
ROLLS
ROYCE
Naval Solutions
WE MOVE YOU. WITH AGILITY
AND POWER.
mtu
A Rolls-Royce
solution

CONTENTS

US Navy - Independence Class (LCS)
CODAG 2x 20V 8000 M91, gasturbine

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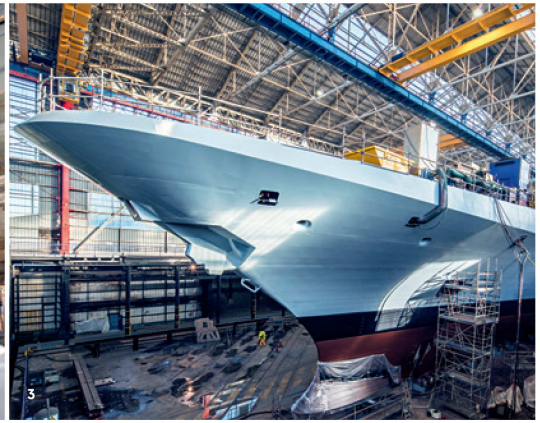

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PIONEERING THE POWER THAT MATTERS.

01

We at Rolls-Royce provide world-class power solutions and complete life-cycle support under our product and solution brand ***mtu***. Fully utilizing the potential of digitalization and electrification, we strive to develop climate-neutral drive and power generation solutions that are even cleaner and smarter and thus provide answers to the challenges posed by climate change and the rapidly growing societal demands for energy and mobility. We deliver and service comprehensive, powerful and reliable systems, based on both gas and diesel engines, as well as electrified hybrid systems.

A solution provider
mtu systems power the most modern yachts, the strongest tugboats and the biggest land vehicles and provide energy for the world's most important mission-critical applications. With advanced solutions such as microgrids we integrate renewable energies and manage the power needs of our customers.

For over 110 years we have provided innovative solutions for our customers – meeting even the most demanding drive and power requirements. Our products and services span a wide range of applications and power needs, with both standard and customized options.

An expert in technology
mtu products are known for cutting-edge innovation and technological leadership. That same spirit of innovation inspires our sustainability efforts. Our focus is on developing and implementing system solutions that both maximize efficiency and reduce emissions – which in turn helps to reduce our impact on the environment.

A passionate and reliable partner
We at Rolls-Royce spend every day working together with our customers, to deliver engines, systems and complete life-cycle solutions that best fit their needs. We understand that each application is different and has its own specific demands. Our engineers embrace the challenge of finding the perfect solution for your unique power requirements. Every step of the way – from project planning, through design, delivery and commissioning; to the lifetime care of your equipment – we are dedicated to helping you get the most from your ***mtu*** investment.

You want to know more about ***mtu*** solutions?

Get in touch with us.

1 U.S. Coast Guard National Security Cutter CODAG 2x 20V 1163 TB 93, gasturbine

2 We are a reliable partner that sets trends. We look ahead to ensure the best results for our customers.

3 We are passionate about fulfilling the needs of our customers with the utmost professionalism and precision.

4 As a supplier of high-quality performance propulsion solutions, we stand for the highest level of technological expertise.

System solutions

MORE THAN STEEL. MORE THAN DIESEL ENGINES.

02

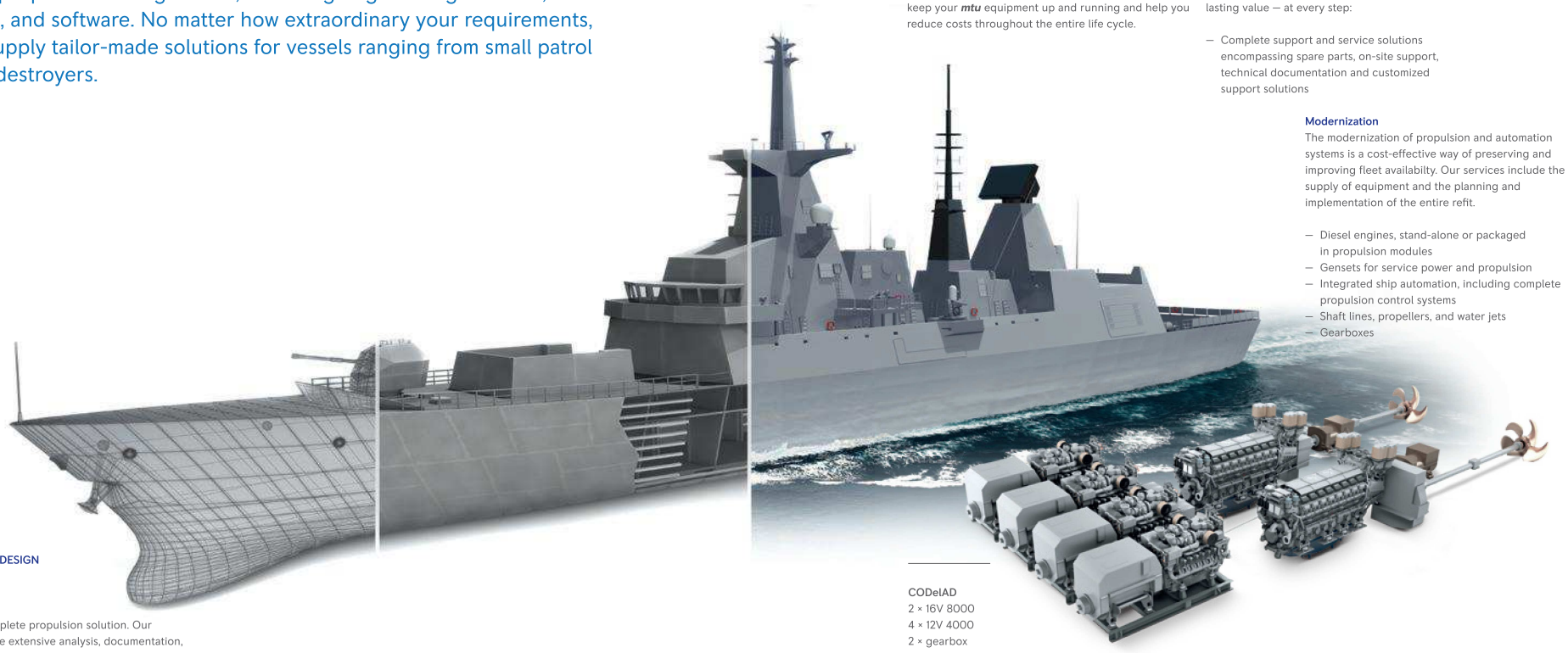
Our engines and propulsion systems play an important role in many countries' armed forces. Our navy propulsion systems are based on ***mtu*** commercial shipping engines, thousands of which operate successfully all over the world. They are modified according to the special requirements of military and governmental vessels. High power density, low weight, compact design, and mechanical and thermal stability characterize ***mtu*** engines, just as much as simple operation, straightforward maintenance, and low life cycle costs.

Ready for your missions
More than half a century of experience and expertise makes us a strong partner – worldwide, whatever mission you are on.

System solutions

A LIFETIME OF INTELLIGENT POWER.

Our propulsion is with you all the way, from planning and design to operation. Our expertise in ship applications encompasses every possible propulsion configuration, including engineering services, hardware, and software. No matter how extraordinary your requirements, we can supply tailor-made solutions for vessels ranging from small patrol boats to destroyers.



PLANNING AND DESIGN

Planning
We supply a complete propulsion solution. Our engineers provide extensive analysis, documentation, and risk mitigation services as well as integrated mechanical, electrical, and electronic interfaces.

Propulsion system integration
We provide comprehensive engineering and technical support for the design and implementation of a vessel's propulsion system. Our PSI team helps to reduce design, installation, and commissioning costs.

PROCUREMENT AND CONSTRUCTION

Propulsion systems
Our engines and propulsion systems are characterized by their high power density, low weight, and excellent response behavior as well as simple operation, optimized maintenance, and low life cycle costs.

CODelAD
2 × 16V 8000
4 × 12V 4000
2 × gearbox
2 × e-drive

Integrated automation system
Our ***mtu*** NautIQ marine automation solutions allow operators to monitor and control the whole propulsion plant, the onboard power supply, and the entire vessel. Our automations systems are versatile, user-friendly, and modular.

OPERATION

Integrated Logistics Support
Designed to meet the unique challenges of Naval Operations, Integrated Logistics Support (ILS) delivers a customized package — including analysis, spare parts, training and technical documentation — designed to keep your ***mtu*** equipment up and running and help you reduce costs throughout the entire life cycle.

mtu **ValueCare**
Every client is different. Our comprehensive ***mtu*** ValueCare service solutions portfolio allows us to tailor offerings for each individual customer aimed at maximizing performance, uptime, and lasting value — at every step:

- Complete support and service solutions encompassing spare parts, on-site support, technical documentation and customized support solutions

Modernization
The modernization of propulsion and automation systems is a cost-effective way of preserving and improving fleet availabilty. Our services include the supply of equipment and the planning and implementation of the entire refit.

- Diesel engines, stand-alone or packaged in propulsion modules
- Gensets for service power and propulsion
- Integrated ship automation, including complete propulsion control systems
- Shaft lines, propellers, and water jets
- Gearboxes

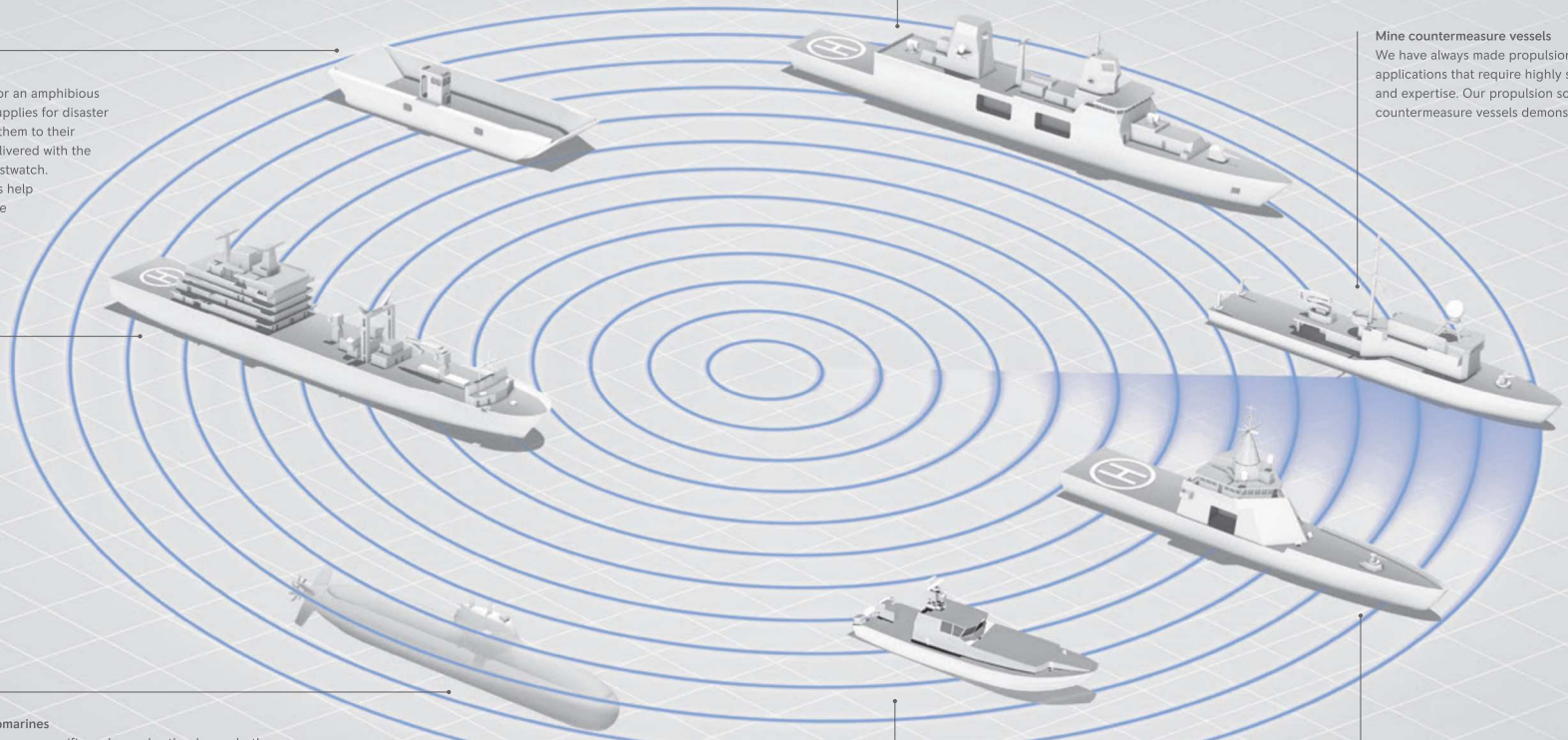
Applications overview

PROPULSION SYSTEMS TAILORED TO YOUR NEEDS. 03

Corvettes, frigates, destroyers
Corvettes, frigates, and destroyers have an impressive presence through their enormous versatility, their wide spectrum of use, and their extraordinary propulsion systems. With our engines and propulsion systems, they are superbly equipped for their demanding tasks.

Amphibious craft
When landing troops for an amphibious operation or landing supplies for disaster relief, you need to get them to their destination on time, delivered with the precision of a Swiss wristwatch. Our propulsion systems help you to keep to schedule wherever you are.

Mine countermeasure vessels
We have always made propulsion systems for applications that require highly specialized knowledge and expertise. Our propulsion solutions for mine countermeasure vessels demonstrate this perfectly.



Large amphibious and support vessels
Although not on the first line, support vessels are vitally important: they feed the fleet with vital supplies and transport troops and equipment where they are needed. That's reason enough to give support vessels propulsion systems that are always dependable – wherever they operate.

Submarines
The more specific and complex the demands, the more important and valuable expertise and experience are. We have been setting quality and performance standards for submarine engines for decades.

Patrol vessels
With a wide range of duties including police, coast guard, border control, and customs, inshore patrol vessels need propulsion systems with very fast responses.

Offshore patrol vessels
Uneventful patrols at high sea can suddenly turn into serious operations. All the more reason to install a robust propulsion system which keeps going – whatever the situation.

Engines

DECISIVE ACTION REQUIRES A STRONG HEART.

04

The higher the requirements and the more specific the application, the clearer the need for one of our propulsion systems, including ***mtu*** engines, gearbox, shaftline, and propeller/waterjet. We develop the optimum propulsion solutions for all individual tasks – solutions with the highest performance, greatest reliability and availability as well as superior agility.

Engines

ALL ENGINES AT A GLANCE. READY FOR DUTY.

Our customized solutions for large military vessels correspond to strict navy standards and guarantee:

- High reliability and availability
- A broad engine characteristic map and unlimited low load capability
- High power concentration despite low weight
- Excellent maneuverability and acceleration
- Low acoustic, optical, and infrared signatures
- Substantial shock-proofing
- Low fuel consumption over the entire operating range
- Long maintenance intervals

Series 8000
The powerful high-speed engine meeting maximum demands
7,280–10,000 kW (9,762–13,410 bhp)
Available as: 16V and 20V
Optional: we will offer SCR solutions to meet IMO III emission regulations

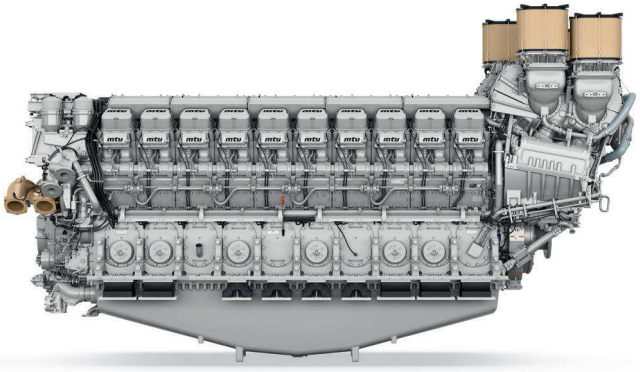
Series 1163
The proven, evolved engine for the naval sector
4,800–7,400 kW (6,437–9,923 bhp)
Available as: 12V, 16V and 20V
Optional: we will offer SCR solutions to meet IMO III emission regulations

Series 2000
The powerful heart for maximum agility
720–1,939 kW (966–2,600 bhp)
Available as: 8V, 10V, 12V, and 16V
Optional: SCR solution available to meet IMO III and EPA Tier 4 emission regulations

Analytics
We use the most diverse analysis and simulation tools to develop state-of-the-art propulsion solutions. That includes vibration analysis, component strength verification, and dynamic response simulations of entire propulsion systems.

Electronics
The latest generation of our electronic management system, Advanced Diesel Engine Control (ADEC), controls key systems such as fuel injection and turbocharging that improve fuel consumption, and emission levels as well as vessel performance.

Fuel injection
We optimize fuel combustion in the cylinder by means of its electronically controlled commonrail fuel injection system in combination with other technologies such as exhaust gas recirculation.



Aftertreatment
We offer exhaust gas aftertreatment systems such as selective catalytic reduction to meet IMO Tier III and EPA Tier 4 emission limits over the engine's lifetime for ***mtu*** Series 2000 & 4000 and will offer SCR solutions for ***mtu*** Series 1163 & 8000.

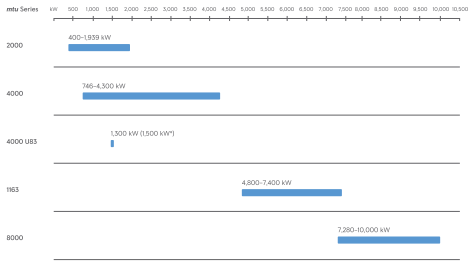
Renewable fuels
In addition to meeting the highest fuel efficiency standards, our ***mtu*** Series 2000 & 4000 engines can also run on renewable fuels such as hydrogenated vegetable oil (HVO) and gas-to-liquid (GTL) in accordance with the EN15940 standard.
The use of renewable fuels such as HVO can lead to a reduction in CO_2 emissions of up to 90%, depending on the fuel manufacturer. The use of these fuels has been successfully proven in practice on the test bench and in the field. EN15940 compliant fuels are approved for use in all ***mtu*** Series 2000 & 4000 system configurations and emission calibrations from 2023.

Turbocharging
We develop and produce our own turbochargers for high-performance applications. Turbocharging helps to achieve low fuel consumption and high performance across a broad range of operating speeds.

Power range
The wide range of engines meet the most extreme demands that can be required from propulsion systems. Solutions include the highest performance, greatest reliability and availability as well as superior agility.

Mounting
Our engines are installed on special rubber mountings to reduce the transmission of structure-borne noise to the ship's hull. New active mountings support the passive rubber mountings and make their noise reduction far more effective.

Demagnetization
We are a leader in the field of propulsion systems with low magnetic and acoustic signatures, allowing us to reduce the magnetism of all ferromagnetic parts with our own method to a stable minimum.

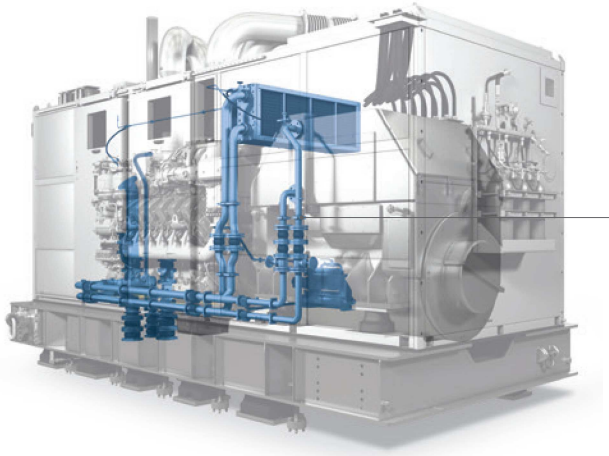


* optional

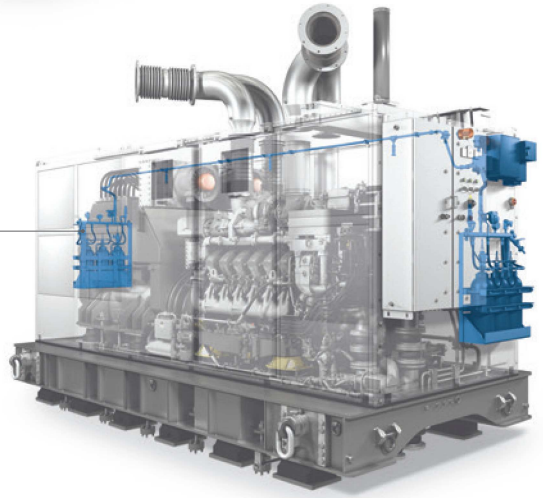
Please scan the QR code for more information about marine solutions and detailed technical data.

Series 4000
One of the most successful heavy-duty engines ever
746–4,300 kW (1,000–5,780 bhp)
Available as: 8V, 12V, 16V, and 20V
Optional: SCR solution available to meet IMO III and EPA Tier 4 emission regulations

Series 4000 U83
The battery charging unit for submarines
1,300 kW (1,500kW*)
Available as: 12V

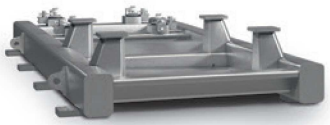


Integrated engine fluids pipework



Fire detection and fighting system

Baseframes in different designs for different purposes



Gensets

GENSETS FOR SERVICE POWER AND PROPULSION. 05

Our flexible genset solutions are tailored to your needs.
You can order them in standardized or customized versions:

- Standardized gensets for cost-effectiveness and favorable lead times based on our proven Series 2000 and Series 4000 engines
- Customized gensets tailored to the specific requirements for the most challenging conditions

Based on our successful Series 2000 and Series 4000 engines, they serve power demands between 330 and 3,015 ekW.

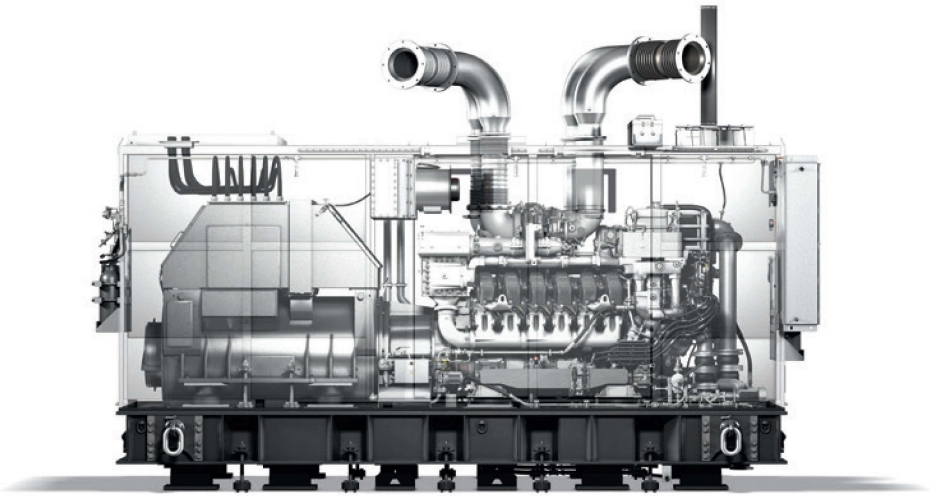
System support from a single source
Upon request, we can act as single-source vendor to take on the technical and commercial responsibility for the entire propulsion, power generation, and automation system – from project engineering and management to support and service. Consolidating these responsibilities reduces the number of interfaces and, therefore, the risks both to the shipyard and the end user.

Resilient mounting system for acoustic and shock requirements
mtu advanced gensets are engineered and based on a proven design. Depending on your individual requirements, you can choose between a constant or variable speed configuration.

The characteristic feature of these gensets is its double-resilient mounting system, which reduces structure and airborne noise emissions that can significantly reduce the acoustic signature of the vessel.

Preinstallation of components such as filters directly on the base frame reduces installation work and space, allowing easy connection to the ships' interfaces and fast commissioning. All gensets are fully pretested at ***mtu's*** test facilities with respect to technical guarantees so that component function and readiness for operation on board are proven.

Overall, ***mtu*** advanced gensets provide the most attractive cost/performance ratio on the market. The ***mtu*** Genset will be operated and monitored by the ***mtu*** NautIQ Genoline NG system including a local operating panel (LOP).

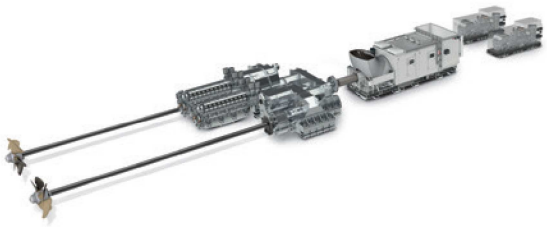


Propulsion systems

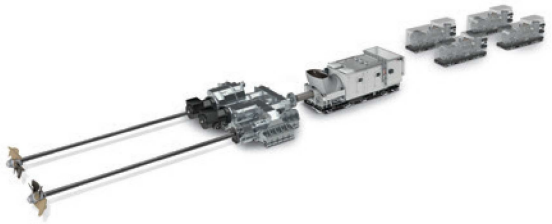
COMBINED PROPULSION SYSTEMS – CUSTOMIZED OPTIONS. 06

We can deliver combined propulsion systems customized to your needs. You can rely on us to design, build, and integrate the complete propulsion system including gearbox, shaftline, propeller/waterjet, and automation systems. Our engineers provide extensive analysis, documentation and risk reduction services, as well as integrated mechanical, electrical and electronic interfaces. Our propulsion systems demonstrate excellent reliability and flexibility. Our on-site engineers supervise the installation of the system, ensuring efficient propulsion system commissioning and trials. The automated control of the system is performed by the ***mtu*** NautIQ.

1 **CODAD (Combined diesel and diesel) with controllable pitch propellers, e.g. 4 x 20V 8000**
Four diesel engines power two controllable pitch propellers (CPP) through two main gearboxes. In cruising operation, one diesel engine powers both shafts; for maximum speed the other two diesel engines are also switched on.



2 **CODAG (Combined diesel and gas turbine) and CODOG (Combined diesel or gas turbine) with controllable pitch propellers, e.g. MT30 + 2 x 20V 8000**
Two diesel engines and/or a gas turbine power both CPPs through two main gearboxes and a cross-connect gearbox. If only one diesel engine or only the gas turbine is running, the two CPPs are equally powered through the cross-connect gearbox. If both diesel engines are running, this gearbox can be declutched. Using a two-stage gearbox, one diesel engine can bring the ship to cruising speed.
Top speed is reached with the gas turbine or diesel engines and gas turbine.



3 **CODelAG (Combined diesel electric and gas turbine) CODelOG (Combined diesel electric or gas turbine), e.g. MT30 + 2 x E-Engine**
The diesel engines drive generators, which produce electricity for two electric propulsion motors. A gas turbine drives two propeller shafts with CPPs via a gearbox either alone or in combination. The diesel-electric propulsion units ensure the cruising speed of the vessel. Maximum speed is reached when the propulsion system of the vessel runs in combined mode, i.e. diesel-electric plus gas turbine.

PROPULSION VARIANTS

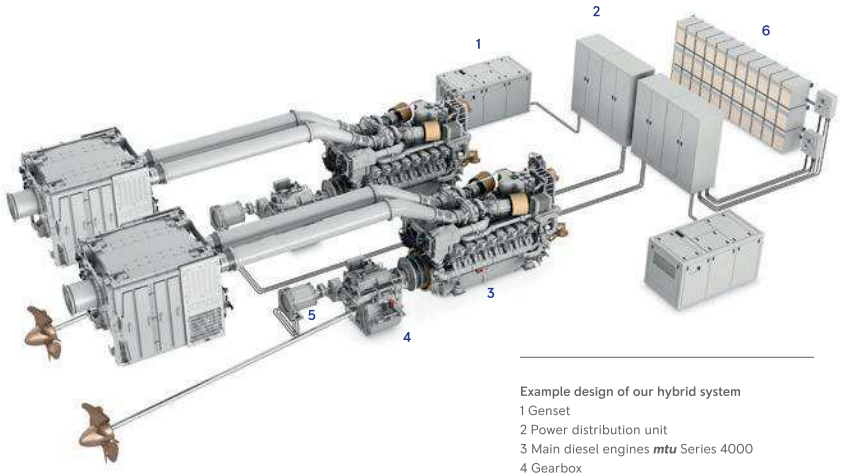
SiSo **s**ingle **i**n / **s**ingle **o**ut		
CODAD **Co**mbined **d**iesel **a**nd **d**iesel with controllable pitch propellers	—	**CODelAD** **Co**mbined **d**iesel **el**ectric **a**nd **d**iesel
CODAG **Co**mbined **d**iesel **a**nd **g**as turbine with controllable pitch propellers	—	**CODelAG** **Co**mbined **d**iesel **el**ectric **a**nd **g**as turbine
CODOG **Co**mbined **d**iesel **o**r **g**as turbine with controllable pitch propellers	—	**CODelOG** **Co**mbined **d**iesel **el**ectric **o**r **g**as turbine

E-Drive solutions

HIGHER PERFORMANCE. MORE FLEXIBILITY.

07

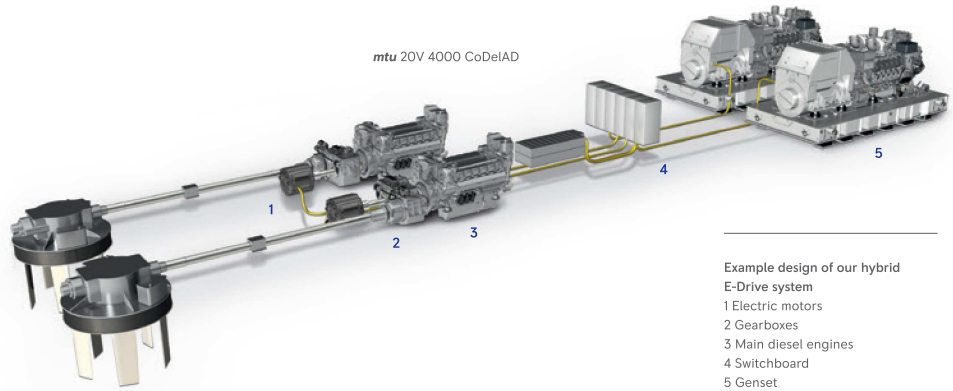
Hybrid PropulsionPacks based on the proven ***mtu*** Series 2000 and 4000 and E-Drive systems are ideal for more flexibility and maximum ease of use. What's more, conventional electric drive systems can be upgraded using optional battery modules to enable silent operations.



Example design of our hybrid system
1 Genset
2 Power distribution unit
3 Main diesel engines ***mtu*** Series 4000
4 Gearbox
5 Electric motor module
6 Battery module

mtu hybrid propulsion for patrol vessels
The main advantages of hybrid systems for marine applications is to optimizes the vessel's maneuverability through its high system redundancy and flexibility.
In addition hybrid system are improved in reducing noise and vibration, the ability to enter ECA (Emission Controlled Areas) and the reduction of life cycle costs for the diesel main propulsion system through ideal engine utilization.

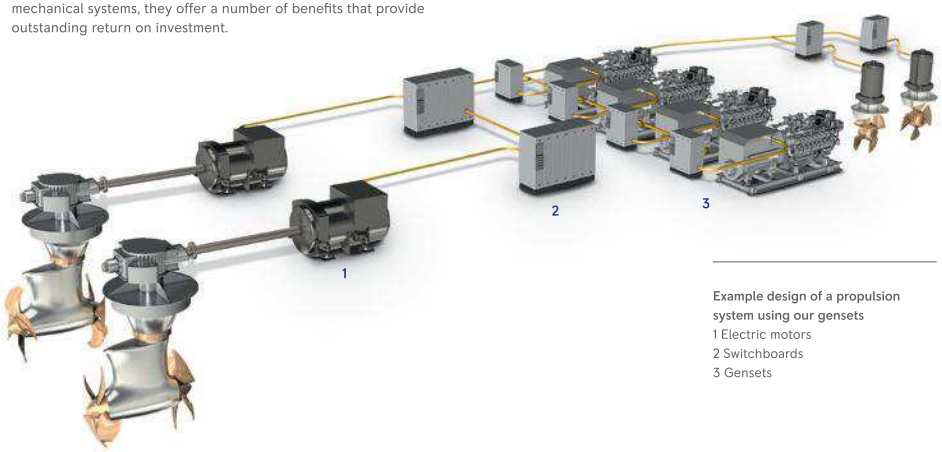
mtu 20V 4000 CoDeIAD



Example design of our hybrid E-Drive system
1 Electric motors
2 Gearboxes
3 Main diesel engines
4 Switchboard
5 Genset

Innovative E-Drive solutions
Our mechanical, electrical, logical, and thermal system integration engineering helps manage the complexity of E-Drive systems.
We design and supply customer-specific E-Drive systems including fully integrated automation systems based on the proven ***mtu*** Series 2000 and 4000 marine diesel engines. While E-Drive propulsion systems require a higher initial investment than standard diesel-mechanical systems, they offer a number of benefits that provide outstanding return on investment.

mtu 20V 4000 Diesel Electric Drive

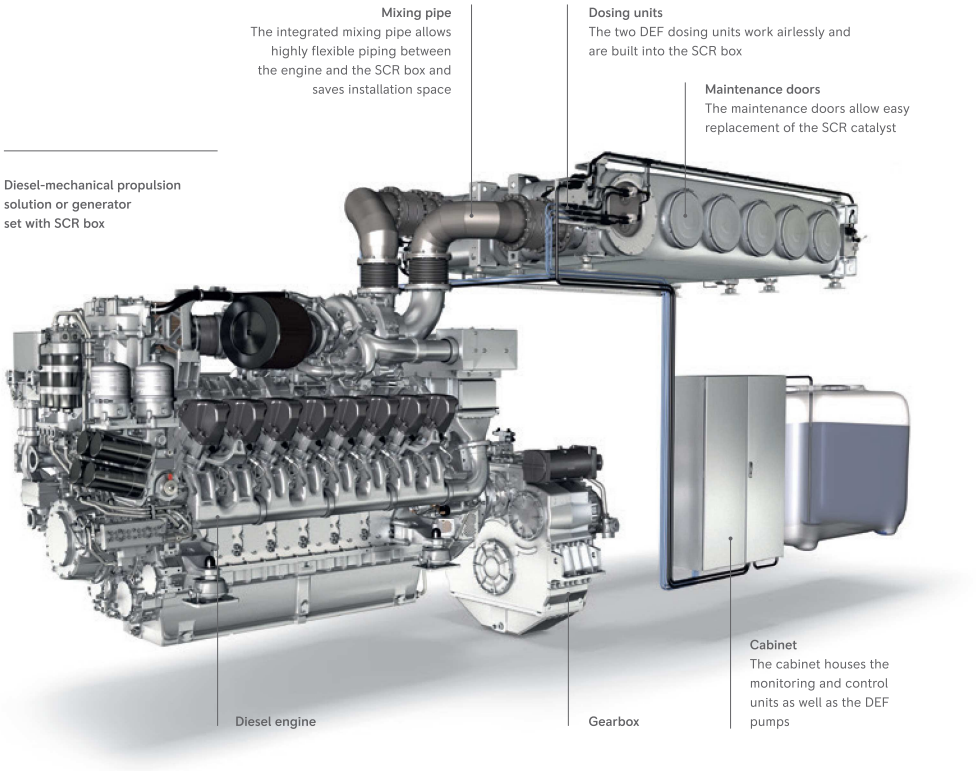


Example design of a propulsion system using our gensets
1 Electric motors
2 Switchboards
3 Gensets

Emission reduction technologies

LOW EMISSIONS. MAXIMUM FLEXIBILITY. 08

The sea is a sensitive environment. Assuming responsibility for protecting the water and air and keeping them clean is second nature to us. We have always played a leading role in developing environmentally friendly engines and, in particular, solutions for reducing emissions. All the key technologies are bundled within our company.



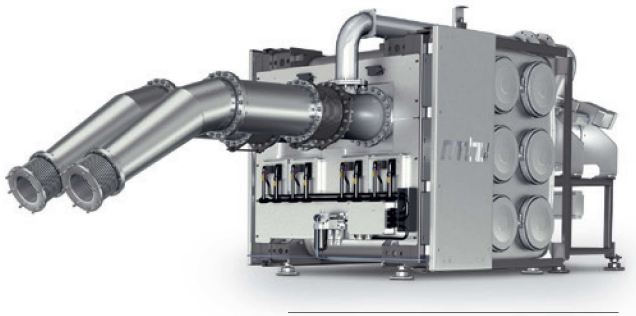
Selective catalytic reduction solution
The airless SCR (selective catalytic reduction) solution developed by us is compact and maintenance-friendly. It has easily accessible doors for the replacement of the SCR catalysts. Highly flexible pipework options make integration easy for the shipyard.

The extra space needed for the exhaust gas aftertreatment system is reduced to a bare minimum. Ammonia slip is prevented under all operating conditions by a closed loop regulated control system.

SCR – the ideal solution for the marine world
We regard SCR as the preferred solution to maintain the reliability of our engines and the safety of your vessel and crew. SCR technology allows lower-quality fuel to be used. As well as reducing emissions, our SCR system also helps achieve lower noise levels.

Developing all major key technologies – such as SCR, exhaust gas recirculation, turbocharging, and common rail fuel injection – in-house means we can design the ideal solution to meet IMO III and EPA Tier 4 emissions regulations.

Vertically arranged SCR box.

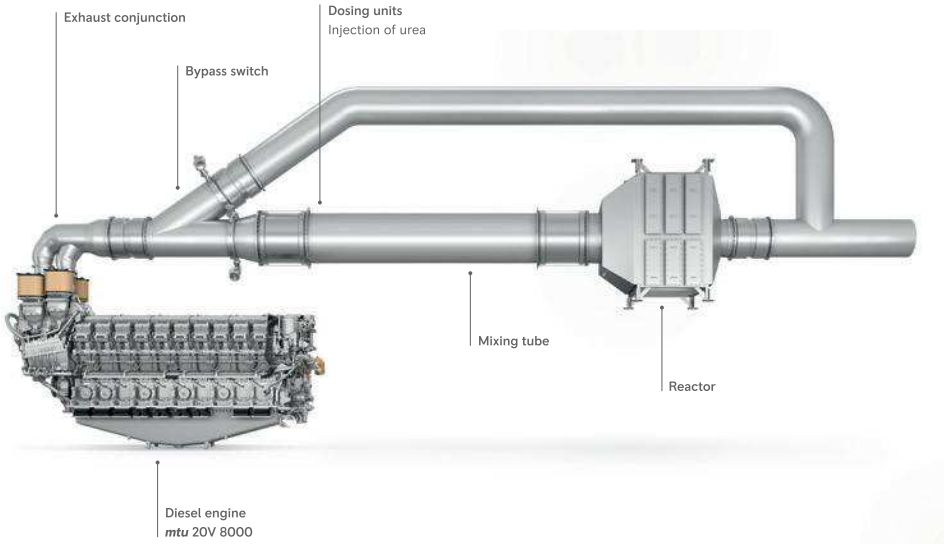


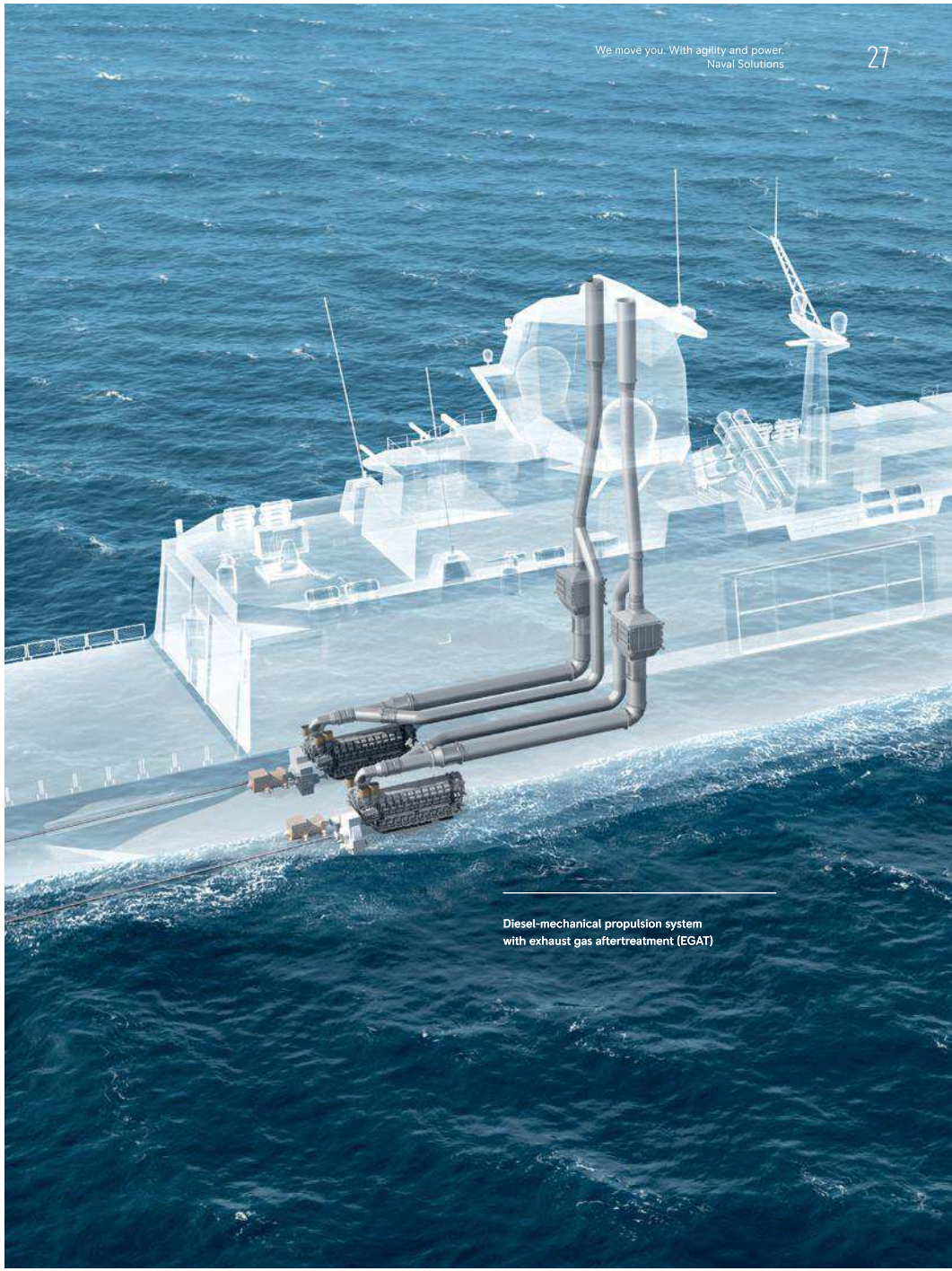
SCR box designed as a cube, for assembling in horizontal direction.

Emission reduction technologies

UMLIMITED POWER. LIMITED EMISSIONS.

With new-generation emissions technologies, we are once again combining the strongest performance with sustainability: We are further developing our proven large marine engines of the ***mtu*** Series 1163 and 8000 by equipping them with exhaust gas aftertreatment with SCR system to comply with the IMO Tier III emissions directive. With this step, we are continuing the journey towards net zero emissions.





Diesel-mechanical propulsion system with exhaust gas aftertreatment (EGAT)

Fuel solutions

ON THE COURSE TO NET ZERO.

Helping navies to achieve ambitious emissions targets requires solutions that are both innovative and individually adaptable. Our ***mtu*** engines already address emission reductions by meeting the highest standards in fuel efficiency. On top of that, we optimize our systems to support your journey to net zero by enabling the use of sustainable fuels.

Thanks to over one hundred years of experience in engine construction and systems business, our products continue to set new standards in power effciency, low fuel consumption and emissions. At the heart of our sustainable solutions is the development of innovative technologies and systems – as the basis for extremely sustainable, environmentally friendly products of the future. The focus is on engine effciency, alternative fuels, electrification, digitalization and fully integrated system compatibility. By 2023, our leading ***mtu*** Series 2000 and Series 4000 will be able to run on sustainable fuels.

Our roadmap fo climate-neutral naval solutions:

Sustainable fuels
- CO_2 reduced fuels by 2023 e.g. HVO (hydrotreated vegetable oil) with up 90 % reduced CO_2 emissions acc. to EN15940
- Onwards CO_2 neutral fuels based on Power-to-X technology e.g. e-Diesel, e-LNG, e-Methanol or Hydrogen

Efficiency improvement
- Further optimization of engines and systems for CO_2 and emission reduction

Integrated system solutions
- Optimization of the system solutions from bridge to propeller to the vessels mission profile

Digitalization
- Integrated automation solutions like ***mtu*** NautIQ Foresight EHMS
- Autonomous self-piloting capabilities

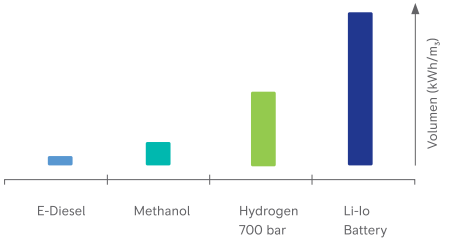
The Mission purpose is the key driver for the propulsion system arrangement.

E-Diesel
E-diesel is produced from CO_2 and green hydrogen mainly via the Fischer-Tropsch process, which is why this fuel is often referred to as Fischer-Tropsch diesel. Compared to fossil diesel, e-diesel contains hardly any sulfur and no aromatics. It also has a higher ignition propensity due to its chemical structure. As a result, it burns more cleanly and is better suited to storage. The energy density is almost comparable to that of fossil diesel.

Methanol
Methanol can be produced carbon-neutrally using the Power-to-X process. Here, hydrogen is synthesized with CO_2 in methanol. The energy density of methanol is high in comparison with hydrogen, and since the fuel is liquid at room temperature, it is very convenient to store and transfer. Even existing infrastructure can continue to be used in many cases. Unlike ammonia, methanol is not highly-toxic and is environmentally safe. Methanol can be used not just in diesel and spark-ignition combustion engines, but also in conjunction with zero-emission fuel cells. We're working on both products.

Hydrogen
Hydrogen is produced by a process of electrolysis applying electrical current to water. If this electricity comes from renewable sources, the product is referred to as green hydrogen. The fuel contains no carbon, so no CO_2 is released during combustion, the only by-product being – once again – water. However, hydrogen has a low energy density – if the necessary tank infrastructure is taken into account. It must be stored under high pressure or in liquid form at very low temperatures (minus 253 degrees Celsius). As early as 2022, our gas engines will be able to run on 25% hydrogen, and we expect to increase this percentage steadily until we reach 100% hydrogen operation.

Volume/weight ratio
The choice of the best technology depends on the specific vessel and operational profile and requirements. The volume/weight ratio is an important criterion for ship design.
E-Diesel propulsion continues to best meet the high performance power and energy density requirements for marine applications.
Methanol is a possible option if the mission allows the ship design or deployment to change.



Marine automation solutions

CONTROLLING THE POWER WITH *mtu* NautIQ SOLUTIONS

09

Our engines are powerful and technologically advanced. But in order to offer the best efficiency, reliability, safety, and environmental compatibility, they need more than just power. They need intelligent electronic management. Modern engine management systems handle the control and monitoring of the hardware and enable perfect performance. Our marine automation solutions ***mtu*** NautIQ are designed to offer the ideal combination of performance and precision individually for your applications from a wide range of solutions.

INTEGRATED SHIP AUTOMATION AND PERFORMANCE & EQUIPMENT HEALTH MANAGEMENT SOLUTIONS

mtu NautIQ Master
mtu NautIQ Core
mtu NautIQ Foresight

PROPULSION AND GENSET MONITORING & CONTROL SOLUTIONS

mtu NautIQ BlueVision NG
mtu NautIQ Genoline NG

REMOTE & AUTONOMOUS CONTROL SOLUTIONS

mtu NautIQ CoDirect
mtu NautIQ CoOperate
mtu NautIQ CoPilot

Scan the QR-code for more details about ***mtu*** NautIQ solutions portfolio

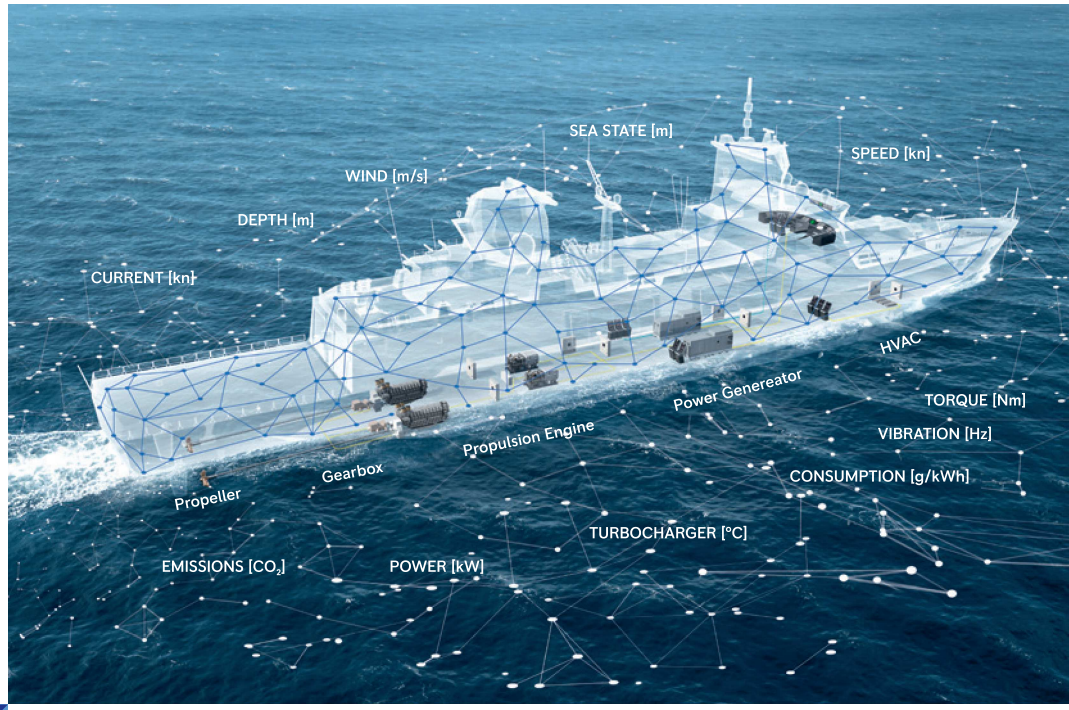
mtu NautIQ Foresight

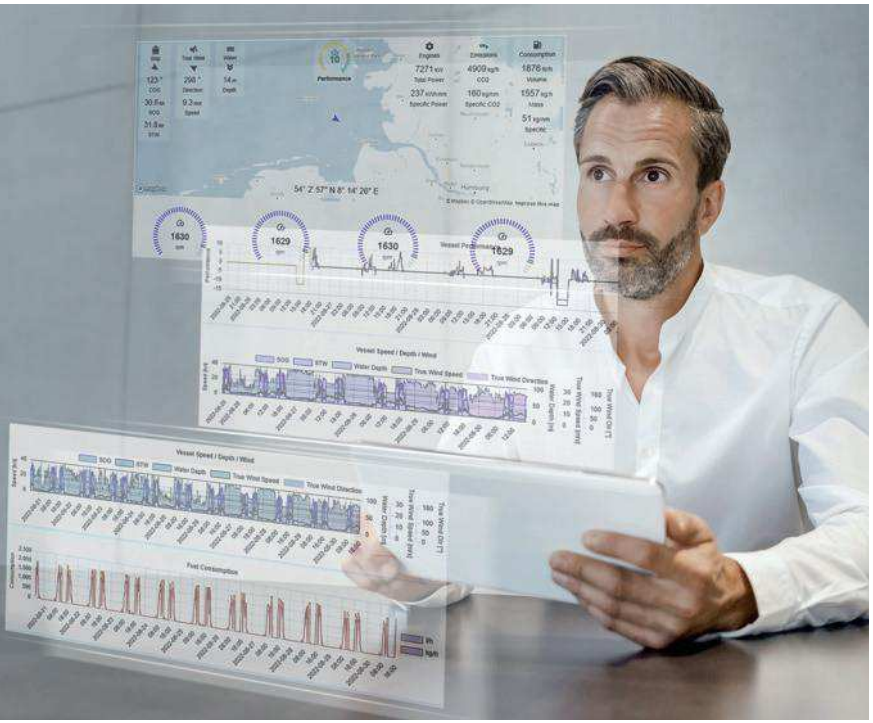
FROM BRIDGE TO PROPELLER

mtu NautIQ Foresight is an Equipment Health Management System. It allows you to monitor and have full control over the technical condition of your vessel from bridge to propeller.

The system maximizes the availability of your vessel, and you can even use it to monitor a whole fleet. By providing system status at a click, ***mtu*** NautIQ Foresight makes availability management easier than ever before. It provides support for the maintenance and upkeep 24 hours a day, 7 days a week – and thus helps minimize vessel downtime.

With ***mtu*** NautIQ Foresight you can collect and analyze data from ***mtu*** systems and third-party key components on the vessel, considering additional factors, such as navigational data.





Improved vessel availability
It's all about uptime. Real-time data analytics combined with artificial intelligence and machine learning techniques reduce unplanned downtime and maximize asset availability.
The real-time sensor data on vibration, pressure, and temperature is compared with long-term figures for the respective operating conditions and ideal characteristic curves. The results enable optimum operation.

Peaked performance
Monitoring fuel oil consumption and measuring torque is the first step to understanding the state of the vessel. This information, combined with the health monitoring data, allows you to analyze and improve the vessel's performance. Weather and navigational data let you draw conclusions about factors such as hull condition. Additionally, the optimal speed can be determined. This performance monitoring system enables fuel cost optimization and contributes to reduced emissions.

Optimized life cycle costs
Maximized availability and peaked performance optimize life cycle costs. Due to the improved plannability, downtimes are reduced to a minimum and unplanned maintenance is turned into planned maintenance.

Reduced emissions
mtu NautIQ Foresight bundles all operational data in one system. The combination of engine, power generation, navigational and weather data enable in-depth analytics of the vessel's movement and its performance. In the next step, the operation of the vessel can be adjusted to run in a more efficient and environment-friendly manner.

Scan the QR-code for more details about ***mtu*** NautIQ Foresight

mtu NautIQ Master

INTEGRATED PLATFORM MANAGEMENT SYSTEM

Scan the QR-code for more details about *mtu* NautIQ Master

mtu NautIQ Master is an Integrated Platform Management System and offers the optimal solutions to meet a wide range of needs for all types and sizes of vessels. Optimal for the special requirements of military and governmental vessels.

Integrated Platform Management System (IPMS)
With marine naval design becoming more sophisticated, and more capability being integrated with fewer people on board, only proven designs and software functionality can truly meet the demands within modern project time scales and risk profiles. As world experts in the field of integration, we introduce ***mtu*** NautIQ Master, the latest evolution of our powerful IPMS solution, allowing more COTS product integration. It is a true System of Systems capable platform.

This powerful mix of ***mtu*** NautIQ Master distributed processing and highly redundant architecture, coupled to industry standard equipment and protocols allows for a truly supportable platform, with minimal obsolescence risk. This reduces platform cost, integration time and commissioning/installation issues, whilst retaining the survivability and power of the original ***mtu*** NautIQ Master, with its scalability and flexibility in terms of system architecture.

- Multiple operator workstations
- Integratable Propulsion Control System (PCS)
- Damage Control System (DCS)
- Multi-level redundant networking including fibre optics
- Integratable Automatic Power Management System (APMS)
- Equipment Health Monitoring and Dynamic Analysis
- Remote Data Collection and Control Units
- On Board Training Systems (OBTS)

mtu **NautIQ Master overview**
mtu NautIQ Master offers advanced bespoke solutions designed to suit the complex automation and integration requirements for operators of specialist vessels.
mtu NautIQ Master is capable of providing a fully integrated turnkey electrical and automation solution, being a scalable and feature rich system capable of incorporating the following sub-systems and plug in modules:

- Navigation Bridge System
- Vessel Management System
- Communications
- Digital CCTV Surveillance
- Propulsion Control
- On Board Training System
- Power Management
- Condition Based Monitoring System
- Damage Control System

mtu NautIQ Core

ALARM, MONITORING AND CONTROL SYSTEM

Scan the QR-code for more details about *mtu* NautIQ Core

mtu NautIQ Core Alarm, Monitoring and Control System (AMCS) option is an entry-level system that offers a reliable and highly cost-effective solution and is designed using pre-engineered building blocks incorporating built-in expansion for future proofing. A selection of display systems are available to meet operational requirements and console design.

mtu NautIQ Core has been specifically created to deliver Commercial Off-The-Shelf (COTS) solutions for all shipping sectors including: bulk carriers, container ships, tankers, passenger ships, offshore support vessels, tugs and salvage vessels, inland waterway and small leisure craft. The standard ***mtu*** NautIQ Core packages are future-proofed allowing for later integration of additional hardware, software and auxillary equipment through the vessels lifetime.

Key Features:

Cost Efficient
- Placing Remote Terminal Units (RTU) near the process reduces cabling
- Pre-engineered solution reduces engineering costs
- Self-diagnostic features help to improve maintenance scheduling

User-Friendly
- Unified interface across devices
- Intuitive HMI
- Simple modular design

Flexible
- Option to interface with external systems
- Modular design allows for customisation
- Up to 50% expansion available within each RTU

Safe and Reliable
- Multiple levels of redundancy
- BITE safeguards the network while safeguards the vessels systems
- COTS hardware with no moving parts

mtu NautIQ Gate

Opens up a new world of connectivity
mtu NautIQ Gate has been specifically created to deliver compact and modular solutions for all shipping sectors including: smaller passenger ships, offshore support vessels, tugs and salvage vessels, inland waterway and luxury yachts. The standard ***mtu*** NautIQ Gate packages are future-proofed allowing for later integration of additional hardware, software and auxiliary equipment through the vessel's lifetime.

The ***mtu*** NautIQ Gate unit is the latest design from the ***mtu*** ship automation solutions featuring unparalleled flexibility across the entire range of legacy, current and future ***mtu*** NautIQ installations. The NautIQ Gate platform allows a single unit to be built with the correct number of interfaces. The ***mtu*** NautIQ Gate platform allows connection to Ethernet and/or ARCNET networks via single or preferably, dual interfaces. This allows ***mtu*** NautIQ Gate to function not only within any ***mtu*** NautIQ system but it can also be used to retrofit most other manufacturers' old, unsupportable systems.

Lifecycle solutions

OUR MISSION: OPTIMIZE YOUR FLEET AVAILABILITY AND UPTIME.

10

Integrated Logistics Support
Designed to meet the unique challenges of military operations, Integrated Logistics Support (ILS) offers customers a customized package that includes analysis, spare parts, training, and technical documentation. ILS keeps your ***mtu*** equipment up and running at the highest level of availability and reliability.

Our Integrated Logistics Support includes:
- RAM / LCC analysis
- Technical documentation
- Training
- Genuine spare parts and consumables

GENUINE SPARE PARTS

Only we can guarantee genuine spare parts that are designed, tested and approved specifically for ***mtu*** engines and systems to reach maximum uptime.

Genuine parts maximize performance, prolong engine life and meet today's strict requirements (e.g. emission regulations), all thanks to years of intensive research and development, quality audits, and progressive modifications – making them the best possible match for your engine and guaranteeing state-of-the-art technological fit. We offer a supply chain management, optimizing your purchasing and ordering processes.

Scan the QR-code for more information about our ***mtu*** lifecycle solutions.

Take advantage of broad benefits of *mtu* genuine spare parts:
- Engineered to secure high engine reliability and availabilty
- Value sustainability of your equipment / the only parts that live up to ***mtu*** standards
- Factory / OEM warranty coverage incl. professional service support
- Long-term supply solutions through the entire equipment lifetime
- State-of-the-art Parts Logistics Centers

Non-genuine parts are simply not worth the risk of endangering your mission.

TECHNICAL DOCUMENTATION

Our high-quality technical documentation is easy to understand and available at the right time, in the right place and in proper format.

Our technical documentation can be individualized to specific propulsion system configuration in order to support the optimal fleet availability by providing the appropriate technical specifications for seamless operations on board and onshore.

Scope of supply: Manuals for Operation, Maintenance, Repair and Workshop Spare Parts Catalogs

- Available in all standard structures and formats
- Fulfills specifications: ASD S1000D, ASD S2000M
- Material number codification in accordance with the customer standards for the entire lifecycle

Configuration Management
Configuration management at ***mtu*** solutions fulfills ISO 10007, STANAG 4159 and JSP886 in terms of content. Monitoring of design status and obsolescence to ensure supply availability and increase system availability with annual reports and updates of technical documentation. Logistic processes are ensured.

Scope of supply
Configuration management plan, obsolescence management plan, change memos if required, yearly reports and updates of technical documentation.

Interactive 3D Technology
New 3D visualization technology for systems, engines and components is available and fully interactive offering support for trainings with state-of-the-art technology for greater efficiency and clarity.

3D animated Maintenance Tasks
Animated step-by-step support for execution of maintenance and repair tasks. Format: HTML

Augmented Reality
AR for maintenance task descriptions with supportive functions and information.

Lifecycle solutions

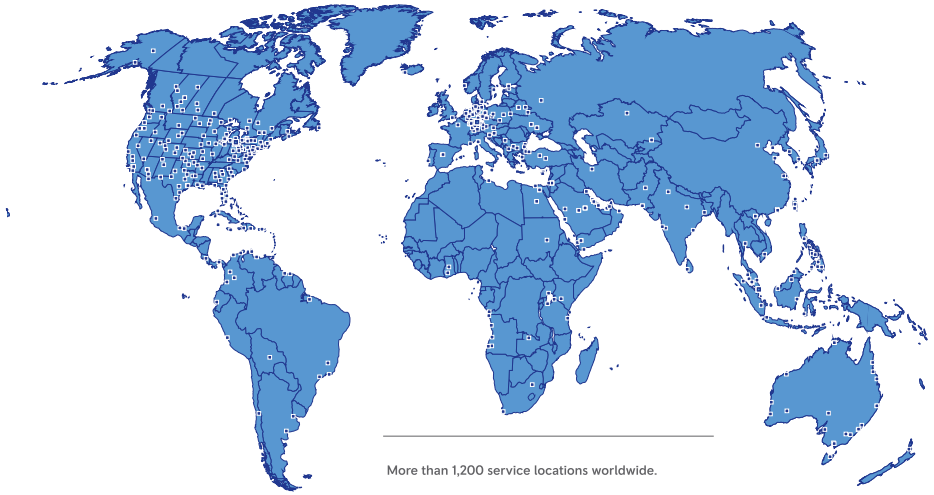
FACTORY OVERHAUL

Turn back the clock
mtu engines are built to last thanks to our high engineering standards and unwavering commitment to service and support. After a long and productive life, our factory overhaul can further extend it. Provided by the same experts who built the original engine, a factory overhaul restores it to like-new condition – delivering the same high standards of performance, service, life and quality as comparable new products.

- Full factory warranty of the overhauled engine up to 12/18 months
- Fixed pricing options available or on time and material basis
- Complete reworking of all components by original manufacturer / specialist department – e.g. crankshaft by OEM
- New design and model-related updates incorporated
- Comprehensive packages for complete systems, including gearbox, coupling, etc.
- Rigorous dynamometer testing under simulated customer-specific operating conditions

LOCAL SUPPORT – WORLDWIDE

The most important part of your power system isn't a part at all – it's your local service team. With more than 1,200 service locations worldwide – backed by our own regional Parts Logistics Centers in Europe, Asia, and America – you can count on responsive support by expert technicians, wherever the next mission takes you.



More than 1,200 service locations worldwide.

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