WÄRTSILÄ

Powering the world's navies

Solutions and services for naval, coastguard and research vessels

Powering the world’s navies

Wärtsilä is a leading provider of innovative propulsion and electrical solutions and services for naval, coastguard and research vessels. More than 140 countries use Wärtsilä equipment in their naval and non-military fleets.

Wärtsilä optimises vessel reliability and efficiency using a holistic approach that takes into account power systems, propulsion and propulsion control systems (PCS) and vessel operation and maintenance. Wärtsilä’s integrated propulsion solutions include engines, generating sets, reduction gears and propulsion equipment (propellers, shafts, nozzles, thrusters and waterjets).

Wärtsilä develops and delivers vessel propulsion systems that can adjust to varying load requirements across a wide range of operational profiles. We have an extensive track record in delivering propulsion solutions for a wide variety of naval vessels including corvettes, destroyers, frigates and aircraft carriers as well as solutions for offshore patrol vessels (OPVs) that perform non-military functions. These include coastguard and rescue operations and fishery-related activities. We can also assist in the development of propulsion concepts using commercial off-the-shelf equipment.

Leading system integrator

Wärtsilä's vessel lifecycle approach covers all stages from ship design and construction to ongoing operation and maintenance. The key to creating an efficient propulsion system is optimising the interaction between the hull and the propulsors. Significant efficiency gains can be made by optimising the propeller design and matching it with the prime movers.

Engine selection and configuration is also critical to optimising overall efficiency. Wärtsilä propulsion packages for naval vessels are designed and developed according to the intended mission profile of the vessel.

Wärtsilä's capabilities include:

- Design and delivery of integrated propulsion systems
- System integration
- Hydrodynamic studies in cooperation with marine institutes
- Lifecycle cost analyses
- Integrated logistics support
- Preventive and corrective maintenance

Having Wärtsilä as a full-service partner throughout the entire life cycle of the vessel – from conceptual design to construction and operation – greatly reduces the risk of unforeseen complications, delays, costs and vessel downtime compared to working with multiple suppliers.

Technological leadership

Significant investments in research and development have made Wärtsilä a leading global supplier of innovative technologies that boost vessel energy efficiency and enable environmentally sound operation at sea.

Our solutions for naval vessels are focused on efficiency improvements, minimising noise and vibration, reducing environmental impacts and optimising maintenance.

Maximising propulsion efficiency
Wärtsilä can design and optimise vessel propulsion systems that meet the most stringent requirements of modern navies, including specific requirements related to noise and signature. Vessel efficiency is maximised and fuel consumption and environmental footprint minimised by using data from sailing pattern analyses to optimise the design of the propulsion unit early in the design phase.

Reducing environmental footprint
Naval, coastguard and research vessels are moving towards a more sustainable future in order to comply with International Maritime Organization (IMO) regulations put in place to drive the green transformation of shipping. Wärtsilä can deliver the mission profile required with a sustainable approach. Solutions include:

- Advanced flexible hybrid systems
- Future fuel operated engines and fuel gas handling
- Exhaust gas emission reduction technology
- Propulsion solutions optimised for the mission profile of the vessel

Wärtsilä's fuel-flexible engines are designed to operate on a variety of fuels, including conventional fuels like heavy fuel oil (HFO) and marine diesel oil (MDO) as well as alternative fuels such as liquefied natural gas (LNG) and methanol. This flexibility allows navies to adapt to changing regulations, fuel availability and pricing fluctuations while also enabling them to reduce emissions and transition towards more sustainable operations. Wärtsilä 4-stroke engines are fully compliant with IMO Tier II exhaust emissions regulations and can also be equipped with a SCR catalyst to meet IMO Tier III NOx emission levels.

Full lifecycle support
Wärtsilä can assume full responsibility for service and maintenance across the entire vessel lifecycle. Wärtsilä's global service network operates in 70 countries worldwide and offers a range of solutions and services including installation, commissioning, performance optimisation, upgrades, conversions and outcome-based service agreements with a focus on achieving specific performance targets.

Royal Netherlands Navy combat support ship HNLMS Den Helder (© Damen Naval)

Engineering expertise

Wärtsilä experts can help to develop designs that reduce forces in case of shock impact through:

- Installation of the engine, generator and auxiliaries on a common base frame. A static and dynamic analysis of the base frame design (stiffness of the seatings below the engine and generator fittings, natural frequencies and mode shapes) is generally done through a finite element model.
- Selection of the number of resilient mount stages. At least one stage of resilient mounts between the common base frame and the machinery foundation is fitted on the ship's hull plating. If needed, in addition to the previous stage, a second resilient mount stage is fitted between the engine and the base frame (and for some applications, between the generator and the base frame).
- Selection of the type of resilient mounts (natural frequencies generally in the range of 3 to 10 Hz, displacement capability from 10 mm up to 70 mm for naval applications with shock requirements).
- Design of the auxiliaries' fitting and pipe clamping, which may have a significant influence on resilient mounting efficiency.

For some projects, an acoustic enclosure might be needed when the noise level in the engine room has to be below the standard engine airborne noise, or when vibration has been reduced to a very low level. This is because in these circumstances the underwater radiated noise (URN) may be influenced by the airborne noise of the diesel-generating set.

Case – the world's first LNG-powered patrol vessel

The Finnish Border Guard's next-generation OPV, Turva, is powered by three Wärtsilä 34DF dual-fuel engines that can burn either crude oil-based marine fuels or LNG. The engines can switch fuels without losing power or speed.

As well as border management duties, the multipurpose vessel performs maritime search and rescue missions and participates in demanding operations such as responding to oil spills or other environmental emergencies in the marine environment.

Wärtsilä's scope of supply

- 1 x Wärtsilä 12V34DF engine
- 2 x Wärtsilä 6L34DF engines
- Wärtsilä Airguard and Wärtsilä Sternguard seals

© Meyer Turku Oy

Generating sets

Wärtsilä can supply generating sets complete with alternators mounted on a common base-frame which meets customer requirements for shock, noise and vibration levels. Double mounting arrangements and acoustic enclosures ensure that naval standards are met and exceeded. Wärtsilä generating sets are used by multiple navies around the world to generate electric power for diesel-electric propulsion and onboard services.

Auxiliary and emergency generating sets
A wide range of generating sets is available for supplying electric power for the vessel hotel load. Because of their reliability and efficiency, Wärtsilä's generating sets are often included in the scope of equipment needed to supply electrical power in emergencies.

Gearboxes

Wärtsilä marine gears meet the highest standards of operational efficiency and reliability, with low noise and vibration levels.

Our gears cover a power range from 1 to 24 MW for single input gears with vertical or horizontal offset and 2 to 35 MW for double input gears. The Wärtsilä 2-speed gearbox enables lower propeller speeds with optimised propulsion efficiency and is available from 2 to 13 MW in either a vertical or horizontal configuration.

Key features
- Modular and flexible
- Compact and reliable
- Plain bearings
- Rigid housing structure:
  - Minimal deformation
  - Low stress levels
  - Cast iron or welded
  - Low noise and vibrating levels
- Precision ground gearwheels with profile correction:
  - Optimal load distribution
  - Minimal efficiency losses
  - Low noise
- Optional PTO/PTI enabling hybrid solutions
- Optional built-in hydraulic multi plate clutch
- Combined hydraulic system for gearbox and propeller

Engines

Wärtsilä medium-speed engines have been developed based on a vast amount of knowledge accumulated over decades of successful operation. Key benefits include:

- Reliability and low maintenance costs
- High thermal efficiency and low emissions
- Modular construction with fewer parts
- Ergonomic interfaces
- Minimised consumables
- Cylinder liner with anti-polishing ring
- Extended time between overhauls (up to 24,000 hours between top overhauls)
- Variable inlet valve closing (VIC) for low smoke and improved load response
- Compliant with IMO Tier II emission limits

Engine performance
Wärtsilä engines incorporate modern turbo-charging technology, which allows Miller valve timing and variable inlet valve closing (VIC) to be used. At full load, early closure of the inlet valves enables a low effective compression ratio, and as a result, comparatively low temperatures at the end of the compression stroke. The charge air, being both somewhat expanded and cooled on its way through the receiver into the cylinders, has a global temperature that is still high enough to guarantee reliable and stable ignition of the fuel/air mixture in the combustion chamber.

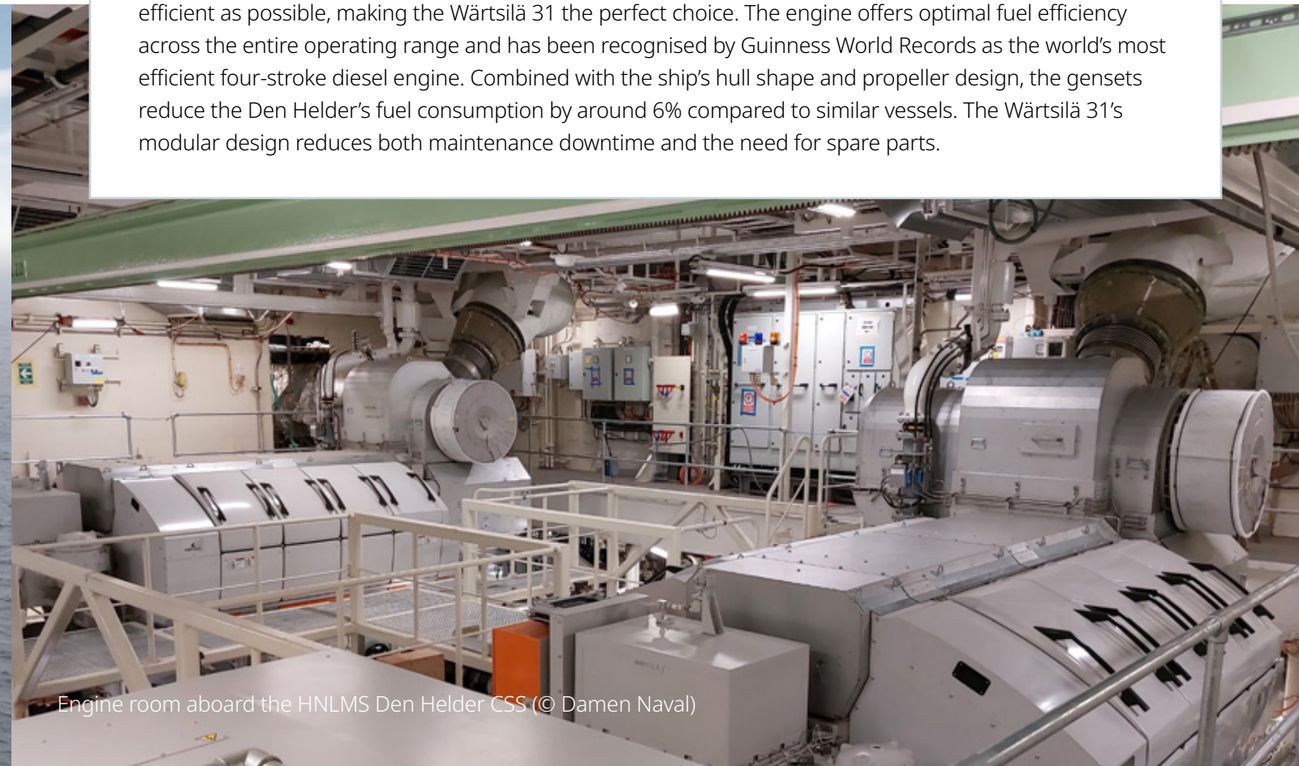
The quick expansion of the combustion gases quickly reduces the high temperatures that cause the formation of intensive NOx within the combustion chamber. This results in a combustion process that generates far lower emissions while also being extremely efficient.

Case – the world's first naval vessel with Wärtsilä 31 gensets

The Royal Netherlands Navy's (RNLN) combat support ship (CSS) the HNLMS Den Helder is equipped with four Wärtsilä 31 diesel gensets and a selective catalytic reduction (SCR) unit from Wärtsilä. The SCR unit reduces Nox emissions, enabling the vessel to comply with IMO Tier III limits.

Damen Naval and the RNLN were seeking to make the Den Helder as environmentally friendly and energy efficient as possible, making the Wärtsilä 31 the perfect choice. The engine offers optimal fuel efficiency across the entire operating range and has been recognised by Guinness World Records as the world's most efficient four-stroke diesel engine. Combined with the ship's hull shape and propeller design, the gensets reduce the Den Helder's fuel consumption by around 6% compared to similar vessels. The Wärtsilä 31's modular design reduces both maintenance downtime and the need for spare parts.

© Damen Naval


Engine room aboard the HNLMS Den Helder CSS (© Damen Naval)

Controllable pitch propellers

Wärtsilä controllable pitch propellers (CPP) provide outstanding reliability and low operating costs, are easy to install and integrate and are intuitive to control. Naval applications often require tailor-made solutions based on standard equipment to meet demanding requirements such as the need for high shock resistance and low noise and vibration levels. A CPP consists of a hub, propeller blades, shaft, hydraulics and a remote control system. Optional accessories can be added according to vessel-specific requirements.

Key features of Wärtsilä CPP:

- Advanced design methods including finite element method (FEM) and computational fluid dynamics (CFD)
- Small hub size
- Increased loading capacity
- Compliant with EPA Vessel General Permit 2013 requirements
- 5-bladed option for greater noise and vibration reduction

Reduced noise and vibration
Wärtsilä's standardised range of 5-bladed propeller hubs reduce vibrations in the aft of the vessel and in ship's quarters. The design also reduces underwater radiated noise (URN).

Key benefits of a CPP:

- High efficiency for reduced fuel consumption
- Minimum noise and vibration
- Improved reliability
- Reduced weight
- Easier maintenance (hub disassembly without removing shaft)

Built-up propellers

Wärtsilä built-up propellers (BUPs) combine advanced technology and state-of-the-art equipment to ensure high performance and efficiency. They reduce vessel operating costs and environmental footprint by lowering fuel consumption and emissions.

Thorough analysis of both propeller performance and propeller-hull interaction during the design process maximises efficiency. Wärtsilä's design process reduces the need for model-scale testing and enables thorough full-scale performance analysis. To ensure the highest fatigue strength, Wärtsilä maintains complete control over the production process. The result is optimal efficiency and minimal propeller weight.

Built-up 5-bladed propeller

Wärtsilä has developed more than 25 different bronze alloys for marine propellers, the most commonly used being Cunial® bronze – a copper, nickel and aluminium alloy with unparalleled durability and reliability. Casting is an extremely complex procedure, and to ensure a successful casting process, solidification simulation software is used for the more difficult geometries. Propellers can be produced with the required number of blades in diameters of up to 12 metres. Both the propellers and shaft lines are designed to meet every possible Ice Class notation and are compliant with environmentally acceptable lubricants (EALs) as required for vessels operating in US inland and coastal waters.

OPTI Design
Wärtsilä's OPTI Design methodology improves CPP and BUP performance in a way that is not possible with conventional design methods.

CFD calculations are used to analyse propeller performance and the way the propeller and hull interact. By using these numerical flow calculations to determine the effects of the interaction between the propulsion unit and the vessel, the OPTI Design process delivers optimal efficiency. This in turn leads to reduced fuel consumption, fewer exhaust emissions and lower operating costs.

Thrusters

Steerable thrusters
Wärtsilä steerable thrusters generate considerable cost savings due to their reliable and durable components, efficient propeller and maintenance-friendly design. Thrusters can be delivered with modular, retractable, underwater mountable or containerised designs in both fixed pitch and controllable pitch configurations.

Transverse thrusters
Wärtsilä transverse thrusters can be equipped with fixed pitch or controllable pitch propellers and are designed to be easy and cost effective to inspect and maintain.

Propellers for research vessels
Every part of a vessel contributes to underwater radiated noise (URN): the active inner parts (such as machinery) and the passive outer parts like the hull, due to turbulence in the flow over these surfaces. Propellers are a significant source of URN, which increases with vessel speed due to increased cavitation.

Wärtsilä can provide propulsion machinery with the operational flexibility research vessels need, as they typically have varying operating modes. Steerable thrusters – without a nozzle – help to minimise URN, which is an important consideration in the environmentally sensitive areas where these vessels typically operate.

Propulsion control systems

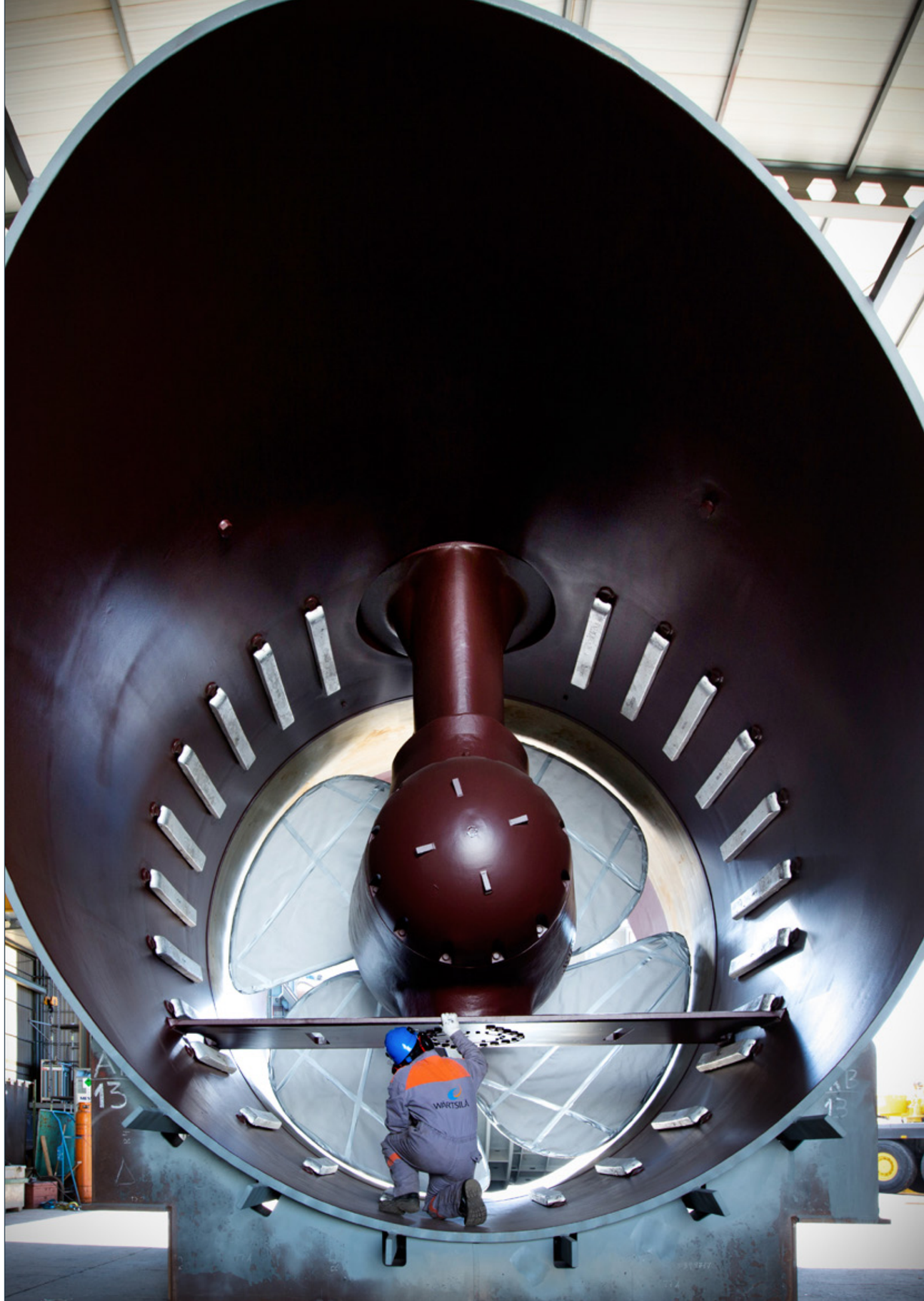
Wärtsilä's Propulsion Control System (PCS) consists of control devices, displays, indicators and modules that are compatible with any propulsion configuration on a modern ship. Controlling the propulsion system is easy with the Wärtsilä ProTouch remote propulsion control system. Its lever unit and touchscreen provide an easy-to-use, responsive interface for controlling the vessel's propulsors. Control is easy whether there is a single propulsor or several.

User-friendly controls
With the Wärtsilä PCS you can control all thrust, steering and auxiliary system functions. The ProTouch panel saves space and enables easier and more intuitive operation of thruster functions. Installation of the control cabinets, panels and cabling is straightforward since all system components are connected using CAN-open buses.

Seals, bearings and stern tubes

Wärtsilä Shaft Line Solutions can support your propulsion systems with a range of integrated products, dedicated services and 24/7 support to ensure every vessel in your fleet remains equipped to respond. We have worked with over 140 of the world's navies since 1966 and our products are fitted to more than 2,000 naval, governmental or coastguard vessels in service today.

Features such as built-in redundancy and in-situ replacement options help you to keep vessels in active service for longer by avoiding the need for dry docking. With Wärtsilä as your partner you can improve both the Mean Time Between Overhaul (MTBO) and Mean Time To Repair (MTTR) of your propulsion systems. The Wärtsilä Sea-Master condition monitoring system collects real-time data, providing valuable information about the operational health of the tail shaft equipment. This helps you to maximise uptime and reduce lifecycle costs. The Wartsila Sea-Master system is Approved in Principle by DNV and enables customers to meet DNV Tailshaft Monitoring (TMON) requirements for unlimited intervals between tailshaft withdrawal surveys.



Waterjets

Wärtsilä waterjet solutions have been developed in line with the latest operating demands for naval vessels to ensure optimal efficiency, excellent hydrodynamic performance and reduced maintenance.

Wärtsilä offers modular and midsize waterjets. Modular waterjets are fully optimised according to your vessel type and power source, with a high level of customisation options available. They are constructed in 100% duplex stainless steel for outstanding durability. Wärtsilä midsize waterjets are available in five standard sizes with proven designs that offer shorter lead times and reduced costs. To reduce weight onboard, some parts are constructed from casted aluminium; critical components are constructed from high-grade stainless steel.

For larger waterjets the design of the inlet duct is optimised to fit the specific vessel requirements. Because of its size, the duct is part of the vessel construction. Our design capability for larger waterjets includes units of up to 50 MW.

Axial jet technology
Wärtsilä axial waterjets are single stage, compact, high-performance systems that combine mixed flow properties with an axial construction. This results in much less space being needed on the vessel's transom and greatly increased waterjet cavitation margins for optimum operational flexibility.

The reduced transom space is achieved without reducing the inlet duct diameter or size of the waterjet pump, maximising fuel efficiency. For naval architects, axial jet technology creates the possibility to apply a larger power density onto narrower hulls in order to achieve outstanding vessel performance.

25% less transom space needed on average
Unlike a non-axial design, an axial waterjet does not expand in a radial direction downstream. As the water flow is directed through the pump along the most efficient path, it is easier to fit the jet into the available transom space.

15% lighter on average
The reduced transom size can reduce the weight of the installation by as much as 15–20% compared to non-axial designs.

Improved manoeuvring and operational flexibility
The increased pump cavitation margin of 35% and the lower impeller tip speed allows more power to be introduced to the pump during manoeuvring. This results in 15% higher manoeuvring thrust and a faster response to acceleration. Operational flexibility is improved through a combination of a reduced number of shaft lines and higher loads on the remaining engines.

Electrical solutions

Wärtsilä Ship Electrification Solutions is a leading systems partner to the marine industry, providing electric propulsion, drives and power generation systems for vessels of all types and sizes. Electrification is one of the key enablers of marine decarbonisation.

Our state-of-the-art products and solutions are efficient, reliable and cost effective, and are supported by 24/7 customer service around the world.

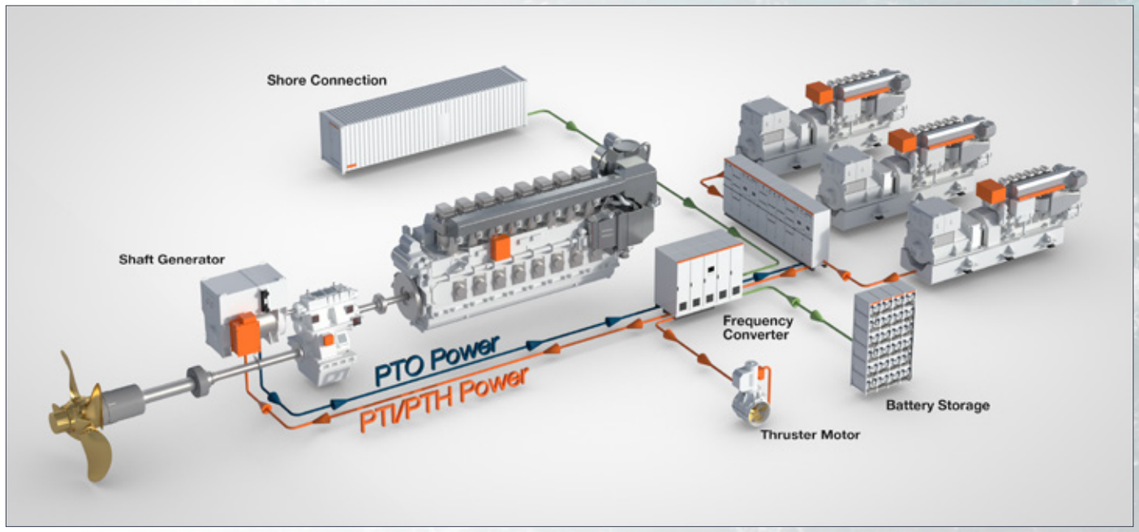
Integrated electrical power distribution
Wärtsilä Ship Electrification Solutions provides innovative and custom-made solutions for all types of naval vessels and can assume responsibility for the integration of complete electrical packages. Our scope ranges from highly sophisticated and proven system installations to standardised solutions. We also provide individual products for naval applications including main switchboards, load centres, distribution boards, power supplies and conversion equipment.

We are proud to have participated in many national and international projects, including amphibious transport vessels for the Chilean Navy.

Propulsion and drive systems

Our innovative diesel-electric propulsion systems are used on ships with special requirements. These systems are based on the principle of speed-controlled AC motors driving the propeller directly or through gearing. The most reliable and low-noise design is direct drive. Depending on the rated power, the system will be designed using low-voltage or high-voltage technology.

For propulsion power on board, the most economical drive solution is to install synchronous or induction motors fed by LCI synchro or PWM frequency converters, depending on the arrangement of the propulsion system and the vessel's operational profile. PWM converters are usually designed in a 12 or 24-pulse arrangement or as a transformer-less active front end (AFE) solution. Wärtsilä also offers its patented low loss concept (LLC). AFE PWM converters are also available with modular multi-level infeed up to 6.6kV. This converter type provides an almost sinusoidal input voltage and low harmonics without the use of additional line filter units.



Wärtsilä PTO/PTI/PTH shaft generator system + hybrid

Case – solutions for Chilean Navy amphibious transport vessels

Wärtsilä supplied the main propulsion machinery and a range of other equipment and systems for two 110-metre amphibious transport vessels operated by the Chilean Navy.

The Escotillón IV project under which these ships are being built will increase Chile's defence capabilities while also allowing the ships to be used for other activities.

Energy-efficient rudders are combined with high-efficiency controllable-pitch propellers, fairing caps and rudder bulbs, resulting in a 3 to 4% reduction in power requirements at the vessels' operating speed. The rudders and steering gears are the result of cooperation between Wärtsilä and Damen Marine Components.

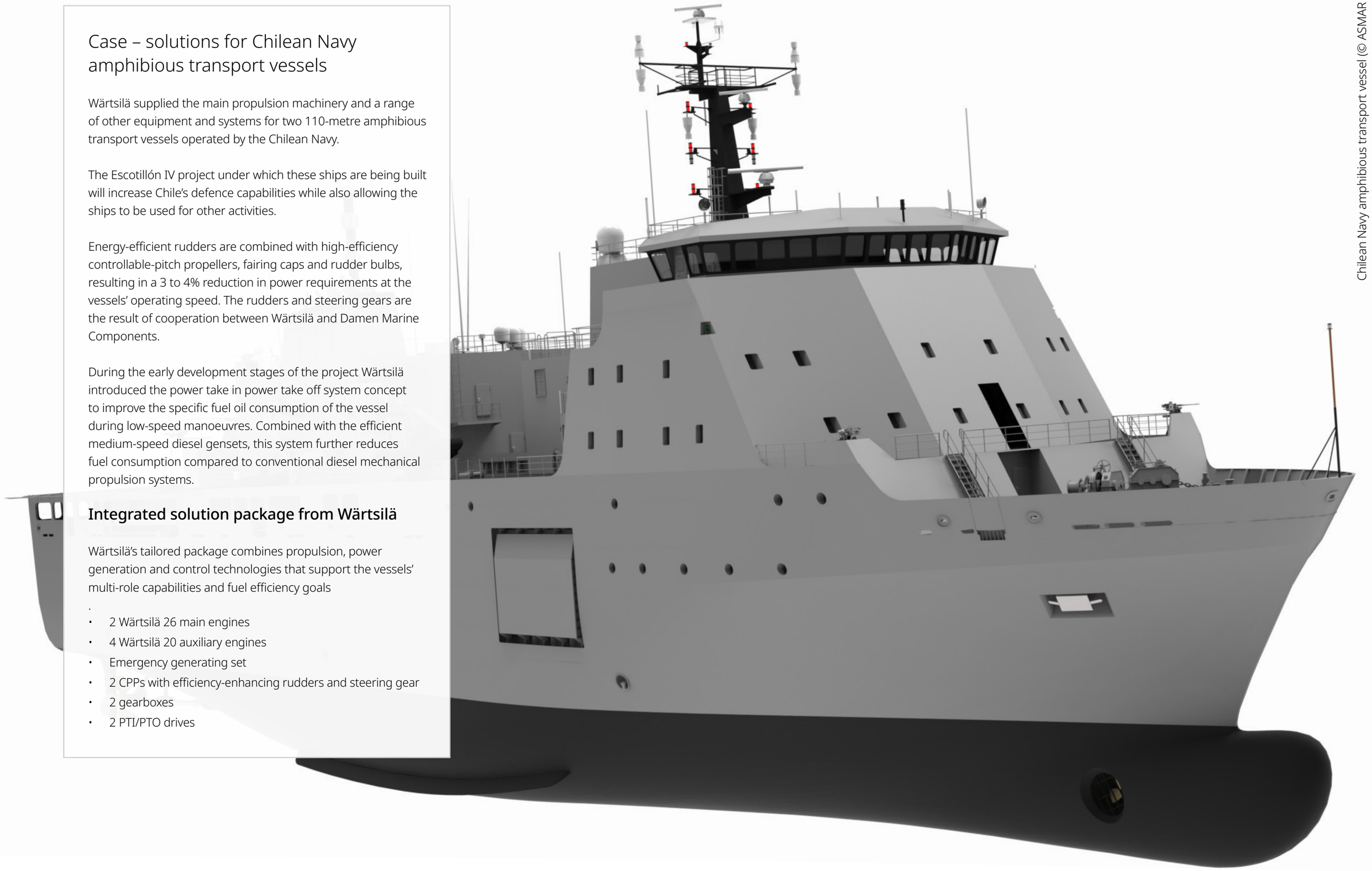
During the early development stages of the project Wärtsilä introduced the power take in power take off system concept to improve the specific fuel oil consumption of the vessel during low-speed manoeuvres. Combined with the efficient medium-speed diesel gensets, this system further reduces fuel consumption compared to conventional diesel mechanical propulsion systems.

Integrated solution package from Wärtsilä

Wärtsilä's tailored package combines propulsion, power generation and control technologies that support the vessels' multi-role capabilities and fuel efficiency goals

.

- 2 Wärtsilä 26 main engines
- 4 Wärtsilä 20 auxiliary engines
- Emergency generating set
- 2 CPPs with efficiency-enhancing rudders and steering gear
- 2 gearboxes
- 2 PTI/PTO drives



Chilean Navy amphibious transport vessel (© ASMAR Shipyard)

Marine services

Wärtsilä's suite of marine expert services for naval, coastguard and research vessels includes everything from genuine spare parts and technical support to maintenance and repairs.

- **Genuine spare parts** from Wärtsilä are reliable and have a long lifetime. They can also save you money in the long run.
- **Technical support:** Do you have a technical question or need help to solve a problem? Our experts can help you get ahead whenever you need it, remotely or face to face.
- **Training:** Take your professional skills to the next level with high-quality practical training from the Wärtsilä Land & Sea Academy.
- **Maintenance and repairs:** Do you need maintenance, repair or overhaul services for your vessel? Our team of experts can get your vessel back into operation in no time.
- **Service agreements:** A lifecycle agreement with Wärtsilä as your expert partner will help you improve vessel uptime, save fuel and decrease emissions.
- **Port and fleet optimisation:** Ensure efficient operations both in ports and at sea to achieve a seamless, safe and sustainable supply chain.
- **Decarbonisation services:** Do you want to adopt future fuels for your vessels? Wärtsilä decarbonisation services can help you get started with three simple steps.
- **Cyber services:** Get first-class cyber security protection for your maritime operations – both at sea and onshore. Choose cyber services from Wärtsilä.
- **Lifecycle upgrades:** Take full advantage of your investments while improving the efficiency and performance of your 2 or 4-stroke engines and other equipment.

08.2025 / TenFour

Work with Wärtsilä to navigate decarbonisation with confidence.

Build your success on Wärtsilä's broad portfolio of engines, propulsion systems, hybrid technology, exhaust treatment, shaft line solutions and digital technologies, as well as integrated powertrain systems. These building blocks offer you efficiency, reliability, safety and world-class environmental performance.

The offering includes performance-based agreements, lifecycle solutions and an unrivalled global network of maritime expertise.

www.wartsila.com/marine

Wärtsilä is a global leader in innovative technologies and lifecycle solutions for the marine and energy markets. We emphasise innovation in sustainable technology and services to help our customers continuously improve their environmental and economic performance.