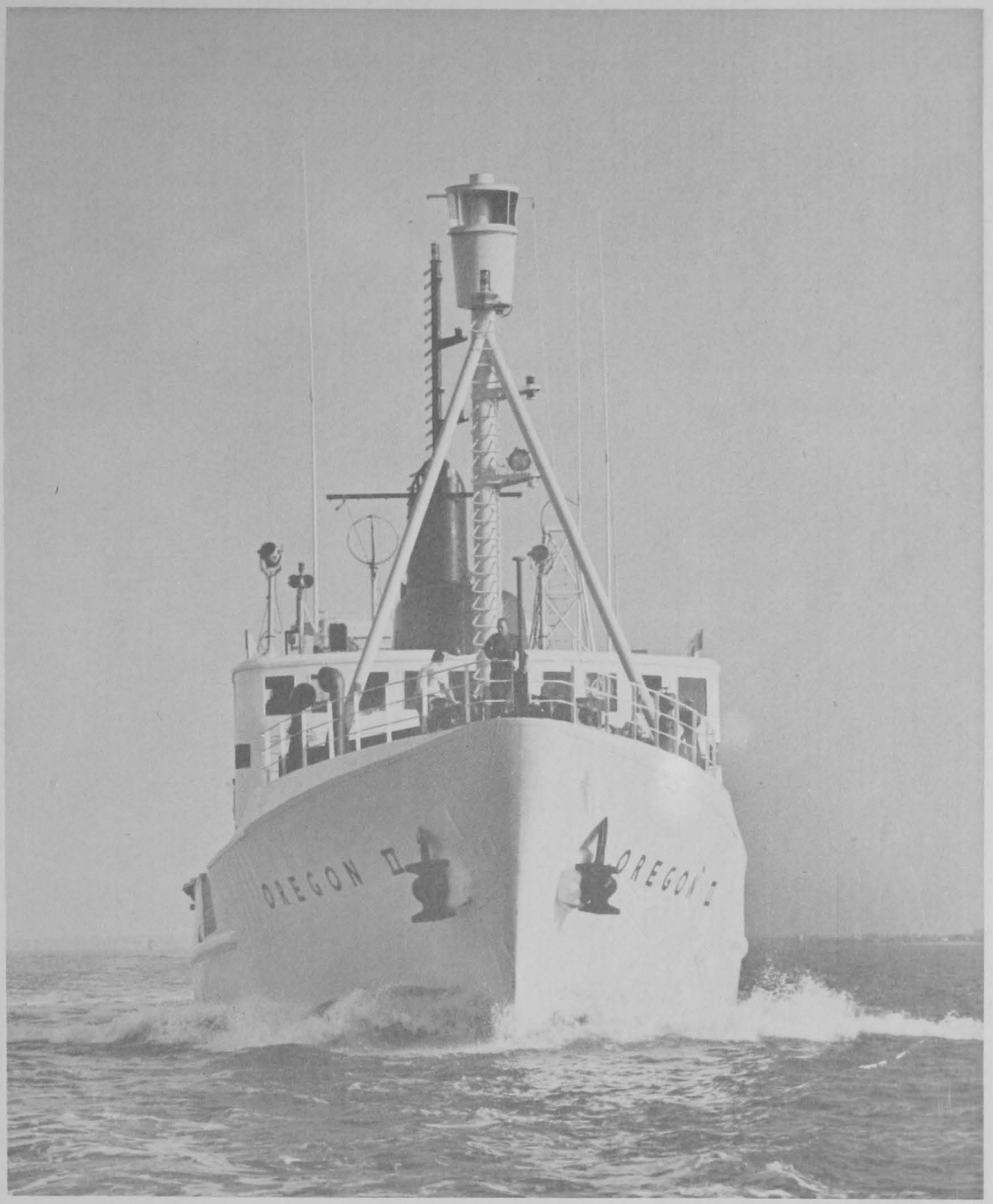
Design of the Fishery Research Vessel Oregon II



UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

BUREAU OF COMMERCIAL FISHERIES

Circular 256

UNITED STATES DEPARTMENT OF THE INTERIOR
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By

FRANCIS J. CAPTIVA

Circular 256

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Cover Photo--Oregon II making 14 knots on sea trials.

Design of the Fishery Research Vessel Oregon II

By

FRANCIS J. CAPTIVA, Fleet Supervisor

Bureau of Commercial Fisheries
Exploratory Fishing and Gear Research Base
Pascagoula, Mississippi 39567

ABSTRACT

This paper describes the United States Fish and Wildlife Service, Bureau of Commercial Fisheries research vessel Oregon II. The vessel has been designed for exploratory fishing and gear development studies in the tropical and subtropical portions of the western Atlantic, Gulf of Mexico, and Caribbean Sea. It will be 170 feet long, will have a mean draft of 12-1/2 feet, and a beam of 34 feet. Two 800-horsepower engines will propel it through a single propeller. The vessel incorporates many innovations for ease, safety, and flexibility in gear handling.

INTRODUCTION

Commercial fishery research and fishing gear studies of the United States Government are done by the Bureau of Commercial Fisheries of the United States Department of the Interior. This Bureau, which operates fishery research vessels in the Atlantic and Pacific Oceans, the Great Lakes, the Gulf of Mexico, and the Caribbean Sea, is now modernizing its fleet with new vessels.

This paper describes the features of a modern fishery research vessel designed primarily for exploratory fishing surveys, commercial-scale fishing operations, fishing gear development studies, and oceanographic research in the Gulf of Mexico, Caribbean Sea, and the tropical and subtropical Atlantic Ocean. This vessel, which is to be named Oregon II, is the seventh research vessel contracted for by the Bureau of Commercial Fisheries in the past 3 years. It replaces the fishery research vessel Oregon (figure 1) a converted 100-foot tuna clipper that has carried out most of the fishery research work for the past 15 years in the Gulf and southwest Atlantic. Oregon II will have much greater capabilities than her predecessor, for she has been designed expressly to: (1) meet the needs that have become apparent during the 15 years, and (2) have the features considered most desirable by many of the leading designers of research vessels.

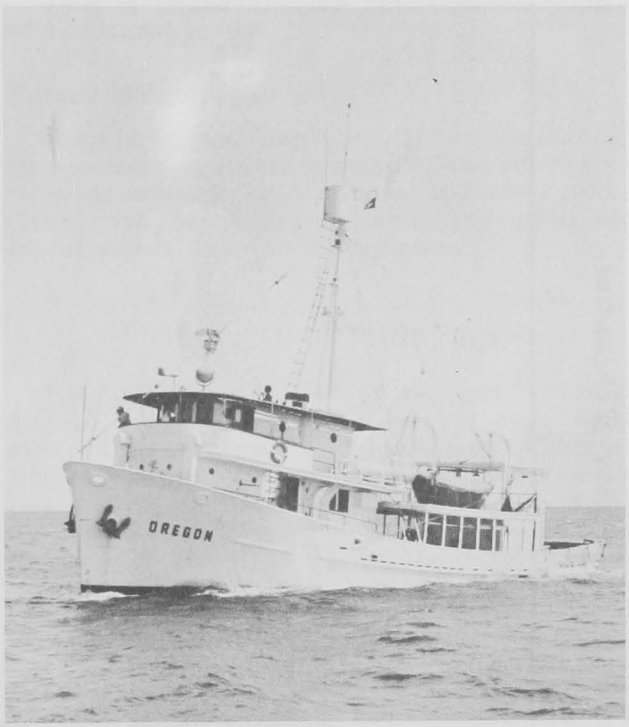


Figure 1.--R. V. Oregon - 100-foot converted tuna clipper used in exploratory fishing surveys in the Gulf of Mexico and southwestern North Atlantic Ocean during 1950-65.

The primary aim of this vessel is to increase the production of United States fishermen by conducting: (1) exploratory fishing surveys to determine if commercially harvestable fishery stocks are available in unexplored areas; (2) fishing trials with conventional and new types of fishing gear to develop improved fishing methods and techniques; and (3) surveys of the Gulf, Caribbean, and middle and south Atlantic regions to determine the identity, abundance, and distribution of the marine fauna.

The original design, which is described here, has special and unique features that will probably be incorporated into the vessel when money is available.

DESIGN DEVELOPMENT

The design was developed by the joint efforts of three groups: (1) staff members of the Exploratory Fishing and Gear Research Base, Pascagoula, Mississippi, prepared the preliminary operational criteria; (2) Robert H. Macy, Naval Architect and Marine Engineer of Pascagoula, Mississippi, developed the design and prepared the contract plans and specifications; and (3) the Bureau of Commercial Fisheries Vessel Design Committee provided objective review and counsel throughout the design period.

The design evolved around the following principal criteria:

Extended Operating Range

Many of the surveys will be off the coasts of foreign countries. The ship must have independence at sea because many of these countries are relatively underdeveloped, thus making it difficult, or impossible, to obtain uncontaminated water, suitable fuel and lubricating oil, and vessel stores. An operating range of 9,000 nautical miles and 60 days endurance before return to port for bunkering and supplies was considered minimal.

High Cruising Speed

A cruising speed of 13 to 15 knots is desired, so that running time to and from distant portions of the assigned area is kept to a minimum, leaving more working time available. The difference in available work time that results from higher cruising speed is shown in figure 2.

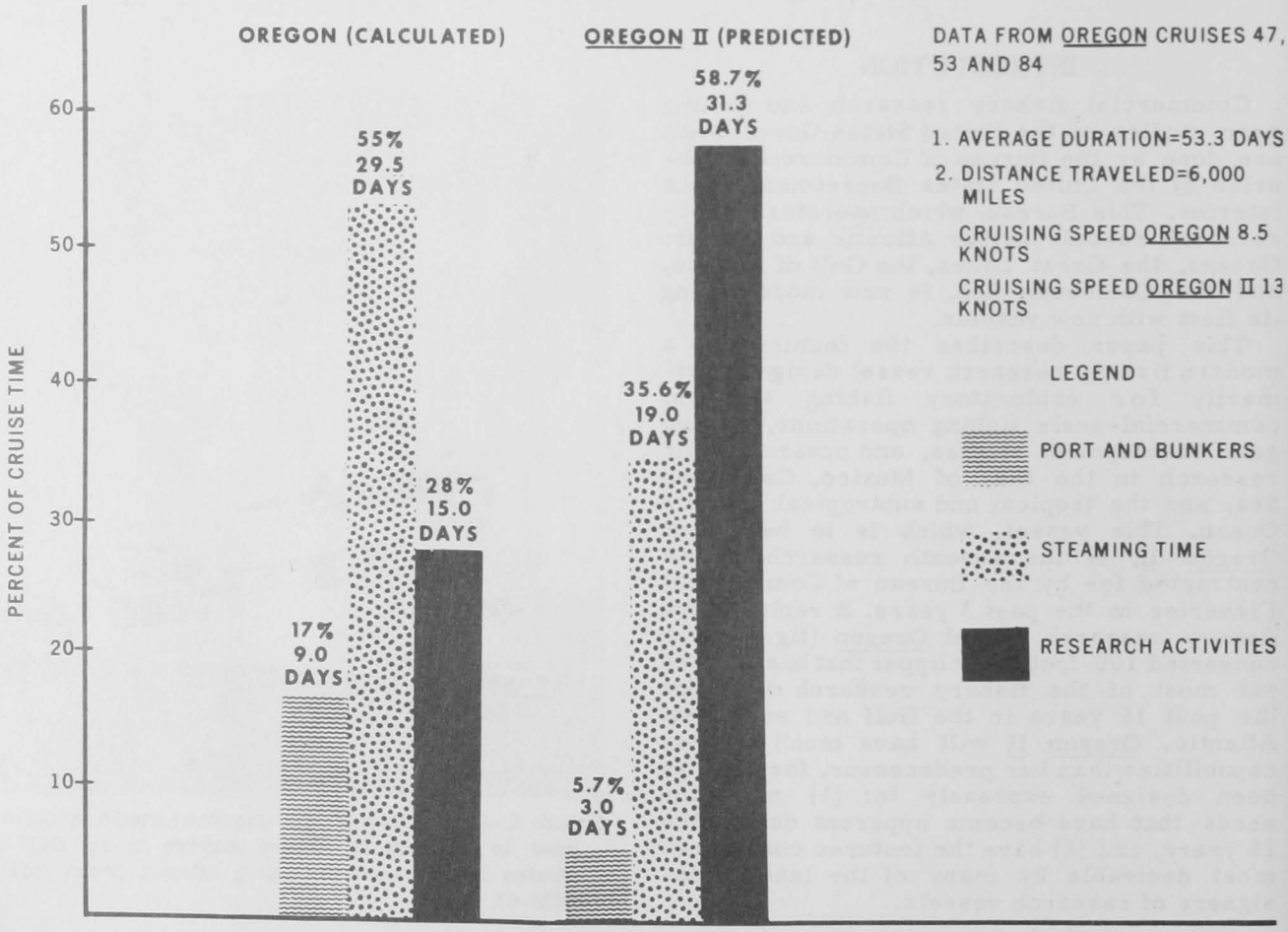


Figure 2.--Comparison of running time versus work time for Oregon and Oregon II.

Versatility

It is mandatory for the vessel to be able to perform a wide variety of fishing and resource-evaluation activities during any cruise without modification to structure, machinery, or existing arrangements. To assess the fishery resources of a given area requires sampling with a wide assortment of fishing gear because each type of fishing gear is highly selective in what it catches.

Automation

An automated fishing gear and catch-handling complex is needed to keep the vessel crew to a minimum and the ratio of crew to scientists at or near 1:1.

Research Facilities

Laboratory facilities are needed for specialists (and their equipment) in the different fields of exploratory fishing, gear research, biology, technology, and oceanography, thereby precluding the need to transport personnel and equipment to and from distant-water ports as the cruise aims change.

Habitability

To enable us to hire and keep qualified personnel and to ensure their well-being and high productive effort during long cruises, living quarters must be as attractive and spacious as possible.

Figure 3.--Master's stateroom--double-berth cabins for crew and scientists are similar in decor and arrangement.

Seaworthiness

The cruising area is subject to tropical cyclones, so the ship must have stability under all conditions of load and weather.

Seakindliness

It is not always easy to define "seakindliness," which is the sum total of many characteristics. We need a vessel that can be used in fishing and oceanographic operations in the open sea in sea states caused by winds as high as Beaufort 8 (36 knots). The ability to heave-to comfortably is a special design requirement.

Safety

Vessel safety standards are in accordance with applicable United States laws and requirements.

Arrangement

Laboratories and living spaces are located within the area of least motion. Most working and living areas are accessible without need to traverse the open deck.

Maneuverability

High maneuverability is needed, together with refined speed control from dead-in-the-water to maximum speed.

Reserve Displacement

This is necessary for safe accommodation of additional loads.

Future Maintenance

Simplicity and dependability of machinery components and arrangements, and adherence to modern concepts of corrosion control practices, are necessary to keep operation and maintenance costs to a minimum.

GENERAL DESCRIPTION

The hull form is that of the North Atlantic distant water trawler, a vessel type considered to have superior seakeeping qualities. The conventional trawler deck arrangement has been modified to enable the vessel, without further rigging or alteration, to function as a side trawler, stern trawler, double-rigged shrimp trawler, purse seiner, longliner, gill netter, or shellfish dredger (fig. 4). There is a partial deck below the main deck, two superstructure decks, and a forecastle. Fourteen crewmen and 11 scientists can be accommodated in one- and two-man cabins with facilities for off-duty relaxation and study. All living and most working spaces are air conditioned and heated.

The vessel will be powered by two diesel engines driving one controllable pitch propeller through a compound reduction gear.

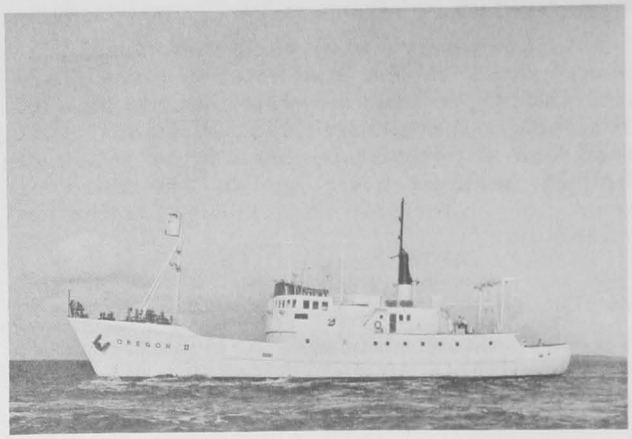


Figure 4.--Outboard profile, port side. Note that working deck areas are located both fore and aft.

The hull will be transversely framed and of all-welded steel construction except for the upper house, which will be aluminum. Typical sections are shown in appendix A, figure 1. It will have a raked stem and a modified cruiser stern.

The vessel will be equipped with advanced fish-finding, navigational, and communication equipment, and will have six independent laboratories, each fully equipped to carry out its assigned function. The fore and aft open deck areas are arranged to provide adequate working space for scientific and fishing efforts.

The vessel will have a variety of winches and gear-handling devices. These include two trawl winches, a hydrographic winch, a bathythermograph winch, six sacking winches, two cranes, an anchor windlass, two hydraulically actuated gallow frames, and an interlaboratory and working deck overhead monorail hoist.

The engineroom and machinery casings are sound insulated to reduce noise levels.

The tripod foremast has an enclosed crow's nest. Two free-standing kingposts are aft. Exhaust gases from the main propulsion, generator engines, and the heating boiler are expelled above the top of the pilothouse through a combination stack mast for low exhaust noise levels and clean decks.

Five freezer compartments hold a total of 60 tons of fishery products.

The principal dimensions are given in appendix A, table 1.

VESSEL CLASSIFICATION

The vessel and its equipment will be constructed under the special survey of the American Bureau of Shipping to the classification ✠ A1 Ⓔ ✠ AMS Fishing Vessel-Ocean Service. It will be inspected by the United States Coast Guard and built to their CG-257 "Rules and Regulations for Cargo and Miscellaneous Vessels," except for minor deviations such as quarters arrangements, and will meet the major requirements of the United States Public Health Service.

ARRANGEMENT

The general arrangement is shown by the outboard and inboard profiles and the deck arrangement plans (appendix A, figures 2-5).

Subdivision

The ship is designed to meet a one-compartment standard of subdivision but is capable of withstanding two-compartment flooding forward of the engineroom, throughout its normal range of loading up to the design draft.

Deck Arrangement

Main deck arrangement provides adequate working space both fore and aft for handling fishing and oceanographic gear. The main trawling winch is located athwart-ship forward of the house structure. Deck bollards are arranged to fairlead the trawl warps to the gallows frames fore and aft and to the outrigger booms. The house is asymmetrical, leaving the starboard side clear for handling large roller-rigged trawls and deep cores. A hinged gate is located in the forward starboard bulwark to facilitate longline and gill net fishing.

A revolving extensible crane is mounted between the forward hatch coamings, thereby permitting the crane to serve the four freezer compartments and handle the overboard gear.

The foredeck is protected by the raised forecastle. A breakwater on the forecastle deck diverts seas from the working area of the foredeck.

The afterdeck is protected by the house and, except for one hatch coaming, is clear to facilitate working with purse seine gear and double-rig shrimp trawls.

A combination purse seine and trawl winch is mounted on the upper deck, and a second crane, which serves the hold and handles overboard gear, is mounted on the after main deck just aft of the hatch coaming. The cranes and winches are controlled from central stations on the upper deck aft and in the pilothouse.

Lifeboat and inflatable liferafts are on the upper deck and top of pilothouse.

The hydrographic and bathythermograph winches are located on the upper deck, port, and starboard, respectively. A hinged, extensible hydrographic platform is recessed into the bulwark at main deck level just below the hydrographic winch and adjacent to the entrance of the hydrographic laboratory.

Interior Arrangements

Lower deck and hold.--The interior of the hull is divided by nine watertight bulkheads. Fuel oil is stored in 11 deep tanks. Lubrication and hydraulic oil storage tanks and fuel oil settling tanks are recessed into number 4 fuel tank. The potable water tanks are isolated from the hull and fuel tanks and are installed port and starboard in the gyro compass and sonar room, which is in the hold. An automatic sewage treatment unit is also in this space. The hold is ventilated by the air-conditioned space immediately above to reduce humidity.

The engineroom, located aft of midships, extends to the main deck in two levels. The main propulsion and generator engines and the ship service pumps are in the lower engineroom. Refrigeration and hydraulic machinery, evaporators, heating boiler, switchboard, workshop, and control console are located on the machinery flat.

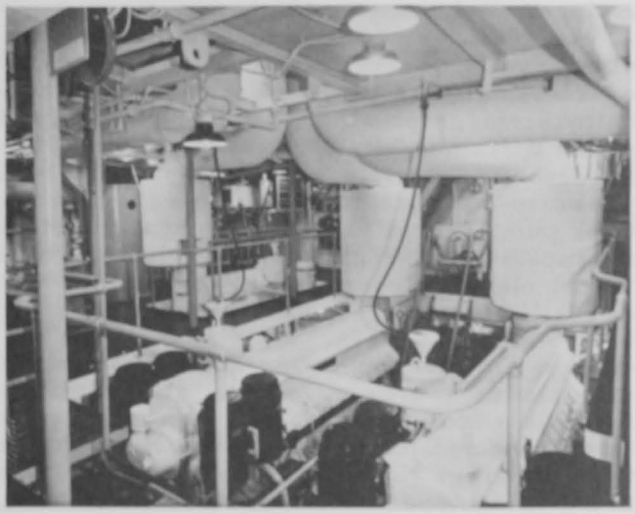


Figure 5.--Engine room looking from aft forward. Main propulsion and ship's service generators are located at the lower level and auxiliary equipment at the upper level.

The brine freezer and dry freezer holds are located to port and starboard forward and extend from the tank tops to the main deck.

Nine two-man cabins are in the midship section of the lower deck.

Ship stores freezer, cool box, dry stores, and net storage spaces are aft of the engine room on the lower deck level.

Main and upper decks.--The superstructure houses the laboratories, messroom, galley, and accommodations for four men at main deck level.

The pilot house, conference room, radio and chart room, scientific data center, and accommodations for three men are on the upper deck.

Figure 6.--Conference room is equipped for on-board study or conferences or for off-duty relaxation.

Washroom facilities are on each deck level.

All enclosed living and working spaces are in the area of least motion and are accessible without traversing the open deck.

MACHINERY

Main Propulsion

The machinery arrangement is shown in appendix A, figures 6-9. The main propulsion machinery consists of two identical diesel engines directly connected to a compound reduction gear equipped with two air-actuated disconnect clutches and one controllable pitch propeller. Drive from each engine is through a

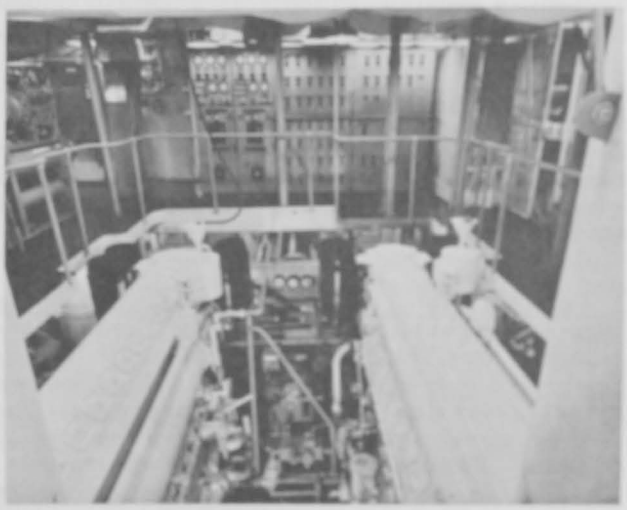


Figure 7.--Engine room looking from forward aft. Note C-P propeller control equipment located between main engines at forward end of the reduction gear box.

torsionally resilient torque shaft to the disconnect clutch mounted on the aft end of each high-speed quill pinion. Propeller speed is 240 revolutions per minute.

The minimum continuous rating for each engine is 800 brake horsepower based on a maximum brake mean effective pressure of 125 pounds per square inch for 4-cycle engines and 85 pounds per square inch for 2-cycle engines. Maximum allowable piston speed is 1,500 feet per minute.

The main propulsion diesels and the main generator diesels are of the same manufacture, type, bore, and stroke to facilitate maximum interchangeability of parts and operating and maintenance familiarity.

Multiple engine propulsion was chosen because of the requirement for (1) high speed in making passage to distant areas and for towing heavy gear, and (2) low power and low speed necessary for hydrographic and experimental work. This system also results in a shorter engineroom.

Twin-screw propulsion was not considered because of the increased risk that the fishing gear might foul the propellers. A controllable pitch propeller was specified to permit extremely slow vessel speeds while delivering the high power needed for the winches, which necessitated main engine drive. A controllable pitch propeller arrangement also provides an almost ideal solution for maintaining constant engine power, regardless of vessel speed through the water, because it permits optimal setting of propeller pitch under the various power demands for trawling, steaming, and creeping or holding position. Pitch control is not coordinated with engine speed to obtain optimum thrust, because this feature is not compatible to main engine drive of the trawl winches, but pitch setting and engine revolutions are controlled individually. An alarm system is provided to indicate engine overload throughout the operating range of the engines.

Auxiliary Machinery

Evaporators.--The vessel is equipped with two salt-water evaporators using heat from the generator engine cooling water. Capacity of each is about 750 gallons per day.

Refrigeration, air conditioning, and heating.--Refrigeration and air-conditioning machinery consists of three identical 10-horsepower and one each 7-1/2- and 15-horsepower direct expansion freon 12 compressors. The 10-horsepower compressors serve the 5 to 20 degrees Fahrenheit freezer compartments. The 7-1/2- and 15-horsepower compressors serve the 38 degrees Fahrenheit cooler and the air-conditioning system, respectively. Heat is furnished by an oil-fired marine-type hot-water boiler.

Electrical.--Electrical service is furnished by two identical diesel generator sets rated 200 kilowatt, 275 kilovolt-ampere continuous duty, 3-phase, 60-cycle, 450 volts with automatic and manual voltage regulation. Provision is made for division of reactive loads during parallel operation. Voltage regulation is to plus or minus 2 percent. Alternating current equipment inoperable on the ship service primary voltage is supplied by transformer banks.

Deck Machinery

Hydraulic systems.--Deck machinery is powered by two separate hydraulic transmission systems. The primary system is main-engine powered, of open loop, closed center, parallel operation design. It operates the main and combination winches. Each main engine drives two fixed displacement vane pumps so arranged and cross-connected that either of the winches can be operated individually from either power source. Power rating at each drum is 150 horsepower.

The secondary system is also of open loop, closed center, parallel operation design and operates the cranes, hydrographic winch, bathythermograph winch, sacking winches, and gallows frames. It is powered by three 50-horsepower electric motors that drive six pressure-compensated, variable-volume vane-type pumps in pairs. The secondary system is capable of 105 gallons per minute, which is calculated to operate the necessary groups of auxiliary machinery simultaneously.

Main trawl winch.--The main trawl winch consists of two heavy-duty single-drum reversible winches, which can be mechanically interconnected. Controls are provided at the winch and in the pilothouse console. Each drum is equipped with automatic level wind, cable counter, brush and slip rings, and a trawl warp tension indicator. Its use is primarily for heavy-duty and deep-water trawling operations.

Each drum has the following capabilities:

(1) Capacity for 6,000 feet of 1-inch diameter cable with flange margin to accommodate 50 fathoms of 3/4-inch diameter steel cable bridles.

(2) Line pull of 14,000 pounds at about 300 feet per minute on the mean drum layer in series connection.

(3) Line pull of 28,000 pounds at about 150 feet per minute on the mean drum layer in parallel connection.

Auxiliary trawl winch.--This winch is located on the upper deck aft and consists of one reversible, parallel shaft, combination purse seine-trawl winch. The parallel shaft (opposed drums) arrangement is ideally suited

to fishing two trawls simultaneously, and for handling the towline and purse line during seining operations. It is also used to hook up the towing warps when stern trawling. It has an automatic level wind device, cable counters, and brush and slip rings. Control is from a central station overlooking the working deck.

The winch has the following capabilities:

(1) Line pull of 7,000 pounds at 300 feet per minute on the mean drum layer in series connection (both drums simultaneously).

(2) Line pull of 14,000 pounds at 150 feet per minute on the mean drum layer in parallel connection (both drums simultaneously).

(3) Line pulls are doubled for single drum operation.

(4) Capacity for 9,000 feet of 1/2-inch cable with flange margin for bridles.

Sacking winches.--Retrieving lines to the nets (quarter ropes and lazylines) are handled by five sacking winches, which take the place of the conventional gypsy heads. These winches are recessed into the deckhouse, are remotely controlled, and have the following capabilities:

(1) Drum capacity for 250 feet of 3/4-inch rope.

(2) Line pull of 4,000 pounds at mean drum layer.

(3) Line speed of 75 feet per minute at mean drum layer.

Hydrographic winch.--One single drum hydro-winch with extensible A-frame is installed directly over the hydrographic laboratory. Operation is from the hydro-platform which is located near the entrance of hydrographic laboratory. This winch is reversible and capable of controlled power hoisting, power lowering, and gravity lowering. It is equipped with level wind mechanism, cable counter, and slip rings.

Capabilities include:

(1) Drum capacity of 12,000 feet of 3/16-inch cable.

(2) Line pull of 1,500 pounds at 400 feet per minute at the mean drum layer.

Bathythermograph winch.--The bathythermograph winch installation is similar to that of the hydro-winch except that capacity is 3,000 feet of 1/8-inch cable and line pull is 500 pounds at 400 feet per minute.

Hydraulic cranes.--The two deck-mounted cranes have the following features and capabilities:

(1) A 360-degree continuous rotation.

(2) Two-stage hydraulically activated extensible boom retracts to a minimum of 16-1/2 feet and extends to a maximum of 30 feet.

(3) Sixty-degree boom topping permits a minimum working radius of 7 feet.

(4) Dual cable hoist provides one single-part hoist and one double-part hoist capable of independent or simultaneous operation.

(5) Line speed of 117 feet per minute and single line pull of 6,000 pounds.

(6) Safe load operating range of 12,000 pounds at 7-foot radius, 5,000 pounds at 18-foot radius, and 3,000 pounds at 30-foot radius.

LABORATORIES

The laboratory arrangement is shown in appendix A, figure 10.

Wet Laboratory

The wet laboratory is located in the starboard side of the deckhouse aft and has an area of 275 square feet. It is designed to permit rapid and continuous flow of the catch from the deck through the laboratory for processing, identification, preservation, or ultimate disposal overboard. The system incorporates a deck-mounted hopper into which the catch is deposited, a 23-foot conveyor belt, a heading and filleting bench, and an automated specimen sorter and tabulator. Water chutes carry edible products to the weighing and packaging station, and fish offal to the overboard discharge chute.

Other facilities include a wet gear locker, scientific stores locker, dumb waiter to freezer compartment, reference and identification room with microfilm reader and image control board, and necessary sinks and cabinets.

Services include 120-volt alternating current, hot and cold fresh water, and sea water.

Hydrographic and Chemical Laboratory

The hydrographic and chemical laboratory is on the port side of the deckhouse aft and has an area of 210 square feet. It is designed for processing water samples and for technological studies of fishery products. Equipment includes Nansen bottle and bathythermograph racks, work benches, sinks, refrigerator-freezer, and storage cabinets. Instrumentation is provided for determination of surface water temperature, air temperature, relative humidity, barometric pressure, water depth, and vessel position. Services include 120- and 240-volt alternating current, hot and cold fresh water, sea water, compressed air, and gas.

Specimen Laboratory

The specimen laboratory is designed primarily for the preservation and storage of selected specimens and has an area of 100

square feet. It is equipped with large chemically resistant tanks and storage racks for specimen jars. Built-in pressurized tanks are provided for the preservative solutions. All sinks and work tables are of chemically resistant material. The inboard longitudinal bulkhead is portable to facilitate removal of the large specimen tanks. This laboratory has an independent air supply and exhaust system so as not to contaminate other living or working areas with toxic fumes. Services include 120-volt alternating current, hot and cold fresh water, sea water, and compressed air.

Live Specimen Laboratory

The live specimen laboratory is located forward of the specimen laboratory and has 75 square feet. It contains sink, work counter, storage cabinets, four aquariums, and a seawater storage tank. Aquarium piping and pumps are of nontoxic material. Services include 120-volt alternating current, hot and cold fresh water, compressed air, and sea water.

Dry Laboratory and Darkroom

The dry laboratory and the darkroom are in the deckhouse structure forward on the starboard side. Combined area is 130 square feet. The dry laboratory has a drafting table, two desks, storage cabinets, and a cushioned laboratory counter for microscope mounting. The darkroom contains work counters, storage cabinets, and sinks with hot and cold fresh water.

Instrumentation in the dry laboratory is generally similar to that specified for the hydrographic laboratory.

Instrumentation Laboratory

Because the vessel will have considerably more than the normal amount of electronic equipment on board, it was considered necessary to provide a laboratory specifically for the development, testing, maintenance, and repair of electronic equipment. Equipment includes oscilloscopes, frequency indicators, tube checkers, and various types of built-in monitors. Services include 120-volt alternating current and variable voltage direct current.

ELECTRONIC EQUIPMENT

The vessel is equipped with electronic instruments of late design. Notable among these are:

1. Two radar transceivers--one for general navigation and one for scientific purposes.
2. Double side band transceivers amplitude modulation for short-range and single side band transceivers for long-range voice communications.
3. Loran A and C for accurate position determination.
4. Automatic radio direction finder for position determination in areas lacking Loran coverage.
5. Four depth sounders with range capabilities to 6,000 fathoms, including a precision depth recorder.
6. High resolution, horizontal and vertical scanning fish finders, including a Fish Detection System, which uses a seabed lock mechanism that permits stabilized magnification of fish echoes at selected depths without the normal interferences.
7. An automatic, impressed current, cathodic protection system for corrosion control of the underwater hull.
8. A speed-distance log that records speed and miles traveled through the water.
9. A closed-circuit television chain with monitor in the pilothouse and cameras mounted in areas not visible from this station.

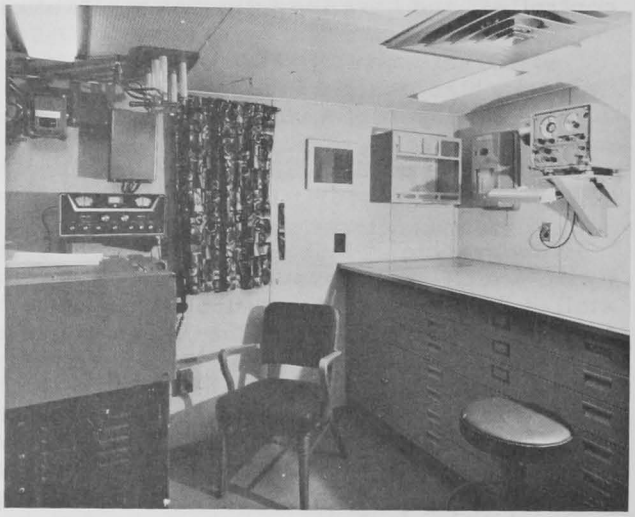


Figure 8.--Radio and chart room showing location of communication and navigational equipment.

MODEL TESTING PROGRAM

Although the technical literature provides extensive data on the distant water trawler hull form, operational criteria for this vessel differed sufficiently from the conventional trawler to justify tank testing of the design.

Extensive model tests in both still water and waves were made.

The model was tested in two load conditions, representing normal departure (Load Condition I) and normal arrival with fish holds full (Load Condition II). The principal dimensions and stability data for the two load conditions are shown in appendix B, table 2.

Still Water Tests

Preliminary resistance and propulsion tests were made with a model of the preliminary lines plan. The results were compared with the Model Basin's statistical records to determine the final lines. The final hull design (appendix B, figure 1) was then tested in still water. A 1:12 scale wax model was used in the still water tests.

Seakeeping Tests

The tests in waves were carried out in two parts: self-propulsion and free-floating (hove to). A 1:16 scale wooden model (fig. 9) was used for the tests in waves. The model was self-propelled with a controllable pitch propeller and completely free in all its motions.

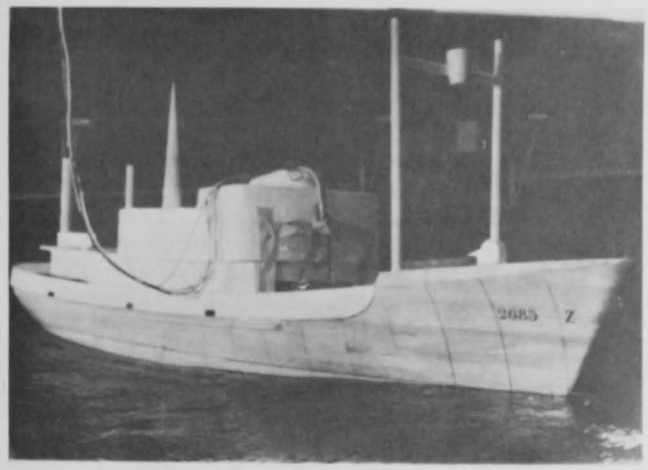


Figure 9.--Wooden model (1/16 scale) undergoing seakeeping tests.

The self-propulsion tests were made in regular head seas, from which the prediction of behavior in irregular long crested head seas was computed.

The free-floating tests with wind simulation were made in irregular beam seas. The mean wave period during these tests was about equal to the vessel's natural roll period, whereas the significant wave height was increased with increasing Beaufort number. This resulted in rather high roll angles; however, the percentage of time that this would happen on the open sea is considered to be negligible.

Roll extinction tests, with and without bilge keels, were carried out in smooth water at zero headway.

Some of the test results are shown in appendix B, figures 2-11.

DESIGN FEATURES

The outstanding features are the built-in versatility, i.e., the ability to function with a wide variety of fishing gears and methods without modification to existing structure, machinery, or arrangements; the centralized orientation of the laboratories and working and living spaces; and the extended operating range. Others include:

1. The use of remote control, rotating extensible cranes that eliminate booms, tackle, and hoisting machinery.
2. Control of propulsion machinery and trawling winches from an integrated console located in the pilothouse. The officer on watch sets and retrieves the gear, reducing normal manpower requirements.

Figure 10.--Ship control console--fish detection equipment is located to port of steering wheel and ship control and navigation equipment to starboard.

3. Automated flow pattern of the catch from the deck to the laboratories for analysis, processing, identification, preservation, or overboard disposal.
4. The method to hold station and maintain vertical wire angle will be different from the standard approach used by most research vessels: heading into the sea and controlling bow motion with a bow thruster. Owing to the considerable transverse thrust demand, this method has proved far from satisfactory. With Oregon II the stern will be placed into the wind and position held by reversing the pitch of the propeller. The modified cruiser stern was adopted to suit this maneuver. The bow thruster will be used to hold the bow down wind rather than up into the wind and sea. This concept for holding station is, as yet, untried; however, we are optimistic because the vessel has a natural tendency to quarter, thus considerably less transverse thrust will be required to hold directional position.
5. Semipermanent installation of laboratory furnishings and equipment to facilitate changeover to future assignments.

6. Standardization of engines, electric motors, pumps, and compressors.

7. Substitution of remote controlled sacking winches to handle fishing lines in place of gypsy heads, which provides a significantly greater margin of safety for operating personnel.

8. A system of fairleads and connectors that enables the four trawling winch drums to perform as one winch. This system offers capabilities equal to that of the oceanographic deep sea winch without the attendant problems of weight, space, and cost. With standard towing warps it is possible to make a 5-mile-deep cast or to fish trawls to 2,500 fathoms. This capability can be extended with smaller diameter cables.

9. The simplicity and dependability of machinery, plus the use of special coatings, materials, and structural shapes, is expected to minimize maintenance. Epoxy and inorganic zinc coatings, cortene steel and aluminum plating, and bulb plates for brackets and beams exposed to the weather will be used where appropriate.

10. The refrigeration system design is such that the catch may be iced, brine frozen, dry frozen, or kept in chilled sea water. The five freezer compartments are designed for a temperature of minus 20 degrees Fahrenheit; however, back-pressure regulators permit control and maintenance of temperature from minus 20 to plus 38 degrees Fahrenheit to facilitate technological studies.

11. Roll stabilization--The nature of the work requires a high degree of roll stabilization. The tank tests show that the roll damping of the hull increased about twice with the application of bilge keels, but provision is made for the future installation of a flume stabilization system should the bilge keels prove inadequate.

Historically, the major problem encountered by a vessel designer is combining into a workable whole the many characteristics desired by the intended owner or operator. Because many of these characteristics are in direct conflict with each other, compromises are forced upon the designer and the owner to obtain a ship satisfying both the needs of the owner and the expected service conditions. In this respect, Oregon II proved no exception.

That the final design fulfills the operational criteria originally set for this vessel is a tribute to her designer and to the many others whose specialized experience and knowledge contributed toward assuring that the Bureau will have a vessel that will take the fishery scientist to sea; place modern well-equipped laboratories, electronic aids, and a wide array of fishing and oceanographic gear at his disposal; permit him to fish and make observations at depths and in sea conditions once considered impractical, if not impossible; and accomplish this with up-to-date comfort and efficiency.

The Ingalls Shipbuilding Corporation of Pascagoula, Mississippi was awarded a contract for construction of the vessel in June 1965. Delivery was scheduled for May 1967.

REFERENCES

GRZYWACZEWSKI, Z., Z. HUELLE, S. SZMID, and J. SWIECICKI

1959. Współczesne statki rybackie (Modern fishing vessels). [In Polish.] Wydawnictwo Morskie, Gdynia, 344 pp. Translation (OTS 61-11362) available from the Clearinghouse for Federal Scientific and Technical Information, U.S. Department of Commerce, Springfield, Va. 1964. Warsaw, 303 pp.

TRAUNG, JAN-OLOF (editor).

1955. Fishing boats of the world. Fishing News, London, xx + 579 pp.

TRAUNG, JAN-OLOF (editor).

1960. Fishing boats of the world: 2. Fishing News (Books) Ltd., London, 781 pp.

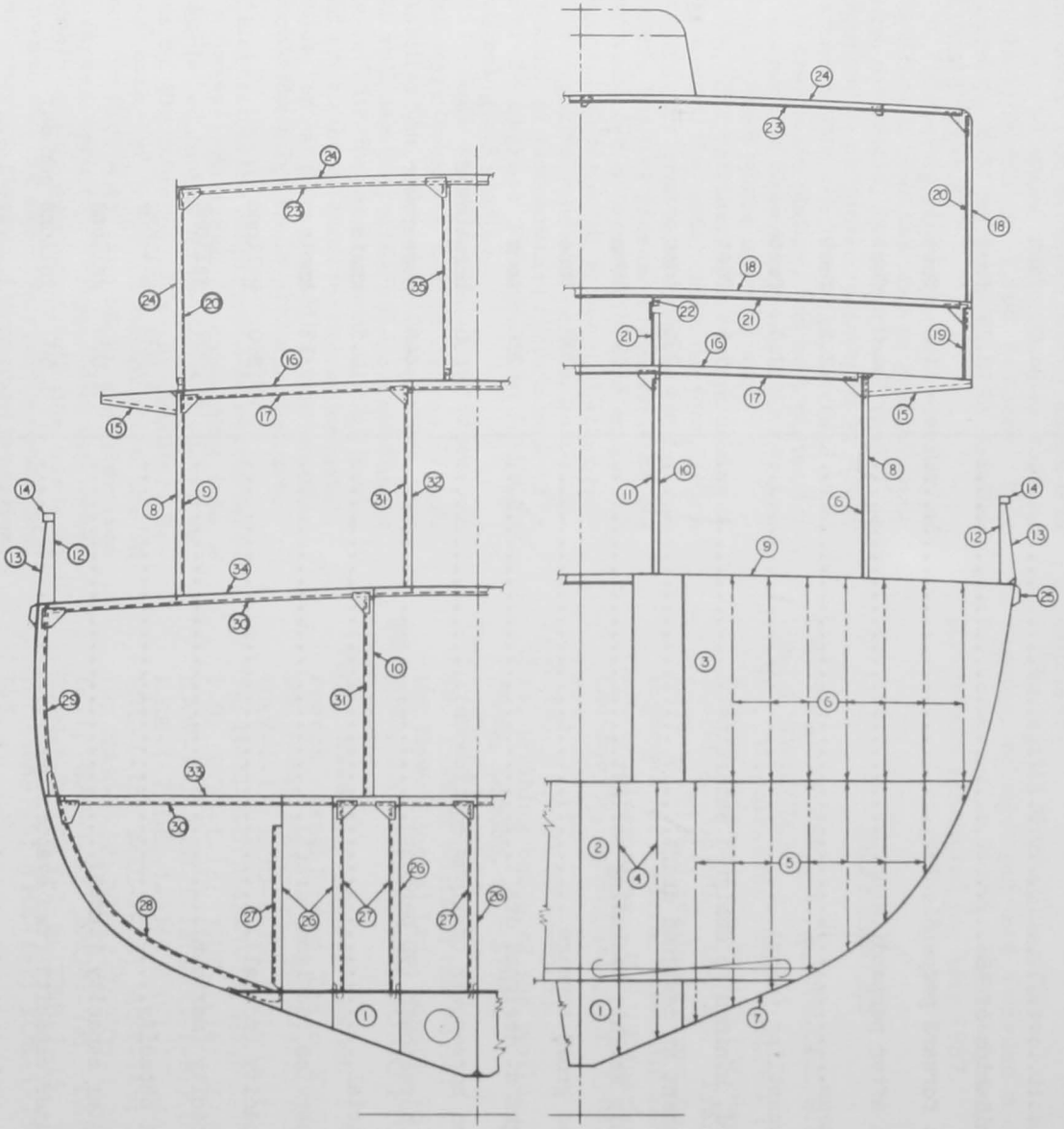
TRAUNG, JAN-OLOF, and NORIO FUJINAMI (editors).

1961. Research vessel design. FAO Research Vessel Forum, Tokyo. FAO, Rome. Pp. 1-84; BEM-1-8; BRA-1-6; BUR-1-6; DAV-1-11; EDD-1-13; FOL-1-11; GRI-1-14; HAM-1-5; HAS-1-13; HER-1-8; HOE-1-9; HOG-1-16; HUS-1-16; KAR-1-25; KAW-1-3; KOJ-1-12; KUG-1-8; KUM-1-4; LEE-1-7; LEI-1-51; LER-1-17; MAN-1-9; MIC-1-15; MIL-1-28; MOT-1-6; NAI-1-10; NAK-1-12; NIN-1-7; POS-1-16; ROS-1-71; SAS-1-6; TAG-1-13; TAK-1-10; TAN-1-3; TAY-1-6; TER-1-15; TRO-1-16; UDA-1-5; WHE-1-7; YOK-1-15; ZIM-1-5.

APPENDIX A

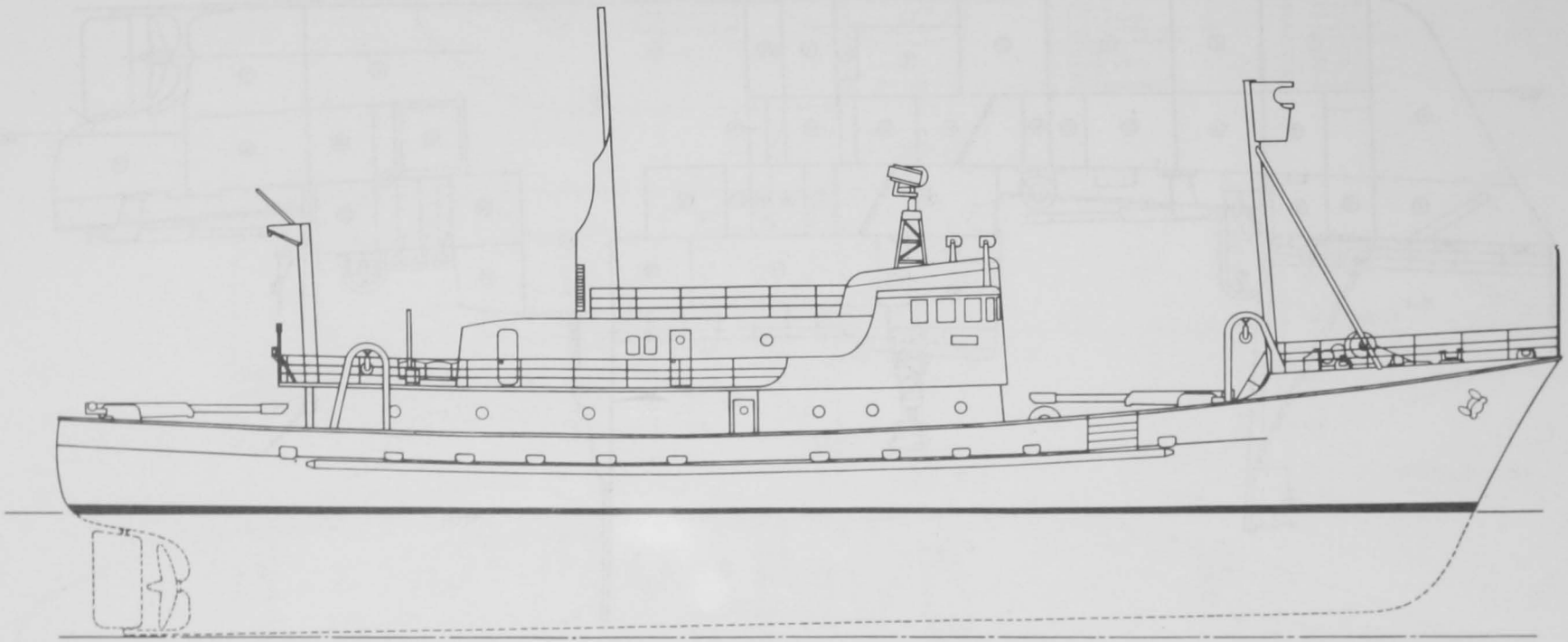
Appendix Table 1.--Principal Specifications of Oregon II

Item	Dimension	
Length, overall	170.0	feet
Length on waterline	158.0	feet
Length between perpendiculars (LBP)	152.0	feet
Beam	34.0	feet
Depth, midships of LBP	18.25	feet
Draft at forward perpendicular	11.0	feet
Draft at after perpendicular	14.0	feet
Draft, mean	12.5	feet
Draft, scantling (mean)	13.5	feet
Freeboard, minimum to designed waterline	5.5	feet
Displacement at designed draft	906	tons
Light ship weight, excluding ballast	670	tons
Estimated gross tonnage	700	tons
Deadweight at designed draft	236	tons
Installed horsepower (maximum continuous)	1,600	horsepower
Service horsepower (90 percent)	1,440	horsepower
Speed, trial	14.5	knots
Speed, service (designed draft)	13	knots
Fuel capacity (normal)	65,800	gallons
Fuel capacity (maximum)	80,900	gallons
Lube oil capacity	1,500	gallons
Fresh-water capacity (tanks)	8,000	gallons
Fresh-water capacity (two evaporators)	1,500	gallons per day
Normal range at service speed	9,100	nautical miles
Extended range at service speed	10,700	nautical miles
Endurance (at service speed)	30	days
Endurance (exploratory operations)	60	days



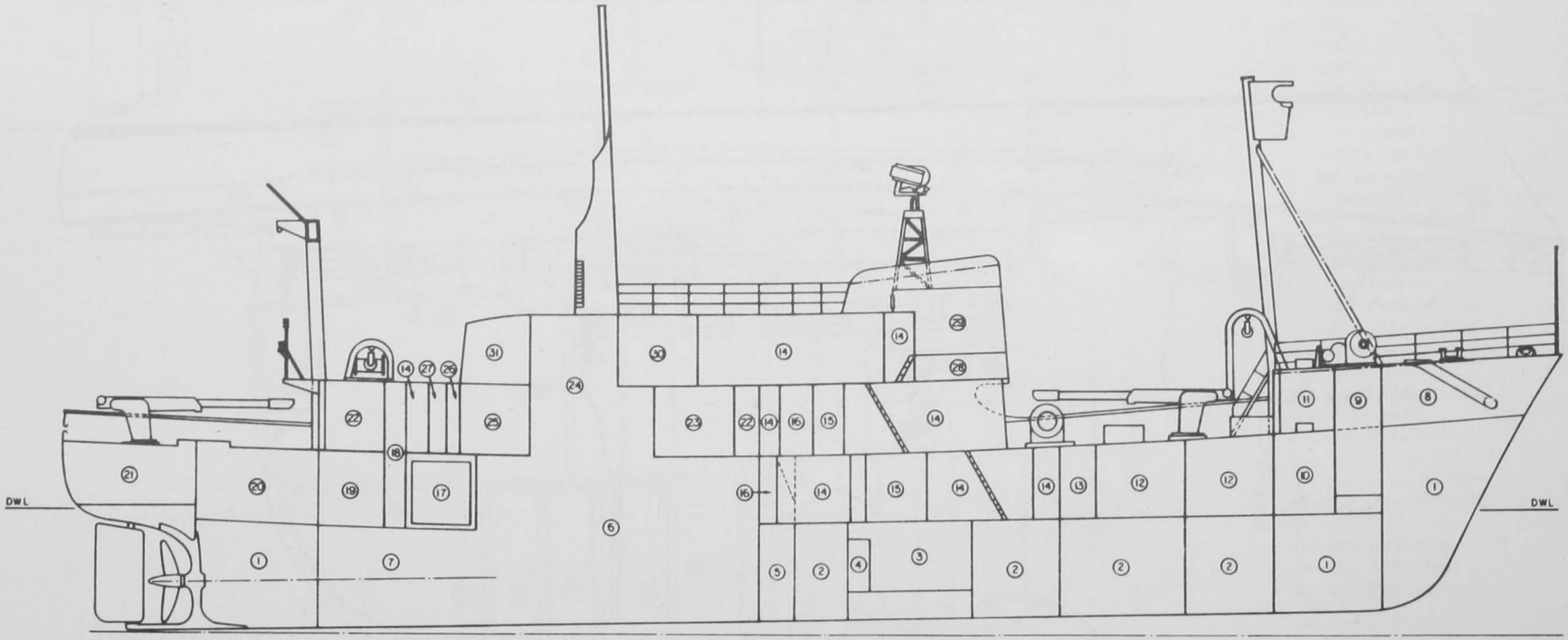
TYPICAL SECTIONS

1 - 3/8" PLT
2 - OT BHD 5/16" PLT
3 - WT BHD 1/4" PLT
4 - STIFF 6"X 3 1/2" X 5/16"L
5 - STIFF 5"X 3"X 5/16"L
6 - STIFF 3"X 2"X 1/4"L
7 - 6"X 1/2"FB
8 - 1/4"PLT
9 - 5/16"PLT
10 - 3/16" PLT
11 - STIFF 3"X 2"X 3/16"L
12 - BRKT-BULB PLT C/F 10"X 3 1/2"X 27.2#
13 - BLWK PLT 5/16"
14 - RAIL-6"X 4" RECT. TUBE
15 - DECK SUPP. PC12
16 - DECK PLT 1/4"
17 - DECK BEAM 4"X 3"X 1/4"L
18 - 1/4"PLT ALUM
19 - STIFF 4"X 3"X 5/16"L ALUM
20 - STIFF 3"X 2"X 1/4"L ALUM
21 - STIFF 4"X 3"X 1/4"L ALUM
22 - GDR 7 1/2"X 3 3/4"X 8.64#/L ALUM
23 - DECK BEAM 3 1/2"X 2 1/2"X 1/4"L ALUM
24 - 7/32" PLT ALUM
25 - FENDER 1/2" PLT
26 - O.T. BHD 5/16" PLT
27 - STIFF 4"X 3"X 5/16"L
28 - SIDE FR 7"X 4"X 7/16"L
29 - SIDE FR 5"X 3"X 5/16"L
30 - DECK BEAM 4"X 3"X 5/16"L
31 - STIFF 3"X 2"X 5/16"L
32 - DECK PLT 9/32" PLT
33 - DECK PLT 5/16" PLT
34 - STIFF 3"X 2"X 3/16"L ALUM



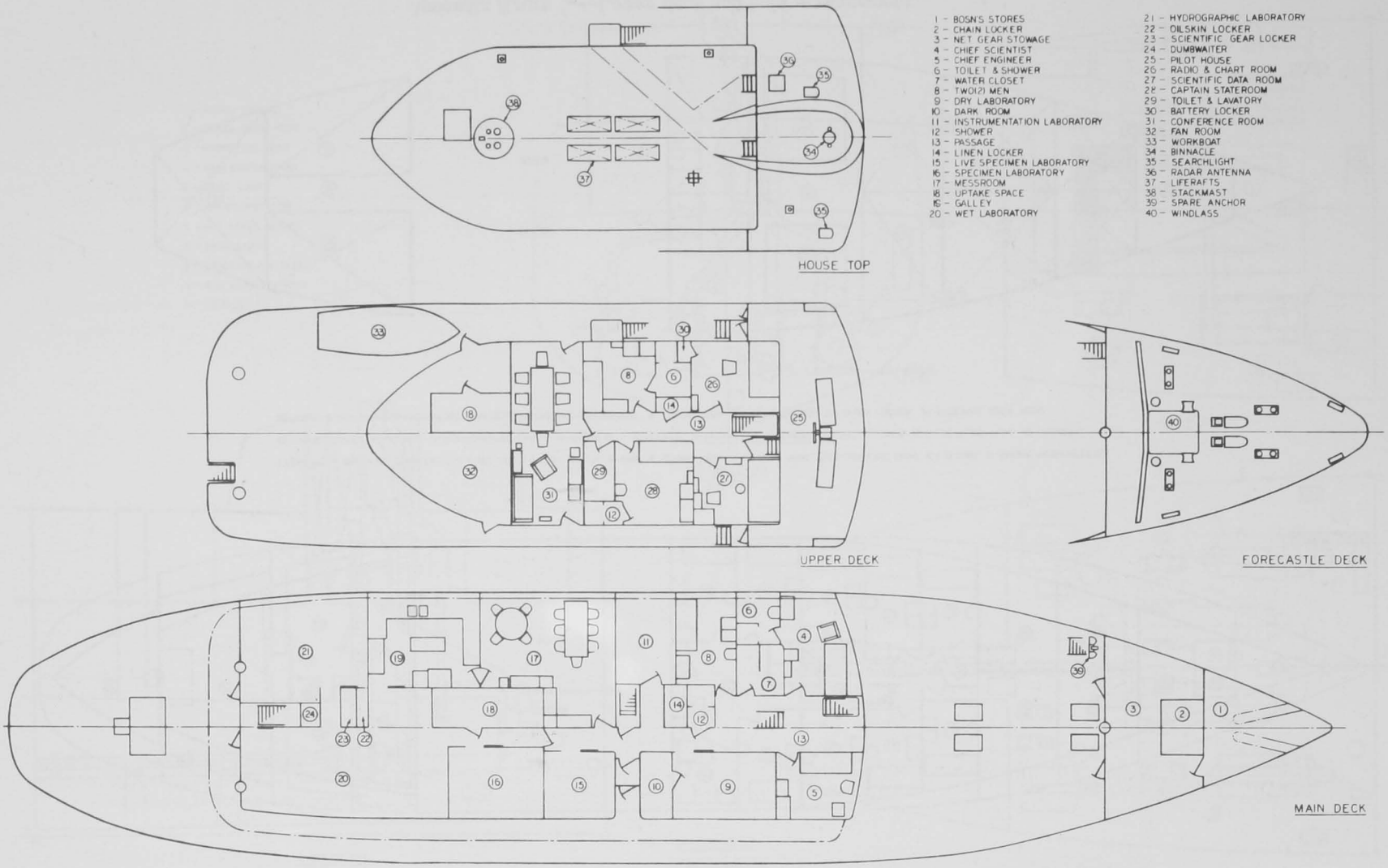
Appendix figure 2.--Outboard profile.

1 BALLAST - 2 FUEL P/S - 3 SONAR ROOM - 4 SEWAGE TANK - 5 FUEL SETTLING TANK - 6 ENGINE ROOM - 7 ENGINE ROOM RECESS - 8 BOSN'S STORES - 9 CHAIN LOCKER - 10 STORES - 11 NET GEAR - 12 REEFER SPACE - 13 LOCKER - 14 PASSAGE - 15 SHOWERS - 16 LINEN LOCKER - 17 REEFER STORES
18 DUMBWAITER - 19 DRY STORES - 20 NET STORAGE - 21 STEERING GEAR ROOM - 22 STAIRWAY - 23 MESSROOM - 24 MACHINERY CASING - 25 WET LABORATORY - 26 OILSKIN LOCKER - 27 SCIENTIFIC GEAR LOCKER - 28 VOID - 29 PILOT HOUSE - 30 CONFERENCE ROOM - 31 FAN ROOM

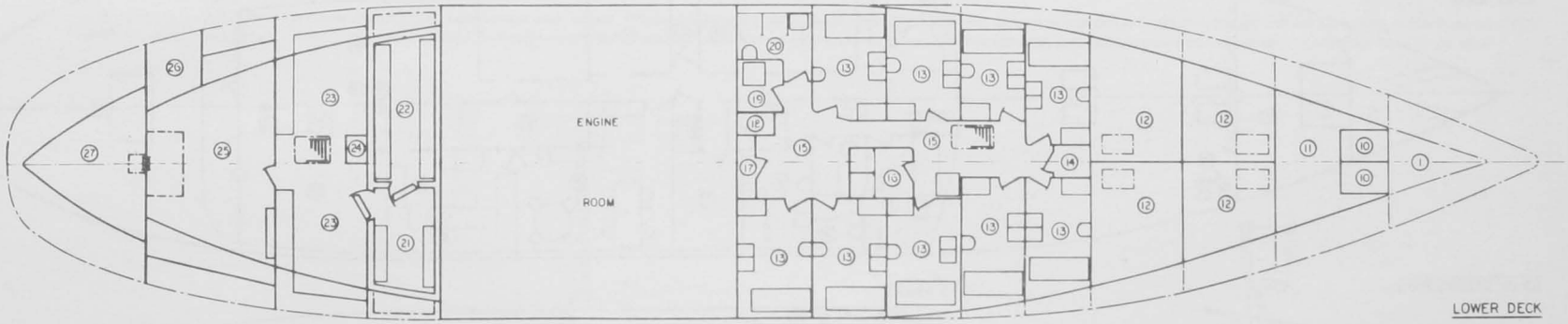


INBOARD PROFILE

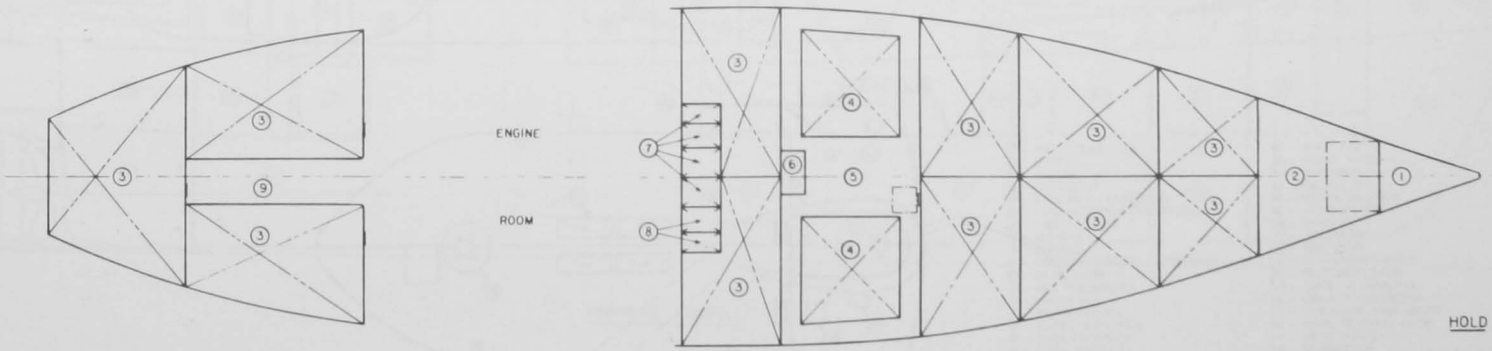
Appendix figure 3.--Inboard profile.



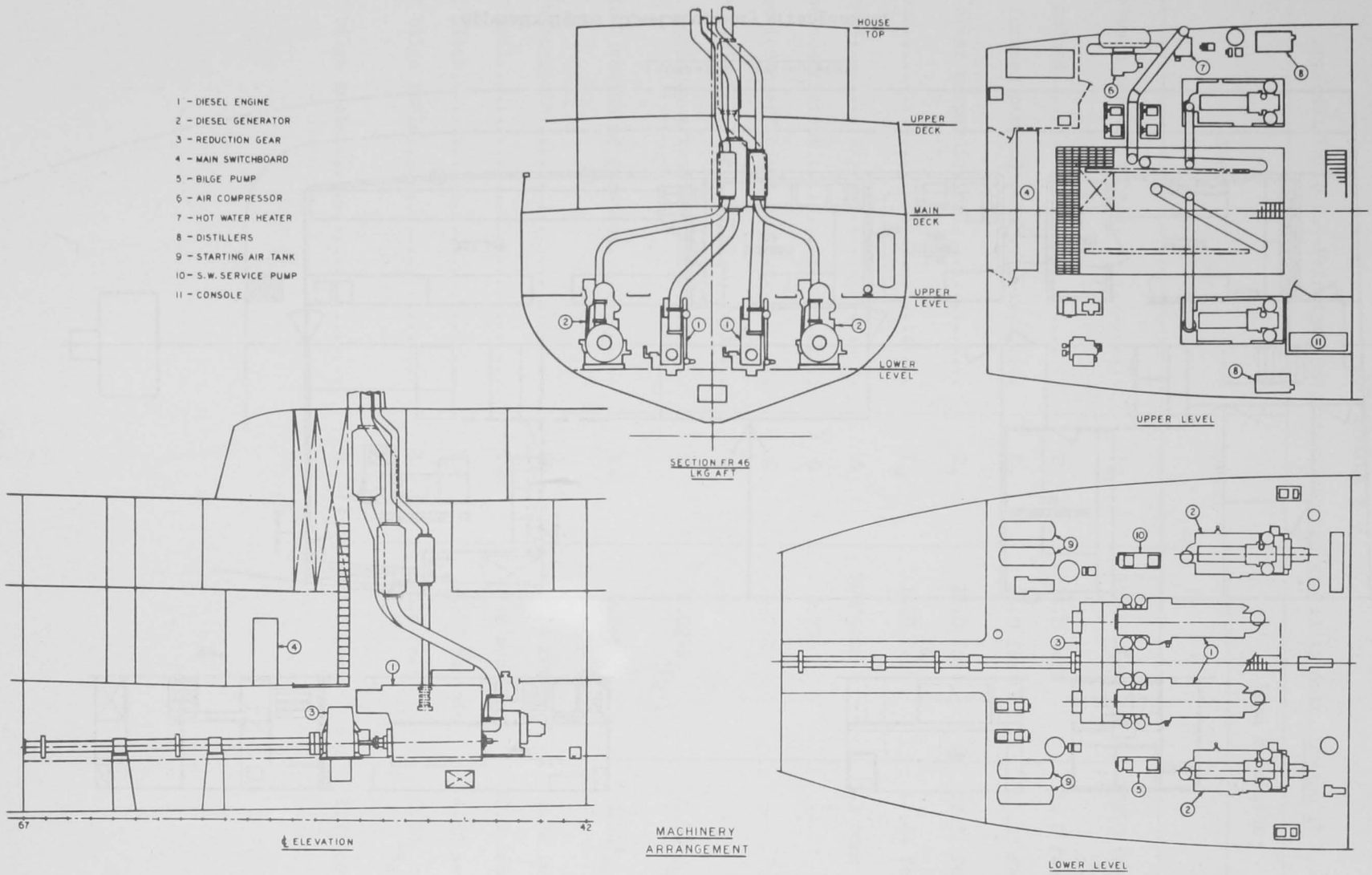
Appendix figure 4.--Main and upper deck arrangement.



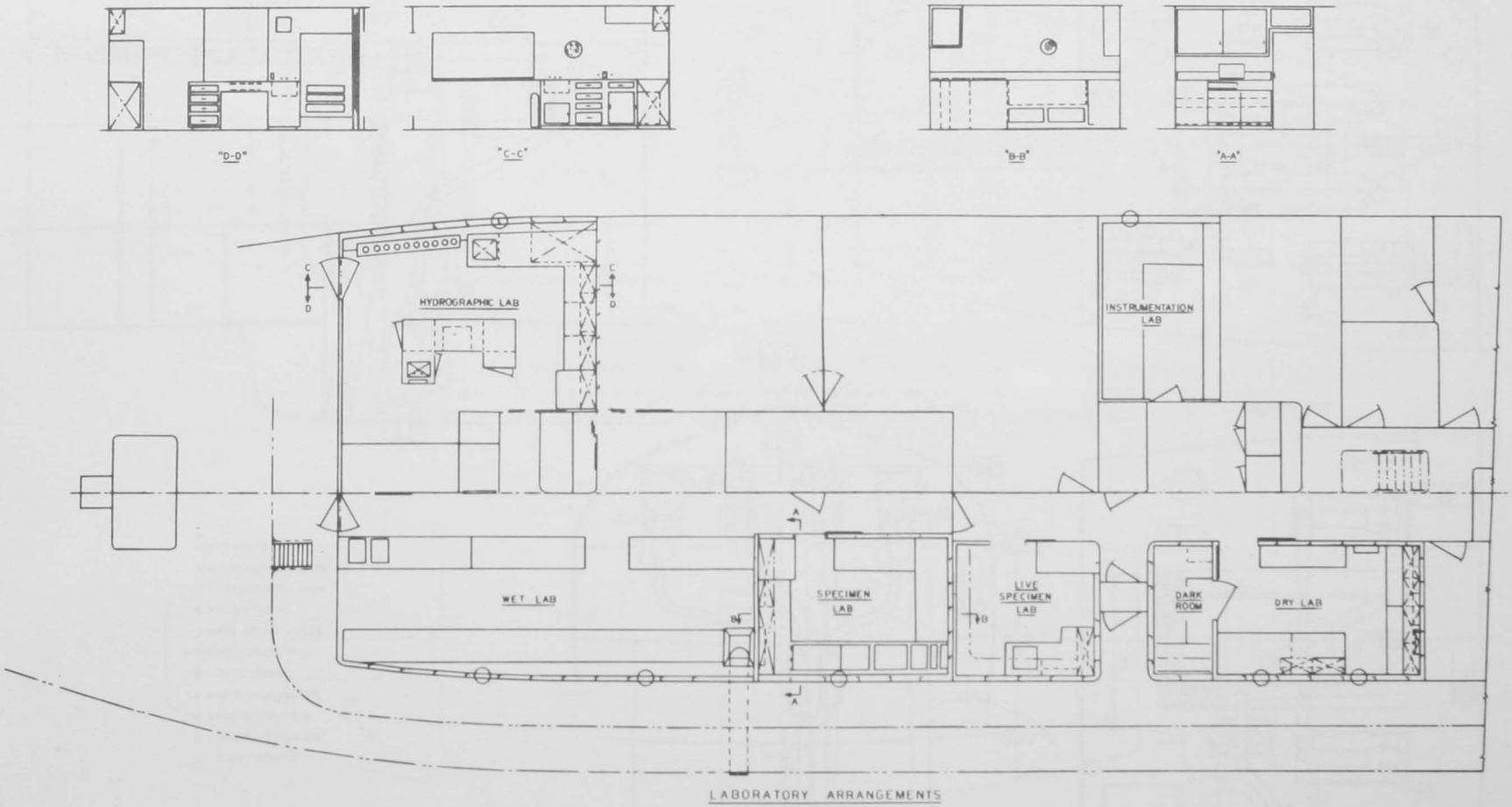
1-FOREPEAK BALLAST. 2-BALLAST. 3-FUEL OIL. 4-FRESH WATER. 5-GYRO & SONAR ROOM. 6-SEWAGE TANK. 7-F.O. SETTLING TANK. 8-L.O. TANK. 9-ENGINE ROOM RECESS. 10-CHAIN LOCKER. 11-STORES. 12-REFRIGERATED CARGO. 13-TWO(2) MEN. 14-LOCKER. 15-PASSAGE. 16-SHOWERS. 17-LINEN LOCKER. 18-F.O. SETTLING TANK. 19-LAUNDRY. 20-TOILET & SLOP SINK. 21-COOLER 38°. 22-FREEZER -20°. 23-DRY STORES. 24-DUMBWAITER. 25-NET STORAGE. 26-SCUBA LOCKER. 27-STEERING GEAR ROOM.



Appendix figure 5.--Lower deck and hold arrangement.



Appendix figures 6-9.--Machinery arrangement.

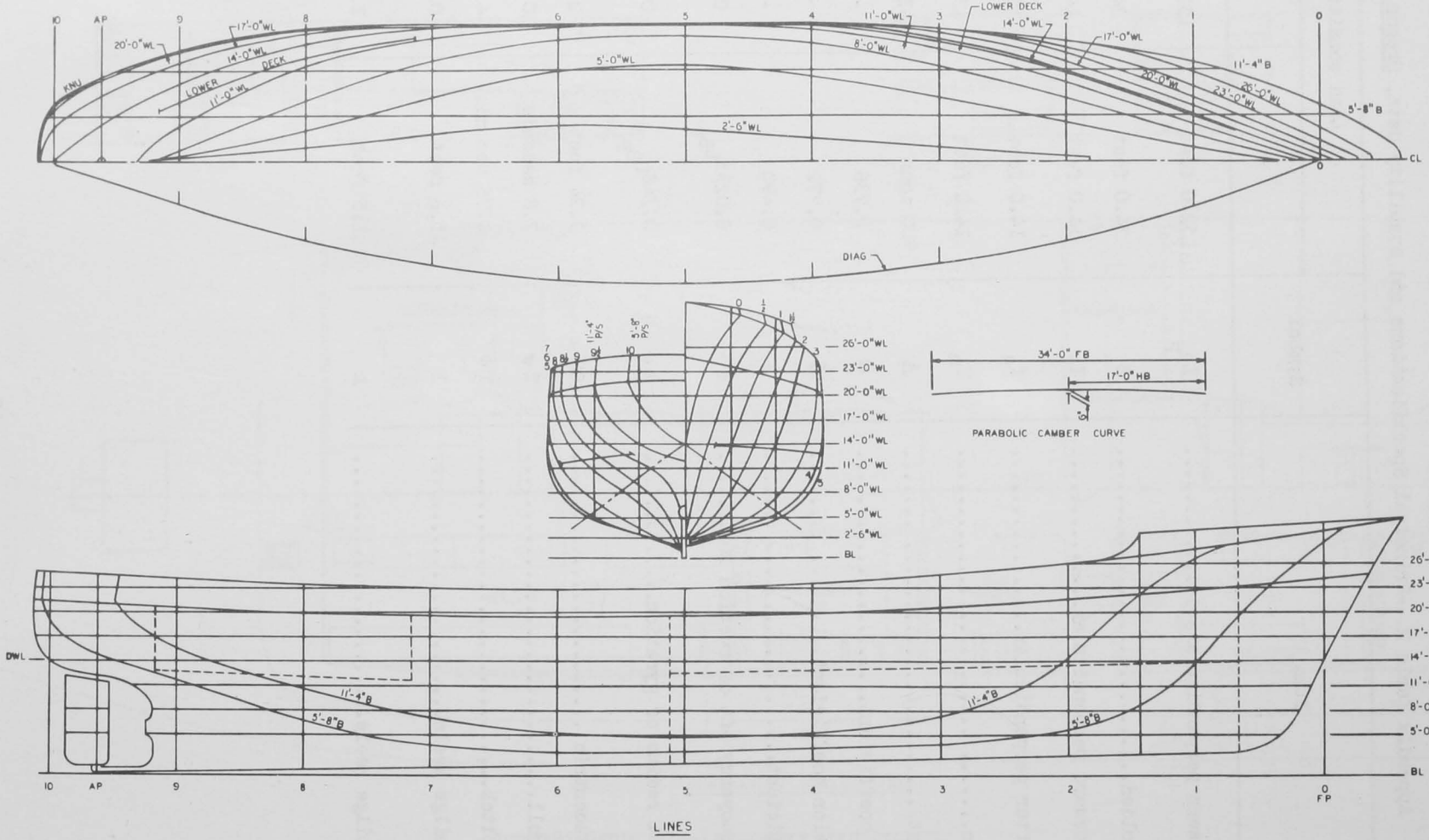


Appendix figure 10.--Laboratory arrangement.

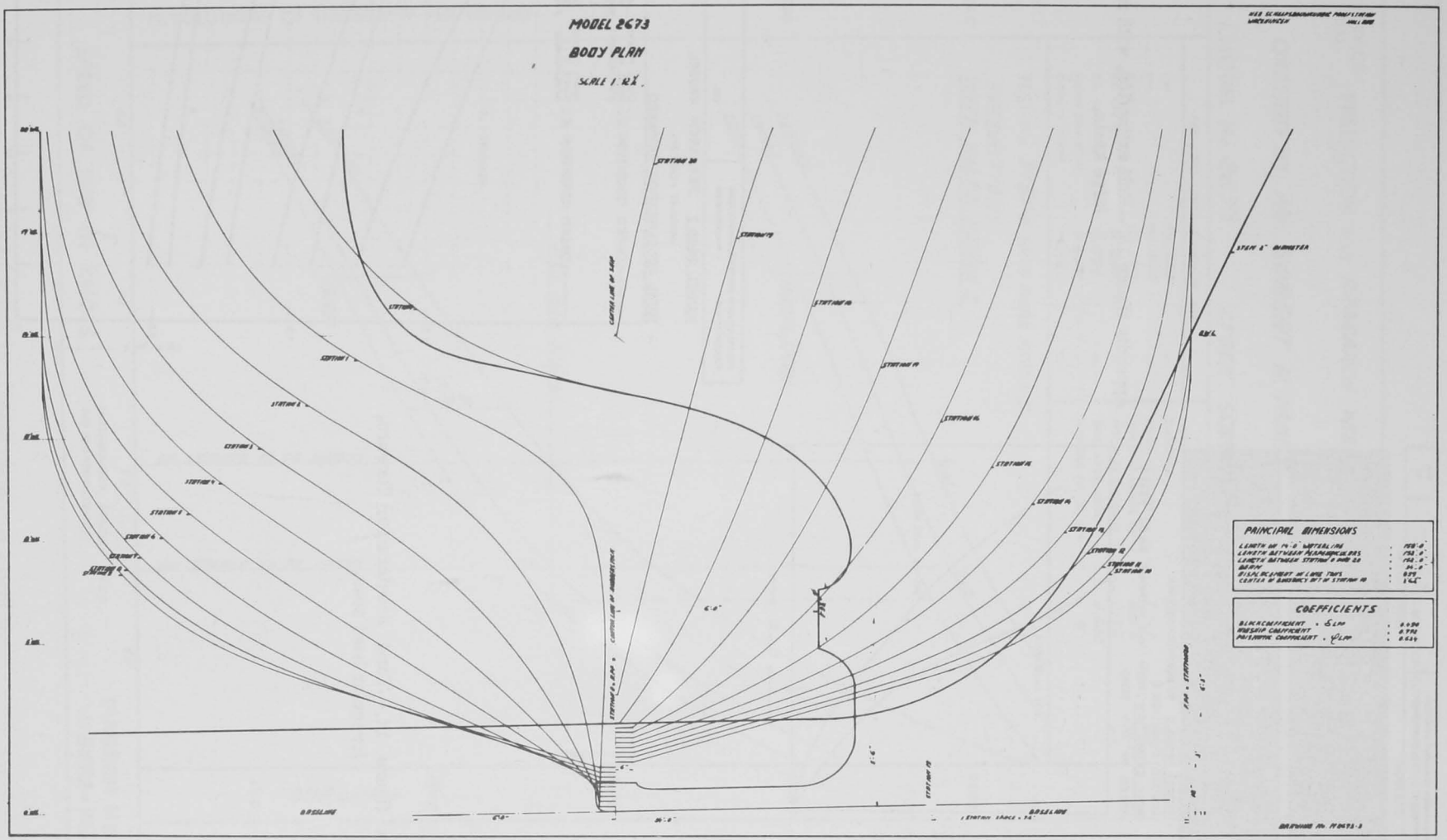
APPENDIX B

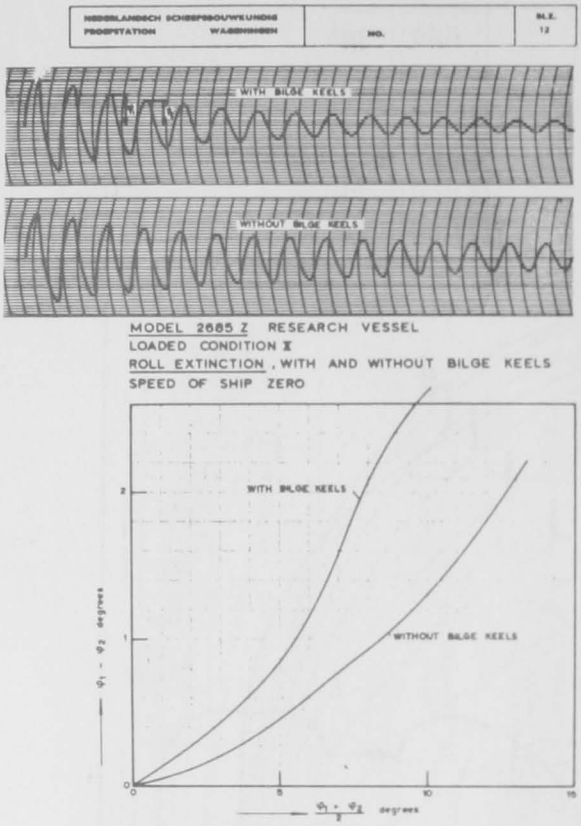
Appendix Table 2.--Principal Specifications and stability data, Oregon II

Item	Symbol	Load condition	
		I	II
Length between perpendiculars.....	L_{B_P}	152.0 feet	152.0 feet
Breadth, molded.....	B	34.0 feet	34.0 feet
Draft at forward perpendicular.....	T_f	14.0 feet	14.37 feet
Draft at after perpendicular.....	T_a	14.0 feet	12.51 feet
Draft, mean.....	T_m	14.0 feet	13.44 feet
Displacement.....	Δ	900 tons	843 tons
Waterplane coefficient.....	α	0.736	---
Midshipsection coefficient.....	β	0.772	---
Block coefficient.....	δ	0.490	---
Center of buoyancy aft of section 10.....	f	$0.0233_{L_{B_P}}$	$0.0042_{L_{B_P}}$
Longitudinal radius of gyration.....	$k\varphi$	$0.248_{L_{B_P}}$	$0.248_{L_{B_P}}$
Height, metacentric.....	GM	3.24 feet	2.22 feet
Period of roll.....	$T\varphi$	7.8 seconds	10.0 seconds
Period of pitch.....	$T\psi$	4.76 seconds	4.82 seconds
Length of bilge keels.....	l	45.6 feet	$0.30_{L_{B_P}}$
Height of bilge keels.....	h	1.5 feet	1.5 feet

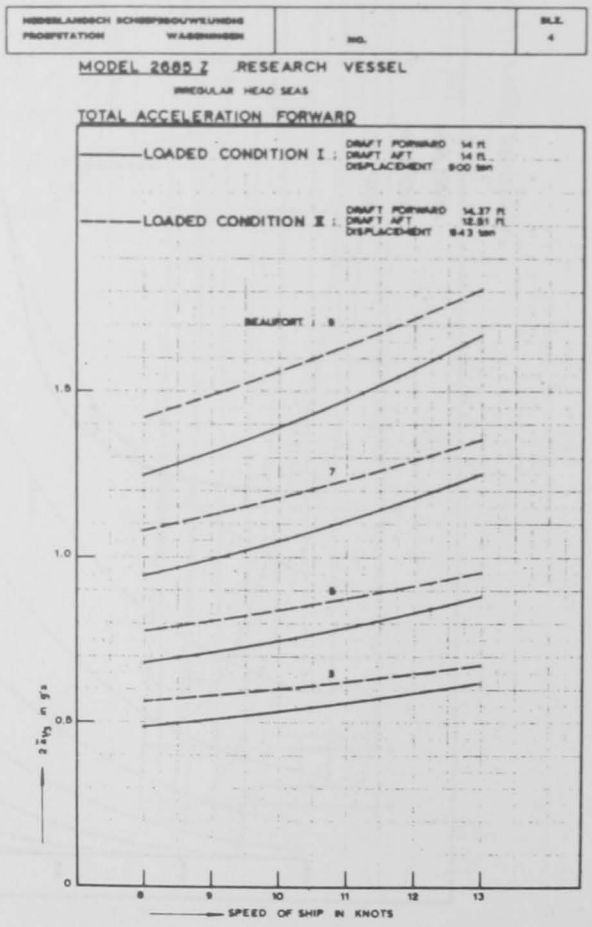


Appendix figure 11.--Final hull lines.

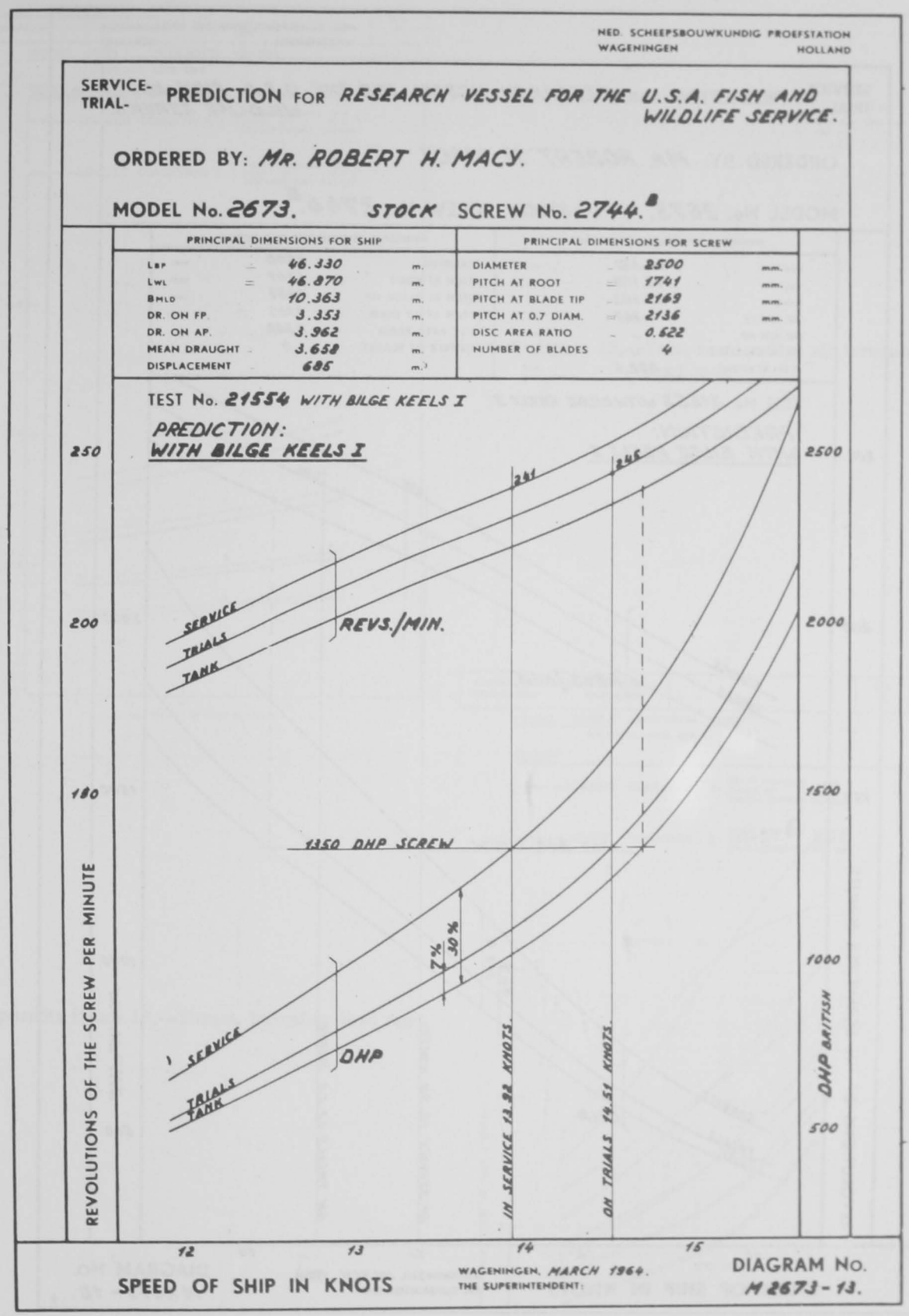

MODEL 2673
BODY PLAN
SCALE 1 12"
PRINCIPAL DIMENSIONS
COEFFICIENTS



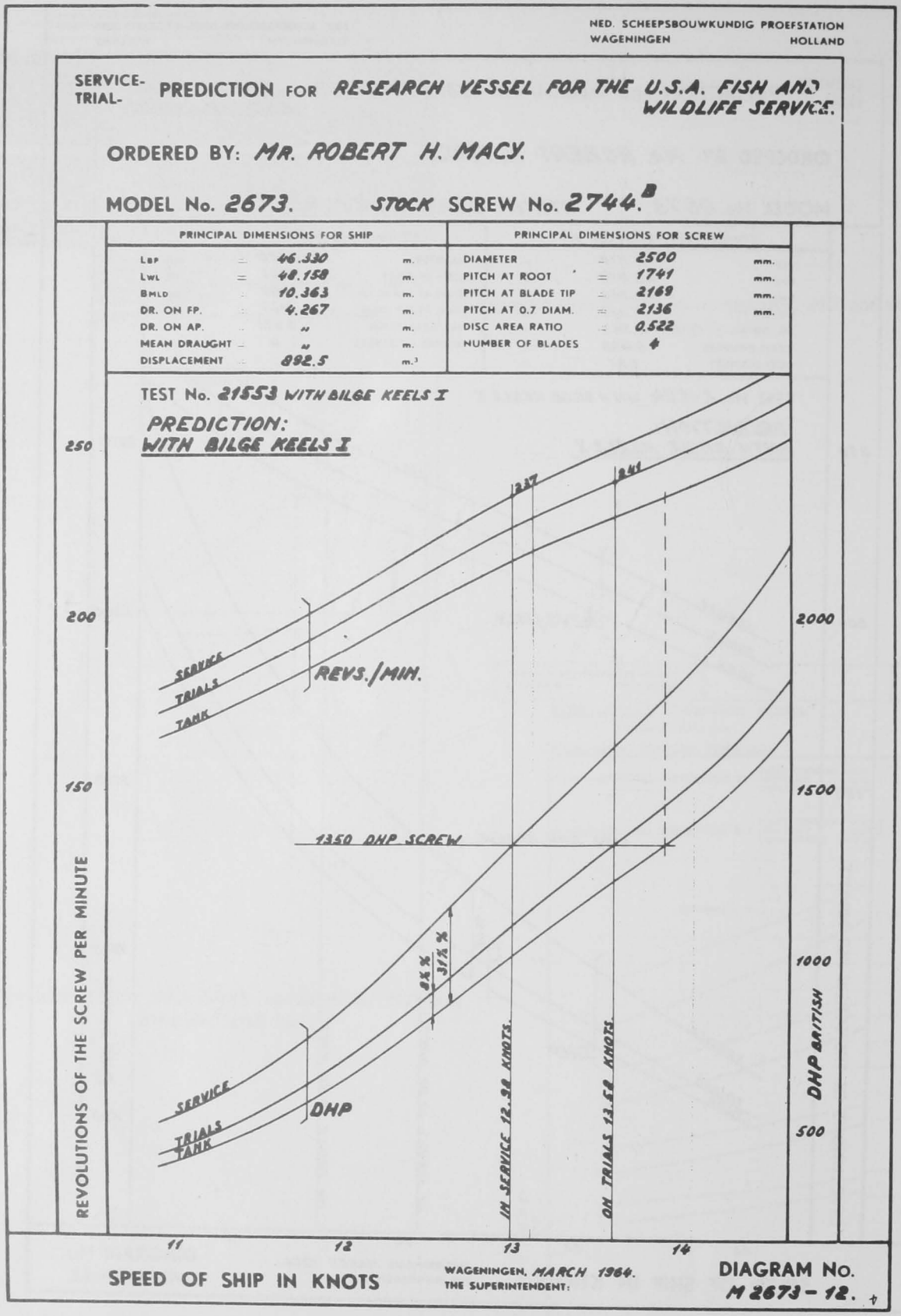
Appendix figure 13.--Roll extinction, with and without bilge keels.



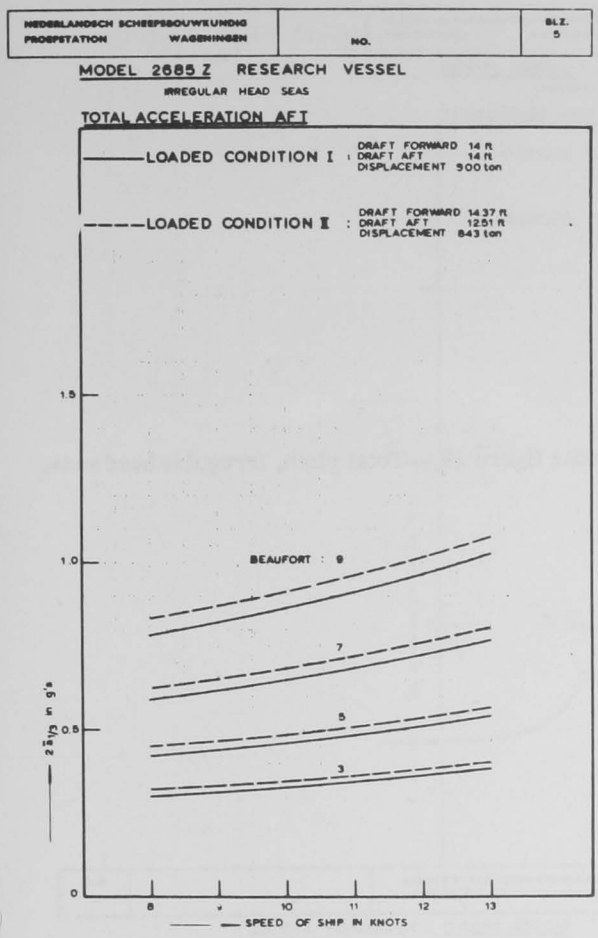
Appendix figure 14.--Total acceleration forward, irregular head seas.



Appendix figure 15.--Speed prediction - light ship.

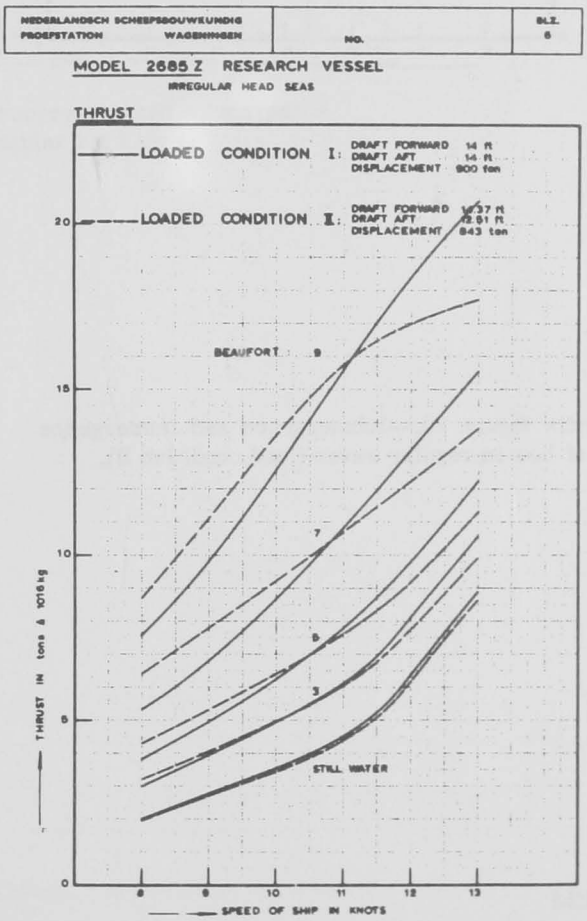


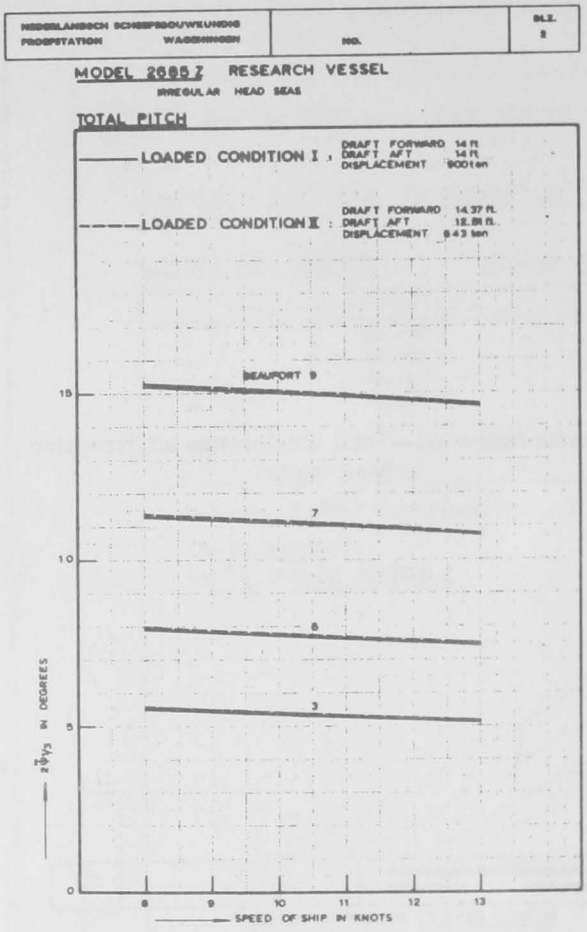
Appendix figure 16.--Speed prediction, design displacement.



Appendix figure 17.--Total acceleration aft, irregular head seas.

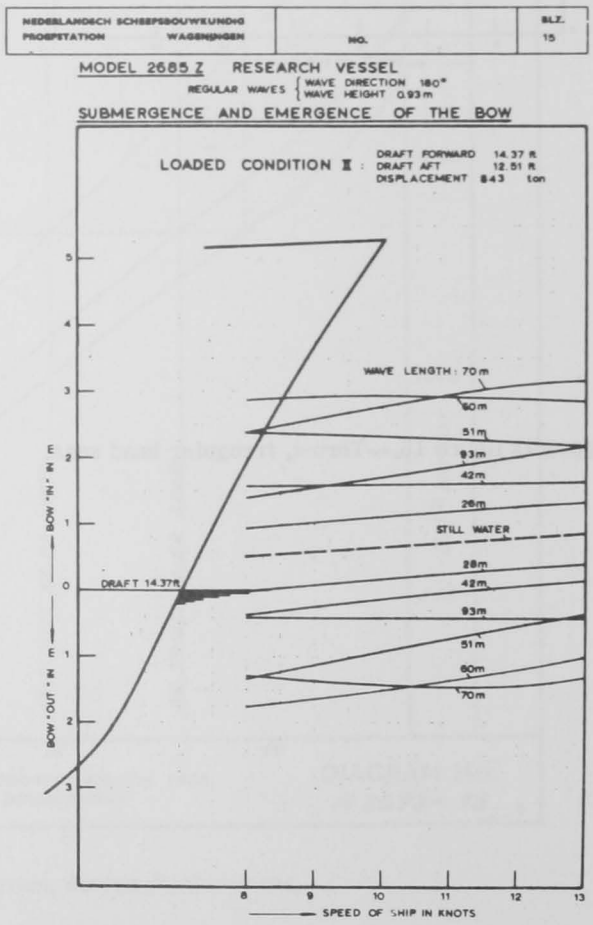
Appendix figure 18.--Thrust, irregular head seas.

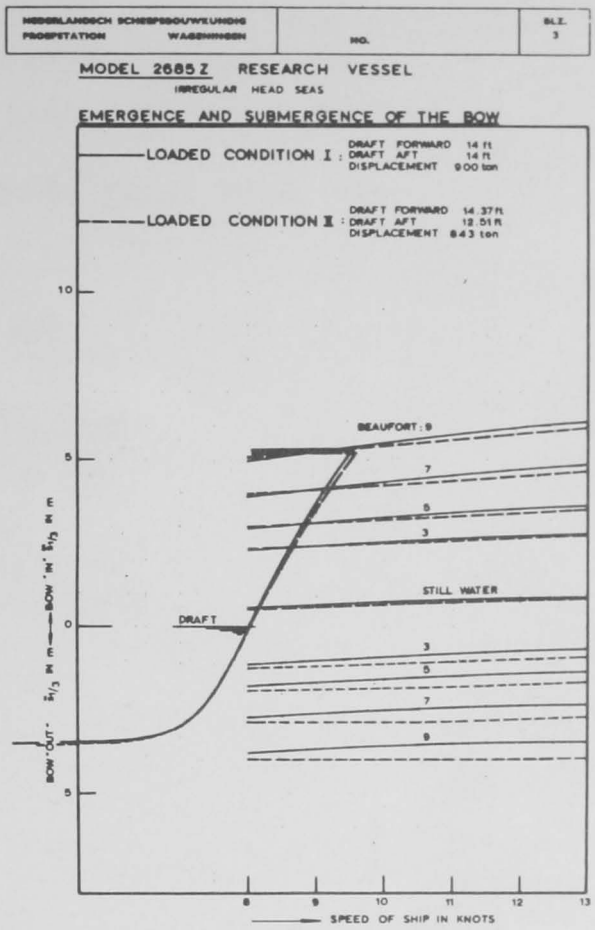




Appendix figure 19.--Total pitch, irregular head seas.

Appendix figure 20.--Submergence and immergence of bow in regular waves (load condition II).





Appendix figure 21.—Immergence and submergence of bow, irregular head seas.

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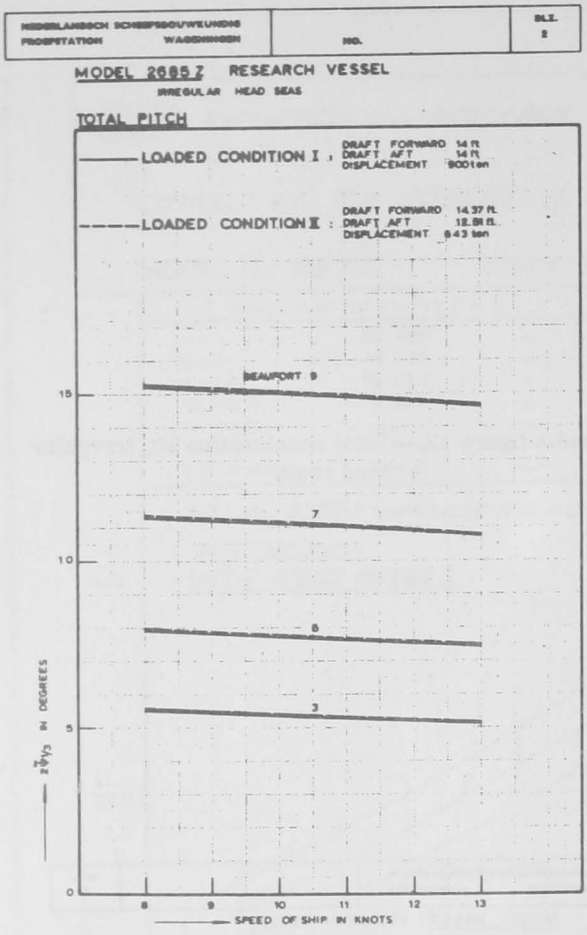
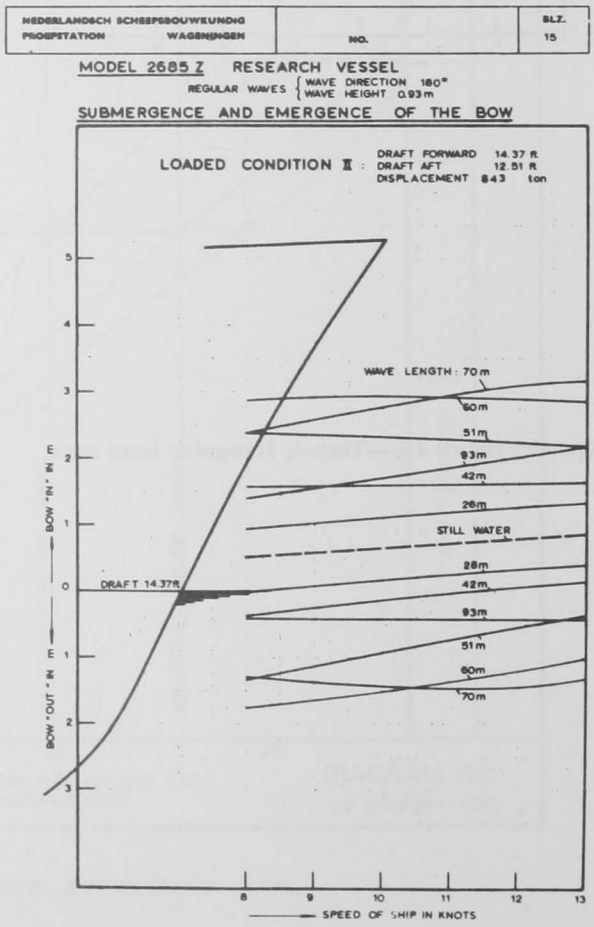
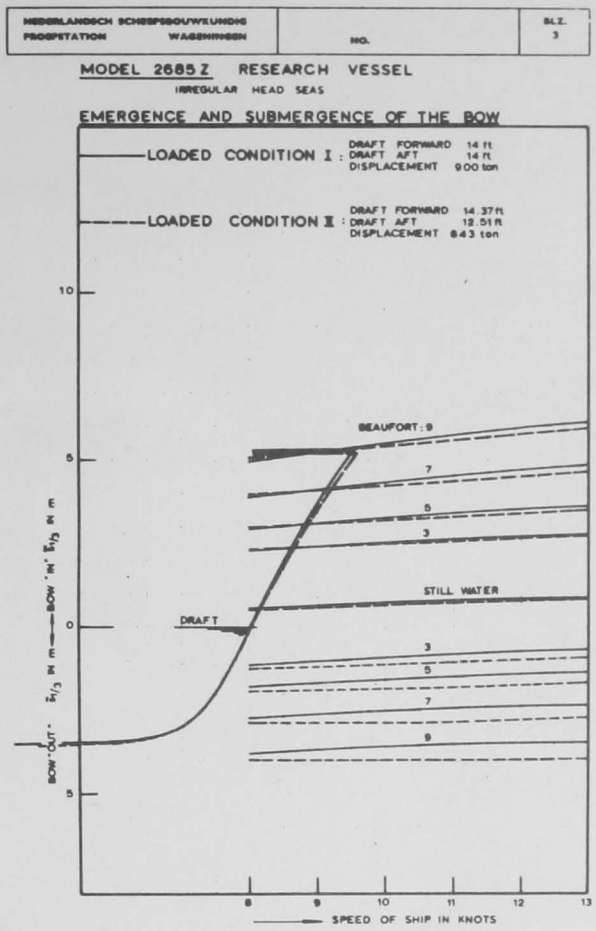


Appendix figure 19.--Total pitch, irregular head seas.

Appendix figure 20.--Submergence and immergence of bow in regular waves (load condition II).





Appendix figure 21.- Immergence and submergence of bow, irregular head seas.

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