In 1963 when it was decided to replace both the Ariel and the Iris two study groups were set up. One to examine the deficiencies of these existing ships, and the other to examine what conditions the new cableships would be required to work under, later this group was also asked to comment upon current trends in cable and cable gear designs.

The principal characteristics where improvements had to be made, were in the sea-kindliness of the vessel where a stable working platform was required in all winds and corresponding sea states up to Force 7. Cable was to be loaded and unloaded in the shortest possible time with the minimum of cable handling. Protection had to be given to the operators and equipment. The cable machinery, cable working gear and plant were to meet the requirements and limitations of the most modern cables as well as existing cables.

When the study groups made their reports it was possible to list the requirements of the proposed vessels.

The operational requirements were described as:

1. Highly manoeuvrable at all draughts, at all speeds especially under working conditions, under all weather conditions and sea conditions. Ideally a cable repair ship should perform equally well when going astern as when going ahead at all cable speeds.

2. Sea kindly, with good sea-keeping qualities, especially under working conditions.

3. Provide a steady working platform under all working conditions.

4. The consumption of fuel, water, and stores to have the minimum effect on draught and trim.

5. The prevention, detection and extinction of fire on board with particular reference to the isolation of machinery spaces, cable tanks, working spaces and accommodation.

The performance objectives were also established and given as follows:

1. The principal consideration of the hull design to be the performance of the vessel on the cable ground. The capability of making fast economical passages, whilst of importance, is of secondary consideration.

2. Reliability is fundamental and comes before efficiency if it is not possible to get both together.

3. Accessibility and ease of maintenance of all equipment or machinery are essential requirements.

4. Human labour and effort to work the ship or any plant, equipment or machinery to be kept to the absolute minimum, consistent with maximum operation efficiency and long term economy.

5. Remote or automatic control to be employed only where it can be shown to increase operating efficiency and promote long term economy.

At this stage the assistance of consultant naval architects was sought and because of their experience in the design of specialist ships, Burness, Corlett & Partners Ltd., were engaged. The new ships were to be essentially coastal water repair ships but capable of deep sea work, this established the minimum length and draught of the vessels. Advantage was taken of the fact that these vessels would be based on a new depot of the latest design and so the "Container" concept of carrying cables was applied. Cable was to be first loaded into pans then these pans to be loaded into the cableship. The same crane that was used to lift these pans was used to remove deck sections first and then replace them once the pans had been placed in the cable tanks.. The advantage of this system was to reduce the cableship turn-round at the depot from one or two days to between four to six hours.

The cable machinery had to be able to handle all types of cable including those with a minimum bending radius of 1.5 m. The forward cable engines were later supplied by Standard Telephones and Cables Ltd. Each cable engine is capable of hauling 30 tons at 0.5 knots, with a paying out speed capacity of up to 8 knots at 3.5 knots. Dowty linear draw off/hold back gear is fitted to each engine.

The naval architects prepared the "lines" of the cableship which was somewhere between the lines of a destroyer (for speed and manoeuvrability) and those of a barge (for a stable working platform). To minimise the vibration of the aft end, particular attention had to be given to the underwater shape there. An incorrect shape would produce flow seperation which in turn would have created propeller and shaft induced vibrations.

With the shape and envelope settled, the next series of problems were how and where to accommodate the ships complement, the machinery to propel her, and the cable machinery and equipment. Each member of the crew had a cabin to himself. The propulsion equipment was carefully considered and the final arrangements were to have only a single screw. Due to the limited space available within the hull the propulsion unit consists of two diesel engines coupled to a two-input single output gearbox. The output being coupled to a controllable pitch propeller. This decision was made because of the problems of the low sinking rate of light-weight cable and the possible risk to the cable from twin screws when laying cable from forward. To give the high manoeuvrability required an active rudder and a bow thruster were also incorporated in the design. The steering gear was so designed that with the active rudder propeller in use the rudder can be turned from 90 to port to 90 to starboard so providing thrust within that arc.

The bow thrust unit can be lowered to project below the bottom of the vessel and capable of rotating through 360° and provide thrust in any direction. In shallow waters, this unit can be operated in the withdrawn position and housed in a tranverse tunnel.

To meet the criterion of being a stable platform in heavy seas an anti-roll Flume stabilisation tank system was fitted.

By this time it was felt that a scale model had to be made to prove the design. First a 1/60 scale model was used in wind tunnel experiments, followed by a 1/30 scale model with a fixed propeller. The technique and method of analysis employed during the tests conformed to the standard procedure for resistance and propulsion experiments with ship models as established by the British Towing Tank Panel.

The station keeping, sea-keeping and manoeuvering tests presented something of a problem in as much as the full range of tests had to be performed with the bow thrust unit and the active rudder operable. Since there is a limit to which a propeller may be effectively scaled, this limit virtually determined the scale of our station-keeping model. Consequently, a 1/12th scale model was manufactured by Britih Hovercraft Corporation to lines supplied by Burness Corlett. This produced a model about 24 ft. long and clearly a model of this size could not be tested in a conventional open tank. So it was decided to test this model in selected areas of the Solent. As the model was required to operate in fairly severe sea conditions in the Solent and elsewhere, it was built using conventional boat-building techniques. The keel was of solid mahogany with laminated mahogany stem and stern posts scarfed into it. Bulkheads were made from marine plywood and fitted at every stage except in way of the cockpit and main engine where frames were used. Longitudinal stringers were fabricated from laminated mahogany and the hull was made of mahogany strip planking which was glued and nailed using galvanised nails and screwed and glued to the bulkheads. The representative superstructure was manufactured to drawings supplied by Burness Corlett and it was intended that this would only be sufficiently detailed for windage to be approximately correct and to allow the helmsman to have the same forward field of vision as the ship's bridge officer and to enable a correct assessment of wetness to be made if required. The model was designed to carry 2 personnel, a helmsman to carry out the various tests and manoeuvres, and an observer to operate the recording equipment. The helmsman's seat was placed such that his eyes were on the same level as the ship's bridge officer. A model of the flume stabilisation system was manufactured in wood and incorporated in the hull.

Models of the bow thrust and active rudder units were constructed. Accurate scale models of propellers for these units were manufactured in white bronze and the nozzles for the propellers were made in a light alloy. Provision was made for the bow thrust unit to be extended or retracted manually. The complete model was finished in Post Office livery for cableships.

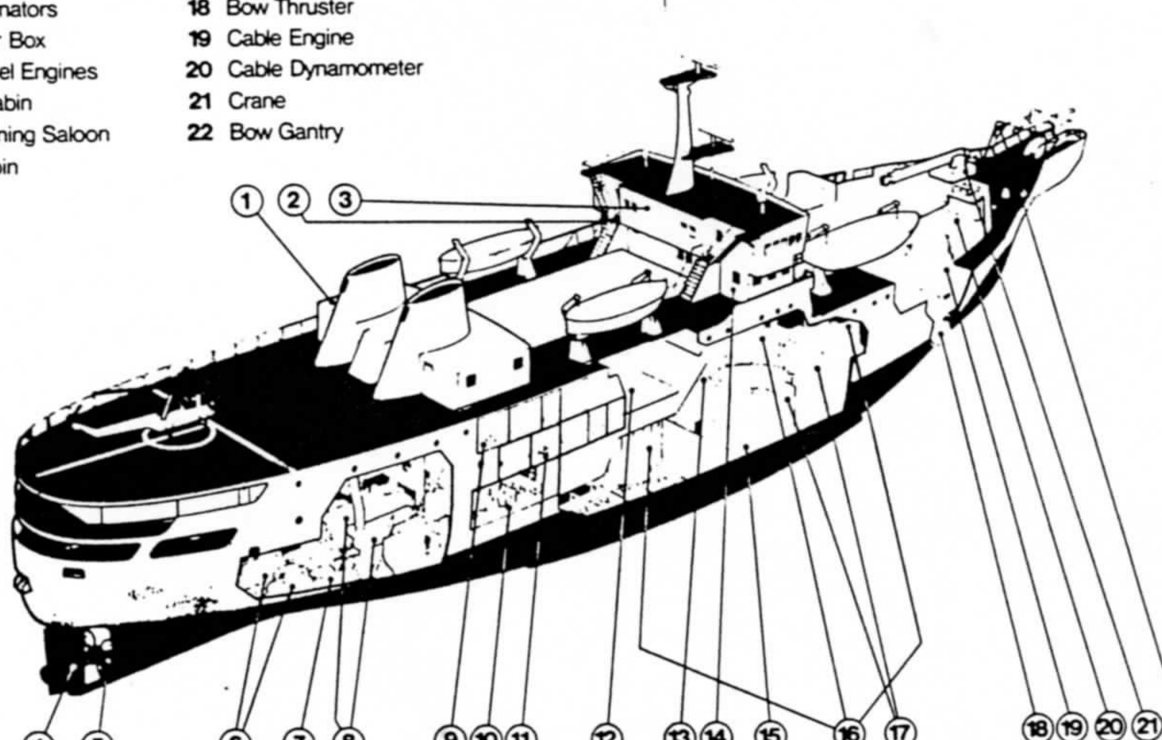
The main electrical supply was provided by 4 × 12 volt heavy duty batteries which were kept charged by a generator driven by the main engine. The latter was a Volkswagen industrial petrol engine type 122 which was also used as the principal forward propulsion unit driving a controllable pitch 3-bladed left-hand propeller. This propeller was not a correct scale model of the full unit but was the correct diameter and was selected to provide a representative wake over the rudder.

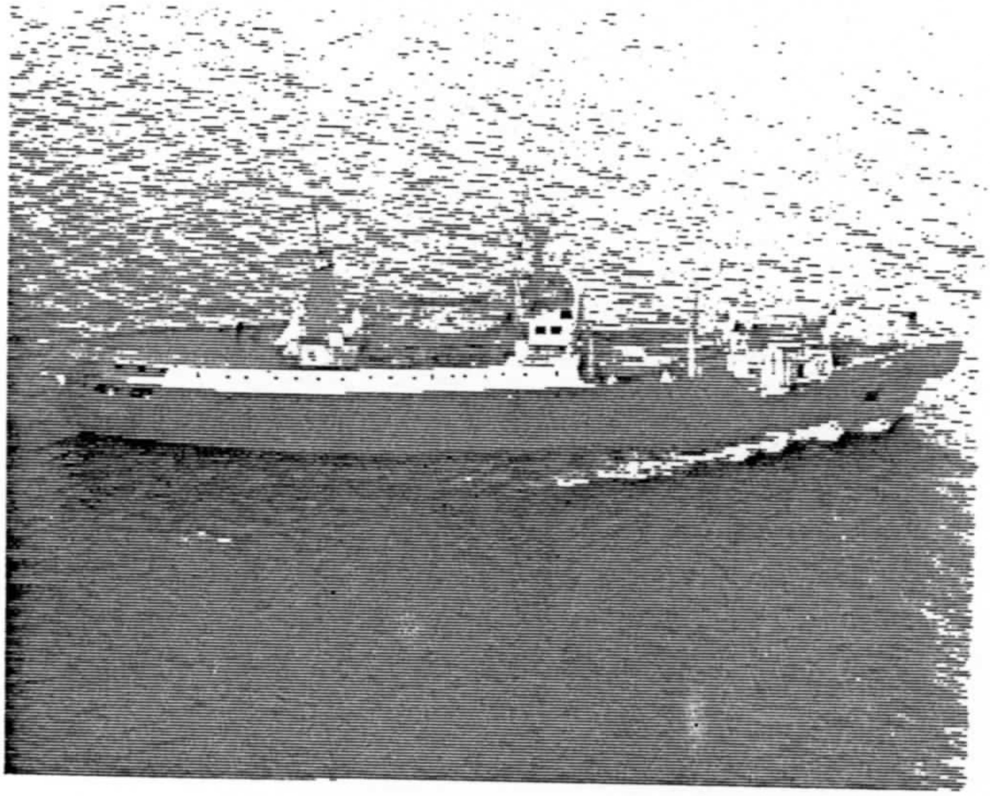
For the majority of the tests facilities were provided to measure and record a whole range of parameters on the model itself including angular position, rpm, thrust and torque of the auxiliary thrust units, and of the model itself were recorded roll, pitch, vertical accelerations, headings, water speed, wind speed and direction. During these tests a launch accompanied the model and from it were recorded tide rate and direction, and sea state. The tests were confined to an area in the Solent near Cowes which was chosen as past experience had indicated that the Solent coastlines and tidal conditions could provide in a matter of days a wide range of sea conditions.

For station keeping tests a suitable site was selected and a buoy was dropped from the accompanying launch to be used as a mark on which to keep station. The launch moved downwind of the buoy and anchored. The ship model was brought up to the buoy under her main engine, the main engine was then cut out and using only the bow thrust unit and active rudder, attempts were made to keep her steady at the mark

▼ *Longitudinal section of Monarch (5) and Iris (3)*

1 Air Conditioning Plant LER Vent Room
2 Captain
3 Navigation Control
4 Active Rudder
5 CP Propeller
6 Main Alternators
7 Main Gear Box
8 Main Diesel Engines
9 Officer Cabin
10 Officer Dining Saloon
11 Crew Cabin
12 Cable Tank Hatch
13 Cable Pan
14 Radio Room
15 Flume Stabilising Tank
16 Main Cable Tanks
17 Auxiliary Cable Tanks
18 Bow Thruster
19 Cable Engine
20 Cable Dynamometer
21 Crane
22 Bow Gantry





◀ *CS Monarch (5).*

under various headings. The rpm of each unit was adjusted till the ship's drift from the buoy was reduced to a minimum. When the ship was considered steady, a recording of the parameters lasting approximately five minutes was taken. The following headings were attempted in each state of the tide speed:

1. Head to seas,
2. Bow to seas,
3. Beam to seas,
4. Stern quarter to seas,
5. Stern to seas.

The station-keeping tests were divided into two sections:

1. Station-keeping against the wind, tide, and waves.
2. Station-keeping against the tide only.

Investigations were carried out in tide rates from zero to three and a half knots and sea states up to that corresponding to Beaufort Force seven. Horsepower requirements for each thrust unit were derived from the corrected thrust values.

Later tests were conducted using a computor aided control system to keep the model on station. The final assessment of all the tests on the 1/12th scale model created such confidence that final arrangements were able to be agreed with the Naval Architects (Burness Corlett & Partners Ltd.). Preliminary structural arrangements were prepared and submitted to Lloyd's for approval. Finally, all specifications and arrangement drawings were prepared for tender.

Hobb Caledon Shipbuilders Ltd., were the successful tenders, and it was mutually agreed that two ships would be built at their Caledon Shipyard, Dundee. General particulars and data are given in appendix 2.

C.S. Monarch was commissioned 1975 and C.S. Iris was commissioned 1976.