

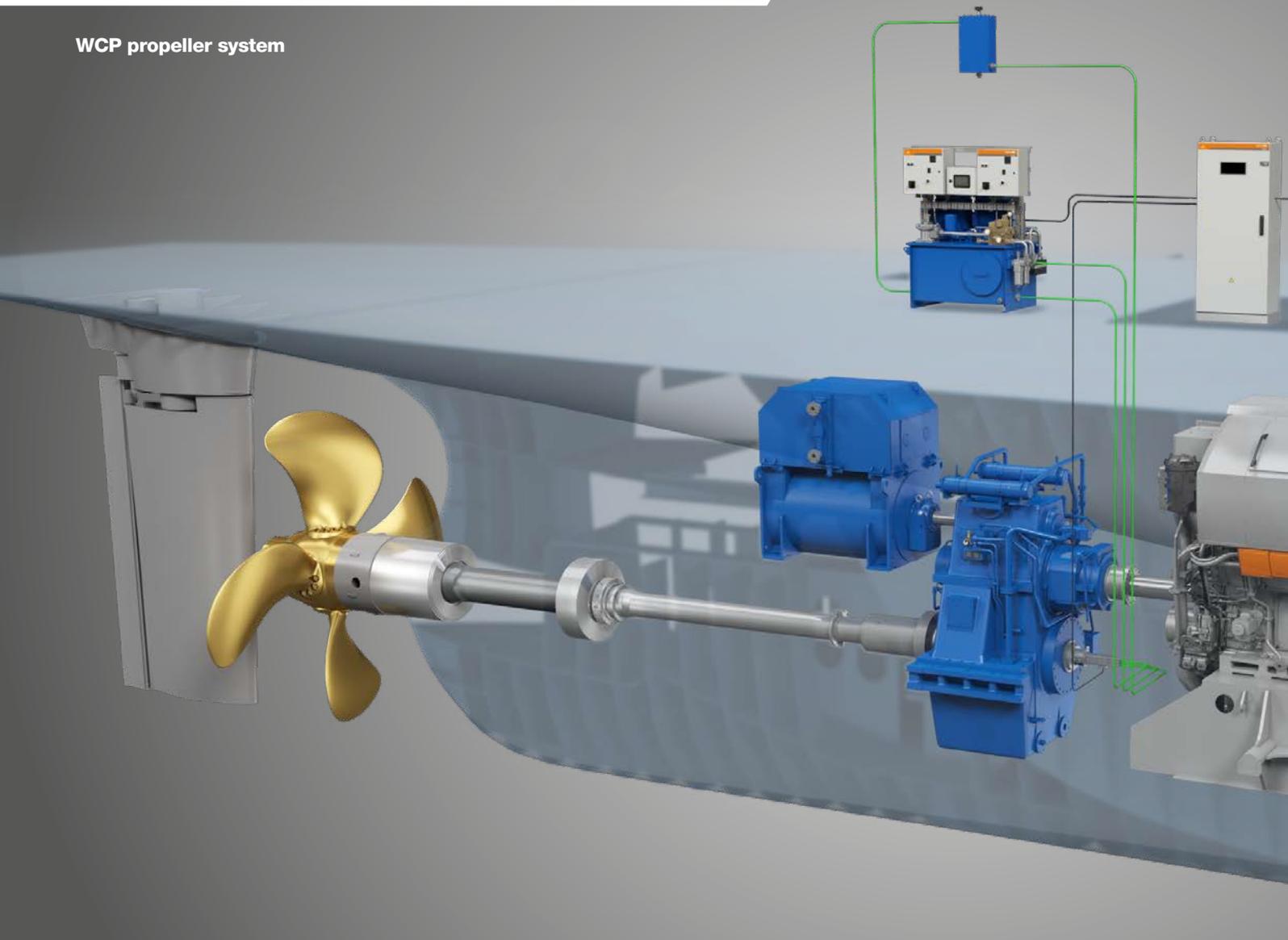
Controllable pitch propeller systems



The Wärtsilä Controllable Pitch propeller systems have been developed to provide outstanding reliability, low operating costs, environmental friendliness, easy installation/integration, and intuitive operating control. Wärtsilä designs and produces controllable pitch propellers for the commercial, navy and superyacht markets. It is a unique product from which the first design dates back to 1903. Today Wärtsilä has accumulated a wealth of experience with more than 20,000 units installed.



WCP propeller system



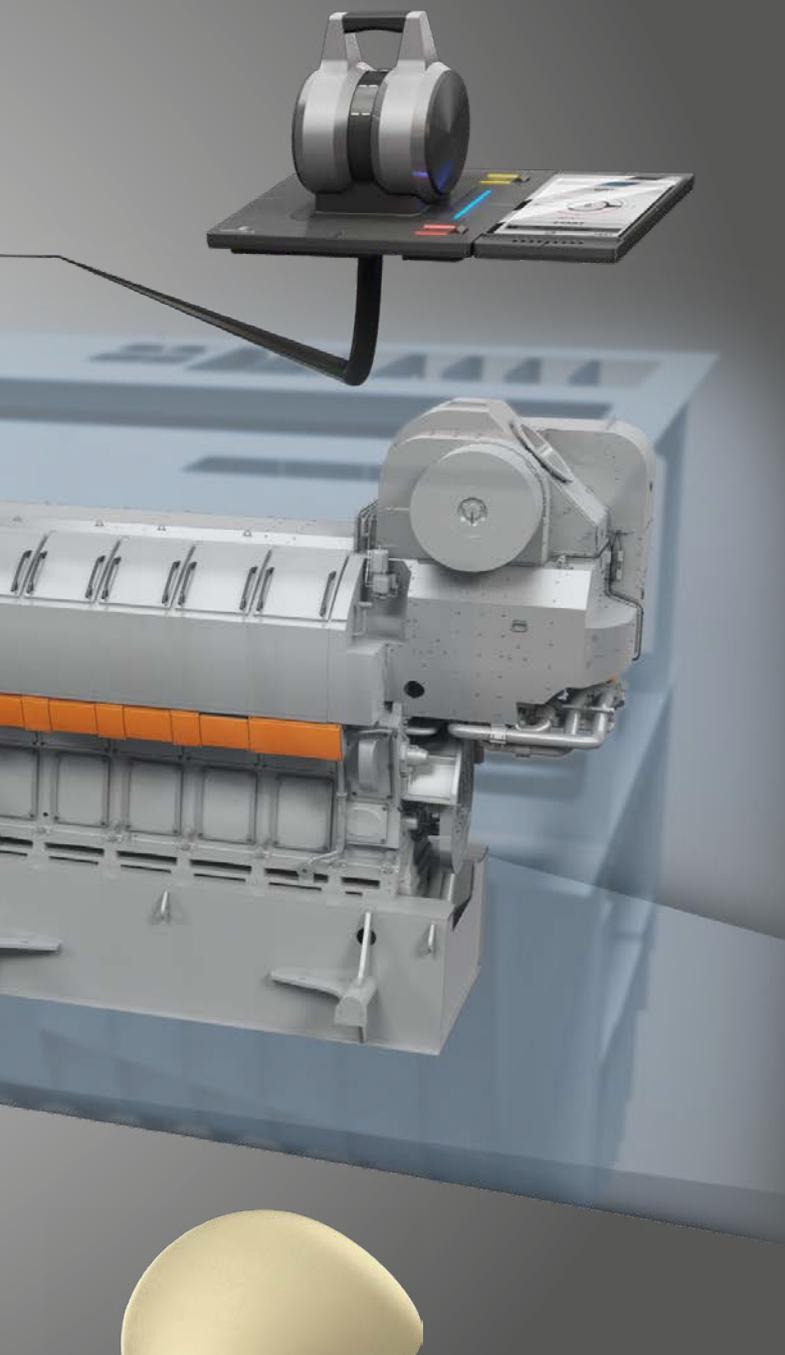
Propulsion solutions with Wärtsilä controllable pitch propeller systems

A Wärtsilä Controllable Pitch (WCP) propeller system consists of a hub, the propeller blades, shafting, hydraulics and a remote control system, as well as any further accessories needed to meet the customer's requirements. For every vessel, the most appropriate solution is available from our 4- or 5-bladed propellers formed perfectly from CuNiAl bronze or stainless steel, with or without a nozzle. The range of WCP propeller systems starts at a power of approximately 1000 kW and a propeller diameter of 1200 mm, and in principle has no upper limit. As your single point of contact, Wärtsilä will take care of the correct interfaces and performance of the total installation.

Why a Wärtsilä controllable pitch propeller system?

WCP propeller systems are particularly beneficial when more than one operating condition is of importance. WCP propeller systems allow operating at optimum pitch settings for various operating conditions, for example when both manoeuvring and free-sailing performance are important. Similarly, vessels that sail in summer and winter / day and night conditions, or that are sensitive to fouling or varying weather conditions can benefit from these systems. A CP propeller is often the choice for installations with a shaft generator (PTO) operating at constant rotational speed. The PTO is either installed at the reduction gear or directly at the shaftline through a tunnel

gear. A shaft generator also allows the use of a redundant propulsion system or booster, in which case the PTO can operate as an electric motor (PTI). For certain types of "double-duty" vessels, such as tugs, trawlers and dredgers, WCP propeller systems give both increased pull and higher vessel speed, since adjusting the pitch makes it possible to utilize full power at both low and high vessel speeds. Finally CP propellers have high manoeuvring and Dynamic Positioning (DP) capabilities. At low vessel speeds, the CP propeller generally makes more propulsive power available than a fixed pitch propeller, and astern thrust is easily achieved using the reverse pitch setting.



The multi-purpose vessel "Beatrix"
(1 x WCP-1190 propeller system)



The Irish Navy's Offshore Patrol Vessel "Samuel Beckett"
(2 x WCP-900 propeller system)



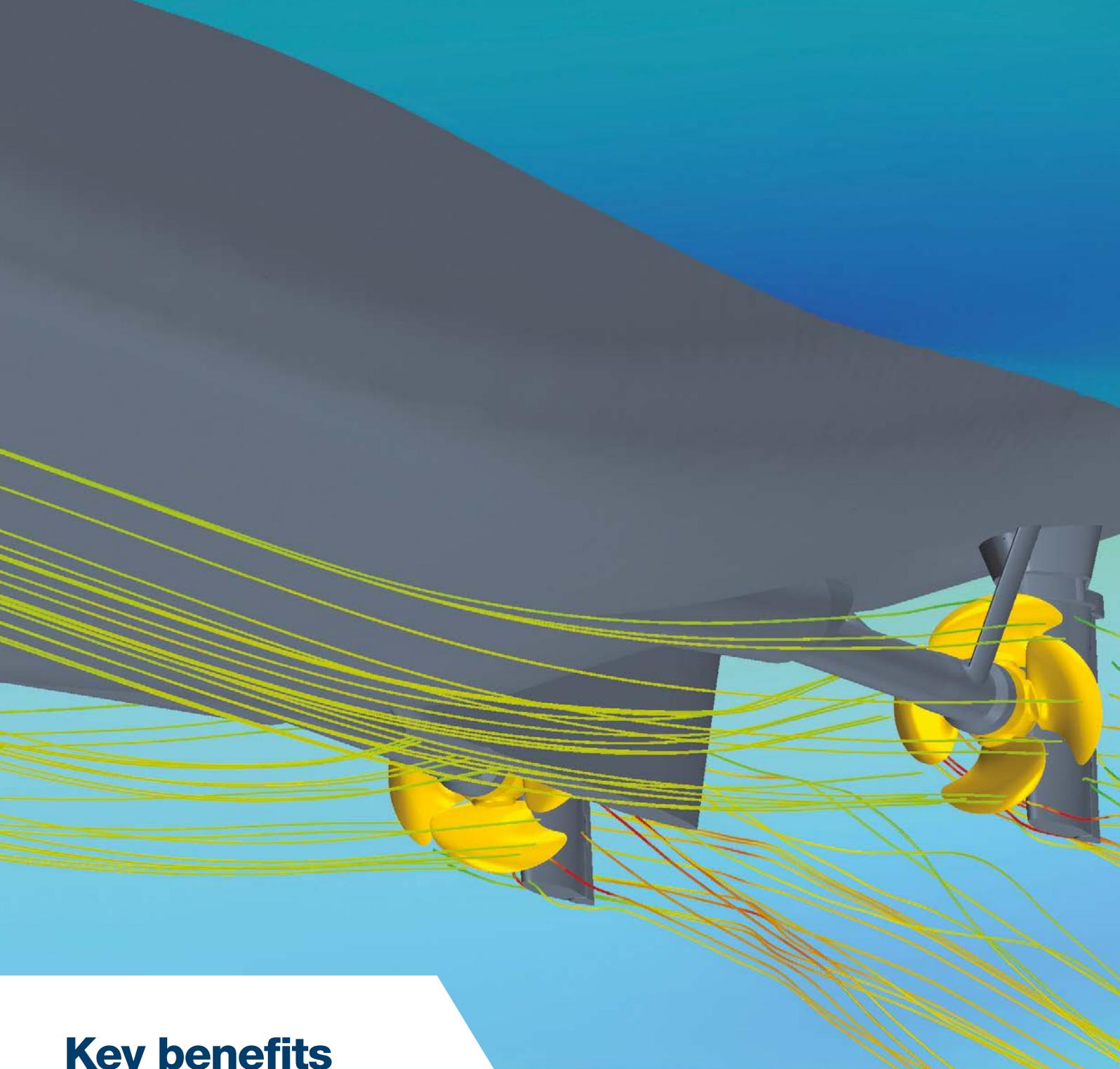
The RoPax Ferry "Blue Star Delos"
(2 x WCP-1514 propeller system)

Wärtsilä's latest innovative controllable pitch hub design

- Advanced design by FEM and CFD
- Small hub size with reduced weight
- Increased loading capacity
- Optimised for Dynamic Positioning and all ICE classes
- Compliant with EPA Vessel General Permit 2013 requirements
- Easy service (hub disassembly without pulling shaft)



Semi-submersible Heavy lift vessel "Dockwise Vanguard"
(2 x WCP-1540 propeller system)



Key benefits

High propeller efficiency: Wärtsilä Controllable Pitch propellers are custom-designed for each vessel. All Wärtsilä propellers are wake-adapted and, in co-operation with the customer, the propeller is designed for optimal performance in all relevant operating conditions. Targeting the highest possible propeller efficiency is a standard, while at the same time ensuring minimal noise and vibration levels onboard and maintaining excellent behavior regarding cavitation. Advanced high lift blade profile sections and optimised propeller tip loadings are natural for us.

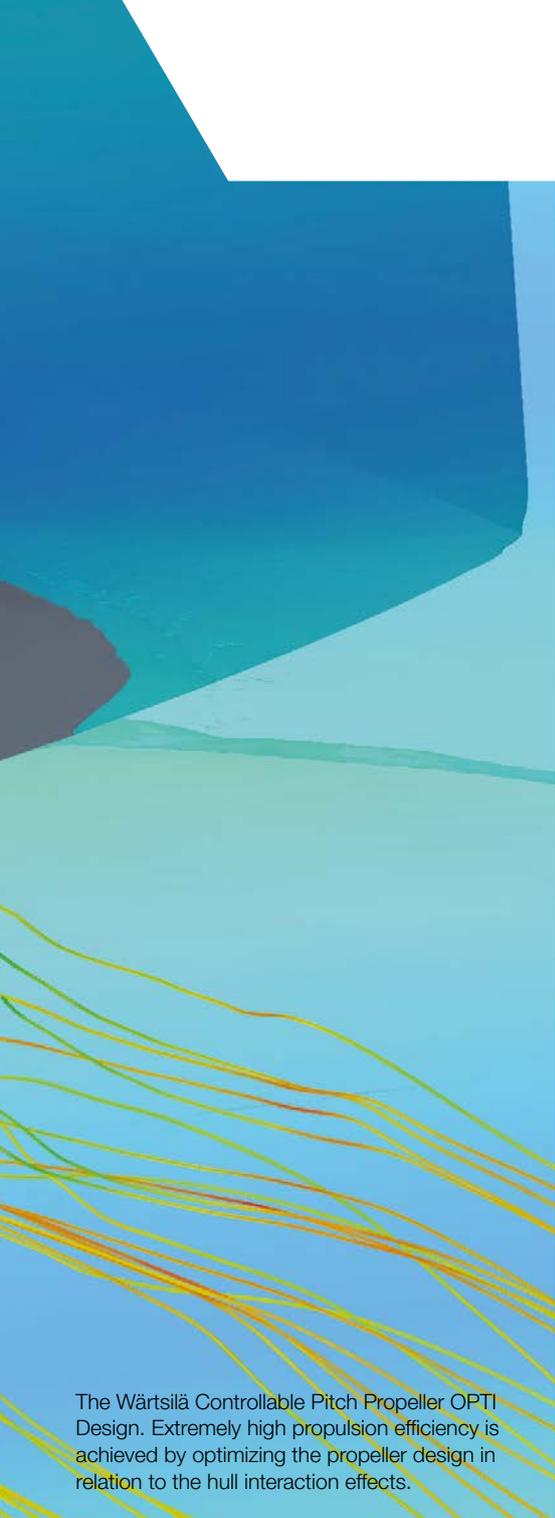
Reduced fuel consumption: The Wärtsilä Controllable Pitch OPTI Design is the result of highly experienced

design engineers in our European R&D headquarters having access to the very latest and most sophisticated software and analysis tools. Computational Fluid Dynamic (CFD) analyses of 3D geometries, analyse not only the propeller performance but most importantly also, the interaction between the propeller and hull. This provides extremely accurate information for achieving design and parametric optimisation. This state-of-the-art design protocol optimises the vessel's overall propulsive efficiency. OPTI Design can provide fuel savings of up to 4 percent. With each WCP propeller being individually customised to meet specific application requirements, the vessel's EEDI/EEOI is

improved. This in turn leads to reduced exhaust emissions.

Minimum noise and vibration levels: Thanks to the use of the state-of-the-art technology, it has become possible to accurately predict propeller induced forces acting on the hull. This valuable propeller design software asset is utilised to find the optimal balance between propeller induced vibrations and propeller efficiency for applications where comfort is of importance. In addition, high end cavitation models and modern CFD codes ensure well predicted noise levels for research and naval applications.

Reliable: Since operational reliability is important, Wärtsilä places high priority



The Wärtsilä Controllable Pitch Propeller OPTI Design. Extremely high propulsion efficiency is achieved by optimizing the propeller design in relation to the hull interaction effects.



Quality assurance as part of the WCP manufacturing process in Wärtsilä propulsion factory

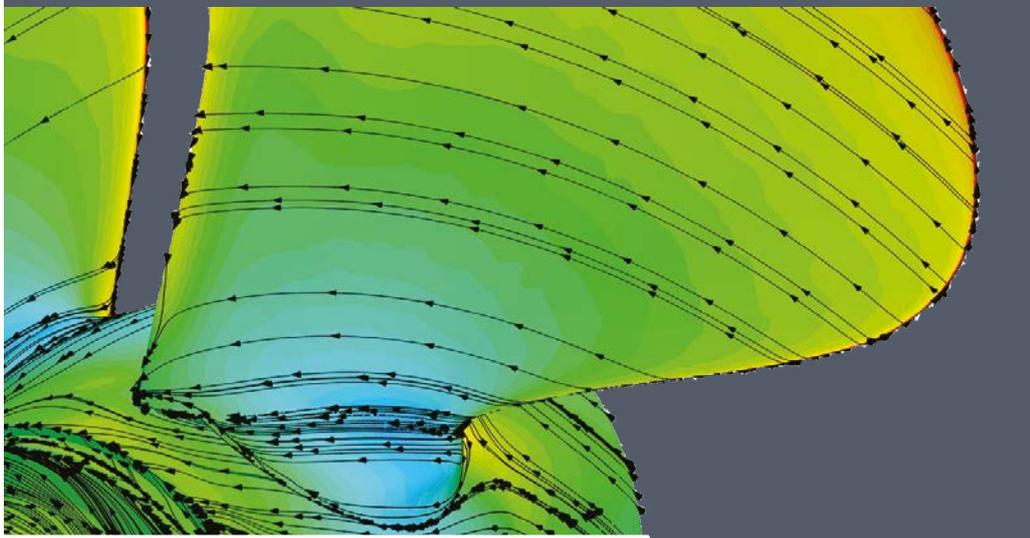


The research vessel "Mirabilis" (2 x WCP-600 propeller system)

Wärtsilä's hydrodynamic design experience

The hydrodynamic design covers propellers for many types of vessels, from heavy-duty vessels like AHTS to high-speed passenger ferries, and from small fishing boats to enormous ice classed container vessels. Our long history and experience in designing propellers gives us extensive hydrodynamic knowledge, and we have developed design tools validated by a large number of model test results, full-scale measurements, and research and development efforts. Co-operation with well known research institutes and universities worldwide ensures our prime position when it comes to propulsor hydrodynamics.

on the robustness of all components used in its products and solutions. The reliability of the WCP propeller system is the result of robust drive line components, such as seals, bearings and the pitch actuating system. The latest hub design features improved blade bearing loading, making the hub specifically suitable for demanding Dynamic Positioning and ICE class applications. The extensive product portfolio, including seals and bearing systems, and Wärtsilä's wide experience with applications in all marine segments, ensure lifelong and trouble free operation of the shaftline and sterntube.



Detailed state-of-the-art Computational Fluid Dynamic analysis of the hub and blade design hydrodynamics



ProTouch, Wärtsilä's latest Propulsion Control System. Touch screen technology and solid ergonomics enable flexible bridge arrangements and intuitive control

Environment: The innovative hub design features forced lubrication and allows the use of environmentally acceptable lubricants (EAL), as required for propulsors operating in US inland and coastal waters. The WCP propeller system is prepared so as to meet the US EPA's VGP 2013 regulatory requirements.

Reduced weight: The latest compact & integrated hub design has been developed using extensive Finite Element and CFD analysis, ensuring a compact design with low stress levels for reduced hub sizes and shaft line weights, while the premium hydrodynamic efficiency has not been sacrificed. The hydraulic system facilitates a minimized flow and pressure drop, an optimised interface to the control system, and easier serviceability.

Easier maintenance: The smart connection method between the propeller shaft and hub, allows the servicing of all hub parts while keeping the propeller shaft in place. The double cylinder support has

proven low maintenance requirements and is reliable. Oil monitoring can be done manually or via a dedicated monitoring system such as the Wärtsilä Propulsion Condition Monitoring Service (PCMS).

User friendly controls: The thrust force is controlled by the Wärtsilä Propulsion Control system. The ProTouch panel design is space saving and designed to allow easier and more intuitive operation of the propulsor functions. Installation of the control cabinets, panels, and cabling is straightforward since all the propulsion control system components are interconnected by means of CAN OPEN field buses. Pitch control with constant engine speed, and combinator control with pitch and engine speed control with one lever are available, as well as load control, running up and slow-down programmes, and also single-lever control.

Fuel saving options: A WCP propeller system is always tailored to the specific

application, giving the opportunity for further specific features. The propeller is suited for operating in a High Performance Nozzle (HPN) that generates additional thrust for relatively low vessel speeds. Energopac is Wärtsilä's optimised propulsion and maneuvering solution for coastal and sea going vessels. The key objective is to reduce the vessel's fuel consumption by integrating the design of both the propeller and rudder. To reduce fuel consumption on vessels with multiple operating conditions, the Wärtsilä 2-speed reduction gear is a good choice. Feathering propellers are applied to save fuel for multifunctional vessels that operate in such a way that one or two propellers are regularly out of use.

The Wärtsilä EcoControl's active combinator uses a smart control algorithm that combines optimal propeller pitch with optimal engine loading in a dynamic way. This leads to its most efficient fuel consumption level during transit sailing modes.



Anchor Handling Tug Supply vessel "Siem Pearl"
(2 x WCP-1190 propeller system)



The Ro-Ro "Finnsea"
(2 x WCP-1190 propeller system)

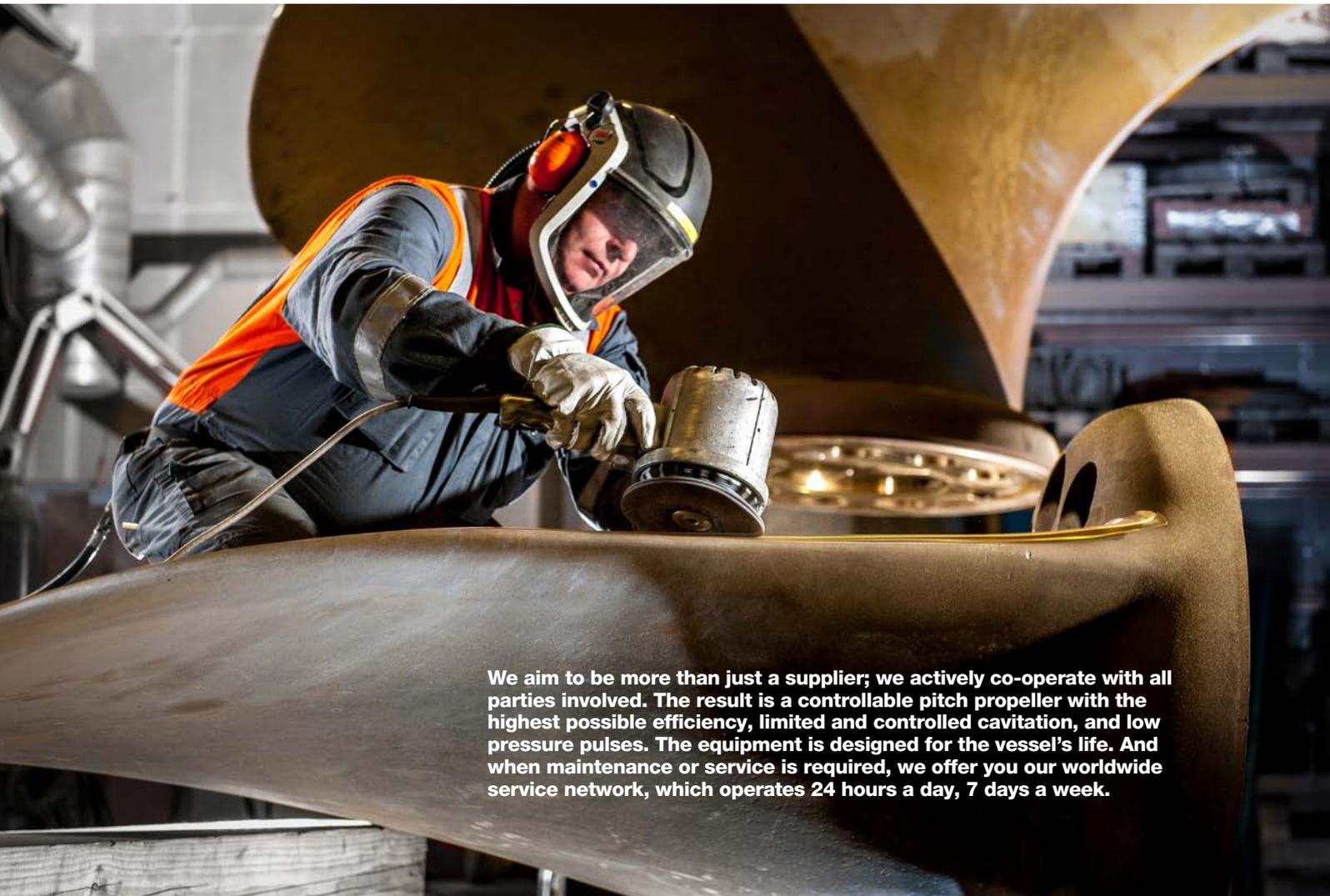


The multi-purpose vessel "Dynamogracht"
equipped with the fuel efficient Energopac system.
(1 x WCP-1540 propeller system)



The stern trawler "Volstad" equipped
with the High Performance Nozzle
(1 x WCP-1000 propeller system)

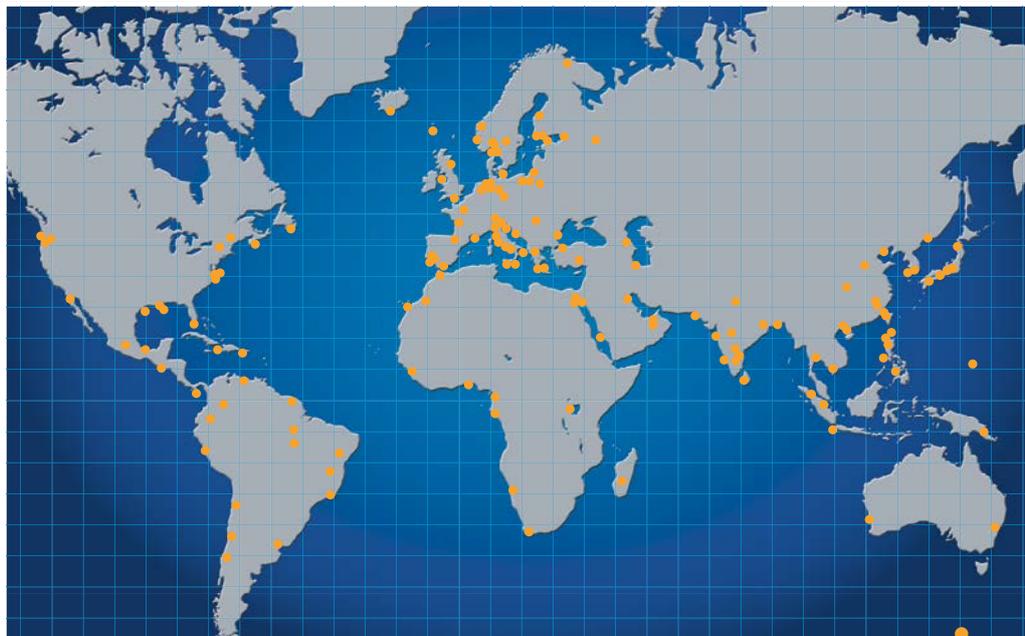
Worldwide service and maintenance



We aim to be more than just a supplier; we actively co-operate with all parties involved. The result is a controllable pitch propeller with the highest possible efficiency, limited and controlled cavitation, and low pressure pulses. The equipment is designed for the vessel's life. And when maintenance or service is required, we offer you our worldwide service network, which operates 24 hours a day, 7 days a week.

Wärtsilä has a worldwide service network that assures you of reliable and efficient support and the quickest possible solution to any propulsion problem during the full operational lifetime of the vessel. Service activities provided include:

- Worldwide field service
- Underwater service and survey
- Original Wärtsilä spare parts
- Metallurgic repairs
- In-house overhaul/repair.
- Retrofits and upgrades
- Personnel training programmes
- Helpdesk



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