

OCEANOGRAPHIC RESEARCH VESSEL

“ H. U. SVERDRUP ” (*)

by I. ENGELSEN,

Norwegian Defence Research Establishment
(Division for Underwater Warfare)

General

The main requirement for an oceangoing research vessel for the Norwegian Defence Research Establishment is seaworthiness to provide reasonable periods of work in the severe climatic conditions of the Norwegian Sea, although it was realized that work under all conditions would probably not be possible. Secondly, the ship should be economic in operation, a requirement which called for a standard design.

The Norwegian Sea and North Sea trawler types satisfy these two requirements reasonably well. These ships have proved their seaworthiness over a long period of years and they have been built in sufficient numbers to produce a certain standardization of the main parts. As long as machinery and equipment similar to that found in these ships are installed, good maintenance service may be expected all along the Norwegian coast, and also to some extent in other countries. Another reason for the choice of this type was the experience obtained with similar types of research vessels : R/V *Helland-Hansen* belonging to the University of Bergen and R/V *Johan Hjort* belonging to the Directorate of Fisheries, Institute of Marine Research.

H. U. Sverdrup was ordered from Örens Mekaniske Verksted in Trondheim in September 1959, launched on 27 February 1960 and delivered on 15 June 1960. She has been built according to the Norwegian Veritas Class +1A1 (Ice), and holds a certificate for navigation in all areas.

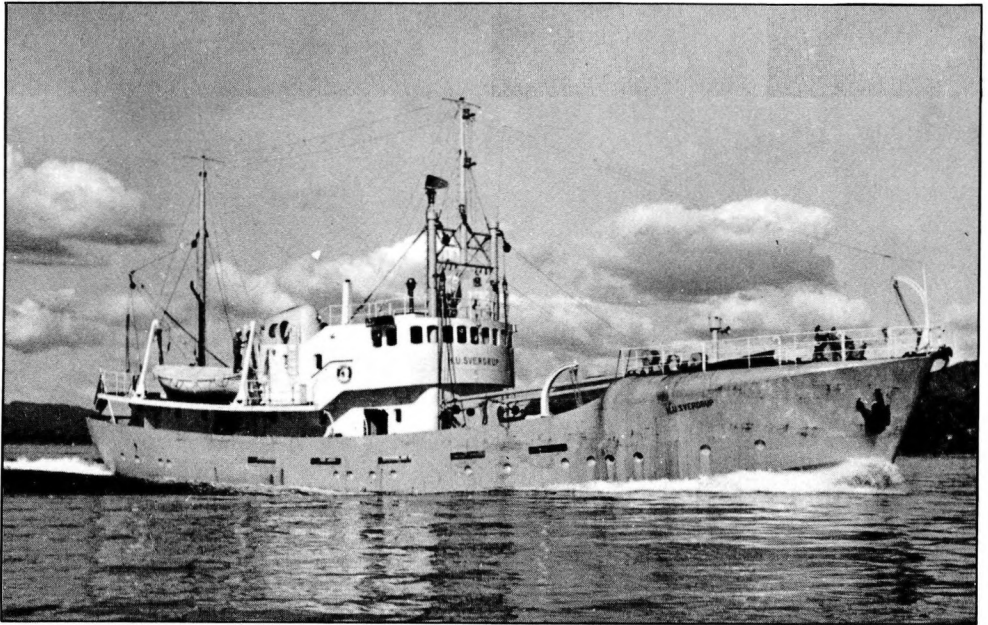
The main specifications are :

Length (overall)	38.9	m	(127 feet 7 inches)
Length (between perpendiculars)	34.0	m	(111 feet 6 inches)
Breadth moulded	7.6	m	(24 feet 11 inches)
Depth moulded	3.95	m	(13 feet 0 inches)
Gross tonnage	295	t	
Displacement	400	t	

(*) The building of R/S *HU Sverdrup* was financed by the *US Mutual Weapon Development Program*, for work in the common interest of NATO countries. She was then transferred to the Norwegian Defence Research Establishment, and is now operated by this Institution.

The main engine is a 600 h.p., 6 cylinder, two-stroke diesel, type Wichmann 6 ACA and the maximum speed obtained during the trials was 11.6 knots. The fuel capacity is 65 tons and the fresh water capacity 40 tons. At full speed the range is 5 000 nautical miles. Most oceanographic work can be carried out in sea state 4, and it is possible, though difficult, also to work in sea state 5.

The drawing and the photograph included in this article show the general arrangement of the vessel.



For inshore work, two officers and two men will suffice to operate the ship, while longer cruises will require 4 officers and 5 men. Under certain circumstances another two men may have to be carried, and as the total number of bunks is 19, 8 to 10 scientists may be accommodated.

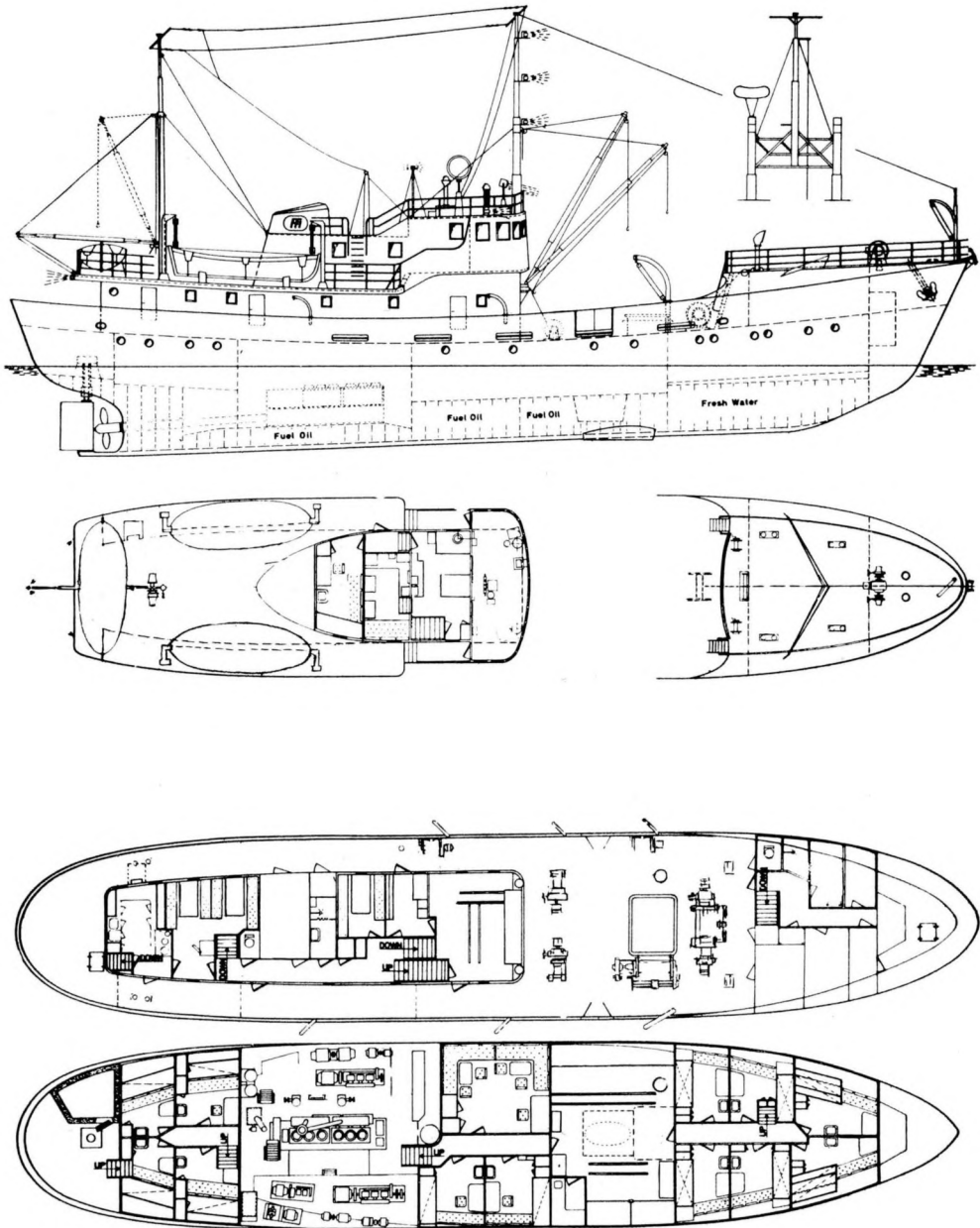
A combined lounge and conference room is provided for the scientists. The small room aft the oceanographic laboratory is now being used as a dayroom for the crew, but as more laboratory space is needed, it is intended to convert this room into a laboratory.

The storage space in the fo'c'sle includes about 360 cubic feet for explosives.

Deck equipment

The following winches are permanently installed :

- 1 deep sea anchoring winch with 5 000 m of 12 mm diameter wire, for anchoring in depths down to about 3 000 m. Combined with the boom, this winch may also be used for lowering heavy equipment down to great depths. Maximum lift 4 tons.



- 1 cable winch with storage capacity for 6 000 to 7 000 m of electric cable with double steel wire armouring. The winch is now being equipped with sliprings for signal transmission whilst hoisting or lowering of equipment is taking place.
- 2 hydrographic winches with 5 500 m of 4 mm diameter steel wire for handling lighter equipment like water samplers, bathythermographs, etc. Hoisting velocity 3 m/s. Maximum lift 1 ton.
- 1 cargo winch for use with a 3-ton boom mounted just forward of the deckhouse on the port side. A similar arrangement on the starboard side is now being replaced by a hydraulically operated crane which will make the handling of heavy equipment easier.
- 1 towing winch mounted on the stern aft of the deckhouse for towing projectors and other kinds of equipment. Maximum lift 4 tons.
- 1 boat winch mounted on the boat deck. Apart from putting the work boat over the side, this winch is used for handling equipment over the stern.

All these winches are hydraulic.

In addition, brackets are fitted flush with the deck at 20 points around the ship for mounting of small portable winches. These winches may be driven manually or pneumatically, as air pressure suitable for operating pneumatic tools is available along both sides of the ship.

A cylindrical well with a diameter of 2 feet goes from the weather deck, through the main laboratory, to the bottom of the ship on the port side between the fo'c'sle and the bridge. This well may be used for lowering smaller instruments into the water.

The superstructure has no supports along the gunwale, and there is unhindered passage for personnel carrying cables aft of the fo'c'sle. There is a 15 m² or a 168 square foot working space aft of the superstructure for use in rough weather.

An 18-foot plastic work boat with a 12 h.p. diesel engine is included, in addition to two regulation lifeboats. The work boat is fitted with a combined echo sounder/short range sonar for work in shallow and inshore waters.

Power plant

Electric power is obtained from two 30 kW, 220 V, 50 c/s generators driven by 45 h.p. diesel engines, and a 12 kW, 220 V, 50 c/s generator driven by an 18 h.p. diesel engine, the latter for use in port. In addition, the following converters are installed :

- One 220 V, 50 c/s - 220 V, DC 5 kW rotary converter
- One 220 V, 50 c/s - 24 V, DC 3.6 kW rotary converter
- One 220 V, 50 c/s - 115 V, 400 c/s 7 kVA rotary converter
- One 220 V, 50 c/s - 117 V, 50 c/s 5 kVA transformer.

A 24 V battery with a capacity of 1 000 Ah is included and may be used to drive a 24 V, DC - 220 V, 50 c/s, 1 kW rotary converter for use when low noise measurements are carried out. All other power is then shut off.

Facilities for synchronizing the two 30 kW generators are incorporated.

Navigational and communication equipment

Great attention has been paid to the the problem of accurate navigation and to the requirement for communication over long distances. Consequently, the equipment in this sector is far above what is considered normal in this type of ship. The following standard navigational instruments are fitted :

- Gyro compass with repeaters in the chart room, on the top bridge and in the sound recording laboratory;
- Automatic pilot;
- Electric log with repeaters in the wheel house, the chart room and the sound recording laboratory;
- Loran receiver;
- Radio direction finder;
- Small type sonar;
- Navigation echo sounder;
- Radar.

In addition, a deep sea echo sounder for soundings down to more than 5 000 m is installed. Furthermore, a plotting table for automatic plotting of own ship and two other contacts, the latter from radar or sonar information, has been fitted.

A gyro stabilizer is mounted in the engine room, enabling stabilized platforms for instruments to be built.

The wireless station contains two 400 W transmitters and two communication receivers, for communicating with both civilian and naval vessels. The frequency band covered is from 1.5 Mc/s to 24 Mc/s, in addition to the medium wave band from 400 to 550 kc/s. There is further a 70-W radio telephone for short-range communication, and a battery-driven emergency radio station. A lifeboat radio transmitter/receiver completes the external communication equipment.

Internal communication is by means of push button operated loudspeakers, and there is an extra telephone circuit between the laboratories and the wireless room. The scientist in charge of experiments can, if necessary, be connected to the wireless transmitter for direct communication with any cooperating ship or shore station.

Laboratory facilities

The following laboratory space is available :

Oceanographic laboratory	6 m ² (65 square feet)
Sound recording laboratory	15 m ² (160 square feet)
General electronic laboratory	35 m ² (375 square feet)
Total	<hr/> 56 m ² (600 square feet)

In the oceanographic laboratory there are racks for 12 Nansen bottles and 600 water sampling bottles.

The sound recording laboratory is on the main deck. Information from navigational instruments is presented on repeaters. The deep sea echo sounder and the ship's sonar are controlled from here. A 7-channel

magnetic tape recorder and a 4-channel pen recorder are permanently installed, together with amplifiers and monitoring equipment for sound propagation measurements. A salinity meter based on conductivity measurements is placed by the door leading to the oceanographic laboratory.

Multicore cables are laid between all laboratories and also to the chart room and the wireless station. Terminal boards make interconnections easy. Instruments for reading supply voltages and frequencies are provided. Accurate frequencies for reference are obtained from a tuning fork controlled chronometer.

The general electronic laboratory is located below deck, between fo'c'sle and bridge. No standard equipment is fitted except voltage and frequency control instruments, since the laboratory is designed to satisfy varying requirements. The cylindrical well goes through the laboratory, and a small hatch may be opened in order to lower small instruments like microphones, etc. This is possible only in calm weather. A photographic dark room is adjacent to the electronic laboratory.

A 60-inch sonar dome is mounted in the keel in the centre of the laboratory, but no permanent directing gear or transducer is installed. In two streamlined fairings on either side of the keel a number of echosounding transducers are mounted. It is intended that ultimately all decades from 10 kc/s to 80 kc/s will be available, but at the moment only 11, 30 and 38 have been mounted. The terminals from these transducers will be taken to a cross-coupling board where they may be coupled to various electronic transmitters. Facilities for combining transducer elements of the same frequency to give different directivity curves will be included. A gyro-stabilized, high directivity 50 kc/s transducer for precision echo sounding is being designed. This will be fitted in the 60-inch sonar dome.