

Björn Karlsson and Ocke Mannerfelt showing the shape of the underwater surface. The EcoShip project was presented at the Göteborg Shipping Week held in January this year.

PHOTO: BO HÅKANSSON

The ECO Tankship – a new and environmentally friendly concept

The ECOSHIP, a new concept for Short Sea Shipping, is under development in Sweden.

The EcoShip idea was born at Volvo Penta in Gothenburg in 1996, when the enginemaker was asked to develop a diesel-electric propulsion system for a container ship especially developed for traffic on the Swedish inland waterways. Very soon they realized that to reach a good overall solution, it was not enough to develop the propulsion system only but also to look at the rest of the ship, mainly the hull design.

Volvo decided that the most suitable engine-room design would be a modularised power-plant with a number of power packs (diesel engine and genera-

tor). A number of small units make servicing easier. It is also easier to update with new technology and it will probably increase the second-hand value of the ship.

The flexibility and the smaller engine-room increase the load volume and the load capacity, since the engine-room can be placed where it doesn't interfere with the cargo space – which conventional engine-rooms often do. This also makes it possible to design the hull, specially the aft part, without having to take engine-room layout into account.

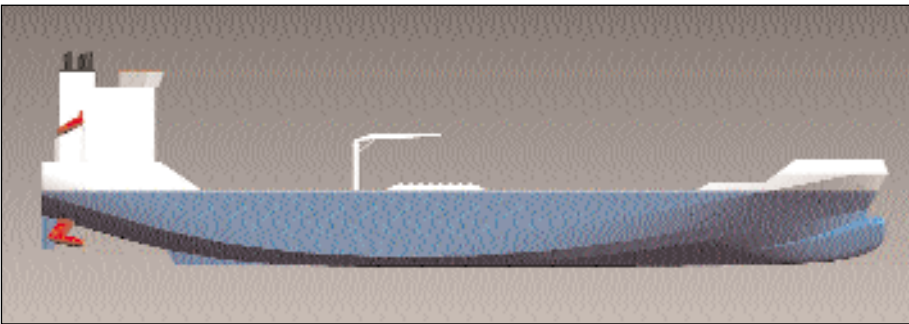
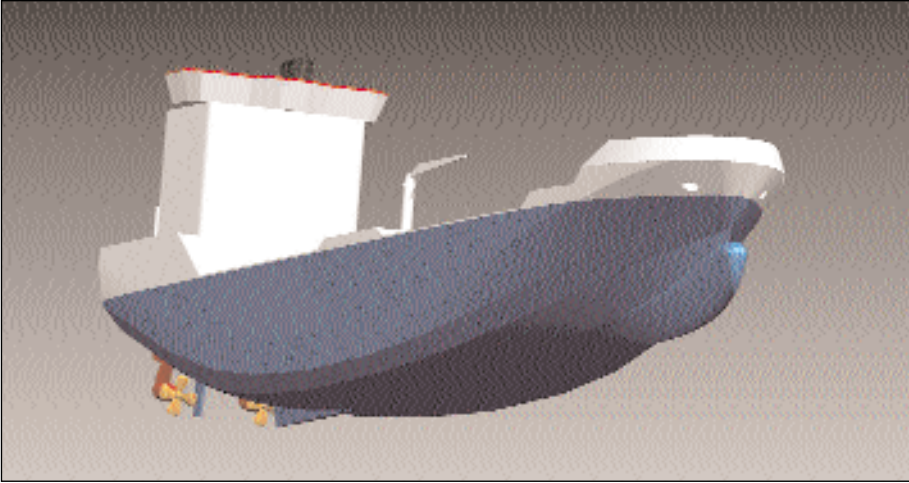
A long co-operation

Volvo Penta has had a long co-operation with the hull-designer Ocke Mannerfelt. This co-operation was increased in 1996 and at the same time Volvo also

began to work together with Kockums Engineering AB in Malmö, El-Marine/Callenberg Engineering and ABB, and also Kamewa.

Later on, FKAB Mattsson Group and IUC Skåne AB became partners in EcoShip Engineering which was founded in 1999. The initial thought was to construct and build four containerships. That prospect, however, was never fulfilled.

In the year 2000, EcoShip Engineering got a proposal from the Swedish shipowner Brevik to construct a modern tanker for short sea shipping. It is a very different task to construct a tanker compared to a container or a ro-ro ship when it comes to the shape of the hull. But the initial EcoShip concept was applied to the new hull without any difficulties.



The newly developed underwater body is reducing the water resistance by approximately ten percent.

The ship is designed in such a way that it can be built in a large-scale module system. The system makes it possible to build the different parts of the ship along different production lines and then put the parts together. The engine-room, for instance, can be built and equipped in a hall and workshop and then be lifted onboard when the time is suitable.

The Swedish National Energy Administration will pay 35 percent of the development costs if the ship is actually built. This means that the first ship that will be built according to the Eco-ship concept will be a demonstration vessel to which new technology will be added continuously.

Reduced water resistance

In the newly constructed hull, the water resistance has been reduced by approximately 10 percent compared to a conventional hull design of the same size. The Eco-ship has, however, a 30 centimetre larger draught but the length and width are the same. Despite the fact that the new hull is more slender than that of a conventional ship, the Eco-ship has managed to increase the dead

weight due to a lighter construction of the ship, due to a large extent to the lighter engine-room. The tank volume has increased by 15 percent.

The three major criteria of the Eco-ship concept are:

1. low energy;
2. an optimum environmental adaptation;
3. an improved volume capacity.

It is important to have a high volume capacity so that benefit can be gained from the dead weight when loading lighter cargoes like, for instance, nafta or kerosene.

The hull is mainly built with single bent plates and the lines of the hull are soft, with most of the weldings in a longitudinal direction that follows the flux of the water, to avoid turbulence and increased water resistance. The whole ship is equipped with a double hull. Even the fuel and oil tanks are located inside the double hull.

The ship has eleven cargo tanks, built according to MARPOL regulations, with a total capacity of approximately 10,600 m³. The tank bulkheads are smooth, for easy cleaning. This means that all reinforcements are on the outside of the tanks. All the tanks are heat-

ed by heat-oil supplied by two low NOx boilers. A deck-drain pipe to a designated tank has been fitted to avoid waste oil ending up in the surrounding water. The ship is also prepared for a future ballast water cleaning system, consisting of cyclone cleaning for the larger particles and UV-radiation for the smaller.

No problems in icy waters

As the ship has very few parallel areas below the waterline, it will have no problems in icy waters and will probably be classified in ice class 1A. Alternatively, the ship can be classified in 1B. The difference will mainly be in the propulsion system. If the ship is to be built according to ice class 1A, it will be equipped with two Azipod Compact POD-propellers with asynchronous motors. If the ship-owner decides to give the ship a lower classification, the propulsion system will be only one Azipod with two counter-rotating propellers.

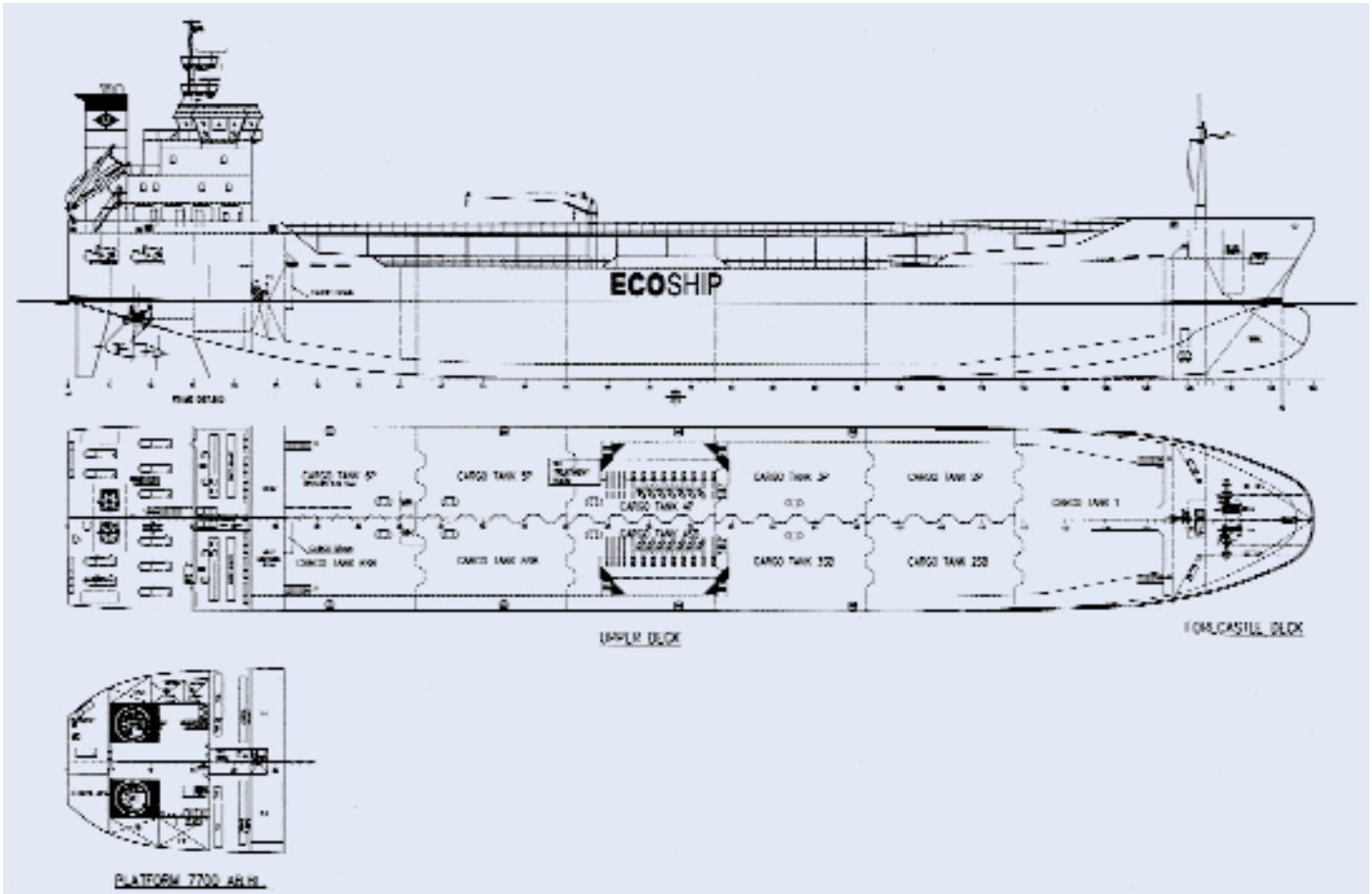
The price of the Eco-ship is slightly higher than that of a conventional ship, mostly due to the diesel-electric propulsion machinery.

The ship will be equipped with ten high-speed low-emission diesel engines each connected to a generator and running at 1800 r/min and developing 428kW each. These ten units will be both propulsion machinery and auxiliary machinery. The main current onboard will be at 690 volts. Both the pods and the cargo pumps will use 690 volts while the computer system and other electrical systems that need a lower voltage will get 440 and 220 volts via rotating transformers. The deck machinery will be both an electric and a hydraulic system.

There is no dedicated emergency generator but the plant is operating in such a way that one engine-generator unit is selected due to service-intervals, running hours etc.

The loads on the propulsion and cargo-handling systems are controlled by a frequency converter, which means that the power is altered by the rotation speed. The capacity of the cargo pumps is adjusted by reducing or increasing the pump-motor speed.

The ten generating sets are continuously and automatically controlled through a computerised power management system, which ensures that the correct numbers of engines are in operation



The ECOSHIP has eleven cargo tanks with a total capacity of approximately 10,600 cubic metres. All tanks, even the bunker tanks, are protected by the double hull.

and matching the power demand. Under normal service speed, approximately 14 knots, nine generators are needed. The engines run at constant speed and under optimal load conditions.

Engines served from ashore

The large number of engines makes it easy to keep each running engine efficiently loaded, between 70–90 percent, and idling is avoided. The relatively small size of the power packs, they weigh about four tonnes each, makes it easy to change a whole pack due to service or a breakdown. The engines will be served from ashore and an on-line monitoring system showing the running hours and the condition of each engine will give the Volvo Penta people in Gothenburg the possibility of checking the status at any time.

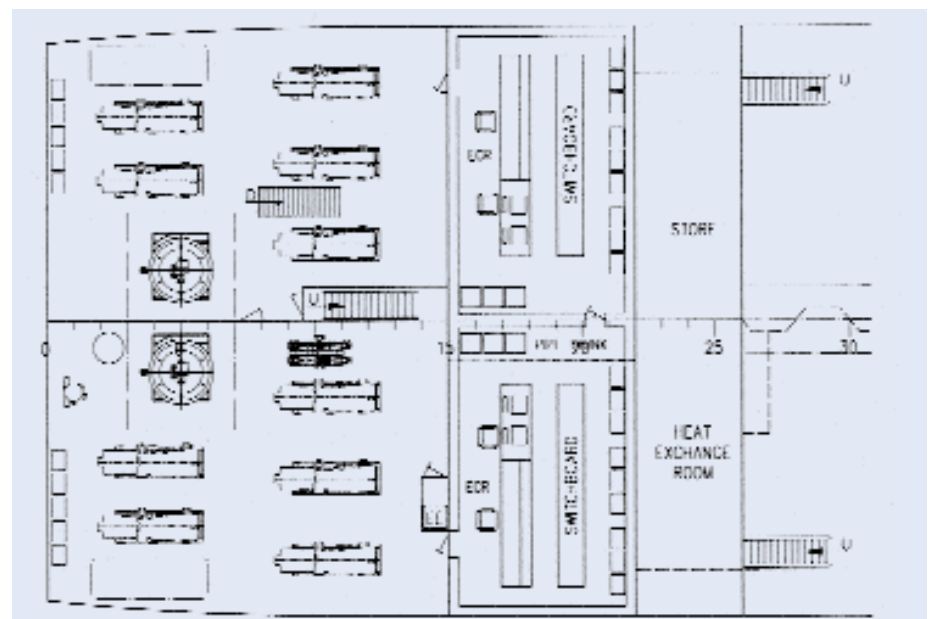
Each engine has its own exhaust gas pipe, to avoid back-pressure. Also, the plant is equipped with (both) catalytic converters, exhaust gas cleaning with an urea injection system that gives an extremely low NOx value: 0,4 gr/kW.

The crew is estimated to be between seven and nine people.

Offers have been sent to both Scandinavian and other shipyards but it has

not yet been decided where the first ship will be built. Hopefully a contract will be signed before the end of this year.

Robert Hermansson



The engine room layout showing the ten generating sets, the boilers and the control rooms.