



MAN diesel engines as basis for innovative hybrid drive system on MS Vision of the Fjords

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Independent operation of diesel and electric engine; system redundancy; with functions as electric engine or alternator

The 'Vision of the Fjords' is a futuristic sightseeing catamaran made of carbon fibre from the Norwegian shipyard Brødrene Aa AS. Particularly groundbreaking is its parallel hybrid drive which allows for both the electric and the diesel engine to be operated independently of each other. A worldwide innovation in the field of marine applications is the arrangement and structure of the vehicle's driveline components as well as its advanced monitoring system. The basis for the parallel hybrid drive is formed by a twelve-cylinder engine from MAN Engines in each of the two drive units.

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Norwegian engineering expertise with German components

The driveline has been developed and constructed by the Norwegian marine drive system supplier MANCRAFT AS. "As a basis for our innovative driveline, we've selected a solid, tried-and-tested product – a diesel engine from MAN Engines," stated owner and managing director Oyvind Alvern, who has been working exclusively with the engine manufacturer from Nuremberg for nearly 20 years. Every D2862 LE422 MAN engine is fitted with a third-generation Common Rail injection system and delivers 749 kW (1,019 HP) at 2,100 rpm.

Innovative driveline

This power is transmitted via a CENTA electro-magnetic clutch through a CENTALINK drive shaft to an Oswald electric engine. The subsequent contactless and inductive torque measurement allows for an advanced selection and control of the power output of both engines. The converted energy is transferred to the ZF gearbox via another CENTALINK drive shaft. This means that the diesel and electric engine can power the propellers

MAN Truck & Bus is one of Europe's leading manufacturers of commercial vehicles and supplier of transport solutions, with revenues of approximately €9 billion a year (2015). The product portfolio includes trucks, buses and diesel engines, as well as services related to passenger and cargo transport. A subsidiary of Volkswagen Truck & Bus GmbH, MAN Truck & Bus employs more than 35,500 people worldwide.



together or independently of each other, creating system redundancy. In the event of diesel operation, its full power can be directed through the electric engine to the ZF gearbox and the CP Propeller.

Emission-free operation

The MAN D2862 LE422 diesel engine for the 'Vision of the Fjords' was already designed to achieve the highest level of emission efficiency, with its third-generation Common-Rail-System helping to keep exhaust gas emissions to a minimum. However, for trips in the harbour or during sightseeing expeditions, the 'Vision of the Fjords' is driven purely by the two Oswald electric engines, which make for a peaceful and emission-free trip lasting up to three hours. The separate damping and insulation of all the individual components of the drive system limit vibration levels and ensure additional safety.

Surplus power for battery charging

The batteries are either charged from shore power or on board at optimal operating point, using the diesel engine's surplus energy produced by the alternator at high speed. The water-cooled electric engine is a permanent-magnet synchronous motor (PMSM), which can function as an alternator or electric engine depending on the operating mode. This means that the energy collected in the batteries can be used as the sole energy source, with the option to put the diesel engine into stop mode at any time.

Classified and expandable system

MANCRAFT submitted to the relevant classification society the complete drive and monitoring system that were tested and approved according to the DNV GL 'high speed light craft' directive for fast and lightweight boats. Thanks to the modular construction of the new parallel hybrid drive, it can be transferred and used in countless other systems.

MAN Engines

MAN Engines – a division of MAN Truck & Bus – offers high-speed diesel engines for workboats in light, medium and heavy duty applications, with an output range from 190 kW to 1,397 kW (234 HP to 1,900 HP). Areas of application include tugs, ferries as well as fishing, ambulance and police



boats. MAN engines are unique for their compact construction, high power spectrum as well as their high torque plateau. All engines comply with the internationally applicable exhaust regulations.

MANCRAFT

MANCRAFT AS offers comprehensive drive solutions from propellers to bridge monitoring systems for high-speed workboats of up to 50 metres. MANCRAFT's core competence, built on decades of experience, lies in the overall understanding of technical planning, control and monitoring, as well as the maintenance of marine drive systems.

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| Name of vessel | Vision of the Fjords (project name: Seasight) |
| Length | 40 m |
| Width | 15 m |
| Material | Carbon fibre in compound construction |
| Seats | 400 |
| Class | DNV GL high speed light craft |
| Main engine | 2 x MAN D2862 LE422, with 749 kW (1,019 HP) output each at 2,100 rpm. |
| Electric engine | 2 x Oswald permanent-magnet electric engines 150 kW, as an alternator 200 kW |
| Propeller | CPP propeller |
| Battery | 600 kWh |



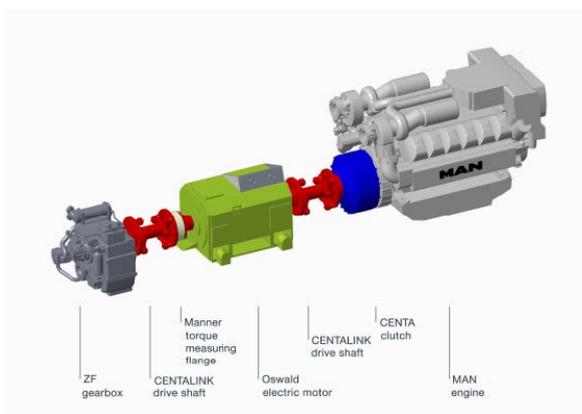
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MS Vision of the Fjords has an innovative design and drive.



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The MAN D2862 LE422 engine is the core of the environmentally friendly parallel hybrid drive.



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Diesel and electric engines can be driven independently of one other.