



KONGSBERG

# VESSEL PERFORMANCE OPTIMIZER

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COST EFFICIENT VESSEL OPERATION



# MAXIMIZING PERFORMANCE BY PROVIDING THE FULL PICTURE

## OUR MISSION

We shall earn the respect and recognition for our dedication to provide innovative and reliable marine electronics that ensure optimal operation at sea. By utilising and integrating our technology, experience and competencies in positioning, hydroacoustics, communication, control, navigation, simulation, and automation, we aim to give our customers The Full Picture. The Full Picture yields professional solutions and global services that make a difference enabling you to stay ahead of the competition.

## OUR PHILOSOPHY

Our success depends on the success of our customers. Actively listening to our customers and truly understanding their needs, and then translating these needs into successful products and solutions is central to achieving our goal. Our people are the key to our success and we empower them to achieve. Working together in a global network of knowledge, guided by our values, engenders innovation and world class performance. Every day we have to think a little differently, because every client is unique. We aspire to translate the imagination and dedication of our staff into successful technologies and solutions. Our commitment is to add value to your operations by providing you with The Full Picture.

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# KONGSBERG SYSTEM PHILOSOPHY

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## **A crystal clear solution**

KONGSBERG, as a supplier of integrated ship systems, plays an increasingly important role when optimizing the operation of vessels. Extensive investments in research and development have resulted in a modular concept, which will largely contribute to improved fuel efficiency and reduced emissions. The vessel performance concept takes a holistic approach where the overall perspective is combined with focus on operational improvements for both hull and engine.

When combined with the KONGSBERG ShipLoad 3-D vessel model based loading solution, information on the hull status to find the ideal draft and trim conditions for the voyage is provided for – a combination that will further increase fuel savings. When hull and engine is tuned, the K-Bridge voyage planning tool ensures that the sailing route is defined in the most favourable way - given the prevailing weather forecast.

## **It's the Combination that Counts**

In its quest to offer the best in environmental solutions for the shipping industry, KONGSBERG has teamed up with AVL List to offer an engine performance monitoring system that enables continuous monitoring of the engine condition and performance. In combination with the powerful decision support system, the engineers will have an easy to use tool for maintaining the engines at optimum performance.



### **Cutting operational costs**

*A holistic approach to improve ship performance reduces your operational costs and thus improves your competitiveness in sea transportation.*



# VESSEL PERFORMANCE

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## **Economical and ecological benefits**

The KONGSBERG Vessel Performance concept provides a set of tools that enables ship owners and operators to manage their vessels in ways that are more economical and ecologically beneficial, in compliance with safety regulations

These tools address specific areas for improvement. That includes engine and power optimization, hull performance, cargo/ballast management, route planning and speed profile optimization. Each of these parts contributes to a complete vessel performance picture, which forms the basis for meaningful adjustments by officers and operators.

The KONGSBERG Vessel Performance concept comprises two main modules, the engine performance and optimization module and the hull module.

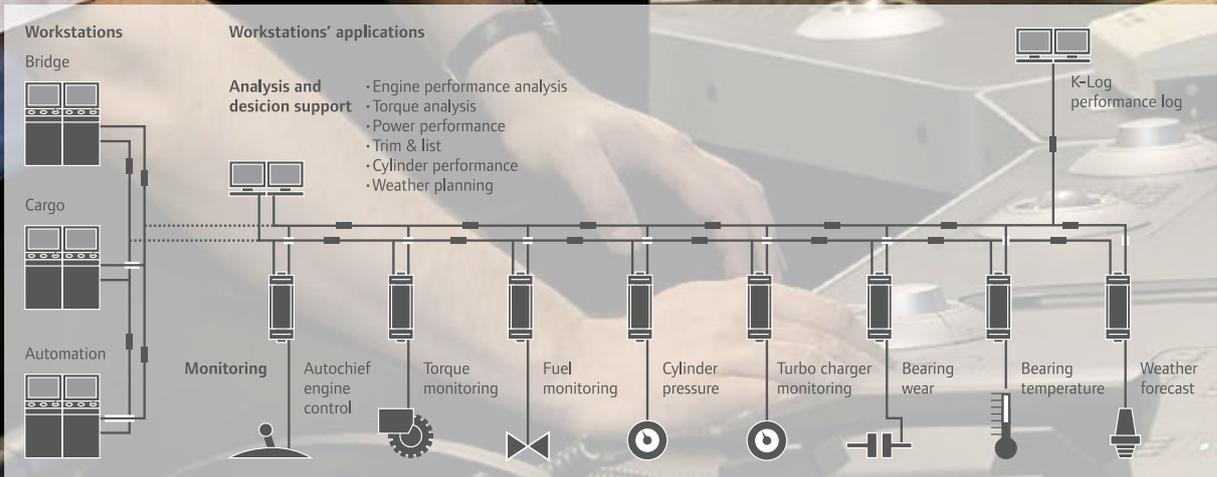
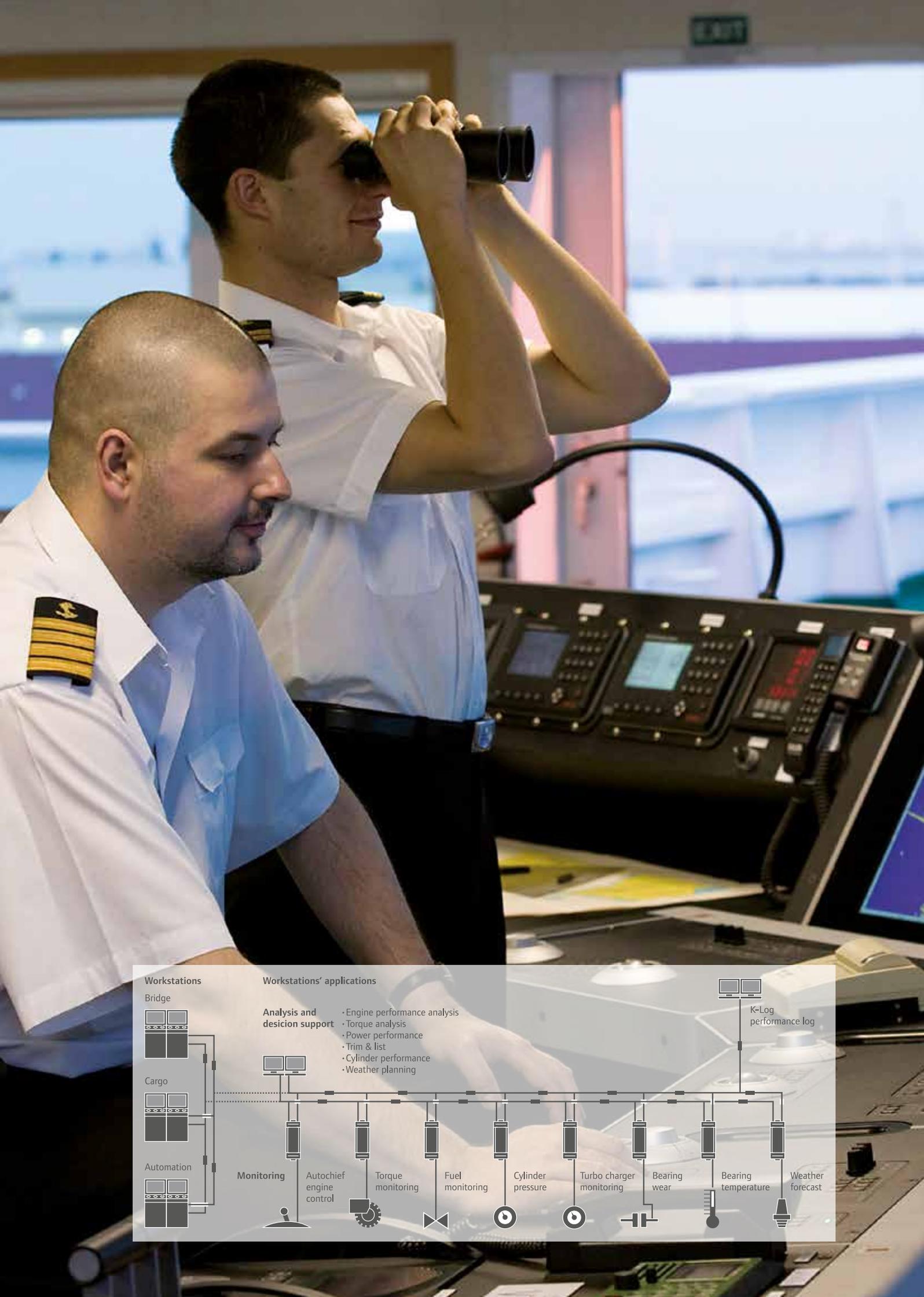
## **Engine optimization**

The engine performance and optimization module is an extension of the KONGSBERG AutoChief® bridge manoeuvring system (BMS). The AutoChief® BMS integrates the AVL engine performance and optimization system (AVL EPOS™) and the torque measurements as well as other performance monitoring sensors, providing a complete solution for engine monitoring.

## **Operational performance**

With KONGSBERG ShipLoad, the 3-D vessel model tool, KONGSBERG has developed a unique solution to manage loading and unloading operations. The system, already tested on board, undertakes calculations to ensure optimal loading and unloading of cargoes as well as ballasting. Combined with K-Bridge weather planning and an intelligent auto pilot, the system advice the mariners on optimal trim and cruising speed to arrive at the destination at the desired time of arrival with forecasted environmental conditions.





# ENGINE PERFORMANCE AND OPTIMIZATION

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## Reliable and efficient propulsion

From decades of experience with control of diesel engine and electric propulsion, AutoChief® BMS offer control solutions that optimizes propulsion prime movers to operate cost effectively, reliably, and with minimum exhaust emission. By integrating the AVL EPOS and other performance monitoring sensors, the AutoChief® BMS provide a complete solution for engine performance monitoring, including;

- BMS for slow and medium speed – fixed and controllable pitch propellers
- Continuous cylinder pressure data
- Torque data
- Fuel consumption
- Turbo charges monitoring

## In support of the operations

All the process and engine performance data is easily available from the AutoChief® control panel, giving the engineers real-time information about the engine condition. When integrated with the K-Chief alarm, monitoring and control systems, the engine performance and optimization module can be expanded to include a complete decision support solution, including a onboard and shorebased reporting system.

## Engine performance

The AVL engine performance and optimization system (AVL EPOS™) has brought the traditional engine condition monitoring a great leap forward. With the smart sensor, specially designed for monitoring of the cylinder pressure, permanent and continuously monitoring of the cylinder condition has been made possible. Years of design and operational experience has been analyzed and systemized in a decision support tool, which will assist in interpreting all the measured data. When combined with shop trial and sea trial data, the AVL EPOS™ will provide information of the engine condition and possible faults e.g.:

- Fuel injection system
- Combustion process
- Liner and piston behaviour
- Valves
- Turbocharger

The graphical users interface and diagnose algorithms provide the engineers with a tool and guide to maintain the engine at optimum condition. In addition, the engine condition information allows for better scheduling of the planned maintenance.

*The Digital Governor System is a complete governor solution – a stand-alone or fully integrated with AutoChief.*





The Control Panel is designed for ease of operation. An advanced, yet easy to use multifunction controller gives access to all system functions.

Integrated to K-Chief - AutoChief sequence view for MC engines.



## Real-time measuring

Proven new cylinder pressure sensors for permanent use with heavy fuel oil were developed and onboard tested. With the smart signal processing unit (SIU), sensor data from cylinder pressure, fuel sensors or other signals that are closely related to the rotation of the engine are processed in real-time.

## Analysis providing practical advice

The principle combustion analysis utilized by AVL EPOS™ is fully verified. The subsequent diagnosis algorithm bases on these empirical results and uses different state of the art methods such as redundancies and physical models.

Changing fuel quality is a challenge, to which AVL EPOS™ provides a practical advice – a detailed guide for adjustments of the engine tuning.

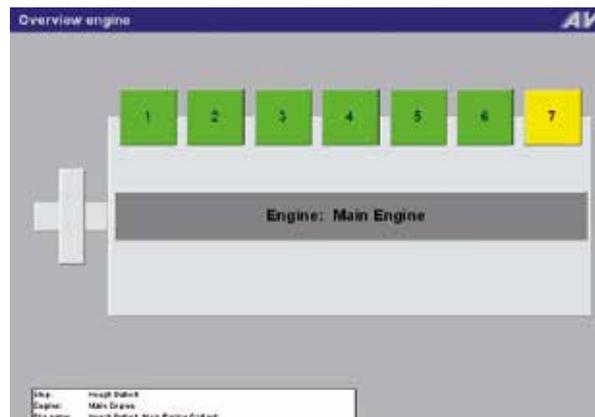
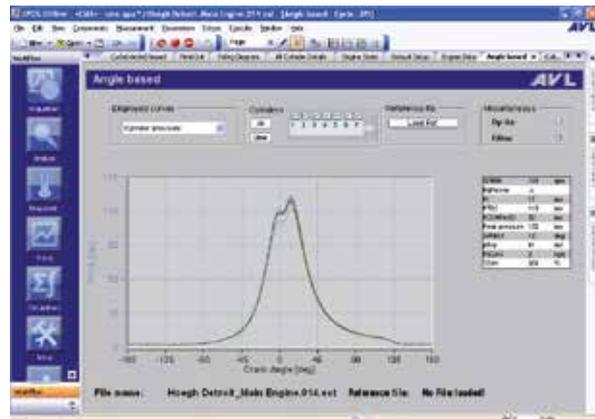
The graphical user interface provided by K-Chief shows measurement data and diagnosis in different detail. The diagnosis of a subsystem is reduced into a representative status for simple overview. The basic version available in the AutoChief® will display real-time information of the engine condition.

## Turbocharger monitoring

The turbocharger is a vital key to achieve optimal operation and performance of the diesel engine. Also, the turbocharger has proven to be the most exposed part of the engine when counting seizure incidents. By combining data from various process parameters/sensors on and around the turbocharger, the engine performance system is able to monitor the real work performance of the charger, and thus warn the operator about reduced efficiency before it shows as a mechanical degradation of the charger and/or higher thermal load on the engine.

## Power performance

The performance monitoring system provides the engineers with a fuel consumption monitoring tool to assess the operational economy of the vessels propulsion and auxiliary machineries. Momentary and accumulated values for fuel consumption and propeller shaft power during a roundtrip or sea voyage are available in K-Chief and in for reporting in K-Log.



### Torque and power measurement

The KONGSBERG MetaPower measures torque and power transferred from the main engines to the propellers. The MetaPower system offers high accuracy and long term stability.

The patented IR Laser technology utilized for measuring the torque provides very high accuracy, long term stability and long life time.

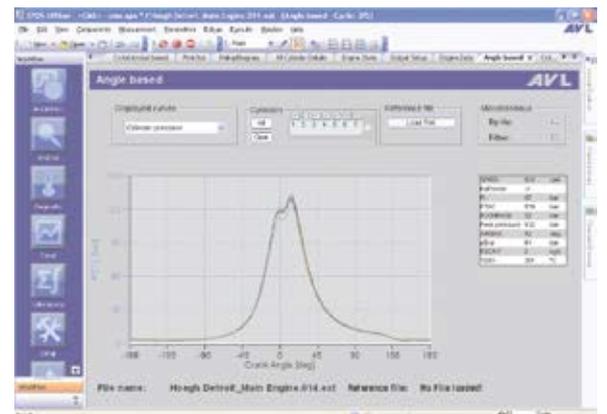
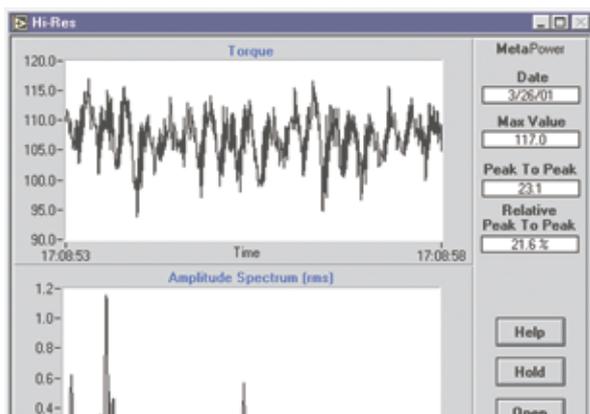
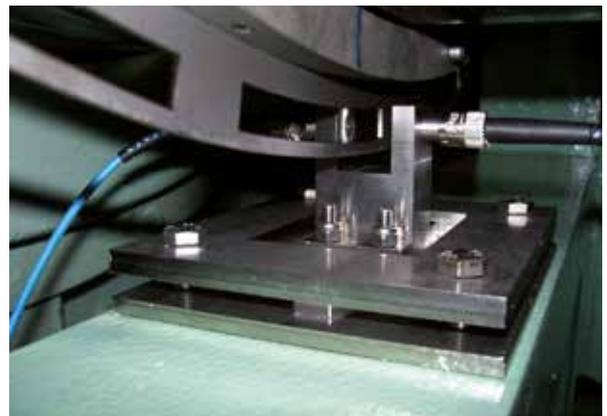
### High accuracy torque measurement

No need for strain gauges or any type of delicate electronics glued to, or mounted on the rotating shafts. The system is a digital measuring system using a IR laser beam for the detection of the shaft torque, the shaft RPM and consequently the transferred power

### Detailed information

Integrated with the AutoChief® BMS, the following data is provided

- Diagnostics of vessel performance based on excess fuel consumption
- Voyage summary report:
  - Duration of voyage
  - Distance sailed
  - Total fuel consumption
  - Accumulated power
  - Fuel efficiency
  - Hull efficiency
  - Overall efficiency







# RESEARCH AND DEVELOPMENT

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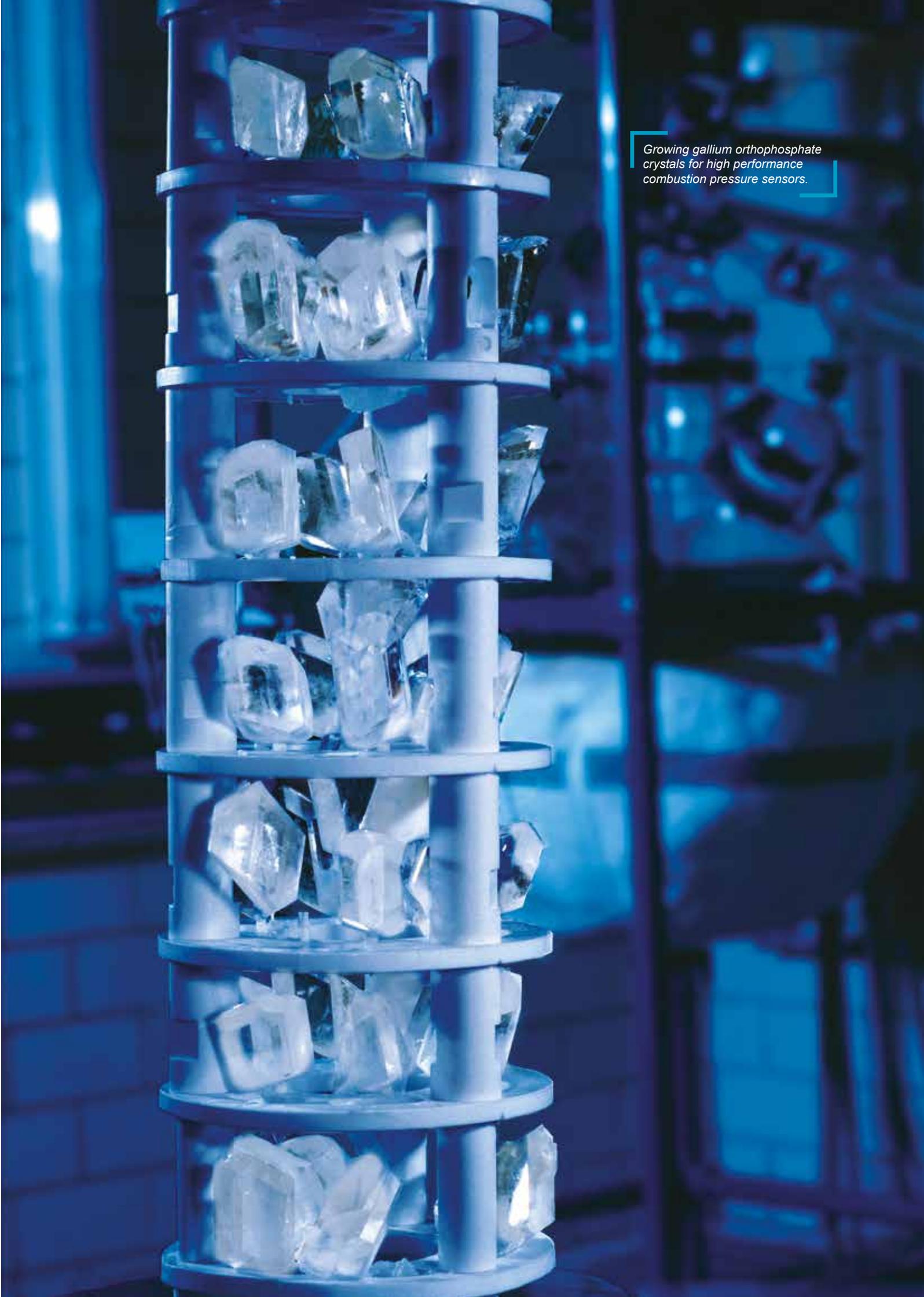
## **A breakthrough in sensor technology**

The greatest barrier to overcoming the challenge of continuous real-time monitoring of the cylinder pressure has been sensors, sensors that can withstand the high temperature in the cylinders. Quartz crystal based sensors have been tried, but have proven not suitable to perform effectively at temperatures exceeding 275 °C. AVL List has made a major breakthrough in sensor development, by being able to grow gallium orthophosphate crystals for high performance combustion pressure sensors. Sensors that can withstand temperatures in excess of 600 °C – just the sort of temperatures generated in the cylinder of your average engine – enabling continuous monitoring of the cylinder pressure.

## **Less consumption and lower emission**

In line with our environmental policy, we are developing a concept for optimal vessel performance that takes into account both the machinery onboard and the way the vessel is navigated - to ensure less consumption of fuel and lower emissions.





*Growing gallium orthophosphate  
crystals for high performance  
combustion pressure sensors.*

# OPERATIONAL PERFORMANCE

## Favourable vessel operation

While the engine performance and optimization module optimizes the engine and propulsion line, the operational performance module assist in optimal operation of the vessel. The operational module assist in finding the optimal vessel's speed, draft and trim, route and engine modes as well as enable weather planning to avoid unfavourable sailing conditions.

## Weather planning

The weather forecast can be used to predict areas where unfavourable conditions will develop. Based on the advice, sailing routes and time of departure can be adjusted.

## Vessel trim and loading

The KONGSBERG ShipLoad loading computer utilizes 3-D model of the vessels' hydrostatic - the full geometric definition of the vessels - as basis for the calculation of loading conditions, floating position and stability and longitudinal strength.

By utilizing the full geometrical definition as basis for the computation, several additional applications have been developed to improve the load planning, condition handling and hull performance. These are all applications that enable optimal usage of the vessel and thereby reduce the relative fuel consumption.

The KONGSBERG ShipLoad loading computer is available for several vessel applications:

- Tankers and FPSOs
- Container vessels
- Ferries and RoRo vessels
- Cruise vessels
- Supply vessels

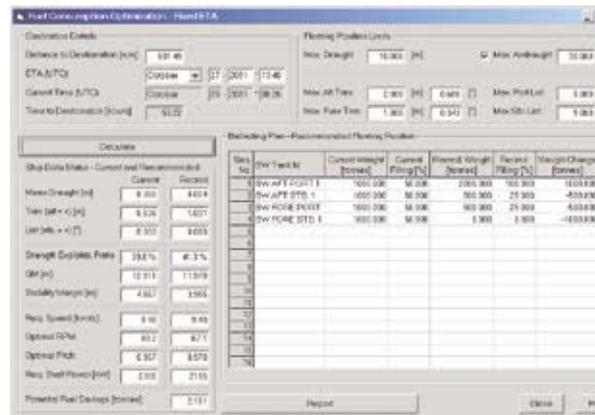
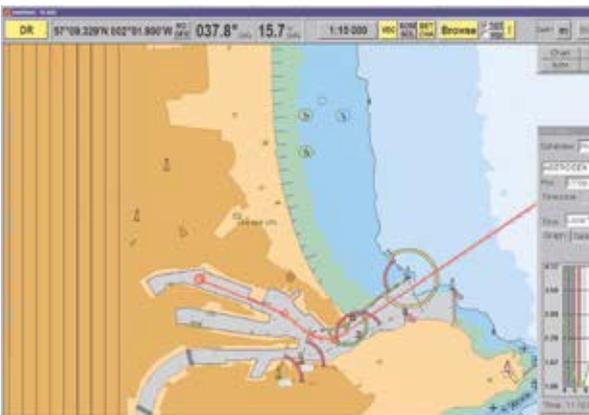
## High end applications

The basic version includes all the required functions and in addition provides optional applications, e.g.:

- Interface to and reading of tank level and trim and list data
- Integration to ballast control system for automated water ballast operations, including planning and automated water ballast exchange functions
- Integration to cargo control system for automated cargo operations

## Additional applications

- Damage stability computation, based on the actual vessel geometry and according to regulations
- Strength method, advanced hull calculations
- Emergency response version, a tool for userspecified damage cases.









# LIFE CYCLE SUPPORT

## Designed to purpose – maintained to last

Our life cycle management service will assist our customers throughout all the phases, from design to commissioning and during the operational life time. Solid in-house competence, both in system design and user competence enables us to provide solutions that are fit to purpose and thus yields efficiency in operation.

Our common base technology provides robust designs, with few and reliable parts, an excellent foundation to maximize the output at competitive costs.

The distributed and open system design employs an industry standard communication network. Standard hardware components used for various applications and the open network approach results in:

- Increased reliability
- Competitive life-cycle support
- Easy up-grade solutions

## Evergreen

We offer continuous hardware and software upgrade to keep your vessel at maximum efficiency. Our system is designed with consistent boundaries between individual systems and control segments. This design strategy makes it easy to add new functionality or complete new control segments thus enable us to offer up-grades step by step to keep your system evergreen.

## Training

Qualified personnel are one of your major assets in efficient and safe operations. Thus, we offer modular training courses for all major subjects – from operator training to technical training that keeps your crew fit on the job.

PLANNING & DESIGN	PROJECT ENGINEERING & DEVELOPMENT	INSTALLATION & COMMISSIONING	OPERATION & MAINTENANCE	MODERNISATION
		On-line support »		
		Technical	support »	
Technical consulting »				
	Design and	software engineering »		
			Field service »	
			Repairs	and spare parts »
			Optimization	and modernization »



### Supported by professionals

*Our systems are easy to install and maintain – supported by professionals either on-site or through remote connectivity. They are designed for optimal operational availability and allow for favourable lifecycle expenditure*

# GLOBAL CUSTOMER SUPPORT

We are always there, wherever you need us. KONGSBERG customer services organisation is designed to provide high-quality, global support, whenever and wherever it is needed. We are committed to providing easy access to support and service, and to responding promptly to your needs. Support and service activities are supervised from our headquarters in Norway, with service and support centres at strategic locations around the globe – where you are and the action is.

As part of our commitment to total customer satisfaction, we offer a wide variety of services to meet individual customers' operational needs. KONGSBERG support 24 is a solution designed to give round-the-clock support. For mission-critical operations, KONGSBERG support 24 can be extended to include remote monitoring. We can adapt the level of support needs by offering service agreements, on-site spare part stocks and quick on-site response arrangements.



## Global and local support

We provide global support from local service and support facilities at strategic locations world wide. Service and support work is carried out under the supervision of your personal account manager, who will ensure that you receive high-quality service and support where and when you need it.

Your account manager will ensure continuity and work closely with your personnel to improve and optimise system availability and performance. Under the direction of your account manager, and with a local inventory of spare parts, our wellqualified field service engineers will be able to help you quickly and effectively.

## SUPPORT 24

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