Vessel Information and Control - VICO
Introducing power of integration with marine automation, energy efficiency and safety
In the thousands of years that humans have sailed the oceans marine technology has gone through a number of astonishing changes. This decade will see a significant evolution, with a new wave of technology featuring software that utilizes all available data from intelligent ship equipment.

This technological opportunity, together with high fuel prices and stringent safety and environmental demands, are the main drivers behind ABB’s Vessel Information and Control solutions - VICO. The VICO product portfolio creates the opportunity for seamless information flow and collaborative operations – from the engine room all the way up to the boardroom.

Some 90 percent of global trade by volume is transported by sea, and the boom in international trade over the past decade has pushed the industry’s carbon emissions to more than 3 percent of global emissions - comparable to a major national economy. Today fuel costs account for up to 80% of a vessel’s operating costs, and new global and regional environmental regulations are challenging ship owners and operators to make energy efficiency their top priority.

By combining state-of-the-art integrated automation systems with unique fleet-wide advisory and performance management solutions, we help our customers improve their vessels’ energy efficiency, availability and overall safety.

Meeting industry challenges
ABB’s VICO portfolio of solutions consists of a broad range of advisory and fleet management reporting solutions, integrated automation, vessel management and control systems, and marine instrumentation and sensors. All of these help our customers meet the challenges of high fuel costs, stricter environmental and safety regulations, shortage of qualified crew and an ever-tighter competitive environment.

“...to keep you ahead of the fleet

More intelligent vessels...

...to keep you ahead of the fleet

“We are committed to the development of cutting-edge technology for our marine customers so that they can meet their operational efficiency and environmental goals.”

Rami-Johan Jokela, Head of Vessel Information and Control Systems for ABB’s Marine and Cranes business unit

Some 90 percent of global trade by volume is transported by sea, and the boom in international trade over the past decade has pushed the industry’s carbon emissions to more than 3 percent of global emissions - comparable to a major national economy. Today fuel costs account for up to 80% of a vessel’s operating costs, and new global and regional environmental regulations are challenging ship owners and operators to make energy efficiency their top priority.

ABB sets the new standard in marine automation & performance management

Meeting industry challenges
ABB’s VICO portfolio of solutions consists of a broad range of advisory and fleet management reporting solutions, integrated automation, vessel management and control systems, and marine instrumentation and sensors. All of these help our customers meet the challenges of high fuel costs, stricter environmental and safety regulations, shortage of qualified crew and an ever-tighter competitive environment.

“...to keep you ahead of the fleet

More intelligent vessels...

...to keep you ahead of the fleet

“We are committed to the development of cutting-edge technology for our marine customers so that they can meet their operational efficiency and environmental goals.”

Rami-Johan Jokela, Head of Vessel Information and Control Systems for ABB’s Marine and Cranes business unit

Some 90 percent of global trade by volume is transported by sea, and the boom in international trade over the past decade has pushed the industry’s carbon emissions to more than 3 percent of global emissions - comparable to a major national economy. Today fuel costs account for up to 80% of a vessel’s operating costs, and new global and regional environmental regulations are challenging ship owners and operators to make energy efficiency their top priority.
The power of integration

ABB offers integrated power & control solutions for a broad spectrum of vessel types including passenger ships, oil & gas exploration vessels, LNG carriers, tankers, dry cargo ships and ice-going vessels. Based on our world-leading automation platform, we deliver seamlessly integrated solutions where energy-efficient electric power and propulsion systems are combined with advanced software tools to optimize operations, energy consumption and safety.

Information integration and optimization

ABB has unique expertise covering all three fields of marine technology – the propulsion systems that drive vessels, the electrical systems that power them, and the automation and advisory systems that control and optimize them.

This expertise enables ABB to provide vertically integrated solutions that collect and process data from all ship components and systems. For example, by combining data from intelligent equipment such as drives, protection relays and motors with information like speed, wind, waves and the weather forecast, we can optimize a vessel’s operation and save energy.

But we don’t stop there. Via online satellite communication we provide owners and operators with full insight into how the vessel and its energy consumption processes are performing. Giving the shipping company the ability to elevate planning, monitoring and vessel benchmarking to a new level.

Tighter integration increases safety and reliability

Integration is about more than costs – it’s also a matter of equipment integrity, availability and overall vessel safety. As a vendor of both the electric power system and the automation system we are in a unique position to integrate these two worlds together in a way which both cuts costs and enhances safety.

Single-screen access to all electric power information ensures that the chief engineers always get the full picture, simplifying both daily operations and more in-depth tasks, such as post-incident analysis and root cause identification.

Another important integration benefit is the use of new communication technology such as IEC 61850 and Profinet/Profinet which ensure very fast communication between the electric systems and the control system, providing more diagnostic information.

The integration of Asset Management and the use of our Remote Diagnostic Services are other ways an integrated solution improves overall ship reliability and maintainability.

Key benefits of sailing with ABB’s Vessel Information and Control solution onboard:

- Provide visibility of Key Performance Indicators
- Integration of power and automation
- Improvement of energy efficiency
- Optimization of vessel operations and performance
- Operational safety
- Onboard equipment reliability and availability
- Easy to use and simple to maintain
- Asset management and optimization
- Increased operator efficiency
- Lower life cycle costs

An integrated ABB solution - propulsion, power, automation and advisory systems - can slash fuel costs by up to 20%.
Energy Efficiency and Advisory Systems

ABB’s Advisory Systems is a unique product portfolio for performance management in marine operations. It reduces fuel consumption and emissions, and increases availability and safety on a single vessel, or on a whole fleet of vessels.

It is important to take energy efficiency, availability and safety into account during the design process of a new vessel or when planning the retrofit of an existing vessel. For shipyards to stay competitive it is becoming more and more critical to think about the long term benefits for owners and operators.

To help shipping companies operate their fleets of ships with the best possible energy efficiency, environmental responsibility and safety, we have developed ABB’s Advisory Systems. This unique performance management solution consists of two product lines which can be combined in any configuration to fit the vessel type and operational profile perfectly.

The first product line, EMMA™ Advisory Suite, includes energy related monitoring and optimization tools. The second line, OCTOPUS Advisory Suite, provides solutions to improve availability and safety of sea-going vessels during weather-sensitive operations.

Energy savings and pay-back time

The energy management software informs a vessel’s operator where and how efficiently every drop of fuel is consumed. This knowledge creates an awareness of a ship’s energy consumption and enables benchmarks to be set and best practices to be targeted. In addition, advanced optimization tools provide instant energy savings through optimization of complex onboard processes such as trim, speed/rpm, power plant and hull fouling.

As an example, a combined solution for optimizing the dynamic trim and speed/rpm can easily save up to 7% of propulsion energy costs. On a large 13 000 TEU container vessel, this means a payback time as short as two months after the initial system implementation and vessel adaptation is completed.

Today fuel costs account for up to 80% of a vessel’s operating costs, challenging ship owners and operators to make energy efficiency their top priority.

“With the implementation of an energy management system aboard our ships, we are setting up Rickmers for sustainability in two ways – increasing energy efficiency means increasing profitability and reducing our carbon footprint at the same time.”

Björn Sprotte, Managing Director of Rickmers Shipmanagement
EMMA™ - minimize energy consumption

The EMMA™ Advisory Suite is a decision-support tool to minimize the overall energy costs for individual vessels and whole fleets. It compares and analyzes the historical and current operational data of the vessel, then calculates and advises on areas for improvement with easy-to-understand displays. The solution consists of onboard & onshore modules for energy monitoring and optimization.

Energy and Performance Monitoring
EMMA™ continuously assesses the vessel’s energy performance based on real-time energy, fuel and process data. By keeping power consumption within the recommended Key Performance Indicator limits, individual crew members can appreciate their own impact on the vessel’s energy efficiency. EMMA™ uses ground-breaking adaptive target calculations to compare the performance with targets, taking into account the actual speed, loading condition and surrounding weather.

Fleet Management
ABB’s fleet management tool offers a modern cloud-based service for fleet management. The target audience for the fleet management tool is the head office personnel of the shipping company, from technical personnel to the top fleet management tool is the head office personnel of the service for fleet management. The target audience for the ABB’s fleet management tool offers a modern cloud-based service for fleet management.

EMMA™ Advanced Optimizer offers a range of advanced energy optimization tools:

Trim Optimization
EMMA’s dynamic trim optimization with easy-to-use displays is a good example of the self-learning and adaptive algorithm ABB has developed. With this solution the operating crew will receive advice on the optimum trim in any operating conditions, including variations in speed, draft, water depth, wind and waves. Depending on the vessel type and operational profile, the savings potential can be up to 5% of propulsion energy cost.

Power Plant Optimization
EMMA™ helps the operator to control and manage the optimum energy balance onboard. EMMA’s power plant optimization tool includes a model of all the energy producers onboard, forecasting the capability for the required load. It calculates and advises the optimum load sharing between the various producers such as diesel generators, shaft motors, main engine, waste-heat recovery and batteries.

Fouling Management - Hull Cleaning and Scheduling
ABB has developed an office-based tool, accessible through the Fleet Control module, which estimates and forecasts the hull and propeller fouling. This is based on EMMA’s advanced data model of the vessel which enables an exact propulsion power breakdown. The Fouling Management tool helps to plan the cleaning schedule and to calculate the return on investment.

Screen shot from EMMA™ Trim optimization

Speed optimization
Fluctuations in propeller RPM is a source of significant energy losses. A recent customer study shows that the fluctuations in RPM cause an average of 4.7% losses in propulsion energy costs. Using EMMA’s speed/RPM advice the losses reduce significantly to only 1%, improving the propulsion energy consumption by 3.7%. The optimum speed/RPM profile is calculated by using intended route, required ETA, weather forecast and vessel characteristics.

OCTOPUS - maximize availability & safety

OCTOPUS Advisory Suite is a comprehensive motion monitoring, forecasting and decision-support toolkit which improves availability and safety of sea-going vessels during weather-sensitive operations. OCTOPUS is developed by Amarcon, a fully owned subsidiary of ABB, and is the industry leader in vessel motion prediction solutions.

OCTOPUS Advisory Suite is a decision-support tool to minimize the overall energy costs for individual vessels and whole fleets. It compares and analyzes the historical and current operational data of the vessel, then calculates and advises on areas for improvement with easy-to-understand displays. The solution consists of onboard & onshore modules for energy monitoring and optimization.

OCTOPUS - Motion Monitoring & Forecasting
World-leading shipping companies have used OCTOPUS since 2003 for route planning and optimization of speed, heading and fuel consumption in every weather condition. OCTOPUS offers a simple user interface and simplifies the main tasks of the officer on watch, by giving support for safe and economic navigation, damage avoidance and route planning.

OCTOPUS gathers information about the vessel, the route or operational plan, the loading conditions, vessel-specific limitations and the weather. It uses this data to provide advice on maximizing operability, whilst guaranteeing the safety of vessel, crew and cargo. Enhancing the crew’s awareness will extend the lifetime of the vessel, thereby reducing the total cost of ownership and giving a better return on investment.

DP Capability Forecasting
For vessels equipped with a Dynamic Positioning system, OCTOPUS provides a DP capability function which gives offshore vessels the possibility to make optimum use of a safe time-window for their weather-sensitive operations. A forecast is given as to whether or not the vessel is capable of maintaining her position and heading in changing environmental and weather conditions, hours and days ahead.

This leads to maximized workability and more productive hours during operations where the DP system is used. The calculations are based on the thruster properties in combination with measured environmental conditions and weather forecasts which are an integral part of OCTOPUS.

OCTOPUS carries out continuous monitoring, simulation and forecasting of the ship’s responses and performance.

Sloshing Prevention for LNG vessels
The sloshing advisory function is an advanced module within OCTOPUS providing warning of the risk of sloshing in LNG vessels. It provides advice to the crew so that the optimum route without risk for sloshing can be chosen and time savings can be achieved. This is calculated by combining the motion measurements or forecasts with GTT model test results for determination of sloshing criteria. Sloshing can cause damages to the LNG membrane tanks resulting in long downtime for the repairs. The OCTOPUS sloshing advice is a must for all LNG vessels to ensure safety and availability of the vessel at all times.
Marine Automation

TUI Cruises’ two new-builds - Mein Schiff 3 & 4 - will reap the benefits of fully integrated ABB solutions.

With ABB’s System 800xA, the crew enjoy a fully integrated ship where all systems and equipment work seamlessly together, operated from a single user environment.

"Our customers are seeing the benefits of partnering with one experienced supplier for their integrated automation and energy management solution. With higher demands for emission reduction and fuel efficiency, and strong growth prediction for electrical and hybrid propulsion systems, integrated automation solutions will be the key to reaching the full potential of a greener vessel operation."

Kjetil Stenersen, Head of Marine Automation for ABB’s Marine and Cranes business unit

The market is requesting integration between power and automation more than ever. With higher demands for emission reduction and fuel efficiency, and strong growth prediction for electric and hybrid propulsion systems, integrated automation solutions will be the key to reaching the full potential of a greener vessel operation. ABB offers a complete set of solutions and services to meet our marine customers’ automation needs whether in relation to new systems, modernizing existing, or integrating multiple systems.

800xA Extended Automation
- maximizes performance and profitability

Our Marine Automation solutions are based on ABB’s System 800xA – recognized as the world’s leading industrial automation platform. It represents state-of-the-art control, safety and communication technology, operator interface, engineering and maintenance tools. Based on this unique integration platform we offer systems and services to meet any marine automation needs.

An integrated ABB Marine automation solution gives distinct advantages compared to solutions based on stand-alone systems. By integrating electric power, propulsion, onboard processes, and asset and performance management systems with the onboard control and safety system, overall vessel effectiveness, availability and safety are increased.

Compact Automation
- standardized and cost-effective

ABB offers a Compact Automation solution designed for smaller vessels and merchant vessels which need an advanced but straightforward Vessel Management System with alarm, monitoring and control functions. It is built on the same hardware platform as 800xA, but scaled down to fit more limited requirements for system size and functionality.

Key benefits of an Integrated Automation System from ABB:
- Intuitive, single-screen access to all information needed to operate the vessel more effectively and safely
- Tight vertical integration with the electric power and propulsion systems reduces investment costs, optimizes maintenance and improves power control and equipment availability
- An integrated certified safety system increases overall safety, saves space and reduces training expenses
- Ship-wide, real-time condition monitoring of critical assets reduces maintenance costs and increases vessel uptime
- Connectivity to advanced performance management systems increases vessel efficiency and profitability
- Reduced cabling and standard swappable components minimize both installation and life cycle costs

ABB Integrated Automation System enhances overall vessel effectiveness and reduces energy consumption and environmental impact.
Empower your ship with the world’s leading automation system

ABB’s System 800xA is scaleable and configurable for any size of marine application and any functionality your vessel may require.

**Power & Energy Management**

ABB’s Power Management System (PMS) is the core of a vessel’s combined power and control system. It ensures optimal use of the vessel’s total power resources in a safe, energy efficient and environmentally-friendly manner.

The PMS is closely integrated with the electrical system by use of high speed communication within ABB’s switchboards, protection devices and controllers. This embedded solution gives full control from power generation to the end user – whether a propulsion system, a DP system, a drilling system or other onboard processes.

ABB’s Power Energy Management System (PEMS) is an advanced control solution prepared for new and alternative energy sources. In addition to ensuring stability of a DC-power grid, it also optimizes available sources to provide maximum performance and energy cost-effectiveness.

ABB’s Diesel Generator Monitoring Systems (DGMS) provides an additional layer of protection against blackouts of marine installations. It supervises the entire power plant, and takes action if other systems fail, thus preventing cascade faults from occurring.

**Safety Systems**

System 800xA offers a complete Safety Instrumented System (SIS) solution, complying with the IEC 61508 and IEC 61511 standards, and is up to SIL3 approved. This is the foundation for the ABB Marine Fire & Gas system which provides early detections of fire or gas hazards, reliable warnings to operators, and the means to avoid hazardous situations. The ABB Marine Emergency Shut Down system prevents or minimizes the consequences of emergency situations, helping to avoid loss of human life, damage to the environment, and/or loss of equipment.

**Dynamic Positioning (DP) integration**

ABB has broad experience in interfacing thruster control and power plants with DP systems. With few, clearly defined interface signals, vessel integrity is maintained without compromising independent system functionality.

**Vessel Management System**

An ABB Integrated Automation System efficiently manages the control, monitoring and alarms of the entire ship’s marine systems. It can also include asset management and predictive equipment maintenance routines.

The ABB Propulsion Control System (PCS) provides comprehensive propulsion control and monitoring for vessels with electric propulsion. ABB provides a Remote Control System (RCS) and the Intelligent Maneuvering Interface (IMI) for interfacing the PCS. This includes levers, buttons and panels that enable the officers to give commands for propulsion and steering.

**Process Control**

ABB has developed a wide spectrum of process control solutions for specific vessel types. This includes, for example, process solutions for LNG carriers, oil and gas drilling vessels, dredgers and large passenger vessels with extensive HVAC demands.
Upgrades and retrofits of marine applications avoid issues associated with obsolescence, performance and regulatory standards. Modernization of existing systems and equipment with the most state-of-the-art components will not only optimize technical and operational performance but also extend the remaining lifetime. Compared to the cost of full renewal, this is a very economical choice. On top of that, additional fuel savings of up to 7% can be achieved with ABB’s Energy Efficiency solutions.

We have decades of experience and highly specialized people to design automation retrofits and provide upgrading solutions for any size or type of marine applications. The modernization package includes everything needed to achieve a successful upgrade of the vessel – from the first ship’s audit to the final turn-key delivery of the project. ABB’s technical competence guarantees timely completion of the modernization project, keeping downtime to an absolute minimum.

Remote Diagnostic Services
To enhance the quality and efficiency of our services while lowering service costs, ABB offers a remote service concept – RDS. RDS is a diagnostic tool providing troubleshooting and condition monitoring for electrical, control and mechanical systems installed onboard. It is linked to ABB’s support center which operates 24/7.

Sensors and Instrumentation

ABB delivers a broad spectrum of sensors and instrumentation solutions that complete our offer within advisory systems and automation solutions. We supply a unique selection of highly developed sensors and instrumentation solutions designed specifically for ship performance management. In addition, our product range includes level gauges and temperature, pressure, and flow sensors for nearly every application.

Examples of sensor and instrumentation solutions from ABB:

1. **Cylmate® cylinder pressure transmitter**
2. **EMMA™ Inclinometer**
3. **CoriolisMaster mass flowmeter**
4. **Torductor® shaft torque meter**

**Cylmate® Advanced Engine Monitoring**
A comprehensive system for continuous engine performance measurement and performance monitoring of large 2-stroke diesel engines.

**EMMA™ Inclinometers**
An advanced three-axis precision inclinometer used for exact measurement of tilting of vessels. Data is transmitted and received over RS485 ModBus communication.

**EMMA™ Draft Radar**
This sensor is used to find out the draft of the ship even when sailing at high seas, and for evaluating the wave height. It is installed in the EMMA trim optimizing system, when the existing draft measurement system does not provide reliable data.

**CoriolisMaster Flowmeters**
An advanced series of mass flow meters for accurate fuel measurements. A robust and compact measuring device ideal for marine and offshore applications.

**OCTOPUS Motion Sensor**
A highly stable instrument for the measurement of ship motions. To measure motion, velocities and accelerations, the system uses one or three motion sensors installed on the vessel.

We supply unique sensors and instrumentation solutions designed specifically for ship performance management.