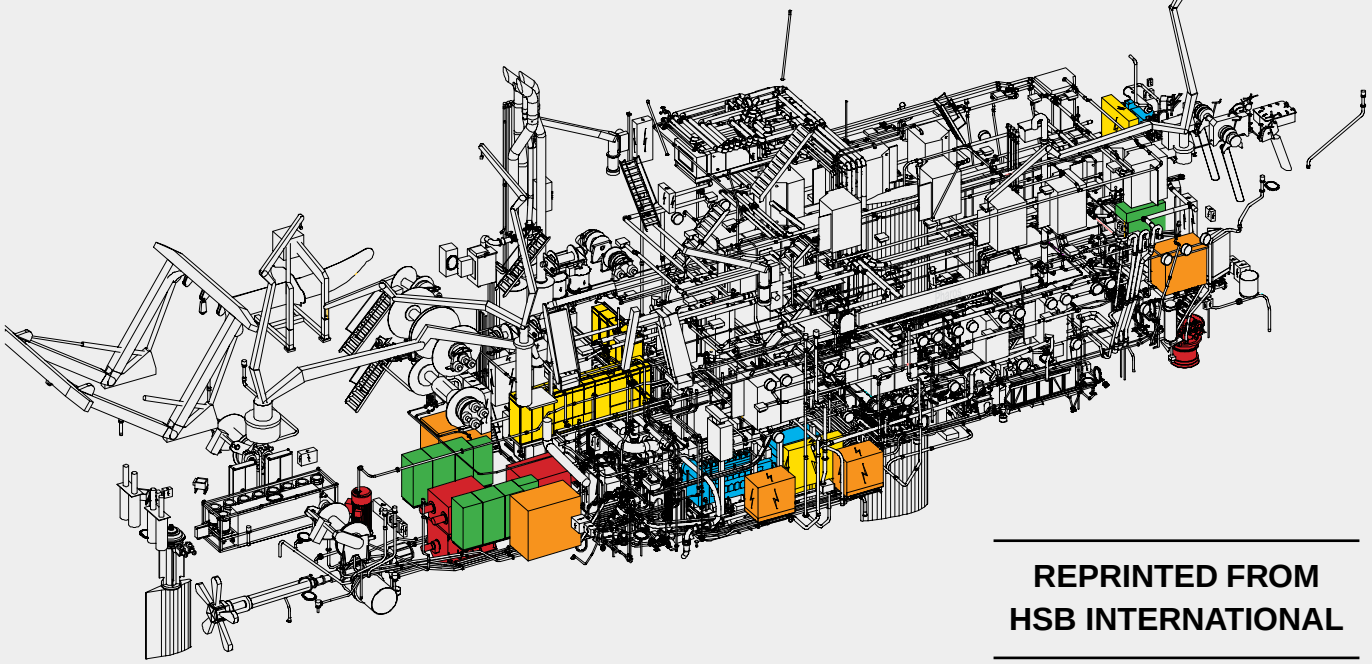
LOW-NOISE DIESEL-ELECTRIC PROPULSION

Successful Turnkey Delivery of Bakker Sliedrecht



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The recent inauguration of the 'Celtic Explorer' will be a huge milestone for Irish marine research. For the first time, the Marine Institute will be in the position to provide a platform for deep-sea research (see the in-depth ship description in the next issue of this magazine).
The 'Celtic Explorer' will be 65.50 m in length and will accommodate 31 personnel, including 17-19 scientists. The new vessel is, in gross terms, six times the size of her predecessor, the 'Celtic Voyager' and will be able to carry out marine research further offshore and will be able to stay at sea for much longer periods of time.
Ireland's unique strategic position in European terms, on the edge of the Atlantic will mean that the 'Celtic Explorer' will be able to facilitate both national and international research and exploration. The vessel will be based in Galway, which is ideally located as the gateway to the Atlantic and geographically close to the main working areas.

Electric Drive Systems

Electric drive systems and energy supply for propulsion and side thruster units invariably means that there are special high requirements for: noise and vibration levels, safety, redundancy, fuel consumption, environment, flexible installation possibilities, maintenance, etc.

As a matter of fact, there has been a sharp increase in the application of electric drive systems for main and auxiliary propulsion, bow and stern propellers in recent years, even more so with the advance of low maintenance systems in the form of AC motors with frequency control.
Sliedrecht based Bakker Sliedrecht Electro Industrie B.V. is one of the leading company's in the Netherlands' marine supply industry and has successfully carried out several projects over the last 30 years. These projects included main, auxiliary as well as emergency propulsion systems and side thrusters. In several cases a combination of these has been applied, including power and ship management systems, control by Dynamic Position (DP) systems, etc.
A major project that recently has been carried out by the Sliedrecht based company concerns the engineering and development work for a low-noise diesel-electric propulsion concept for the research vessel 'Celtic Explorer'. A most innovative concept featuring redundant energy generation. The highly advanced propulsion concept incorporates three main generator sets and a low-noise propulsion system consisting of two e-motor propulsion units and two electric motors for bow and stern thruster units respectively. The research vessel, built by Damen Shipyards Gorinchem, has been ordered by the Irish Marine Institute.

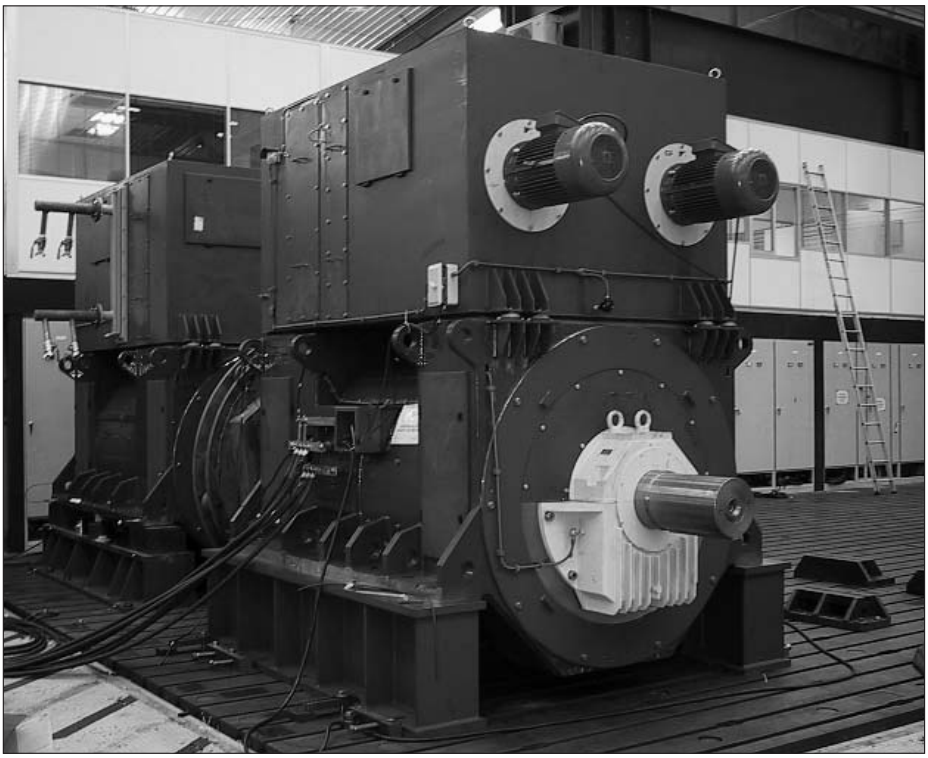
'Silent' Fish Surveying

A striking feature of the research vessel is that the building contract demanded full compliance with the International Convention on Exploration of the Seas (ICES) "209" report on "silent" fish surveying purposes, limiting underwater radiated noise levels across a range of frequencies.
For this project Damen Shipyards Gorinchem also worked in partnership with Royal Schelde Group who contributed acoustic expertise to the vessel's overall design, principally in the area of vibration avoidance.
The vessel, with twelve regular crew, one or two technicians and up to eighteen scientists on board, will mainly be deployed for fishery survey work, oceanographic research work, environmental monitoring, acoustic research, oil recovery support and instrumentation deployment.

Diesel-Electric Concept

The diesel-electric concept, featuring redundant energy generation, incorporates three main generator sets and a low-noise propulsion system consisting of two e-motor propulsion units and two e-motors for bow and stern thruster respectively.
Power is supplied by Indar main generators of 2 x 1,875 kVA and 1 x 1,250 kVA respectively and an emergency generator of 150 kVA. The 690 V

shipboard mains is powered by the three main generators from which propulsion and side thrusters derive their energy. The 400 V mains is also being diverted from these by using two transformers of 650 kVA each.
The propulsion plant is powered by two low-speed (low-noise) Indar DC motors, each of 1,500 kW at 180 rpm, arranged in tandem. The bow and stern thrusters are powered by Indar squirrel-cage motors of 720 and 400 kW respectively.
Opting for a 690 V and 400 V power part has resulted in a technically and most economically attractive solution, which - through the symmetrical construction of both circuits using so-called coupling switches in the various switchboards - forms a redundant system. The redundant system guarantees continuing power supply to the propulsion, side thrusters and on-board circuit even under the most extreme conditions.
A black-out prevention system, also known as Propulsion Power Limitation (PPL), has especially been developed by Bakker Sliedrecht is integrated in the main switchboard.
The main propulsion system is powered and controlled by a tailor-made enclosed DC drive module. In combination with the PPL system optimum availability is provided. The installation will be delivered turnkey, including switchboards, consoles and cabling.



One of the two 1,500 kW low-noise Indar DC propulsion motors in tandem

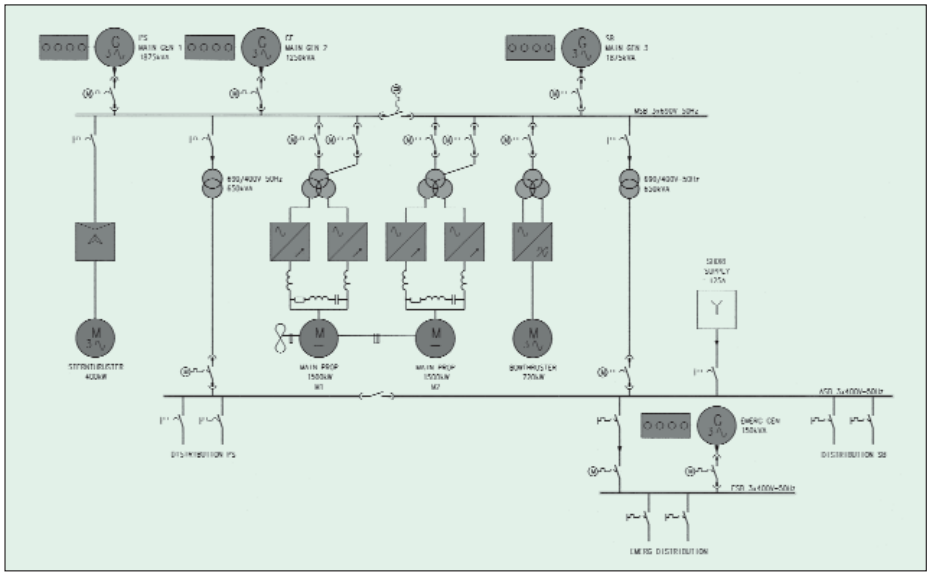
Low Acoustic Signature

The multi-purpose 'Celtic Explorer' is deployed for multi-purpose research into, among other things, the behaviour of various fish species, for which extremely accurate underwater measurements will be carried out. In order to make such measurements possible, it was necessary that the research vessel and her equipment features a very low acoustic signature, fully in compliance with the highest requirements (ICES CRR 209) in this specific field.
As the propulsion train plays an important part in this, the 'Celtic Explorer' has been equipped with two low-noise Indar DC propulsion motors in tandem configuration, each with a power of 1,500 kW, and designed with the aid of the Finite Element Method (FEM).
The DC drives feature a specially designed semi 24-pulse system with so-called double-stock transformers, and a so-called extra "low-noise mode". Diesel generator sets have been mounted double-stage noise- and vibration-free, which provides extra damping.
The decision to opt for a diesel-electric propulsion system can be found in its significantly low noise and vibration levels, installation flexibility, and a total control with efficient power distribution/management of on-board circuits and/or diesel engine load.
In general, such applications can be found particularly on research/survey vessels, buoy tenders, lifting ships, offshore vessels, and ferries as main (auxiliary) propulsion, but also as economical propulsion systems on supply ships and as on-board circuit propeller shaft generators/emergency propulsion combinations.

Summary

The choice of an electric drive and energy system mainly depends on the purpose of the application and its requirements. Marine applications include: research vessels such as the 'Celtic Explorer', ferries, naval survey vessels, lighthouse (buoy) tenders, dredgers, offshore vessels, fishing vessels, long-liners, and crane vessels.
Propulsion drive systems generally consist of several AC or DC motors with static converters for continuous speed control, possibly combined with a number of side thrusters and in more and more cases connected to a Dynamic Positioning system.
An important factor is whether the propeller is fixed or controllable (FT or CT). It goes without saying that fixed propellers give: higher efficiency, smaller diameter, low noise and lower maintenance.
Power generation comprises a number of diesel generator sets, often in combination with a power/ship management system.
Reliable diesel-electric propulsion systems require little maintenance. In case of low noise requirement, generator sets are mounted vibration free, as groups or individually positioned, in a sound proof environment.
The most commonly used system is the low maintenance AC system, however when there is a special requirement for very low noise and vibration levels, a DC direct drive system is more favourable.

The propulsion train plays an important part in the low-noise diesel electric propulsion concept



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RV SIMON STEVIN

A new multidisciplinary coastal research vessel

General information

The new research vessel will mainly be used for academic coastal oceanographic research in the southern bight of the North Sea, as a training platform for students following marine science and maritime programmes and as a test platform for new marine or maritime technologies. In addition, educational trips for primary and secondary schools will be organised aboard the vessel. The ship will sail under the Belgian flag and will be registered in Ostend.

The design of the ship will meet the needs of various marine research disciplines: physical oceanography, fisheries research, marine biology, microbiology, chemistry, technology, archaeology and earth sciences. In view of the variety of scientific objectives and the resulting required flexibility a major part of the scientific equipment will be loaded on board the vessel in and be operated from containers that can be assembled on the afterdeck.

The ship will be equipped with all standard sampling equipment and with hi-tech sonar techniques allowing flow measurements (acoustic flow monitor) and soil characterization (multibeam).

Highly accurate positioning is ensured by means of a dynamic positioning and navigation system that guarantees maximum manoeuvrability up to a sailing speed of 3Kn. A diesel electric drive offers the possibility to sail as a 'silent ship'. This ensures that all acoustic measuring instruments can be used in an optimal manner.

Specifications

- Monohull
- Autonomy: five days
- Working area: southern bight of the North Sea and eastern part of the Channel
- Operations within 200nm (or approx. 370 km)
- Mainly daytime operations with multiple-day trips on a regular basis
- Platform stable up to significant wave height of 2m
- Maximal speed: 12Kn
- Maximum manoeuvrability & capable of sailing a steady course at minimum 3Kn
- Draught: 3.5m
- Dynamic positioning
- Diesel electric drive
- Afterdeck of 80m^2

Accommodation

- At least 8 scientists (2-person cabins)
- Total number of people on board for day trips: up to 20 (students/pupils)

- Common mess and kitchen space for crew/scientists/students

Meeting space/classroom for minimum 12 persons (combined function with mess)

Scientific facilities

- Wet lab space / Fish sorting area / CTD room of 30m^2
- Dry lab space of 25m^2
- Computer room

Working deck equipment

- Oceanographic arm at starboard side
- A-frame at starboard side for small point samplings (1 tonne)
- Large A-frame fence at the stern (6 tonnes)
- 2 main winches, 6 tonnes of tractive power each
- Removable net drum winch
- Hydraulic deck crane (telescopic) for loading and unloading equipment
- Space + fixation points for standard 10 & 20 feet containers

Other requirements

- Seawater intake system
- Freezer/refrigerator room of 5m^3
- Compressed air line
- Flow-through centrifuge
- Meteorological unit on mast at the bow outside the turbulence of the ship
- Working space for bird counters/sea mammal observations on the bridge