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GREEN FLAGSHIP

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Bringing goods to the global market

Wallenius Wilhelmsen's commitment to protecting the environment often runs ahead of the schedules mandated by international legislation. So it may come as no surprise that Wallenius Wilhelmsen is at the forefront of vessel design. The result? The E/S Orcelle, Wallenius Wilhelmsen's vision for the future of an environmentally friendly ocean transport industry.

This concept vessel does not release any emissions into the atmosphere or into the ocean. It uses renewable energy sources and fuel cells to generate the energy required to power the vessel. Its highly advanced design provides optimum cargo capacity to transport cars and other goods around the world more efficiently.

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ALTERNATIVE ENERGY SOURCES

Renewable energy

Sustainable shipping depends on the use of new technologies and on the utilisation of energy from renewable sources. Wallenius Wilhelmsen believes that the future of the shipping industry lies in the utilisation of the energy sources already available at sea: the energy from the sun, from the wind and from the waves.

We believe that the industry as a whole must put more effort into developing sustainable ocean transport solutions that are both viable and cost-effective. To that end, the design of the E/S Orcelle is based on the utilisation of energy from renewable sources. Wallenius Wilhelmsen is well aware that the technologies required to enable this concept vessel to become a reality in the next 20 years need to be developed.

We have observed various emerging technologies that enable smaller ships to utilise energy from renewable sources. And we are keeping a close watch on emerging trends and are hopeful that these solutions may become applicable to larger vessels sometime in the future. Renewable energy sources have the potential to provide an abundant supply of energy with minimal environmental impact and at relatively low cost.

We look forward to the future.

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OPTIMUM CARGO CAPACITY

More versatile vessel

The E/S Orcelle will have an optimum cargo capacity of 85,000 m^2 of cargo deck stowage area, roughly equivalent to 14 football fields. This is up to 50% more space than today's modern car carriers, which are capable of transporting 6,500 vehicles.

The E/S Orcelle will be capable of transporting up to 10,000 cars on eight cargo decks. Three of the decks will be adjustable to accommodate cargo of different heights and weights.

Compared to today's vessels, the pentamaran hull shape of the E/S Orcelle and its utilisation of energy from renewable sources will help optimise the cargo-carrying capacity of the vessel. The E/S Orcelle will have a maximum deadweight capacity of 13,000 tons and weigh 21,000 tons much like today's car carriers. Yet the E/S Orcelle will be capable of carrying approximately 3,000 more tons of cargo, thanks to the use of lightweight materials and the elimination of ballast water.

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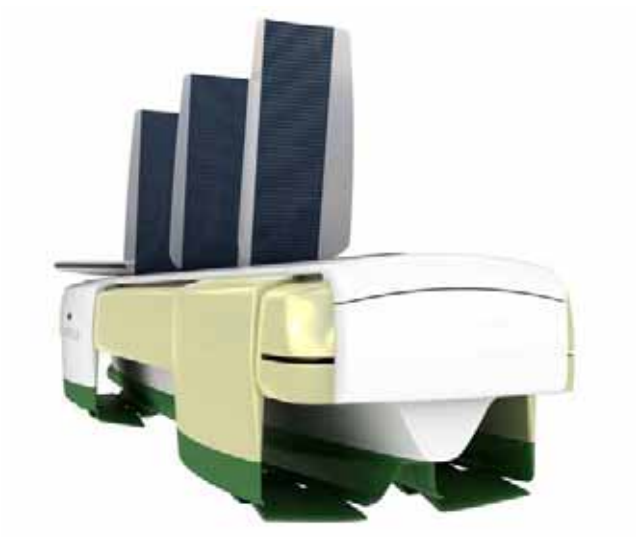
ENVIRONMENTALLY FRIENDLY DESIGN



Design challenges

What does the future hold for shipping in the year 2025? What if fossil fuel oils become too expensive to extract or if they are quite simply no longer available? What if renewable energy sources available at sea could replace the fuel oils used to power today's ships? What if car manufacturers could extend the range of the environmental friendliness of their operations to include the entire supply chain - from factory production through delivery to dealers and onwards to consumers?

These questions constitute the basis for the design and development of the E/S Orcelle, the zero-emission vessel of the future. The main design considerations include:

- Using the sun, wind and waves to employ multiple energy generators that include fuel cells.
- Optimising cargo capacity and lowering energy consumption per transported unit.
- Taking into consideration other environmental challenges, such as completely eliminating the problems related to ballast water, thanks to the new hull design.

Conceptual work on the E/S Orcelle began in 2004 and is continuing. By using alternative energy sources and eliminating emissions, the E/S Orcelle will contribute to the protection of marine ecosystems and of the earth's atmosphere. Wallenius Wilhelmsen envisages a service date of 2025 for this environmentally friendly car carrier.

ENVIRONMENTALLY FRIENDLY DESIGN

No ballast water

According to IMO, ballast water is one of the four major threats to the world's oceans. The E/S Orcelle will effectively eliminate this threat by eliminating the need for ballast water. Thanks to the vessel's pentamaran hull design and the elimination of a traditional stern propeller and rudder, no ballast water will be required on board.

No emissions

With the E/S Orcelle, it will be clean sailing with zero emissions. The E/S Orcelle is powered by the sensible utilisation of energy from renewable sources. These energy sources will include solar energy, wind energy and wave energy, and will be used in combination with a fuel cell system powered by hydrogen. Some of the hydrogen for the fuel cells will be produced on board by solar, wind and wave energy. The only by-products of the production of electricity from fuel cells are water and heat.

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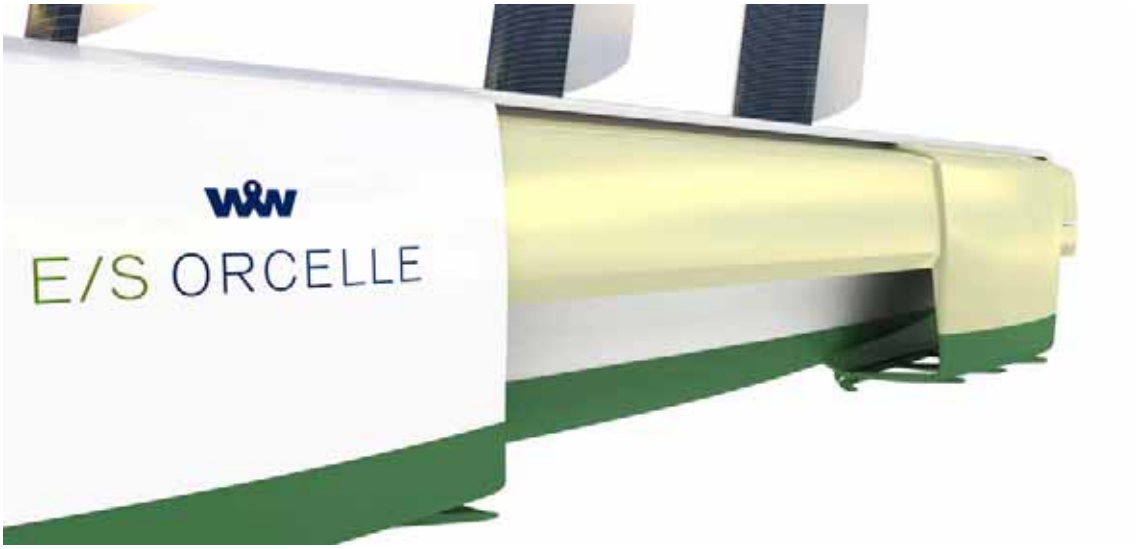
WHAT'S IN A NAME?



The E/S Orcelle is named after the Irrawaddy dolphin, or Orcelle in French. WWF, the global conservation organisation includes the dolphin, which resembles the beluga whale, among the world's critically endangered species.

Although the species now inhabits limited coastal and freshwater areas in South-East Asia, Wallenius Wilhelmsen chose to name its ship of the future after the dolphin in recognition of the immediate danger of this species' extinction.

The abbreviation, E/S, stands for Environmentally sound Ship. The E/S Orcelle releases zero emissions into the atmosphere and no operational discharges into the sea.

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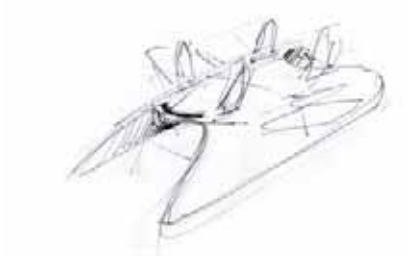
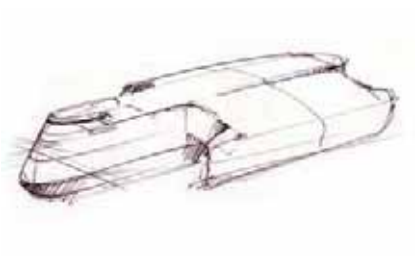
DESIGN SKETCHBOOK



Sketch 1



Sketch 2

Sketch 3

The multi-disciplinary team that is working on the conceptual design of the E/S Orcelle includes naval architects, environmental experts and industrial designers. The challenge presented to the design team was to investigate the use of alternative energy sources, rather than fossil fuel oil, for the vessel's power and propulsion.

Other important design requirements included zero emissions and optimum cargo capacity. Weight and displacement, hull design and speed were also design considerations that the team explored. Below is a brief presentation of the design process.

Sketch 1

The conceptual design of the vessel began as a streamlined trimaran which, compared to conventional monohull designs, provides greater stability, significantly less drag and improved utilisation of energy.

Sketch 2

The design team then explored various alternatives to provide the best combination of the utilisation of alternative energy sources, optimum cargo capacity and other environmental considerations.

Sketch 3

In order to optimise cargo capacity on board, the lightweight of the vessel was decreased by splitting the trimaran's sponsons into two, which resulted in a more dynamic pentamaran hull design.

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VESSEL DESIGN

Lightweight materials

The use of aluminium and thermoplastic composite materials offer these distinct advantages over common carbon steels:

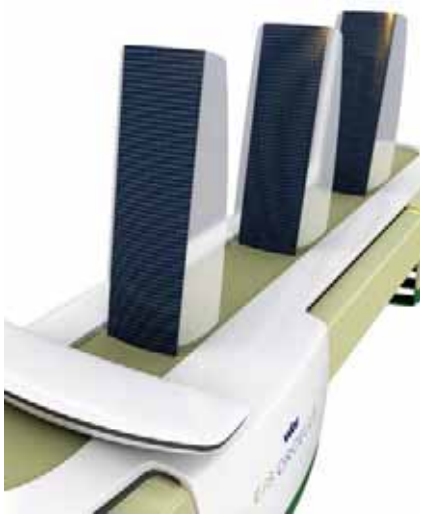
- High tensile strength
- Less maintenance
- Easy to shape
- Lightweight
- Fatigue resistant
- Recyclable

Powerful pentamaran

The E/S Orcelle will have five hulls; a long, slender main hull and four support hulls, or sponsons, to provide stability at sea. The stability offered by the pentamaran hull and its fins, combined with the use of new propulsion systems, will eliminate the need for the vessel to take on and release ballast water. In addition, the pentamaran hull design will contribute to the improved utilisation of energy and to the clean flow of water around vessel.

CLEAN SAILING

Solar energy



Wind energy

Wave energy

The primary energy sources for the E/S Orcelle will be fuel cells as well as the sun, wind and waves. These energy sources will be transformed on board to create energy carriers. An energy carrier is a way of transmitting energy for use. Energy consumers include all equipment on board that utilise energy to operate the vessel.

Primary energy sources

Solar energy

Solar energy will be utilised through photovoltaic panels located in the vessel's sails. When not in use for wind propulsion, the sails may be tilted, laid down or in other ways directed for maximum solar energy collection. The solar energy will then be transformed into electricity for immediate use, or for storage.

Wind energy

Wind energy will mainly be utilised for propulsion directly through three sails constructed of lightweight composite material; a uniquely new twist to the age-old art of sailing. Capable of folding upward and outward, the rigid sails can rotate about the masthead to fix the best position to extract wind energy through the creation of drag force or lift force, or a combination of the two.

Wave energy

Wave energy may be transformed into various types of energy by combining the relative movements of the waves, the fins and the vessel. The E/S Orcelle will have a total of 12 fins in all, enabling the vessel to harness and transform wave energy into hydrogen, electricity or mechanical energy. The fins are also propulsion units that are driven by wave energy or by the electricity or mechanical energy available on board.

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CLEAN SAILING

Energy carriers

Fuel cells

Fuel cell technology is developing at a rapid pace, as evident in its use in the automotive industry. Approximately 50% of the energy used for propulsion of the E/S Orcelle will be generated by fuel cells. Fuel cells will combine two common chemical elements, hydrogen and oxygen, to generate electricity to be used by the electric motors in the pod and fin propulsion systems. The fuel cells will also generate electricity for other energy consumers on board. Generating energy in this way creates by-products: pure water vapour and heat.

Hydrogen

The E/S Orcelle will have a hydrogen-driven fuel cell system on board to generate electricity. The production and storage (at high pressure or low temperature) of the hydrogen itself are currently obstacles that need to be overcome in order to develop viable fuel cell technology for ships.

Wallenius Wilhelmsen envisions that future technologies will be able to transform solar, wind and wave energy into hydrogen for immediate use and/or storage on board. By developing technologies that will enable the production of hydrogen at sea, we will be able to realize a significant reduction in the handling and storage of this energy source on board. In addition, we expect new technologies to solve the hydrogen storage problems, enabling solid materials to replace the fluid.

Electricity

Various energy sources, including the vessel's solar panels, fuel cell system and fins, will generate electricity for propulsion, lighting, equipment, ventilation and navigation. Battery storage facilities will provide operational flexibility.

Mechanical and hydraulic energy

The wave energy generated by the vertical movement of the fins may be transformed into mechanical energy for immediate use in the mechanical propulsion of the fins. In addition, energy from the movement of the fins may be harnessed to generate hydraulic energy that may either be used immediately or stored. Other promising systems for mechanical energy storage, such as flywheels, are under development.

Energy consumers

Electric propulsion system

The E/S Orcelle will have two variable speed electric propulsion systems, known as pods, to complement the vessel's sail and fin propulsion systems. Each pod will house a motor, gearbox and propeller in a single compact unit. One pod will be fitted at each end of the main hull, providing full power and a 360-degree field of manoeuvrability.

Sailing

Electric and hydraulic power supply will be required to erect, unfurl and rotate the sails.

Manoeuvring

Electric and hydraulic power supply will be required to operate the two aft rudders. The rudders will provide steering capabilities during operations when the electric propulsion systems are not in use, for example, while the vessel is sailing.

Onboard systems

Ventilation and onboard systems will utilise energy, which is primarily electrical energy. Hydraulic power will also be required for raising and lowering the stern ramp and for adjusting the height of the cargo decks.

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QUICK FACTS

Concept vessel	Zero-emission car carrier
Hull design	Pentamaran
Design materials	Aluminium and thermoplastic composites
Length overall	250 m
Height	40 m
Total height with sails erected:	95 m
Beam moulded	50 m
Design draught	9 m
Design speed (maximum)	20 knots
Design speed (service)	15 knots
Dimensions	
Solar panels	3 x 800 m^2
Sails	3 x 1,400 m^2
Fins	12 x 210 m^2
Maximum energy output	
Solar panel	2,500 kW
Fuel cells	10,000 kW
Pod propulsion	2 x 4,000 kW
Lightweight of vessel	21,000 tons
Maximum deadweight capacity	13,000 tons
Vehicle capacity	10,000 cars (Based on today's standard units)
Design cargo deck area	85,000 m^2
Number of decks	Eight cargo decks, of which three are adjustable in order to accommodate high and heavy vehicles and equipment

Note: At this stage of development, it is not the intent of Wallenius Wilhelmsen to show every detail of arrangement on board.

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RELATED LINKS

Electrical pod systems (Rolls Royce)
http://www.rolls-royce.com/marine/product/propulsion/electrical/default.jsp

European Hydrogen Association
http://www.h2euro.org/intro/intro_00.html

European Integrated Hydrogen Project
http://www.eihp.org/

Fuel Cell Today
http://www.fuelcelltoday.com/index/

How stuff works: Fuel cells
http://science.howstuffworks.com/search.php?search=fuel%20cells&fr=ch

How the Hydrogen Economy Works
http://people.howstuffworks.com/hydrogen-economy.htm

International Energy Agency
http://www.iea.org

Orcelle dolphin (Irrawaddy dolphin)
http://www.panda.org/about_wwf/what_we_do/species/showspecies.cfm?SID=52&LID=2&FH=E

National Renewable Energy Laboratory
http://www.nrel.gov/

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