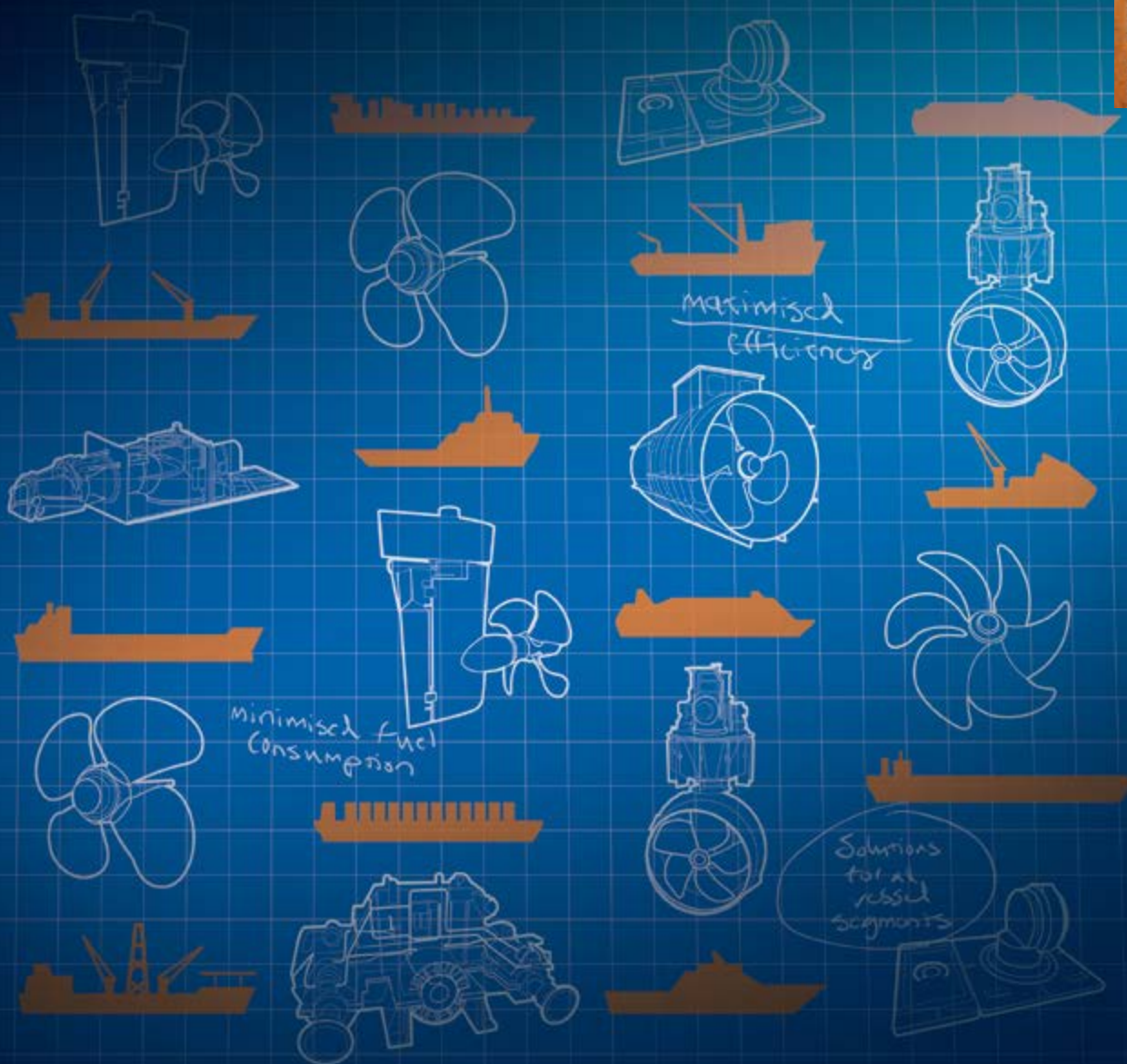


## PROPULSION SYSTEMS

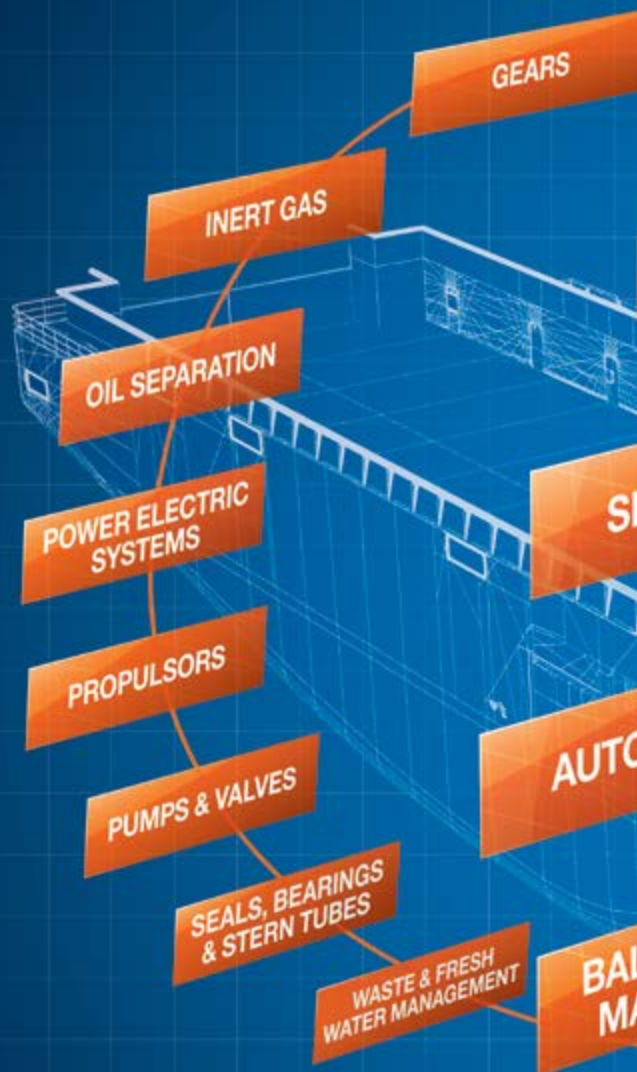
ENERGY  
ENVIRONMENT  
ECONOMY





At Wärtsilä we strive constantly to do what is best for you. This includes optimising the lifecycle value of your installations by offering precisely what you need; a promise we can deliver on since we provide the marine industry's most complete portfolio of products, integrated solutions and global services.

We prioritise operational efficiency, environmental excellence, fuel flexibility and 24/7 support, and are committed to working closely with you. In this way, we help find your shorter route to robust growth, greater profitability and regulatory compliance. This is why today, every third vessel in the world has a Wärtsilä solution onboard.



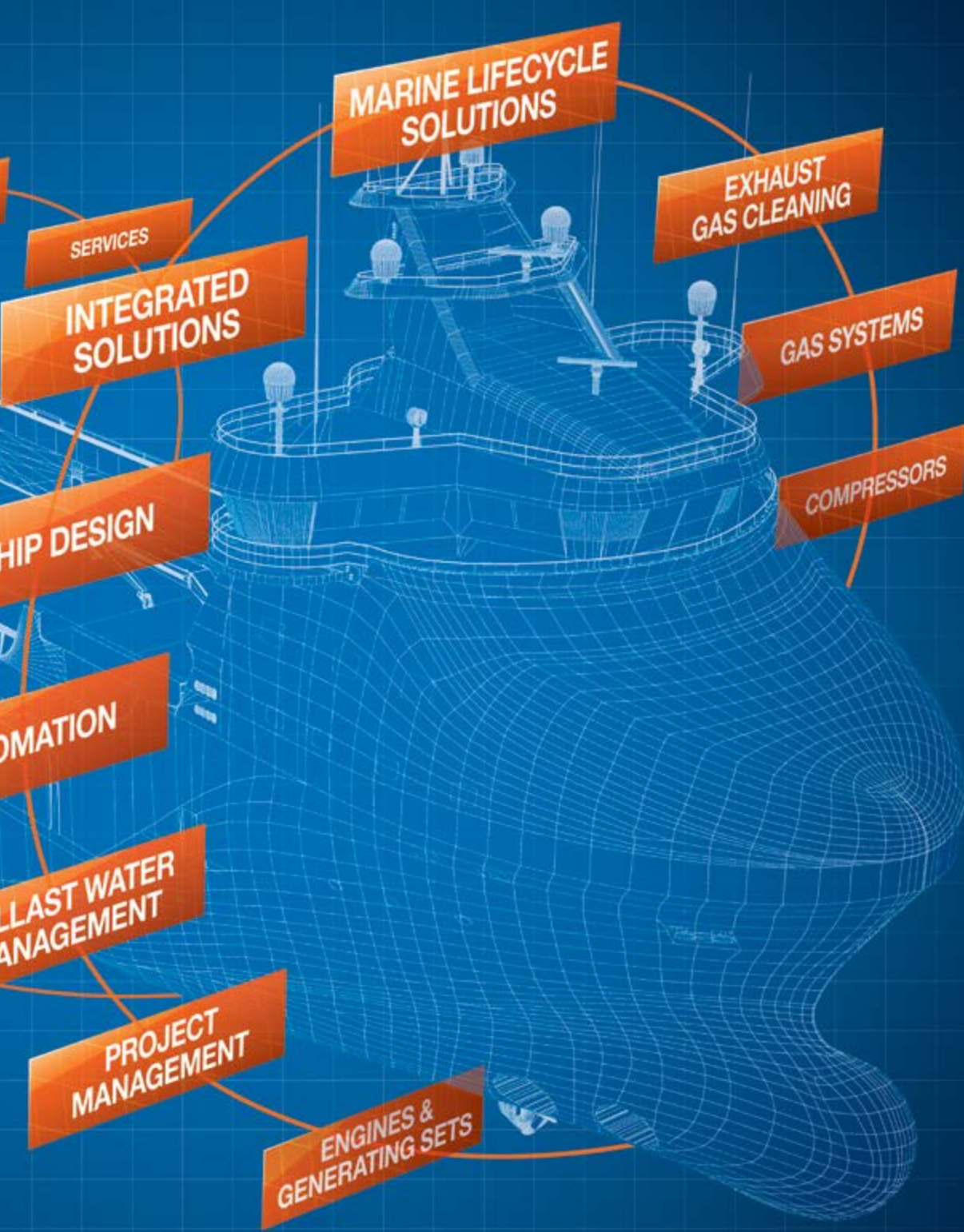
## THE MOST COMPLETE MARINE OFFERING ON EARTH

### UNIQUELY PROVIDING A TOTAL RANGE OF SOLUTIONS TO SERVE THE MARINE INDUSTRY BETTER

Wärtsilä is the marine industry's only total solutions provider. With a complete portfolio offering that includes ship design, main and auxiliary engines, propulsion machinery, control and automation systems, environmental compliance solutions, and a host of technologically advanced complimentary products, we cover the complete lifecycle of a vessel – from initial design planning to daily operating necessities. No other supplier can match this coverage.

By being involved from the very beginning of a new vessel project, and through being able to offer a single source of supply, we can speed the process, reduce scheduling risks, and lower costs. Our products and solutions can be fully integrated and customised to meet specific individual needs. In every case we offer efficiency, reliability, and solutions that are economically sound and environmentally sustainable. In short, we enable an even shorter route to bigger profits for our customers.

With more than 18,000 employees in 170 locations worldwide, our marine and offshore



customers can be assured of truly global support, 24 hours a day.

#### **PROPULSION SOLUTIONS FOR THE NEW ERA OF SHIPPING**

Faced by economic challenges, new environmental legislation, and evolving global trade implications, the marine industry has undergone significant changes in recent years. Wärtsilä has been, and remains, at the forefront in developing technologies to meet the new realities faced by ship owners and operators the world over.

One word – ‘efficiency’ – sums up Wärtsilä’s approach to developing propulsion technology. By creating solutions that are in themselves efficient, and which can be efficiently integrated with other Wärtsilä solutions, the entire vessel propulsion system becomes more efficient. Fuel consumption is then reduced, operating costs are lowered, environmental compliance is eased, and the lifecycle of the installation is extended and optimised.

This brochure highlights Wärtsilä’s propulsion products and solutions, which have all been developed to meet specific application

needs. In each case, the emphasis is on providing customers with tangible benefits that add value to their businesses.

Furthermore, we support our installations with the most comprehensive global service network in the industry. Wherever you are, whenever you need assistance, Wärtsilä can be relied upon to respond, quickly and efficiently.



While the trend in recent years has been towards ever larger container vessels, smaller ships are still required for the transportation of containers to and from the major container ports. The operating profiles of the large and smaller container vessels are clearly not the same, and the propulsion systems needed for larger ships are somewhat different than for smaller ones. Wärtsilä offers a full range of propulsion options for every size and for every type of operation, with fuel efficiency and environmental compliance always emphasised.

Wärtsilä has worked very closely with its container sector customers to develop propulsion solutions that not only take into consideration their current concerns and needs, but which add real value.

High efficiency is paramount in the current economic climate, so our CP and FP propellers are designed and integrated with the engines in such a way that efficiency is maximised and fuel consumption is minimised. The Wärtsilä EnergoProFin is designed to improve propeller

efficiency by decreasing resistance and increasing thrust.

Slow steaming, a standard practice these days, can be accommodated in the most practical and efficient way possible in order to lower operating costs.

The ability to maintain operating schedules is a primary consideration behind every Wärtsilä propulsion solution. The overall performance of the vessel is, therefore, a key criterion in our design approach.

Container vessels need effective manoeuvring capabilities for port operations. The Wärtsilä range of transverse thrusters provides fast and powerful response as and when needed.

# Container Vessels

## LOG-IN JACARANDÁ

Vessel type	Container Vessel, 2700 TEU
Shipowner	Log-In – Logística Intermodal S.A.
Shipyard	EISA Brazil
Delivery	2011
Scope of supply	1 x Wärtsilä low-speed main engine 3 x Wärtsilä Auxiliary engines 1 x CPP
Service speed	20 knots





# Oil/Chemical Tanker Vessels

## BIT VIKING

Vessel type	Oil/chemical Tanker, 27400 DWT
Shipowner	Tarbit AB
Shipyard	Shanghai Edwards
Delivery	2007
Converted to dual-fuel:	2011
Scope of supply	2 x Wärtsilä medium-speed dual-fuel main engines 2 x Wärtsilä LNGPacs 2 x Wärtsilä Auxiliary engines 2 x Wärtsilä gearboxes 2 x Wärtsilä CPPs 2 x Wärtsilä PCSs
Service speed	14.5 knots

Product tankers vary greatly in size according to their loading capacity, and are normally fitted with a single screw propulsion system. In most cases 2-stroke main engines are used in combination with an FP propeller. However, smaller sized vessels might have the propulsion system driven by 4-stroke engines, together with a CP propeller and gearbox. Transverse thrusters are typically used for manoeuvring. Wärtsilä serves all these needs with state-of-the-art solutions, while the Wärtsilä Energopac system reduces fuel consumption through highly efficient integration of the propeller and rudder design.

In order to optimise fuel efficiency, Wärtsilä emphasises matching the propeller design with the characteristics of the engine, in terms of the engine's rpm and optimal operational parameters.

Meeting the sailing schedule is a critical requirement for ship owners and operators.

Wärtsilä propulsion solutions enable the ships to maintain speed under all circumstances.

The Wärtsilä Energopac provides full energy efficiency without compromising either manoeuvrability or comfort levels onboard the vessel. Similarly, the Wärtsilä EnergoProFin promotes fuel efficiency through reducing propeller resistance.

With a PTO installed, the Wärtsilä CP propeller enables the engine to be operated at a fixed speed and therefore allows the PTO to be used even when the ship's speed is changing.

Multiple engines per shaft via twin-in/single-out gearboxes, in combination with a Wärtsilä CP propeller, enable efficient operations at different power levels and/or redundancy for the propulsion system.





# Offshore Support Vessels (OSVs)

## NORMAND INSTALLER

Vessel type	Construction Support Vessel 9511MT DWT
Shipowner	Solstad Offshore ASA
Shipyard	Ulstein
Delivery	2006
Scope of supply	Wärtsilä Ship Design 4 x Wärtsilä medium-speed main engines 2 x Wärtsilä gearboxes 2 x Wärtsilä CPPs 2 x Wärtsilä retractable thrusters 2 x Wärtsilä transverse thrusters Wärtsilä Integrated Automation System Frequency Drive System
Service speed	15 knots

The offshore support vessel (OSV) segment covers a wide range of vessel types, including platform supply vessels (PSV), anchor handling tug supply vessels (AHTS), and offshore construction vessels (OCV). These vessels often operate in difficult sea conditions and require both dynamic positioning performance as well as free sailing speed. Reliability, environmental compliance, safety, low noise and vibration levels, and compact equipment to free up crew and cargo space, are all important design criteria.

Wärtsilä offers customised solutions to meet specific operational requirements,

including dynamic positioning capability and transit speed efficiency.

Integrated propulsion packages from Wärtsilä include propellers, gearboxes, nozzles, thrusters, propulsion control systems, seals & bearings, and electrical & automation solutions to provide excellent reliability and low fuel consumption under all operating conditions.

All applicable environmental legislation, both local and global, is addressed by Wärtsilä's propulsion solutions.

With the industry's most comprehensive global service and maintenance network, Wärtsilä can offer readily available support for OSVs, wherever they operate.

# Drill Ships

Increasing oil prices have triggered the exploration of oil and gas in harsh and/or deep water environments. This has imposed increased demands on the propulsion systems of drill ships designed to operate in these challenging conditions. Dynamic positioning performance is the key aspect, while reliability and transit performance are also high on the agenda.

Wärtsilä's high power steerable thrusters provide the positioning capabilities required by modern drill ships, thanks to the modernized tilted propeller shaft and nozzle.

All propulsion solutions need a reliable control system for manoeuvring the vessel. Wärtsilä has years of experience in electric and electronic control systems that meet varying customer requirements.

Reliability and performance are at the heart of every Wärtsilä propulsion solution. To further improve availability, all units are prepared and can be connected to Wärtsilä Propulsion Condition Monitoring Services (PCMS).

Wärtsilä's emphasis on fuel efficiency assures reduced exhaust emissions; an important consideration when drilling in environmentally sensitive locations, such as the arctic.

For semi-submersible drilling rigs, Wärtsilä can provide larger propellers to provide the same thrust at lower power levels. This enables smaller or fewer generating sets and allows for more payload.

## ODN I

Vessel type	Drill Ship
Drilling contractor	Odebrecht Oil & Gas
Shipyards	DSME, Korea
Delivery	2012
Scope of supply	6x Wärtsilä under water (de-)mountable steerable thrusters





# Tugs

The most common purpose of tugs is to assist other vessels during docking and harbour manoeuvring. To perform this task effectively they need to be reliable, highly manoeuvrable and powerful. The defining characteristic that determines the tug's income is its maximum bollard pull, while all capital investment and operational costs need to be as low as possible.

Wärtsilä's steerable and transverse thrusters provide powerful and efficient manoeuvrability.

The reliable Propulsion Control System (PCS) from Wärtsilä is easy to operate and reduces human operational error by tug crews.

Wärtsilä's integrated propulsion packages not only offer lower operating costs, but also facilitate faster and simpler installation at the shipyard, thus saving CAPEX costs.

The reliability of Wärtsilä propulsion solutions is well established through years of experience and hundreds of reference installations.

Vessel type	Damen ASD Tug 3212
Shipowner	Kuwait Oil Company Ltd.
Shipyard	Damen Shipyard Gorinchem, The Netherlands
Delivery	2013
Scope of supply	2 x Wärtsilä medium-speed main engine 2 x Wärtsilä compact thruster
Bollard pull	80 T







Photo: Robert Heazlewood

# High Speed Ferries

## FRANCISCO

Vessel type	Wave Piercing Catamaran
Shipowner	Buquebus
Shipyard	Incat Tasmania
Delivery	2013
Scope of supply	2 x Wärtsilä axial waterjets
Service speed	47 knots

Powerful propulsion is an obvious competitive requirement for fast ferries, while manoeuvrability is important for docking and control purposes. Waterjets, which are essentially huge pumps that can be of either axial or mixed-flow design, are used to meet these needs. For high levels of thrust, a waterjet has to generate both high flow and high pressure, and this requires what are known as 'mixed flow' properties.

Wärtsilä is established as the preferred supplier of waterjets for the world's biggest high speed ferries.

The unique feature of Wärtsilä's axial built waterjets is that while it has the mixed-flow properties required, it delivers these in an

axial geometry, so the water passing through the waterjet follows an optimal and efficient 'straight-through' flow path.

Wärtsilä waterjets offer high propulsion power and low weight in a compact design. Vibration is minimised to ensure passenger comfort.

With integrated steering and reversing, Wärtsilä waterjets have excellent manoeuvring properties to save time and operating costs.

Wärtsilä has an impressive reference list of high speed vessel installations. Wärtsilä's axial waterjet technology offers the highest available power density among waterjets of comparable size.



## VIKING GRACE

Vessel type	RoPax Cruise Vessel 57000 GT
Shipowner	Viking Line
Shipyard	STX Finland
Delivery	2013
Scope of supply	4 x Wärtsilä medium-speed dual-fuel main engines 2 x Wärtsilä FPPs (built-up)
Service speed	22 knots

# Cruise & Ferry

If timetables and cruise schedules are to be met, the reliability and performance of the propulsion equipment is paramount. At the same time, the comfort levels of the passengers on board always need to be a prime consideration. Increasingly also, environmental performance is of high importance as both local and global legislation becomes ever more stringent.

Wärtsilä strives to optimise the operational reliability, cost-efficiency, and environmental sustainability of cruise ships and ferries.

The propeller solutions that Wärtsilä has developed are based on years of experience and strong in-house know-how. Their low level cavitation minimises noise and vibration levels to ensure passenger and crew comfort.

Wärtsilä's propulsion packages, including propellers, gearboxes, transverse thrusters, seals and bearings, and control systems, can be easily integrated with the main engines to provide high and reliable performance with maximum fuel efficiency and minimal levels of exhaust emissions.





# Offshore Patrol Vessels (OPVs)

Naval and Coastguard OPVs need rapid acceleration capability with a high degree of manoeuvrability in order to effectively carry out their missions. Very often these vessels operate in shallow waters close to shore, for which the underwater propulsion installations must meet specific and challenging parameters.

Wärtsilä has an impressive reference list of high speed vessel installations. Its waterjet technology has even been chosen for a large number of naval support vessel programmes for the US Navy.

The power density of Wärtsilä waterjets yields higher propulsion efficiency and an increased cavitation margin, thereby improving acceleration performance and offering increased thrust for manoeuvring.

The design of Wärtsilä's CP propellers can be customised to meet specific operational requirements.

Full integration of the propulsion package with the vessel's engines is always a Wärtsilä priority in achieving high operational and environmental performance.



## INDEPENDENCE CLASS LCS

Vessel type	Littoral Combat Ship
Shipowner	US Navy
Shipyard	Austal USA
Delivery	2013
Scope of supply	2 x Wärtsilä axial waterjets, each 22000 kW 2 x Wärtsilä waterjets, each 9000 kW
Service speed	over 40 knots





# Wärtsilä Services



Wärtsilä service network ●

## Lifecycle efficiency solutions

Optimising your operations and preventing the unexpected is our shared passion – we serve you whenever, wherever.

Companies now focus on efficiency and impact of their operational expenses. Wärtsilä Services serves and supports customers in improving and optimising their operational efficiency throughout the whole lifecycle of the installation. Wärtsilä Services provides full service throughout the product lifecycle for both marine and power plant customers, and constantly develops its network worldwide.

We offer lifecycle efficiency solutions in the following areas of expertise:

- Engine services
- Propulsion services
- Electrical & automation services

- Boiler services
- Environmental services
- Service agreements
- Service projects
- Training services.

















































Our services cover everything from basic support with parts, field service and technical support to service agreements and condition based maintenance; from installation and commissioning, performance optimisation, including upgrades and conversions, to environmental solutions, technical information and online support. The choice available to you extends from parts and maintenance services to a variety of comprehensive, customised long-term service agreements, including performance and operations & management agreements.

Additionally, we are continually broadening our range of services by adding valuable solutions and specialist services to our portfolio. In this way we support you around the globe through our workshops and in key ports, regardless of your equipment make.

Our Services organisation currently features more than 11,000 dedicated professionals in 70 countries.

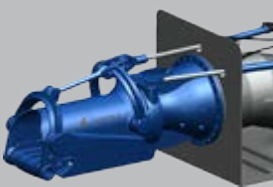
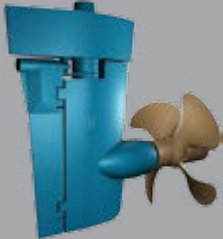
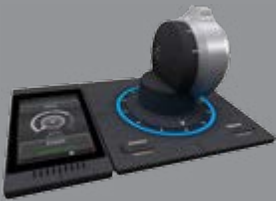


Wärtsilä adds value to your business at every stage in the lifecycle of your installation. With us as your service partner, you receive many measurable benefits such as availability and performance, productivity gains and cost benefits.

Above all, peace of mind in the knowledge that your installation is being serviced by the most experienced partner you could have – Wärtsilä.

				
Vessel Type	Wärtsilä Fixed Pitch Propellers (FPP)	Wärtsilä Controllable Pitch Propellers (CPP)	Wärtsilä Transverse Thrusters (TT)	Wärtsilä Steerable Thrusters (STT)
	<p>Wärtsilä can supply FPPs with any number of blades, the most common being 4, 5, and 6 bladed propellers. With a casting capacity of 110 tons, Wärtsilä can supply virtually all FPP needs. The Cunial material that Wärtsilä uses provides excellent casting, machining, and fatigue strength properties.</p>	<p>The range of Wärtsilä CPPs starts at an engine power of approximately 500 kW, and a propeller diameter of 1000 mm. In principle, there is no upper limit. Thus far, the highest powered CPP absorbs 44 MW, and the largest one has a diameter of 8400 mm.</p>	<p>Wärtsilä TTs are designed for maximum thrust with the smallest possible tunnel diameter. The standard range covers power levels up to 3200 kW and is available with CPP or FPP for auxiliary or DP applications.</p>	<p>The Wärtsilä STT product range covers a wide number of variants, such as can-mounted, retractable, and underwater (de)-mountable thrusters. Wärtsilä steerable thrusters are available at power levels up to 5500 kW for both L- and Z-drive configurations.</p>
				
				
				
				
				
				
				
				
				
				
				
				
				
				
				
				
				

This list provides a general overview of propulsion equipment for the most common vessel types. The actual propulsion system configuration can vary for each



				
<b>Wärtsilä Waterjets</b>  Wärtsilä LJX waterjets are a line of single stage, compact, high performance units that combine the properties of a mixed flow pump with an axial design. The pre-assembled range is available up to approx. 4500 kW. For large jets the inlet duct is designed by Wärtsilä and built by the yard. The design capability goes up to 50 MW. Mixed flow (LJE) jets are also available.	<b>Energopac and EnergoProFin</b>  The Wärtsilä Energopac is an integrated propeller/rudder system comprising several components that vary in design and dimension. These include the propeller, a streamlined fairing cap, and a rudder system featuring a rudder bulb. Energopac is optimised according to the specifics of the vessel.  EnergoProFin is an advanced fuel saving product added to the hub of any FPP. The EnergoProFin is suitable for all vessel speeds and vessel types.	<b>Wärtsilä Propulsion Control System (PCS)</b>  The Wärtsilä PCS has an intuitive user interface that suits all possible propulsion configurations. The control system is split into 2 main parts; one at or near the propulsion machinery, and the other on the bridge. All communication is via a redundant CAN OPEN field-bus. The Wärtsilä PCS controls one or more propulsion systems.	<b>Wärtsilä Reduction Gears</b>  Wärtsilä gears are of modular design and available in four standard models: single reduction gears with vertical or horizontal offsets, 2-speed gearbox, and twin input-single output gears in the power range 800 to 25,000 kW.	<b>Nozzle</b>  Fitting a nozzle increases the thrust at relatively low ship speeds. Significant savings can be achieved in terms of fuel consumption, depending on the number of revolutions and the capacity of the engine. The improved Wärtsilä High Performance nozzle, type HPN, combined with Wärtsilä propellers, can provide up to 5% more thrust than conventional nozzles in bollard pull condition. The nozzle profile offers a double profiled cross section at the inlet side of the nozzle.
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individual project and vessel type.

Wärtsilä is a global leader in complete lifecycle power solutions for the marine and energy markets. By emphasising technological innovation and total efficiency, Wärtsilä maximises the environmental and economic performance of the vessels and power plants of its customers. Wärtsilä is listed on the NASDAQ OMX Helsinki, Finland.

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