The next big wave in maritime innovation

Two hundred years ago the steam engine brought us railways, mechanized shipping and factories, and the Industrial Revolution was born.

This was a ‘sea change’ from rural agricultural economies to industrial urbanization, the beginning of mass production, and widespread electrification. Computers and the Internet have given us unprecedented access to information and a communication superhighway that has fueled a globalized economy.

Today a new era of economic expansion is dawning, brought about by the connection of intelligent machines, fitted with a growing number of electronic sensors, via the Internet, usually referred to as the ‘Internet of Things’. ABB takes a more-holistic approach. For one, ABB’s approach extends beyond manufacturing, or discrete automation, to include process industries as well as utilities and infrastructure. And ABB’s approach concentrates not just on things – those physical devices that are undergoing an automation revolution – but also on services, to ensure these devices are running optimally. People remain central to the process, in that they are making decisions, programming and optimizing all activities performed by these devices.

Put simply, this is the Internet of Things, Services and People (IoTSP) at ABB: Intelligent industrial devices, connected via networks that expand opportunities for remote services and that allow people to make better decisions thanks to their ability to collect, analyze and act on data.

The IoTSP is enabling us to ‘see, hear, and feel’ more acutely than ever before. This revolution is allowing us to operate machines more safely, with greater efficiency, and with less environmental impact, not just individually, but as complete systems, such as power grids and fleets of locomotives, airplanes, and ships.

For the maritime industry, this transition takes advantage of the mass of sensors already on-board,

such as for motion monitoring, engine and power data and GPS (global positioning system), but will require the addition of more to create an ecosystem of sensors and the software to cope with the data.

In addition to power and propulsion solutions ABB is now delivering integrated systems, including sensors and monitoring hardware, and the software to visualize operations, not only for the crew on the ship, but also for the owners onshore, at their operations centers.

Using networks of sensors, ship owners can capture a range of ship-voyage information, including location, weather and ocean-current data, together with performance data from on-board equipment and cargo status. By applying sophisticated analytics to new and historical fleet data, and using data visualization technology to present the insights, ship owners can monitor their vessels' status and condition in real-time, enabling data-driven decisions that support more efficient fleet operations.

For example, shifts towards preventive, condition-based maintenance will enable an engine service to be requested ahead of a predicted decline in engine performance, without wasting time servicing them on a fixed schedule. This will help to reduce unplanned stoppages, resulting in more cost-effective shipping. Should a failure occur, the availability of performance data means remote diagnosis and on-board fault repair can become a reality.

Imagine a 100,000 DWT (deadweight tons) LNG (liquefied natural gas) carrier sailing at full speed across the ocean. An unexpected trip in the starboard power frequency converter causes an immediate loss of 50 percent of its propulsion power. The giant vessel does not lose any of its safety-critical maneuvering capability, but it has to reduce speed significantly. Slower sailing means a longer journey time, resulting directly in higher operational costs.

In a typical case, such a fault would lead to slow sailing for several days, until a qualified service engineer could be reached at the destination. Here, however, that scenario was avoided, because the ship was equipped with an ABB remote diagnostic system (RDS), connected, in the middle of an ocean, to the IoTSP. The crew, having recognized a fault, notified an ABB technical support engineer and within 20 minutes he was able to connect on-line to the RDS on board. The ABB specialists helped the on-board engineer to verify the diagnosis and the component was replaced from spares stored on board. The entire troubleshooting process took about two hours from the first call until the entire propulsion system was back in operation.

Improved satellite connectivity and access to information, through the IoTSP, allows vessels to be on-line, almost all the time, connected to their operators, their owners and to each other. By exchanging shipping route information, captains can know each other’s intended course, allowing the safest and most fuel-efficient diversionary actions to be taken.

ABB’s voyage advisory system, connected via the cloud, enables better time of arrival forecasting and can even predict optimal vessel behaviors under certain weather conditions. These predictions allow the Captain to adjust a ship’s trim for better sailing. Similarly, by constantly measuring the energy and power savings of on-board installations, such as ABB drives and motors, and sending data, including emissions data and fuel consumption to the cloud, ABB’s energy advisory system can recommend actions to optimize fuel consumption and reduce energy losses.

So, by integrating automation and power, both electrical (including the ABB Azipod propulsion system) and mechanical (including ABB turbocharged diesel generators), and life cycle services (through ABB’s RDS), improvements can be made in the overall operational efficiency of individual vessels and ultimately entire fleets. By extending real-time data collection and exchanging information across vessels, ports, cargo and land logistics, the entire movement of people and goods can now be made safer and more efficient.

The Azipod system's signature benefits – low fuel consumption, greater speed using less power, better maneuverability, reduced noise and a compact footprint – typically reduce energy consumption of open-water vessels by 5 to 15 percent, but savings as high as 25 percent have been recorded.

Additionally, ABB announced the first application on a marine engine of its second generation two-stage turbocharging solution. ABB Power2 800-M consists the most advanced two-stage turbocharging solution in the marine market.

The innovative two-stage ABB Turbocharging technology has increased pressure ratio capabilities up to 12, from 8 in the first generation, and turbocharger efficiency beyond 75%, compared to a single-stage turbocharger which is typically around 65-70%. This combination of higher efficiency and higher pressure ratio contributes to increased engine power density, and also translates into significant potential for saving on fuel consumption costs and up to 60% lower NOx emissions.

This second generation of Power2 800-M is also over 20 percent more compact than conventional two-stage solutions, enabling space to be maximized on the engine. It was also designed with high availability and minimum downtime in mind being both easier to accommodate on the engine and, significantly for operators, it enables fast service execution under limited space conditions due to the ‘extractable cartridge’ concept.

ABB Process Automation is delivering products and solutions not only to the Marine Industry, but to Oil & Gas, Mining, Food & Beverage, Pharma and Chemical segments as well.

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