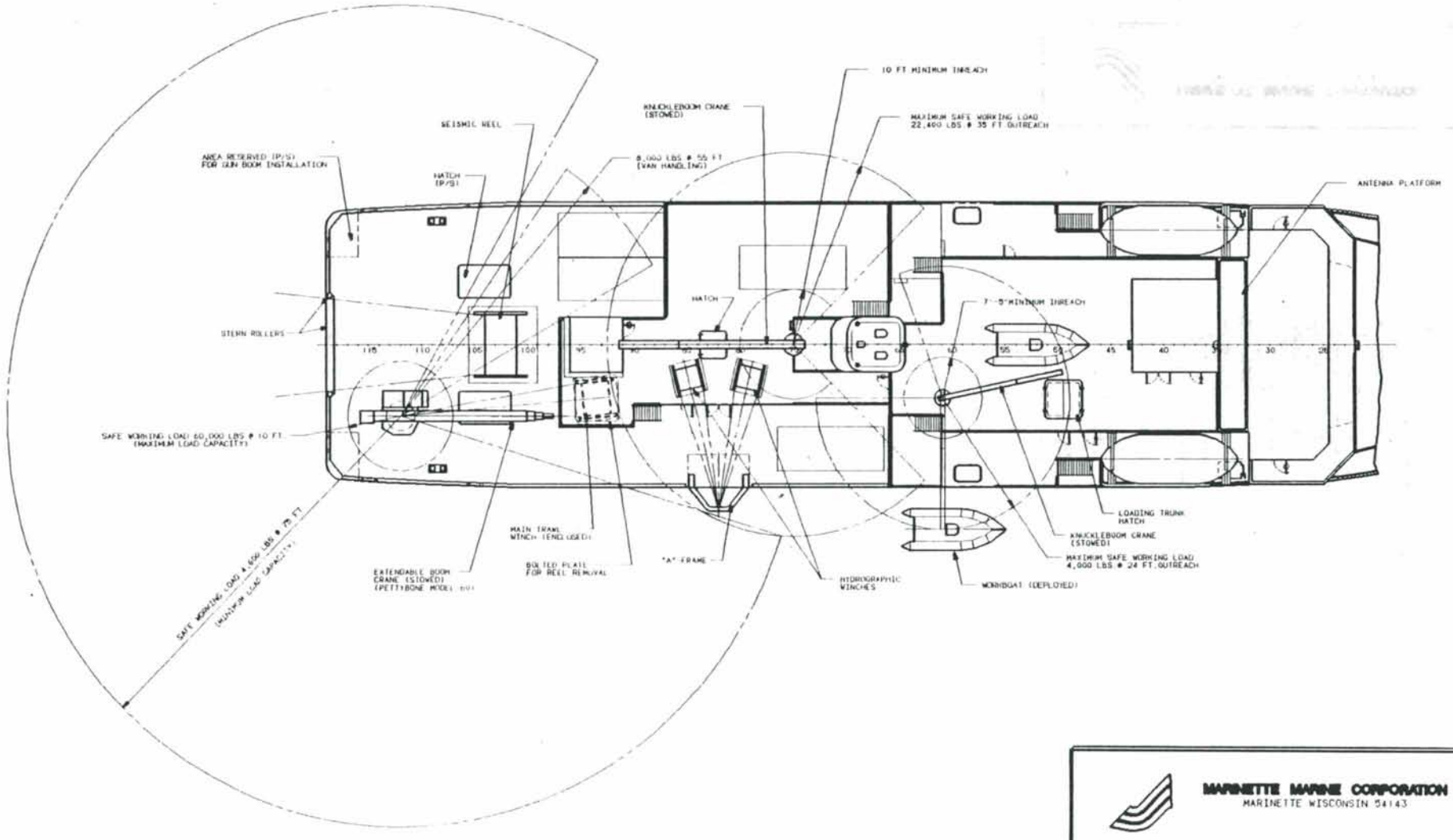


MARINETTE MARINE CORPORATION
MARINETTE WISCONSIN 54143

250 FT NECOR RESEARCH VESSEL

GENERAL ARRANGEMENT


BRIDGE WINGS (P/S)
PILOT HOUSE
(772 SQ.FT.)
20' WORK BOAT
RADIO ROOM
(144 SQ.FT.)
(CHART SM AREA)
DECK LKR.
CURTAINS
STORES CRANE
7'X7' HATCH
03 LEVEL
DECK LOCKER
CLEANING GEAR LKR & STOREROOM
(130 SQ.FT.)
SCIENTIST STATEROOM (2)
(120 SQ.FT.)
TOILET
(54 SQ.FT.)
DECK OFFICER'S STATEROOM (2)
(120 SQ.FT.)
ENGR OFFICER'S STATEROOM (2)
(116 SQ.FT.)
PASSAGEWAY
CHIEF SCI STATEROOM
(140 SQ.FT.)
STACK
LINEN
EMERGENCY GEN ROOM
(120 SQ.FT.)
HOSPITAL
(148 SQ.FT.)
DECK TOILET
(52 SQ.FT.)
COMPANIONWAY
ENGR OFFICE
(109 SQ.FT.)
CHIEF ENGR STATEROOM
(126 SQ.FT.)
CAPTAIN'S STATEROOM
(140 SQ.FT.)
CAPTAIN'S OFFICE/ LOUNGE
(132 SQ.FT.)
DECK CRANE
25 MAN INFLATABLE LIFERAFT (P/S)
DECK LOCKER
26 FT LIFEBOAT (P/S)
02 LEVEL
VAN (ACCOMMODATIONS)
DECK LOCKER
BRIDGE HATCH (RAISED)
TV LOUNGE
(140 SQ.FT.)
MESSROOM
(540 SQ.FT.)
DECK OFFICER'S STATEROOM (2)
(120 SQ.FT.)
SCIENTIST STATEROOM (2)
(110 SQ.FT.)
SCIENTIST STATEROOM (2)
(106 SQ.FT.)
SCIENTIST STATEROOM (2)
(110 SQ.FT.)
48"X48" HATCH (RAISED)
LOOKOUT STATION
AFT CONTROL STATION
(100 SQ.FT.)
FAN ROOM
LOUNGE
(420 SQ.FT.)
SHIP'S STORE
(80 SQ.FT.)
C.G.L.
PASSAGEWAY
SCIENTIST STATEROOM (2)
(134 SQ.FT.)
ENG. CREW STATEROOM (2)
(120 SQ.FT.)
COOK & STEWARD STATEROOM
(120 SQ.FT.)
COMPANIONWAY
A/C ROOM
(116 SQ.FT.)
DECK CHIEF STEWARD STATEROOM (2)
(110 SQ.FT.)
DECK CREW STATEROOM (2)
(106 SQ.FT.)
BOATSW. & CHIEF STEWARD STATEROOM
(110 SQ.FT.)
CLEANING GEAR LOCKER (CGL)
WINCHES (2)
DRY FOOD SERVICE
GALLEY
(630 SQ.FT.)
PROVISIONS
(184 SQ.FT.)
FOOD PREPARATION
GARBAGE STOREROOM
(84 SQ.FT.)
ACCOMMODATION LADDER
DECK LOCKER
ANCHOR WINDLASS
01 LEVEL
MARINETTE MARINE CORPORATION
MARINETTE WISCONSIN 54143
250 FT NEOCR RESEARCH VESSEL
GENERAL ARRANGEMENT

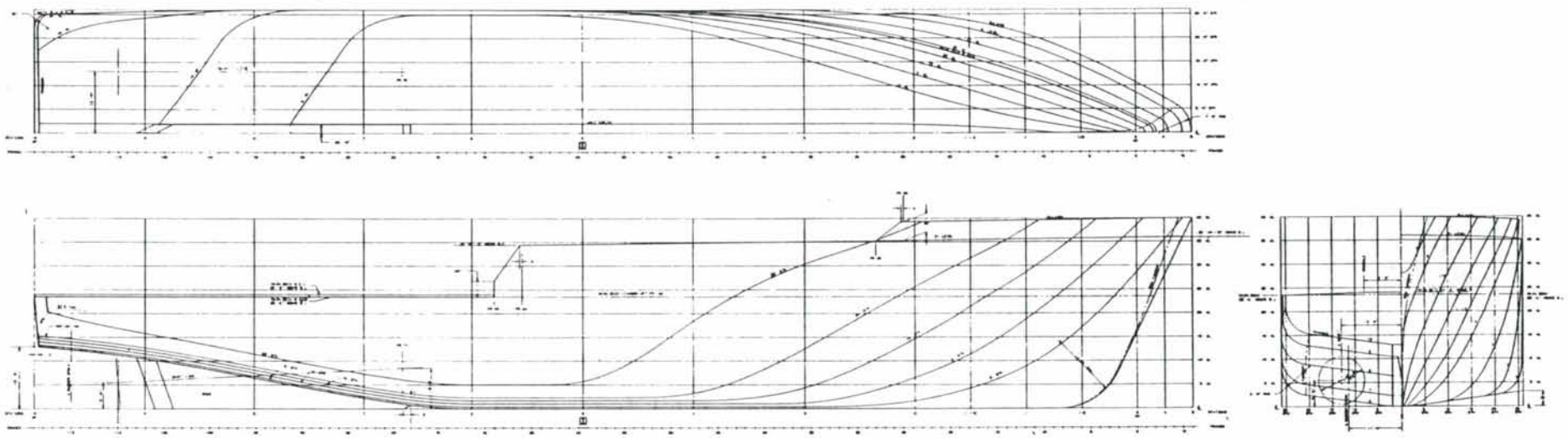


MARINETTE MARINE CORPORATION
MARINETTE WISCONSIN 54143

250 FT NECOR RESEARCH VESSEL

APPD.
APPD.
CHKD.
DRWN: PWH 3-29-85

DECK SYSTEMS
(TOPSIDE VIEW)



MARINETTE MARINE CORPORATION
MARINETTE WISCONSIN 54143

250 FT NECOR RESEARCH VESSEL

LINES PLAN

APPD:	PJV	5/1/85
APPD:	JOH	5/7/85
CHKD:	PWH	5/1/85
DRWN:	CAP	3/21/85

Conceptual Design of a Large High Endurance General Purpose Oceanographic Research with Enhanced Marine Geology and Geophysics Capability

Prepared for

University of Texas
Institute of Geophysics

As part of the fleet replacement planning
of the
University National Oceanographic Laboratory System
[UNOLS]

by

John W. Gilbert Associates
Boston, Massachusetts

OCTOBER 1985

LARGE GENERAL PURPOSE RESEARCH & GEOPHYSICAL SHIP

JOHN GILBERT ASSOCIATES

CONCEPTUAL DESIGN

GENERAL CHARACTERISTICS

LOA	291 ft 0 inches
LBP	275 ft 0 inches
BEAM	58 ft 0 inches
DEPTH	27 ft 0 inches
DRAFT	19 ft 0 inches

Full load displacement: 4,997 L.T. at 18.93 ft.

CAPACITIES

Fuel (normal load)	365,235 gallons
Fuel (additional capacity)	56,000 gallons
Lubes (4 grades)	18,300 gallons
Clean streamer oil	4,250 gallons
Used streamer oil	4,250 gallons
Hydraulic oil	5,000 gallons
Drinking water	10,000 gallons
Lab fresh water	8,075 gallons
Dirty oil	10,000 gallons
Salt water ballast	502 long tons
Fresh water making capacity	6,000 gal/day

INTERIOR LAB AND NAVIGATION AREAS

Wet lab	445 sq. ft.
Gun shop	323 sq. ft.
Auxiliary lab	2,077 sq. ft.
Main lab	1,076 sq. ft.
Computer and instrument room	1,267 sq. ft.
Hydro winch room	634 sq. ft.
Main winch room	1,160 sq. ft.
Library and conference room	891 sq. ft.
Bridge	1,000 sq. ft.
Chart room	224 sq. ft.
TOTAL INDOOR SCIENCE RELATED SPACE	9,197 sq. ft.

WORKING DECK SPACE

Seismic Deck	6,077 sq. ft.
01 Science Deck	5,600 sq. ft.
Foredeck	1,500 sq. ft.
TOTAL WORKING DECK SPACE	13,177 sq. ft.

STORES CAPACITIES

Below deck science stores aft	16,200 cu. ft.
Streamer stores	3,500 cu. ft.
Galley dry stores	9,782 cu. ft.
Frozen and refrigerated stores	5,155 cu. ft.
Forward below deck stores	6,000 cu. ft.
Main deck stores	3,675 cu. ft.
01 Deck stores	6,215 cu. ft.
TOTAL STORAGE	50,527 cu. ft.

ACCOMMODATIONS

26 Two-person staterooms	52 persons
6 One-person staterooms	6 persons

SPEED AND ENDURANCE

Maximum speed	16.0 knots
Cruising speed	14.5 knots
Range at cruising speed	24,000 n. m.
Transit endurance (at cruise with 15% fuel reserve)	70 days
Maximum endurance (limited by stores)	120 days

MATERIAL HANDLING EQUIPMENT

A. Cranes:

1 Pettibone 70-ton extendable-boom crane
1 Alaska 12-ton articulated crane
1 OED 5-ton motion-compensating crane
1 Allied 9-ton extendable-boom crane

B. Lifts:

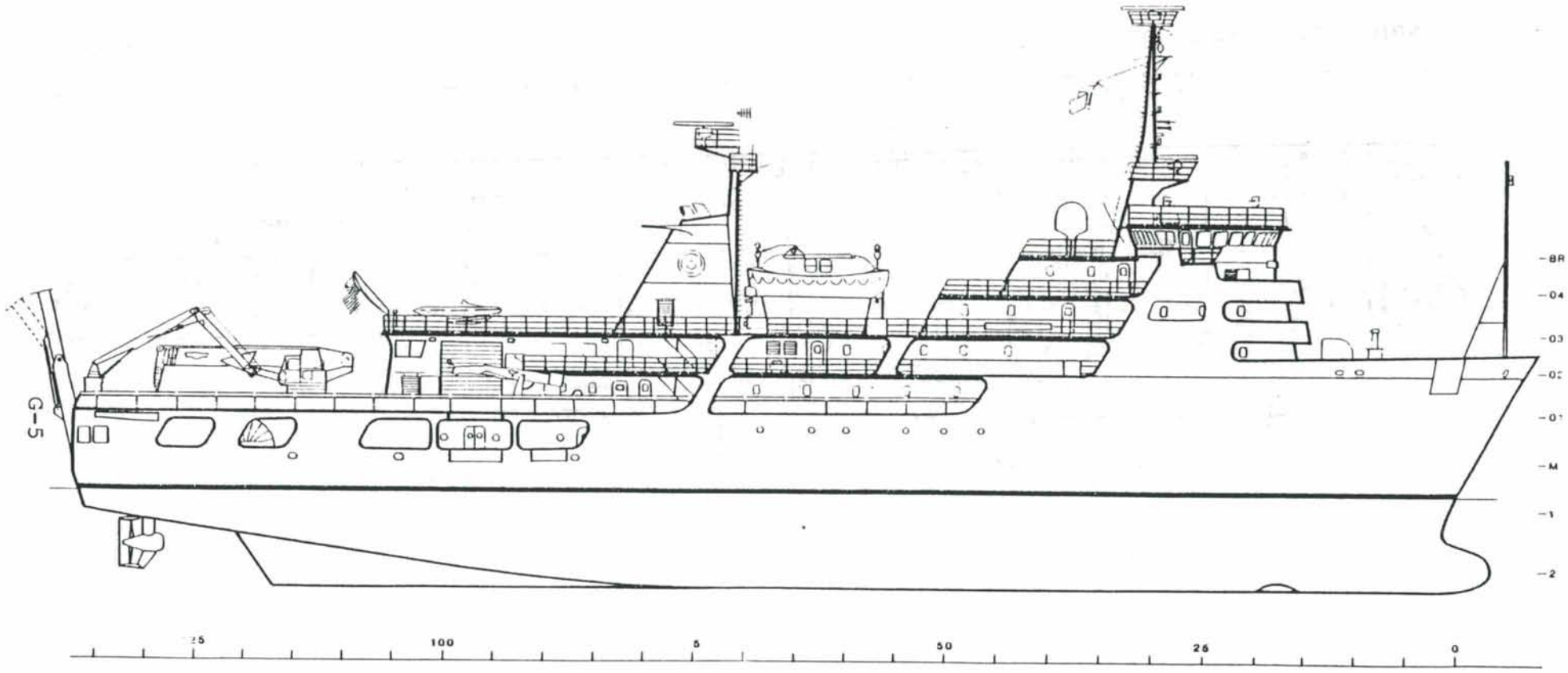
1 MacGregor/Navire 30-ton lifting deck
2 MacGregor/Navire personnel lifts

C. Other Items:

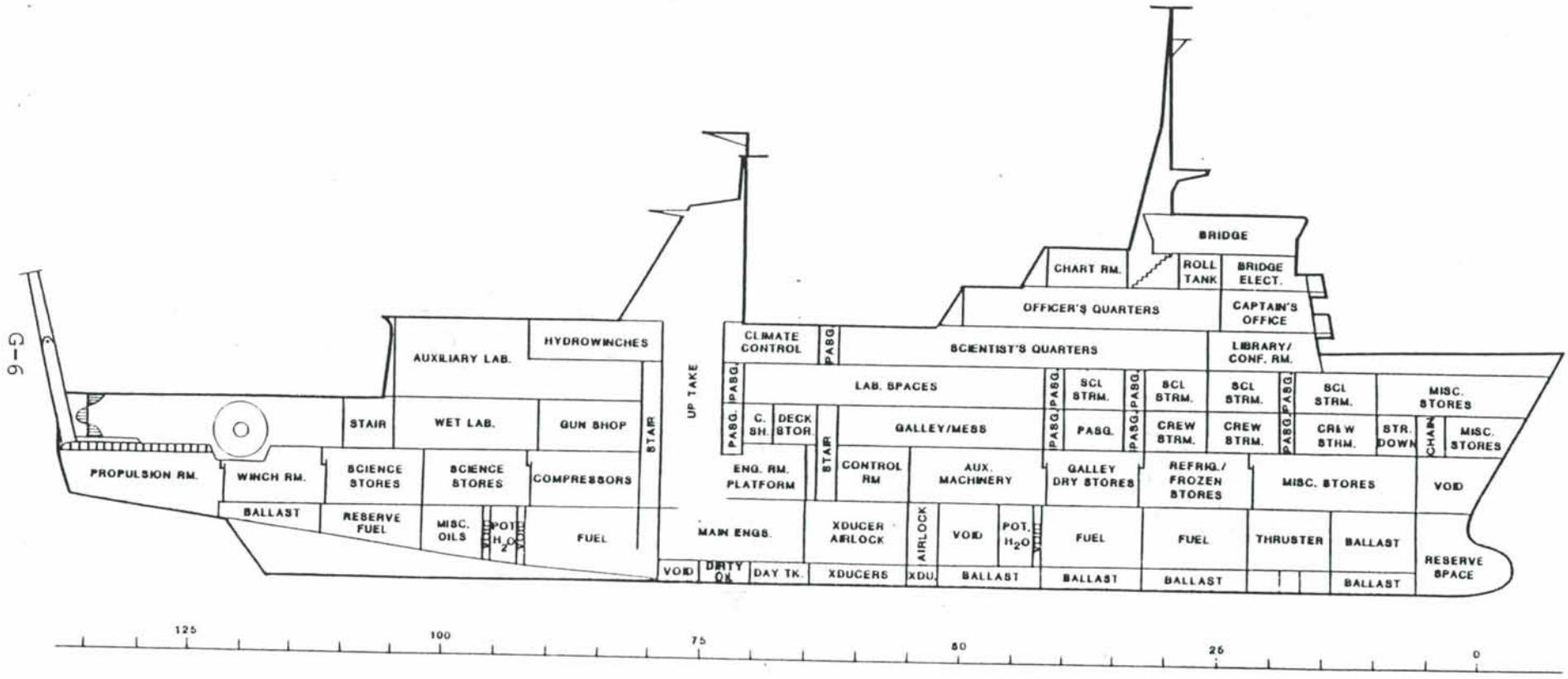
1 25-ton articulated stern gantry
2 MacGregor/Navire deck skidding systems
4 Interior collapsable conveyors for stores handling
8 Overhead gun tracks

* Trolleys in spaces as needed of 2, 5, and 10-ton capacities.

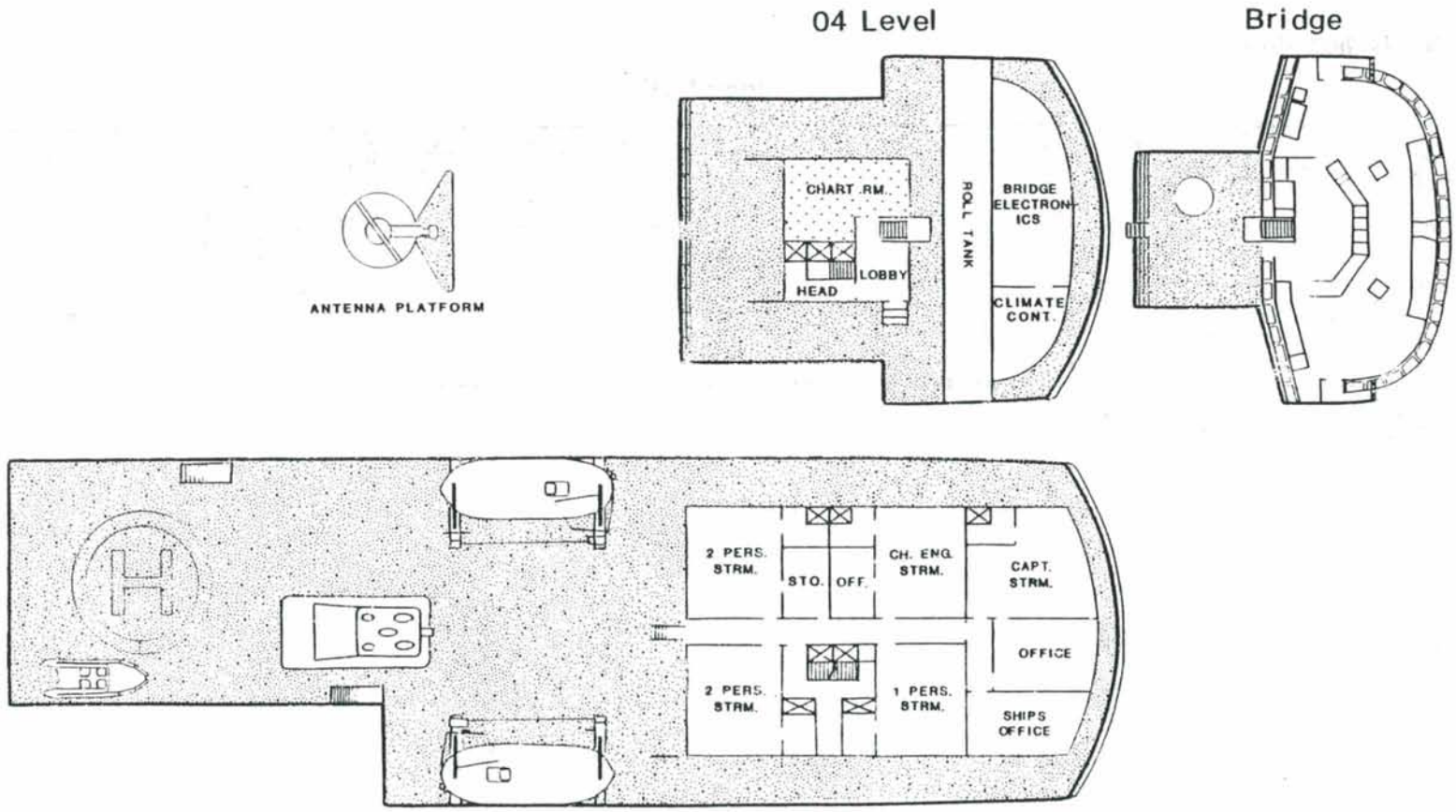
* Portable and fold-down bulwarks where needed.



John Gilbert Associates

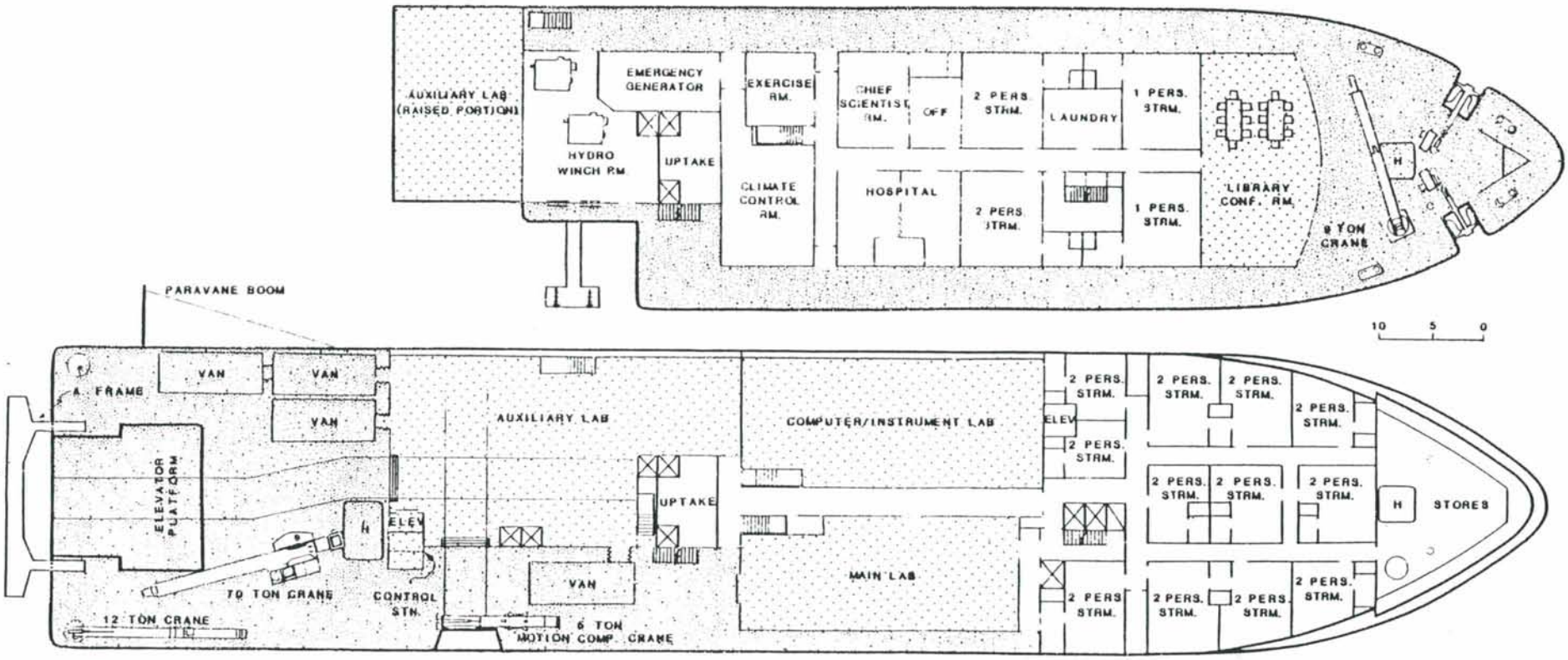


John Gilbert Associates



John Gilbert Associates

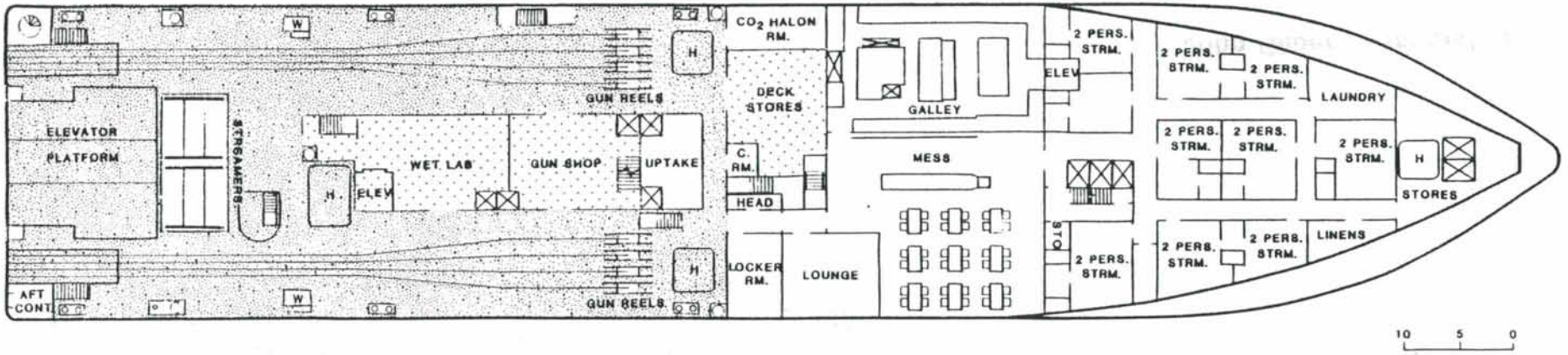
02 Level

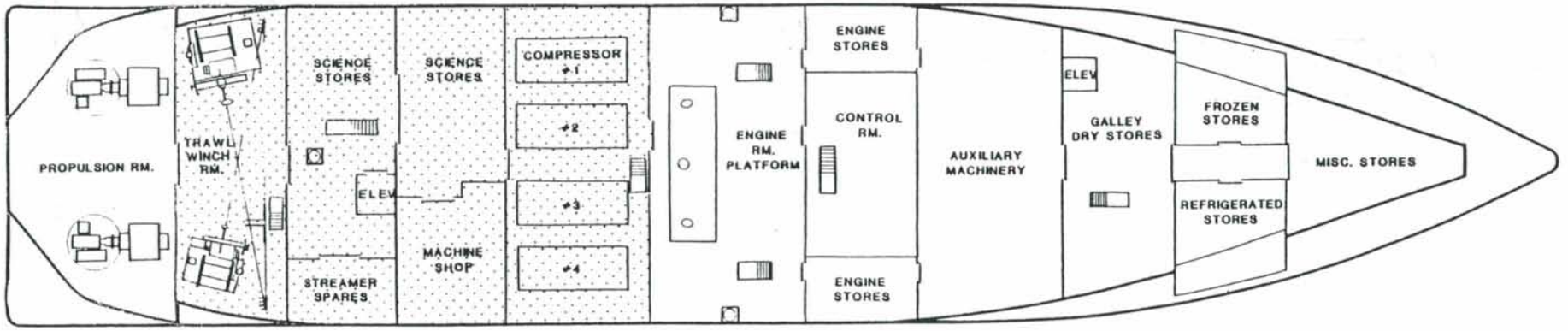


01 Level

John Gilbert Associates

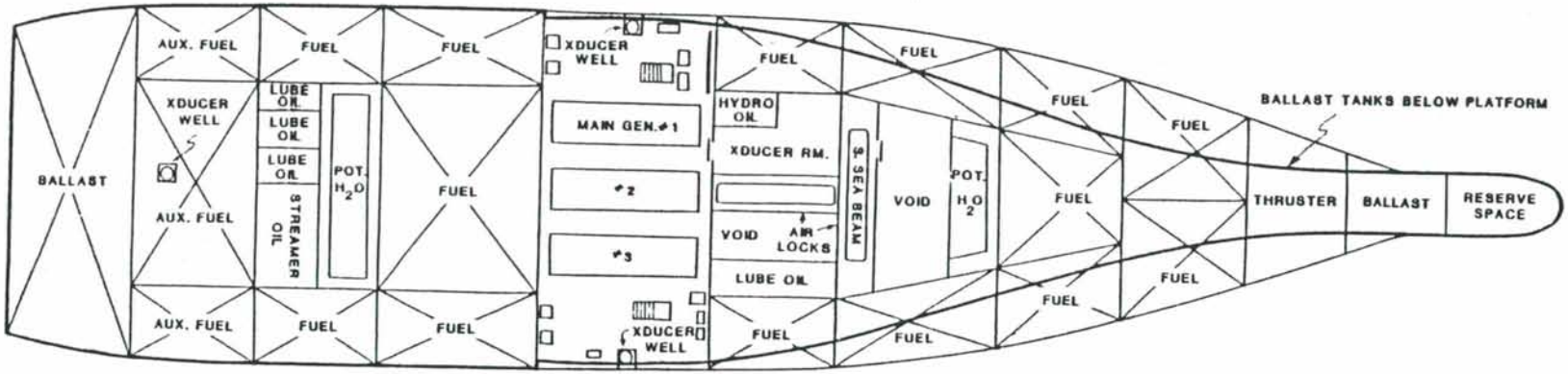
Main Deck





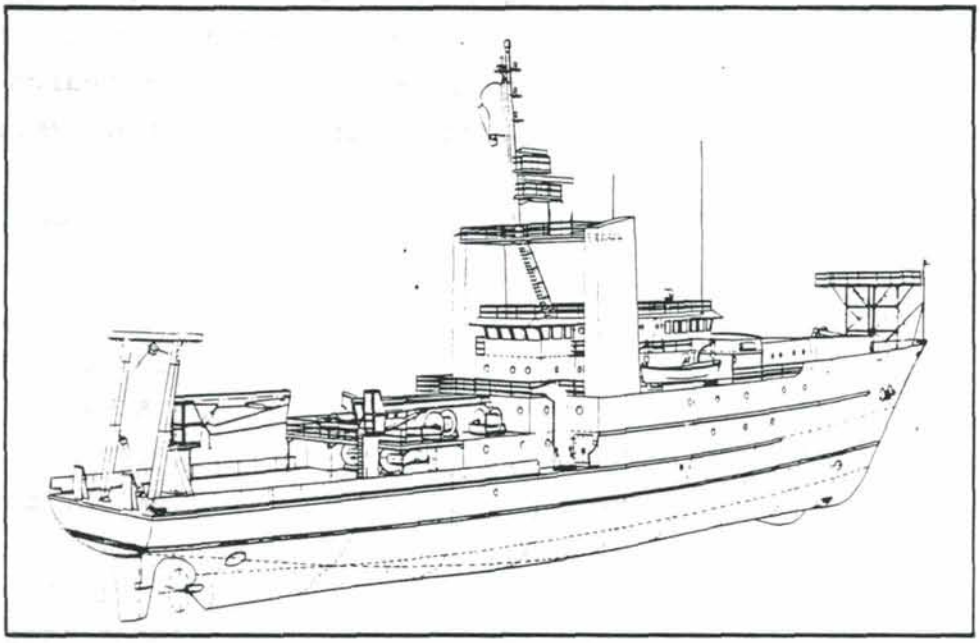
1st Platform Deck

John Gilbert Associates



John Gilbert Associates

Concept Design of a Large Oceanographic Research Ship



Conducted pursuant to the research ship requirements of the University National Oceanographic Laboratory System [UNOLS]

by

M. Rosenblatt & Son, Inc.
Naval Architects and Marine Engineers
350 Broadway
New York, New York 10013

Under the direction of the Rhode Island Graduate School of Oceanography

OCTOBER 1985

SUMMARY

A conceptual design of a Medium Endurance General Purpose Oceanographic Research Ship has been prepared by M. Rosenblatt & Son, Inc. (MR&S) for the University of Rhode Island (URI), Graduate School of Oceanography in accordance with the requirements set forth by the University National Oceanographic Laboratory System (UNOLS) Replacement Committee. This design is to be considered by UNOLS in developing plans for replacement of the research vessels operated by the several institutions within the system.

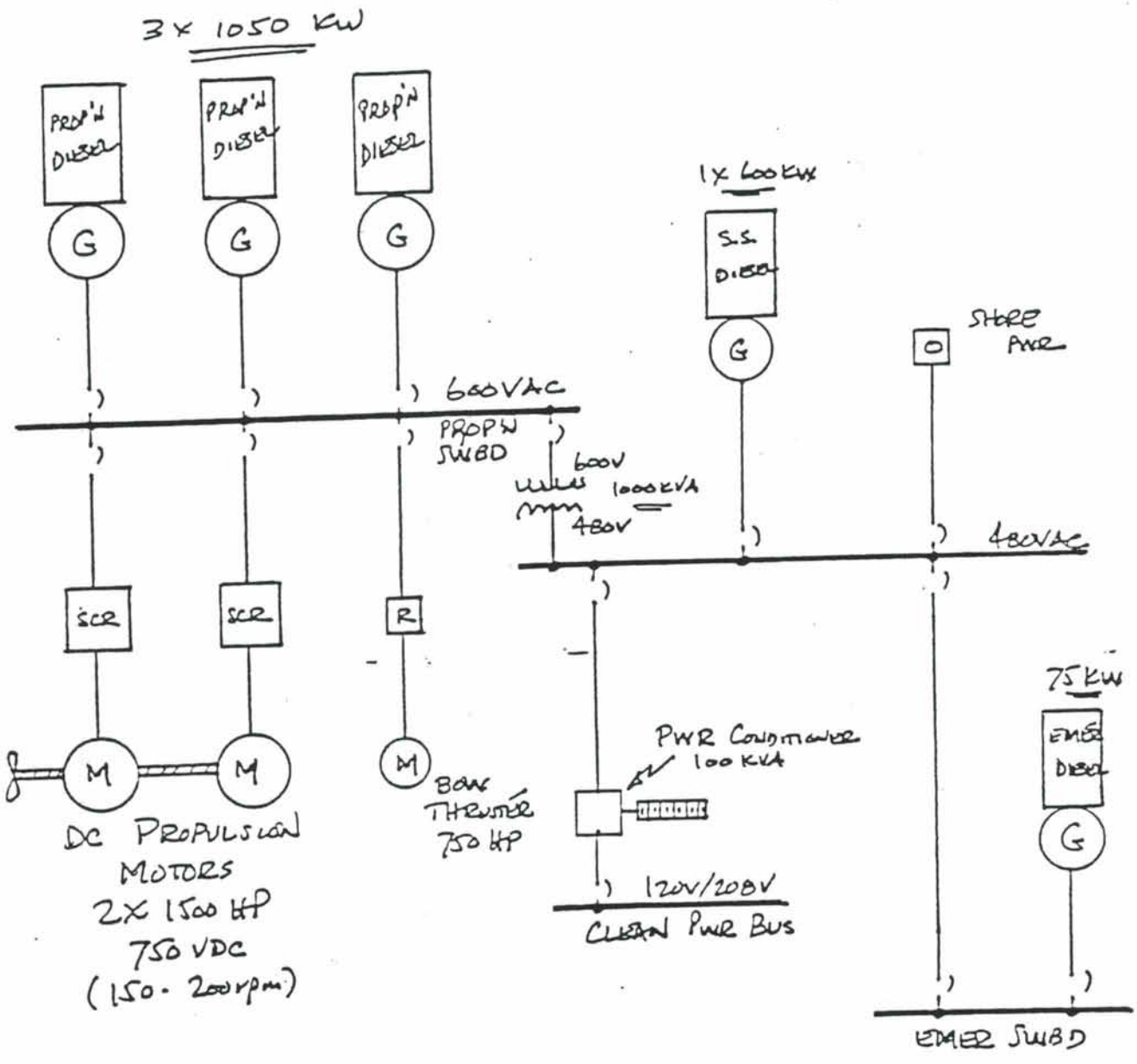
The resulting vessel has the following principal characteristics:

Length (LOA)		233-0"
Breadth		50'-0"
Draft (Full Load)		16'-0"
Displacement (Full Load)		2383 L.Tons
Propulsion		
Type		Diesel Electric
SHP		3000 (2238 KW)
Speed (Calm water, clean bottom)		15.2 Knots
Accomodations:	Crew	14
	Scientists	25
Science Spaces:	7 Labs	3,230 sq.ft
	2 Vans	640 sq.ft
	Storage	2,613 sq.ft
	Working Deck Area	3,550 sq.ft.

Block Coefficient	.485
Prismatic Coefficient	.557
Deck to Deck Height	8'-6"
Propulsion	
Type	Diesel Electric
SHP	3000 (2238 KW)
Propeller	5-Bladed Fixed Pitch, 9'-0" dia.

VESSEL BASELINE AND OPTIONS

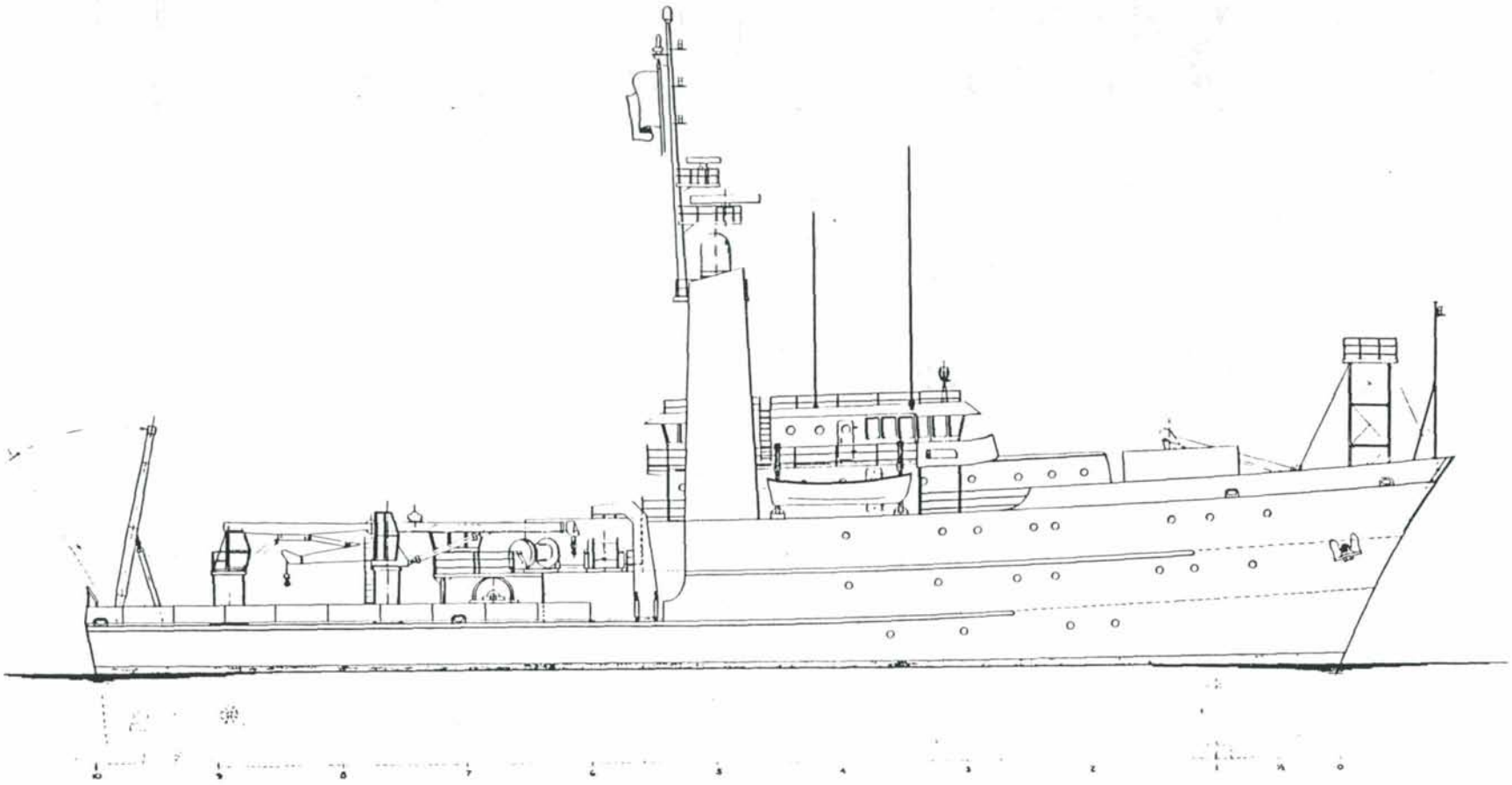
TITLES	BASELINE	OPTIONS
Power/Speed	3,000 SHP	Bulbous Bow
Stabilization	U-Tube	-
Structure	Ice Class C	Note possible to go to B
Thruster	750 hp trainable in bow	750 hp trainable in bow and 300 hp tunnel in stern
Resilient Mounting (Noise)	Simple	Note compound may be required
Main Engines/Generator	3	-
Stack	High to clear smoke and unobstructive to antennas	-
Antennas	Minimum blank spots and generous area for mounting.	-
Propulsion Shafts	1	2
Winches and Take-up Reels	Core winches on main deck facing aft, trawl winches on 01 level facing J-Frame	Core winch drums on second deck
Propulsion	AC, SCR, DC Electric Drive	Direct Diesel
Electric Plant	Integrated	Segregated
Cranes	1 Telescoping Boom Midship, Stbd	
	1 Articulated Aft Port	-
	1 Provisioning Fwd. (Telescoping)	Hydraulic boom hoist
Winch Operation	01 Level Control Station with see through to Main and visible to Pilothouse with enclosed doghouse	-



U.R.I. RESEARCH VESSEL

SCR AC/DC ELECTRIC PROPULSION

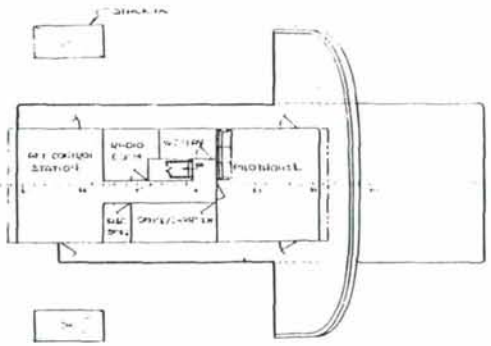
WITH "INTEGRATED" S.S ELECTRIC PLANT



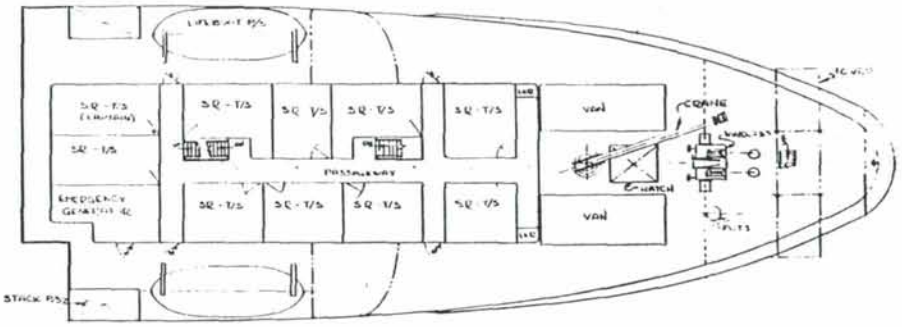
M. ROSENBLATT & SON, INC.
NAVAL ARCHITECTS & MARINE ENGINEERS
350 BROADWAY NEW YORK, NY 10013

OCEANOGRAPHIC RESEARCH VESSEL
UNIVERSITY OF RHODE ISLAND
OUTBOARD PROFILE

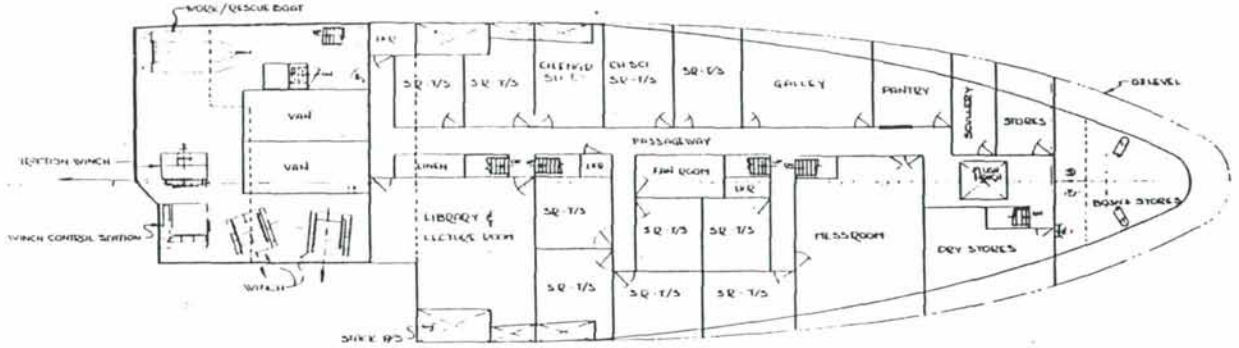
SIZE		DWG NO	REV
F		60604	A



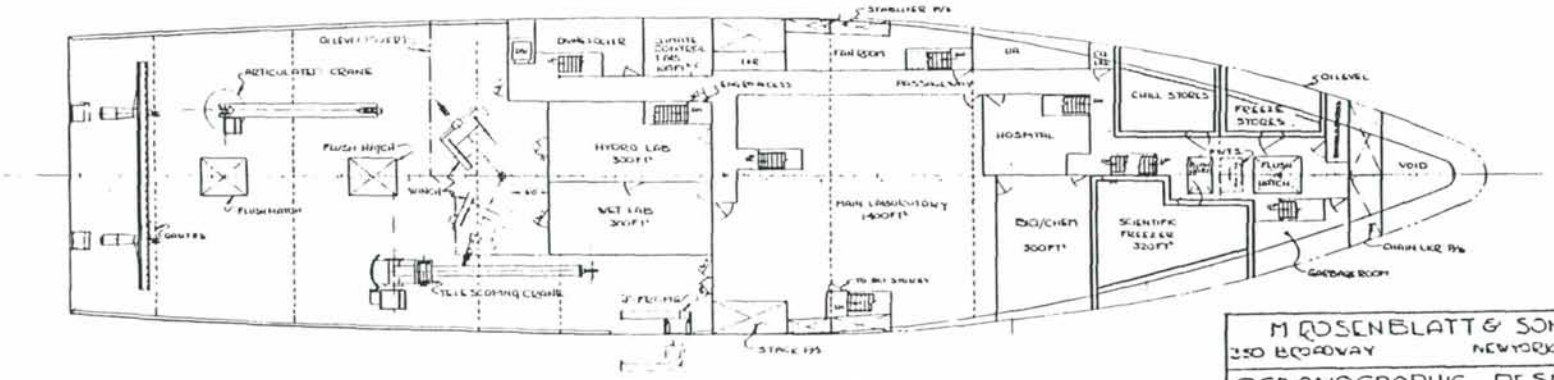
03 LEVEL



02 LEVEL

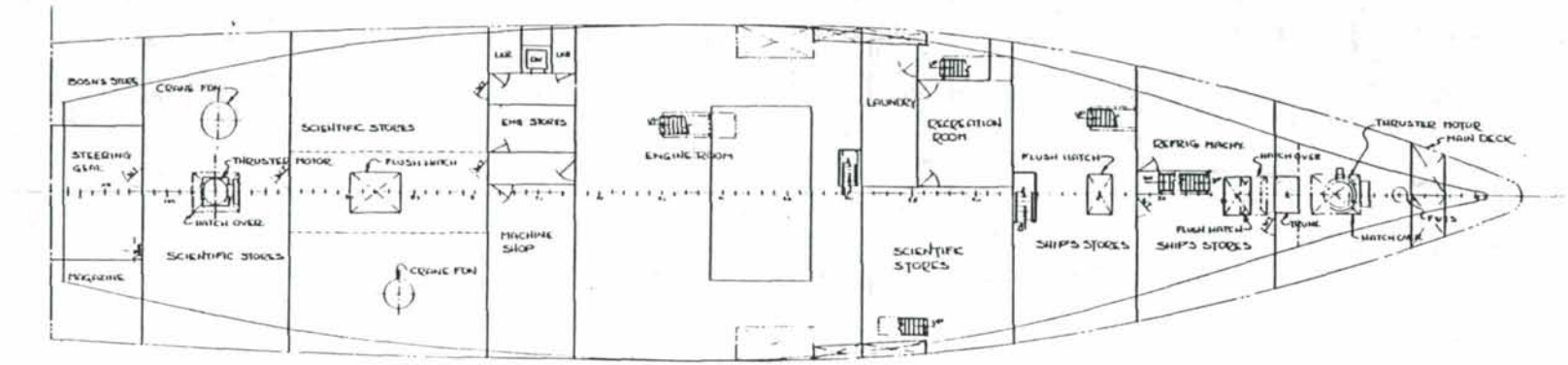


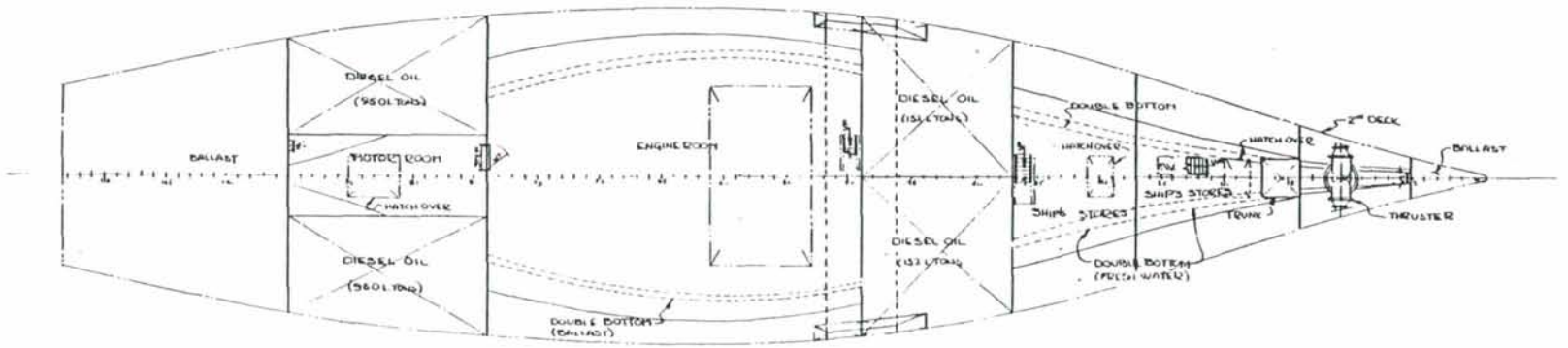
01 LEVEL



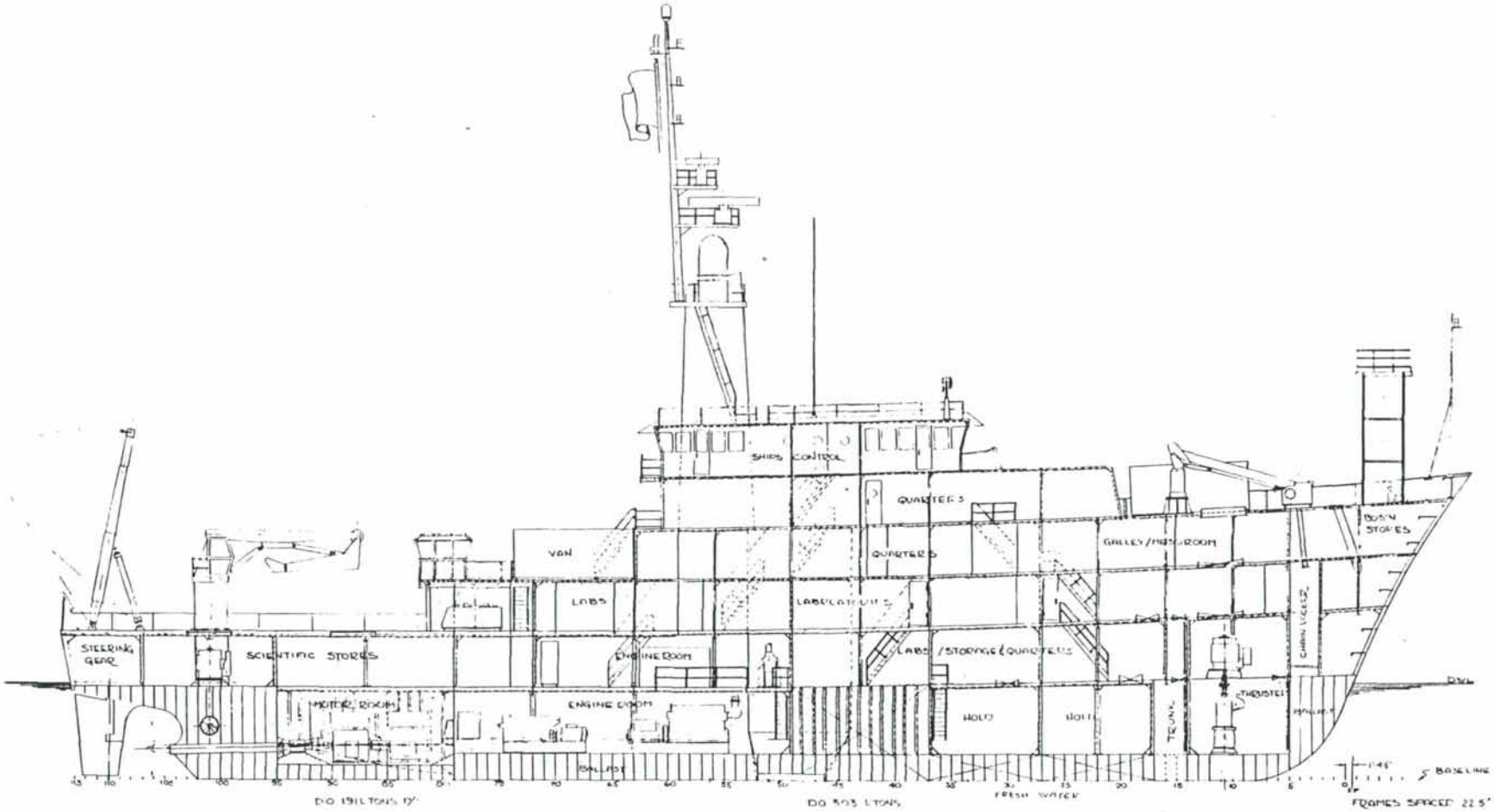
MAIN DECK

M ROSENBLATT & SON INC 350 BROADWAY NEW YORK NY 10013			
OCEANOGRAPHIC RESEARCH VESSEL UNIVERSITY OF RHODE ISLAND ARRANGEMENT OF DECKS			
DWG F		DESIGN 60606	REV -

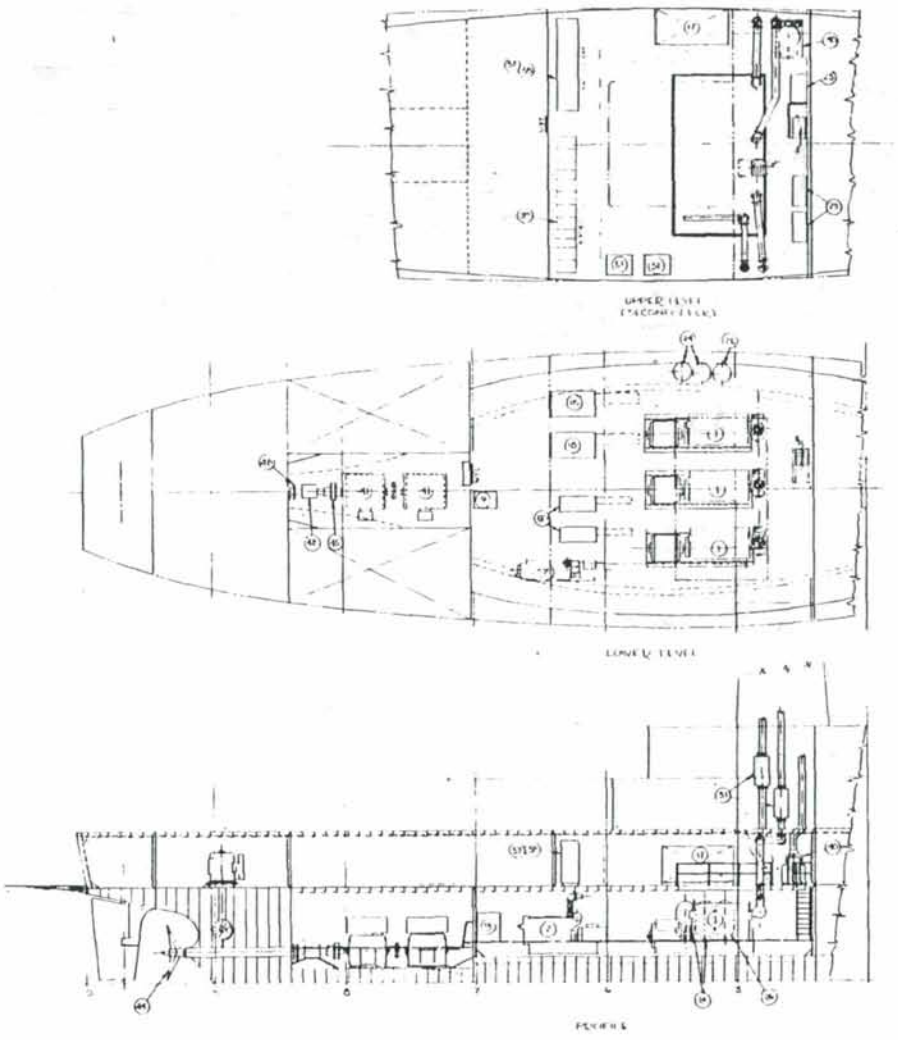




M. ROSENBLATT & SON INC. 350 BROADWAY NEW YORK, NY 10013			
OCEANOGRAPHIC RESEARCH VESSEL UNIVERSITY OF RHODE ISLAND ARRANGEMENT OF DECKS			
LTR F		DWG NO 60606	REV —



M. ROSENBLATT & SON, INC.	
NAVAL ARCHITECTS & MARINE ENGINEERS	
350 BROADWAY	NEW YORK, NY. 10013
OCEANOGRAPHIC RESEARCH VESSEL	
UNIVERSITY OF RHODE ISLAND	
INBOARD PROFILE	
SIZE F	DWG N° 60605
REV A	



UPPER LEVEL
MACHINERY LEVEL

LOWER LEVEL

PLAN

LIST OF MACHINERY

NO	QTY	DESCRIPTION	REMARKS
1	3	MAIN DIESEL GENERATOR	
2	1	STANDBY DIESEL GENERATOR	
3	4	L.O. TRANSFER/PRESSURE PUMP	
4	1	L.O. PURIFIER	
5	1	F.O. PURIFIER	
6	1	PURIFIER BENCH	
7	2	F.O. TRANSFER PUMP	
8	1	F.O. TRANSFER MANIFOLD	
9	1	OIL/WATER SEPERATOR	
10	2	BILGE & BALLAST PUMP	
11	1	BILGE/BALLAST MANIFOLD	
12	2	S.W. SERVICE PUMP	
13	1	FIRE PUMP	
14	1	SANITARY PUMP	
15	1	A/C COOLING WATER PUMP	
16	3	S.W. CHEST	
17	1	L.O. STORAGE TANK	
18	4	A/C UNIT	
19	2	POTABLE WATER PUMP	
20	1	POTABLE WATER PRESSURE TANK	
21	1	POTABLE WATER HEATER	
22	2	HOT POT WATER CIRCULATOR	
23	2	STARTING AIR COMPRESSOR	
24	2	STARTING AIR RECEIVER	
25	1	SHIPS SERVICE AIR COMPRESSOR	
26	1	SHIPS SERVICE AIR RECEIVER	
27	1	SHIPS SERVICE AIR DRYER	
28	1	ENGINE ROOM WORK BENCH	
29	1	ENGINE ROOM LOG DESK	
30	3	MAIN DIESEL EXHAUST LINE	
31	3	MAIN DIESEL SILENCER	
32	1	STANDBY DIESEL EXHAUST LINE	
33	1	STANDBY DIESEL SILENCER	
34	1	L.O. PURIFIER HEATER	
35	3	150 KVA TRANSFORMER	
36	3	75 KVA TRANSFORMER	
37	2	600V SWITCHBOARD	
38	1	480V SWITCHBOARD	
39	6	MOTOR CONTROLLERS	
40	1	BOILER	
41	2	MAIN PROPULSION MOTORS	
42	1	THRUST BEARING	
43	1	PROPELLER TAIL SHAFT	
44	1	PROPELLER	
45	1	FLEXIBLE COUPLING	
46	1	STUFFING BOX	
47	1	BOW THRUSTER	
48	1	BOW THRUSTER CONTROLLER	
49	1	BOW THRUSTER MOTOR	
50	2	REFRIGERATION UNIT	
51	2	DISTILLING UNIT	
52		MOTOR CONTROLLER	

M. ROSENBLATT & SON, INC
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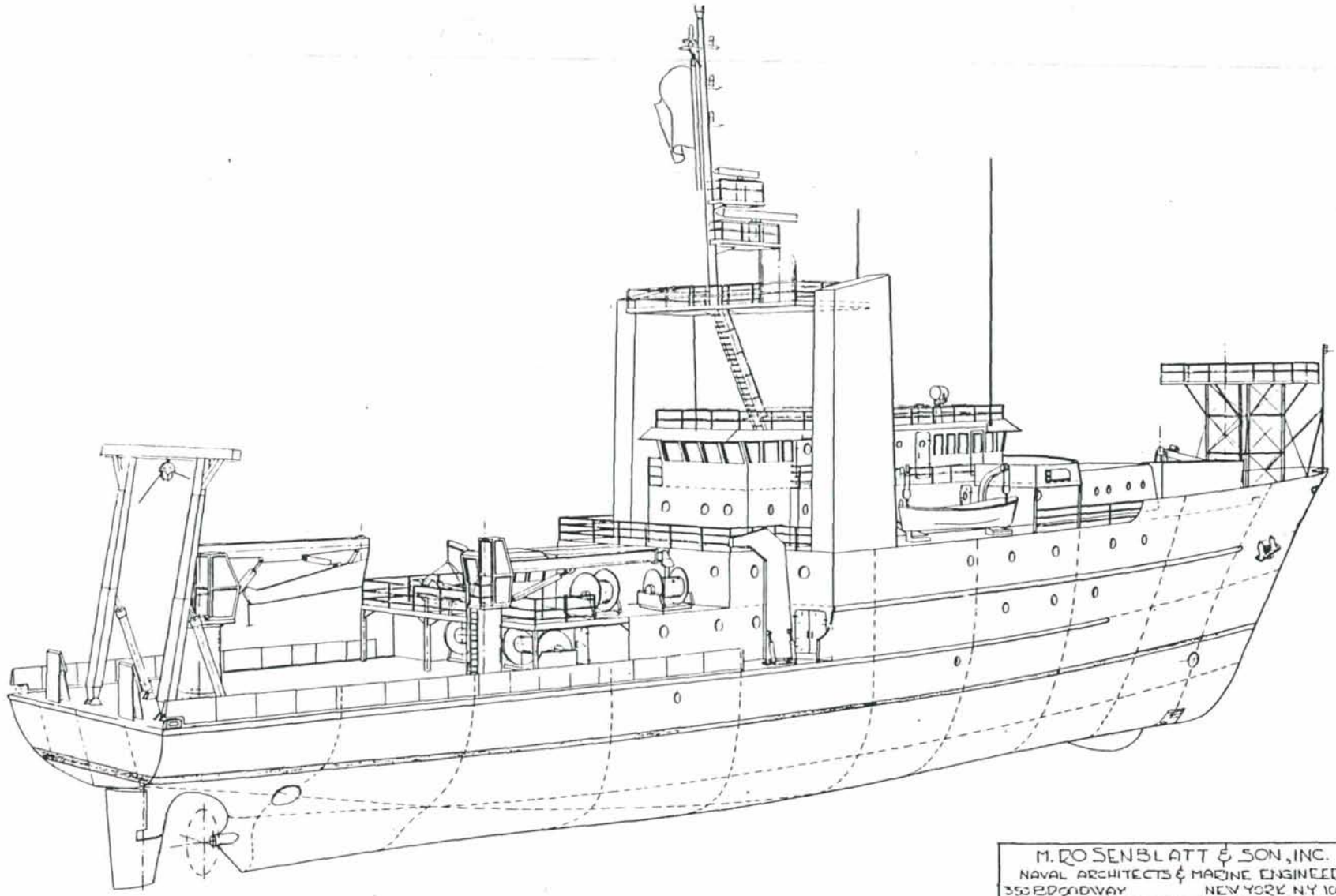
35 BROADWAY NEW YORK, N.Y. 10013

RESEARCH VESSEL
UNIVERSITY OF RHODE ISLAND
MACHINERY ARRANGEMENT

SIZE		DWG. NO.	REV
F	-	60607	A



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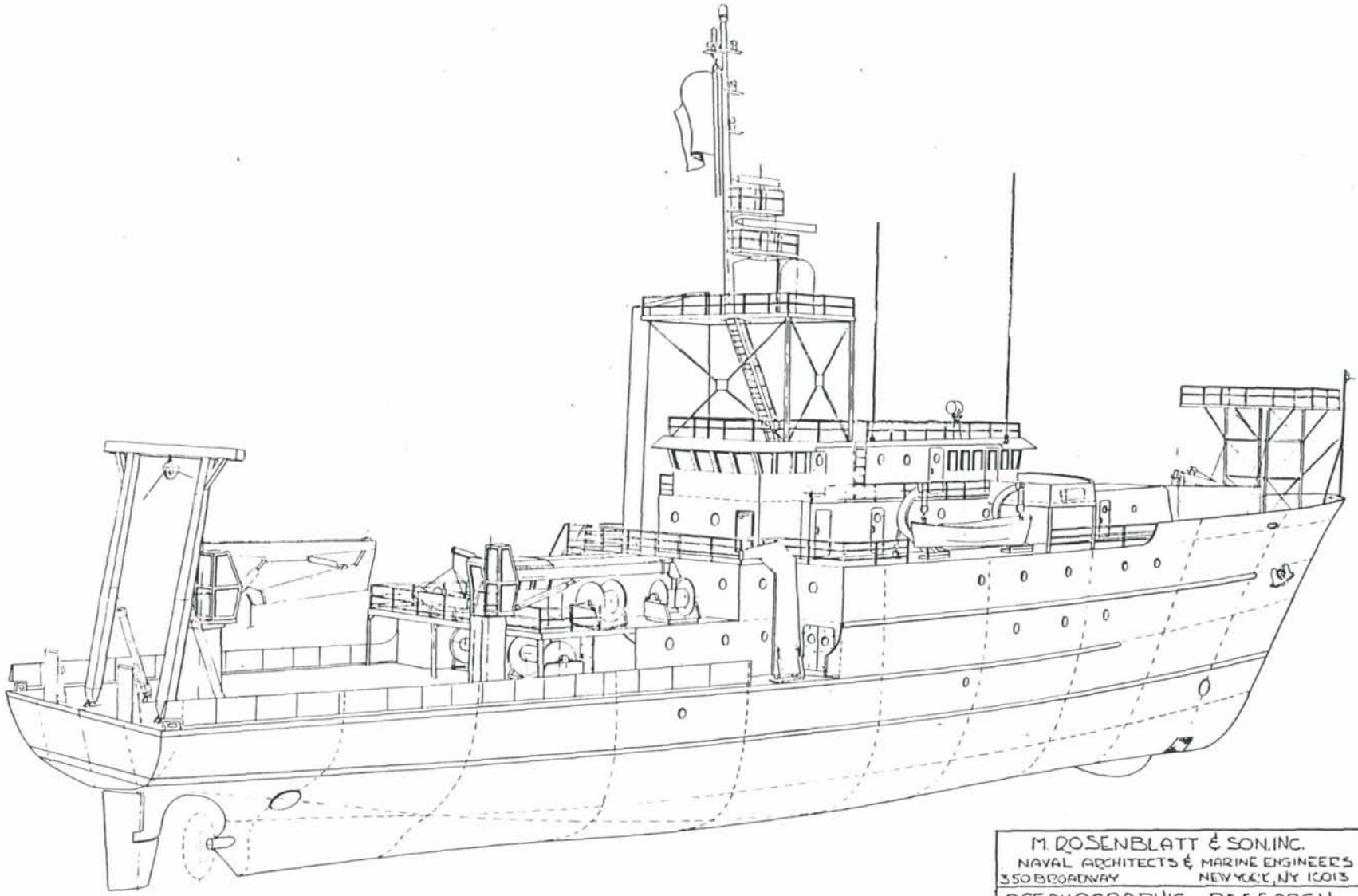
OCEANOGRAPHIC RESEARCH VESSEL
UNIVERSITY OF RHODE ISLAND
(TWIN STACKS)

SIZE		DWG NO	REV
F		60608	A



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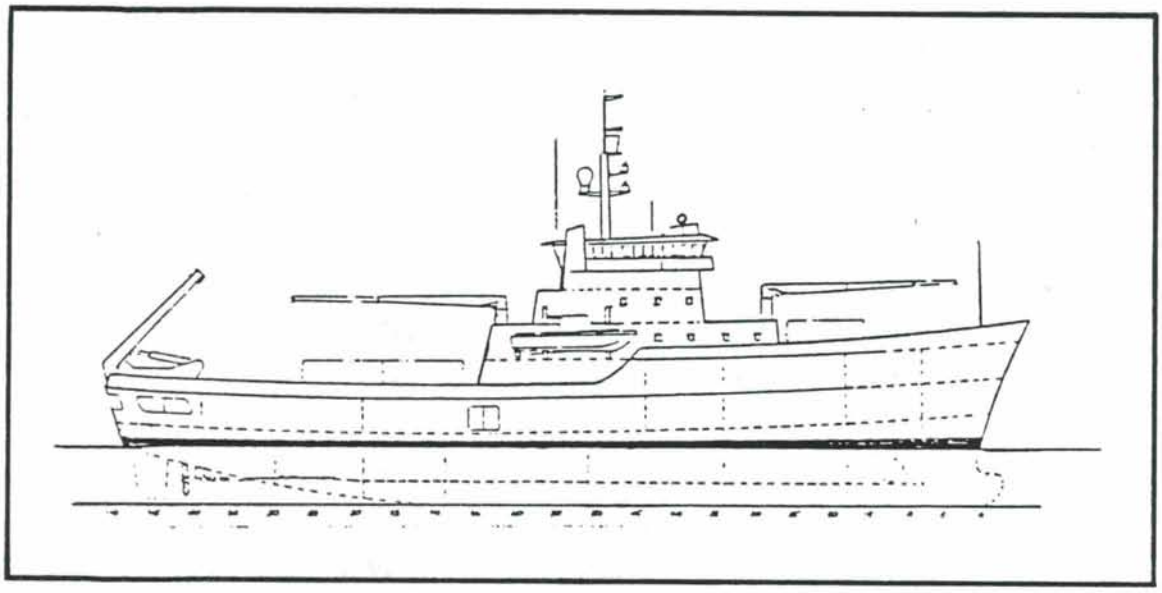
350 BROADWAY NEW YORK, NY 10013

OCEANOGRAPHIC RESEARCH VESSEL
UNIVERSITY OF RHODE ISLAND
(SINGLE STACK)

SIZE		DWG NO	REV
F		60608	A

Concept Design of a Large Oceanographic Research Ship



Conducted pursuant to the research ship requirements of the University National Oceanographic Laboratory System [UNOLS]

by

The Glosten Associates, Inc.
Seattle Washington

Under the direction of the Scripps Institution of Oceanography

NOVEMBER 1985

PRINCIPAL DIMENSIONS AND CAPACITIES

Principal Dimensions

LOA	228'-4"
LWL	212'-0"
Beam (maximum)	64'-0"
Beam (DLWL)	62'-4"
Depth (main deck)	18'-6"
Depth (shelter deck)	28'-6"
Design Draft Amidships	15'-2"
Displacement at DLWL	2468.5 LTSW

Ratios and Coefficients

C_B	(Block Coeff.)	.430
C_P	(Prismatic Coeff.)	.630
C_M	(Midship Coeff.)	.673
C_{WP}	(Waterplane Coeff.)	.780
C_{VP}	(Vert. Prismatic Coeff.)	.544
$\Delta/[\emptyset.\emptyset 1L]^3$	(Displacement/Length Ratios)	259.0
$L/\nabla^{1/3}$	(Volumetric Coeff.)	4.8

Capacities

Total Deadweight Capacity (including 75 L.T. of permanent scientific outfit)		794 L.T.
Variable Scientific Payload		172 L.T.
Fuel Oil Capacity (95%)	136,000 gallons	440 L.T.
Lube Oil Capacity (95%)	4,400 gallons	15 L.T.
Fresh Water Capacity (100%)	8,600 gallons	32 L.T.

Complement:	Officers & Crew	16
	Scientific Party	25
	Additional Crew for Maintenance and Scientific Support	7
	Total	48

Installed Power - Diesel Electric — 3900 HP, 2900 KW
6 @ 650 HP - 5 used, 1 spare

Propellers

Twin four-bladed

Diameter	8.5 feet
Pitch	8.5 feet

Bow Thruster	720 HP White Gill
Stern Thruster	720 HP White Gill
Endurance	greater than 48 days
Range	greater than 13,000 nautical miles at 12 knots

Weights

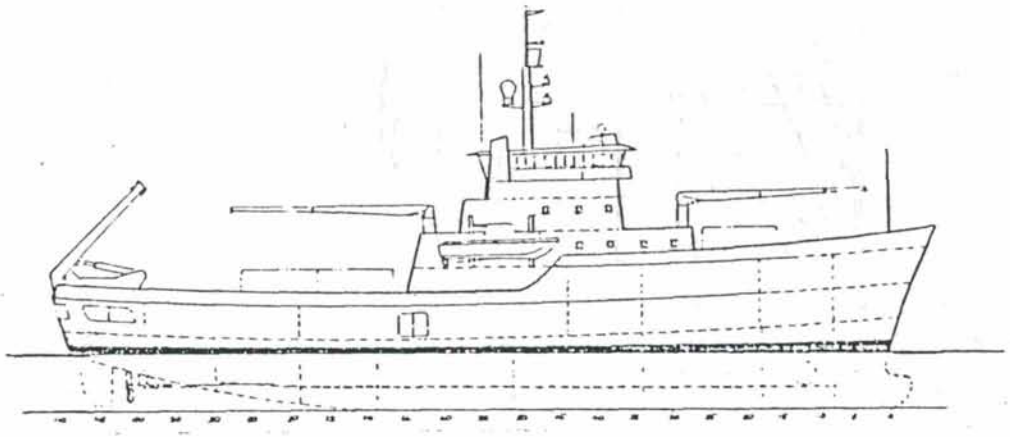
Hull structure	873 L.T.
Propulsion	165 L.T.
Auxiliary systems	110 L.T.
Communication & control	15 L.T.
Outfit and furnishings	220 L.T.
Allow for permanent scientific outfit	75 L.T.
Subtotal	1458 L.T.
Design margin	292 L.T.
Light Ship	1750 L.T.
F.O.	440 L.T.
L.O.	15 L.T.
F.W.	32 L.T.
Crew and effects	10 L.T.
Ship's stores	50 L.T.
Scientific payload	172 L.T.
Full load	2469 L.T.

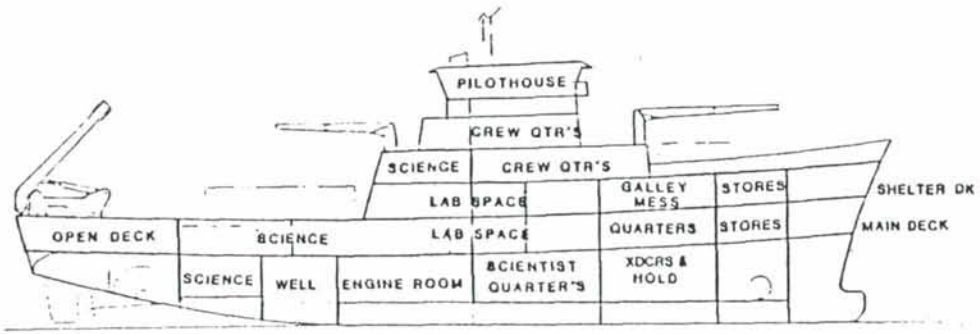
Deck Areas and Laboratory Volumes

Deck areas and volumes have been allocated to conform in general to the requirements put forth by the UNOLS "Scientific Mission Requirements" and in the case of accommodations, spaces equal or exceed those of the R/V MELVILLE class of vessel. The areas

and volumes are tabulated below and where applicable corresponding areas on the R/V MELVILLE are shown for comparitive purposes.

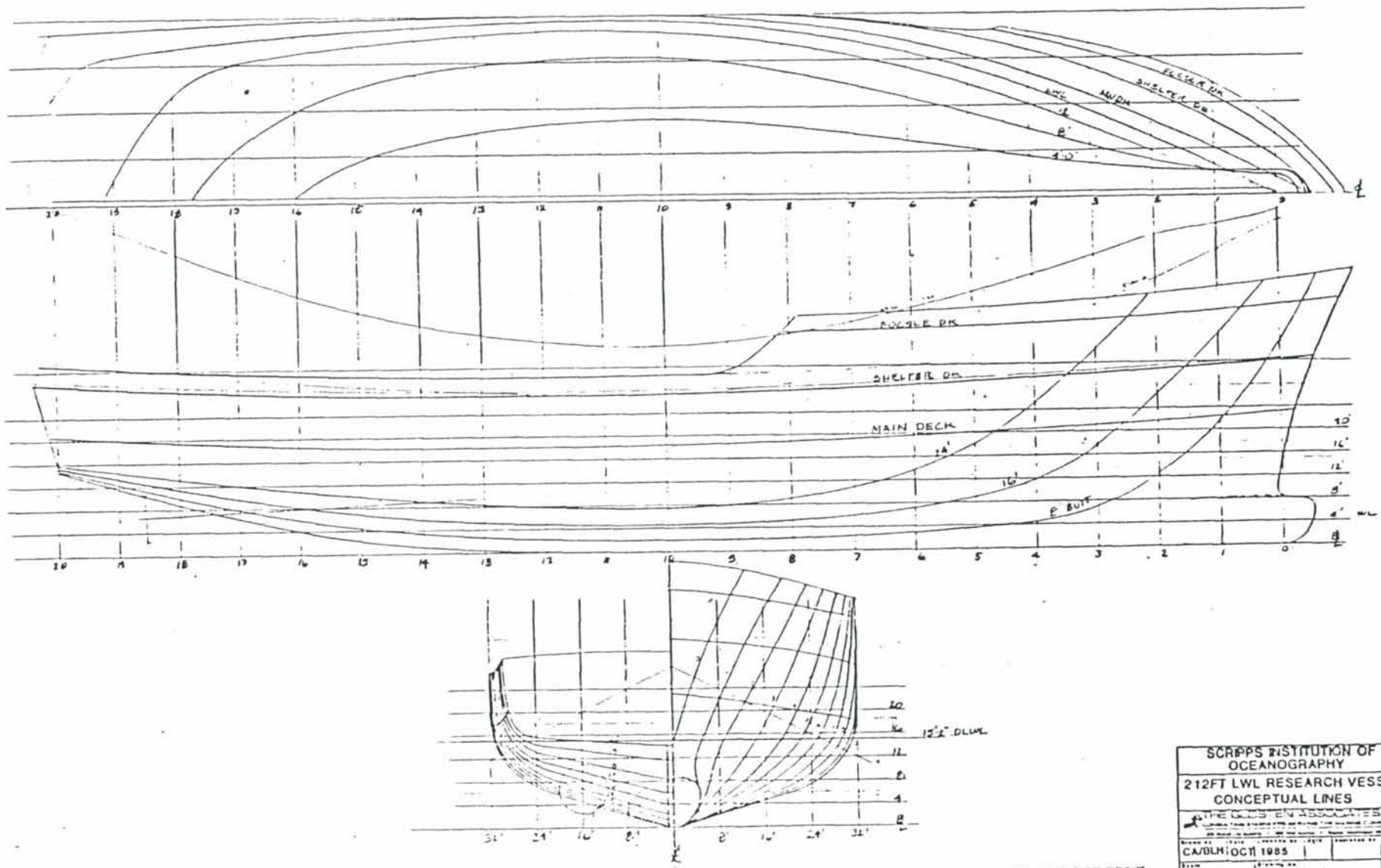
Locale	Area (Sq. Ft.)	UNOLS Requirements	MELVILLE
1. Scientific Areas			
a. Focsle Deck			
1. Open Deck Area	3,080		
2. Library & Office	592		
Subtotal	3,672		
b. Shelter Deck			
1. Labs & Shops	1,392		
2. Open Deck Area	6,706	2,480	3,360
Subtotal	8,098		
c. Main Deck			
1. Scientific Stores 2. Computer Lab 3. Main Lab 4. Chemical Lab/Freezers 5. Wet Lab 6. Hydro Lab	4,056	3,000	3,000
7. Enclosed Deck	2,830		
8. Open Deck Area	1,640		
Subtotal	8,526		
d. Hold			
1. Winch Room	1,364		
Grand Total, Scientific Areas	21,660		
2. Quarters			
a. Upper Deck	2,650		
b. Focsle Deck	1,454		
c. Shelter Deck	640		
d. Main Deck	1,393		
e. Hold	958		
	7,095		4,508
3. Miscellaneous Spaces			
a. Stores & Freezers	1,208		
b. Mess & Galley	1,030		
c. Passageways (Upper, Focsle, Shelter, Main Decks)	2,273		





INBOARD PROFILE

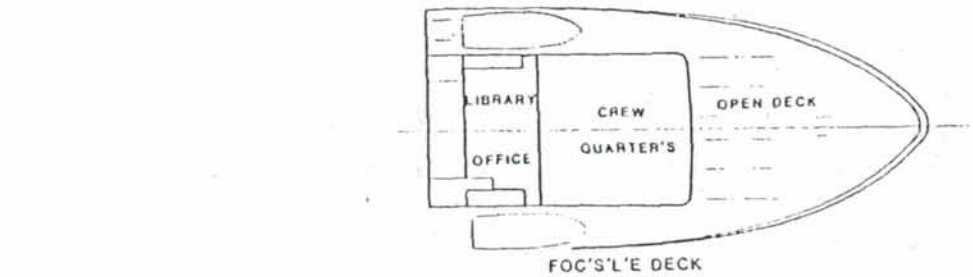
SCRIPPS INSTITUTION OF OCEANOGRAPHY UNIVERSITIY OF CALIFORNIA, SAN DIEGO			
212' LWL RESEACH VESSEL DESIGN CONCEPT- ARRANGEMENTS			
THE GLOSTEN ASSOCIATES, inc. CONSULTING ENGINEERS SERVING THE MARINE COMMUNITY			
CA/BLH	NO SCALE	OCT 1986	8534-2 (1 of 2)



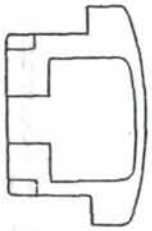
NOTE: REDUCED SIZE PRINT

SCRIPPS INSTITUTION OF OCEANOGRAPHY	
212FT LWL RESEARCH VESSEL CONCEPTUAL LINES	
THE GLOSTEN ASSOCIATES INC	
CA/BLH OCT 1985	
NO SCALE	8534-1

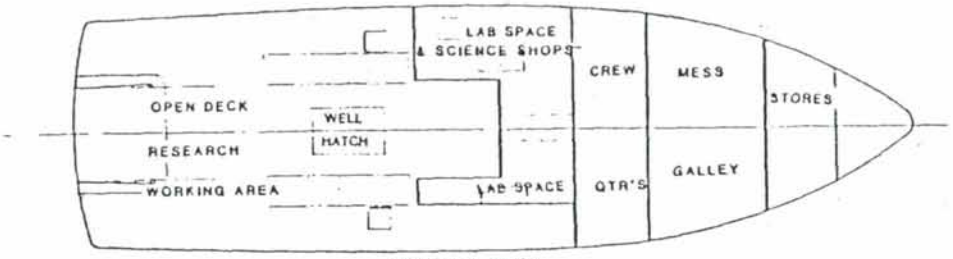
THE GLOSTEN ASSOCIATES INC



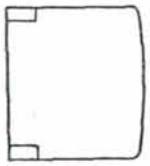
FOC'S'L'E DECK



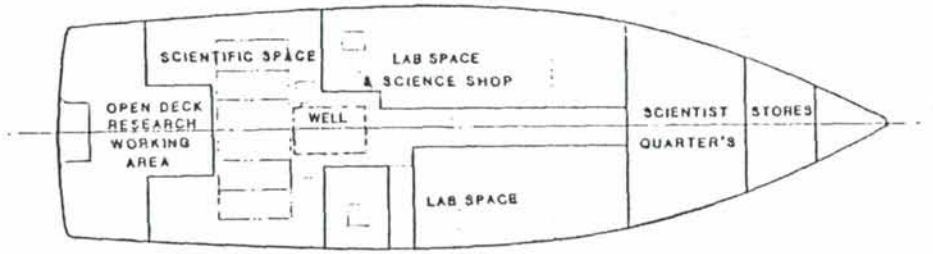
PILOTHOUSE



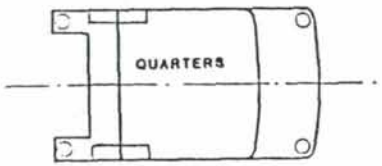
SHELTER DECK



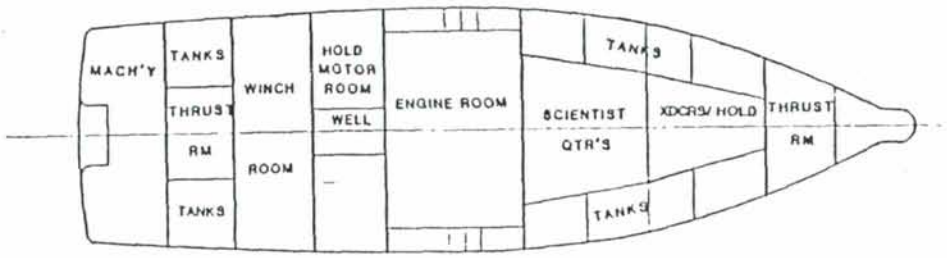
MACH'Y SPACE



MAIN DECK



UPPER DECK



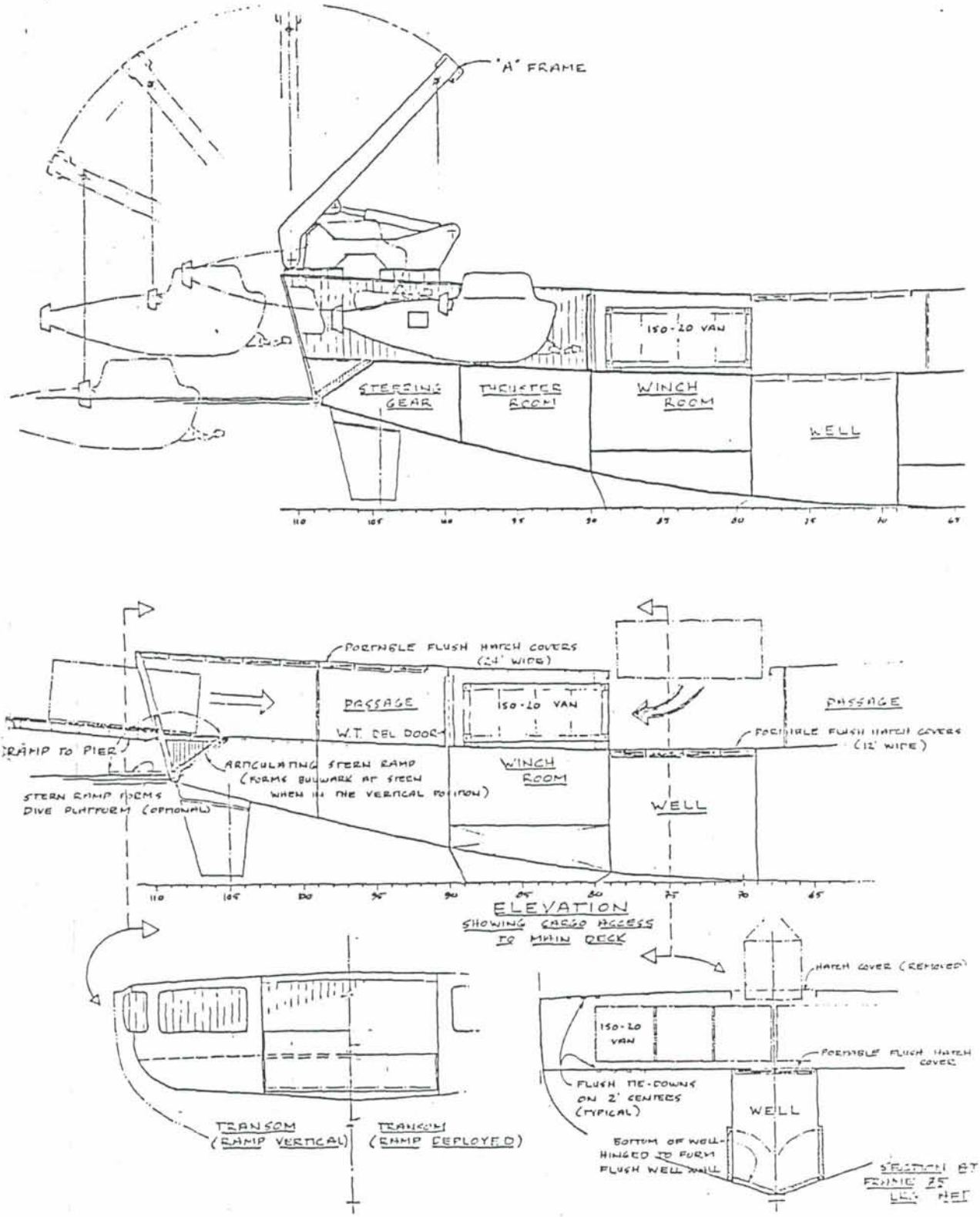
HOLD

SCRIPPS INSTITUTION OF OCEANOGRAPHY
UNIVERSITIY OF CALIFORNIA, SAN DIEGO

212' LWL RESEACH VESSEL
DESIGN CONCEPT- ARRANGEMENTS

THE GLOSTEN ASSOCIATES, inc.
CONSULTING ENGINEERS SERVING THE MARINE COMMUNITY

CA/BLH	NO SCALE	OCT 1985	8534-2 (2 of 2)

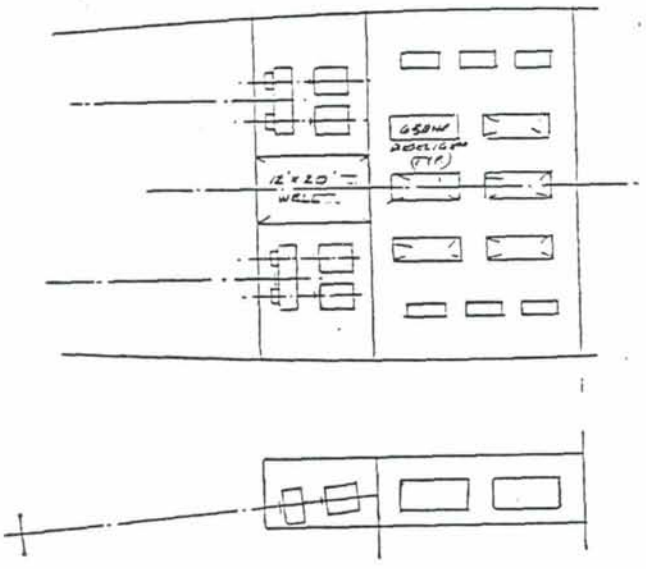


Cargo Access Routes to Main Deck

POWER REQUIREMENTS FOR VARIOUS TYPICAL OPERATIONS

Service	Main Propulsion	Winches & Special Re-Thrusters	Ship's search Load	Service	Total
Cruising @ 14 Kts					
a) geared eiesel	2710 HP	0	100 HP	335 HP	3145 HP
b) diesel electric	2930 HP	0	100 HP	335 HP	3365 HP
On Station					
a) position keeping	135 HP	1440 HP	135 HP	335 HP	2045 HP
b) drifting 0	0	135 HP	335 HP	470 HP	
Towing					
a) 10,000# @ 6.0 Kts	550 HP	0	135 HP	335 HP	1020 HP
b) 25,000# @ 2.5 Kts	940 HP	0	135 HP	335 HP	1410 HP

Diesel Electric - Several (say six) high speed (1800 rpm) diesel engines driving alternators which power direct current propulsion motors through silicon controlled rectifiers (SCR). Motors drive propeller shafting through reduction gearing. Propellers are typically fixed pitch, though controllable-pitch propellers could be used. All deck machinery, thrusters and other auxiliaries are powered from the propulsion alternator bus. Special requirements for "clean" electricity can be provided by motor generators or a separate diesel generator. The following figure shows this option.



The characteristics of the propulsion system include:

* Engine speed can be maintained at constant level while maneuvering
* Can achieve greater propeller speed range than with geared diesel by use of motor field weakening and thus overspeeding
* Highly maneuverable
* Power available for electric driven auxiliaries and ship service power through transformer.
* Multiple small engines allow planned maintenance scheme
* Efficiency is gained through matching number of generators to specific load demand

The diesel electric system requires approximately 3300 brake horsepower. Thus we have shown a total installation of 3900 HP (6 units each having about 650 horsepower, so that even at maximum load one unit can be out of service or on standby. The number and size of units is driven by the requirement to make 14 knots in Sea State 4, so the final selection of power must be examined again as the design develops.