IMPLEMENTING SMART SHIP TECHNOLOGY TO REACH IMO 2030/2050 EMISSIONS TARGETS

A look at the infrastructure and processing requirements of sustainable smart ship technology
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INTRODUCTION

Taking a step towards a greener future the shipping industry is implementing more and more smart ship technologies in an effort to reduce carbon emissions and reach IMO 2030 and IMO 2050 targets.

These technological advancements drive an exponential increase in data volumes and processing requirements – highlighting the need for continuity and reliability in data infrastructure and hardware components.

The purpose of this E-book is to examine the infrastructural needs of implementing zero and low-emission smart ship technology and illustrate why system integrators and original equipment manufacturers will need smarter and more powerful hardware to facilitate the technologies that will define the future of the shipping industry.

Additionally, we will discuss some of the key concepts to consider when retrofitting a fleet and building future-proof smart ship solutions, designed to provide stability and security in a rapidly evolving technological environment.
The International Maritime Organization’s (IMO) initial strategy reduction of greenhouse gas (GHG) emissions from ships is challenging system integrators, shipping companies, and ship owners to find, develop and integrate new and more energy-efficient solutions, to meet GHG emission reduction targets for 2030 and 2050.

Supporting the 2011 MARPOL Annex Chapter VI, the United Nations Sustainable Development Agenda, and the Paris Agreement temperature goals the strategy was adopted on 13 April 2018, following the 72nd Marine Environment Protection Committee (MEPC) meeting in London, UK.

The vision set out in this initial strategy, the first step in the GHG reduction roadmap, states that the IMO “remains committed to reducing GHG emissions from international shipping and, as a matter of urgency, aims to phase them out as soon as possible in this century.”

The strategy identifies two specific emission reduction targets:

- To reduce carbon emissions by at least 40% by 2030, pursuing efforts towards 70%, by 2050 compared to 2008’s levels (IMO 2030).

- To reduce the total annual GHG emissions by at least 50% by 2050 compared to 2008 whilst pursuing efforts towards phasing them out (IMO 2050).

A revised and “final” GHG emissions strategy is set to be adopted in 2023, with several organizations and environmental groups already pushing for even more ambitious goals.

Source: http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/GHG-Emissions.aspx
THE “WHY”

Accounting for 2.5% of global ghg emissions

According to the Third IMO GHG Study 2014, international shipping and maritime transport emits approximately 940 million tonnes of carbon dioxide (CO2) annually, accounting for about 2.5% of the total global greenhouse gas (GHG) emissions – only marginally less than the aviation industry.

In the EU, emissions from the shipping industry represents approximately 13% of the overall GHG emissions from the transport sector.

The IMO estimates that emissions from international shipping could grow with anywhere from 50% to 250% by the year 2050, as the worldwide maritime trade continues to expand.

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THE “WHO”

1.2 Shipping companies joining the global effort

A global threat must be met by a global response and, as such, all companies connected to the shipping industry, regardless of flag, nationality and ownership, will have a part to play in the joint effort to reduce overall GHG emissions in accordance with the Paris Agreement.

Spearheaded by the IMO and governed by the IMO’s Marine Environment Protection (MEPC), the effort to reduce emissions was initially met with varying levels of enthusiasm, however, many of the world’s largest shipping companies have now pledged their allegiance to the cause.

Along with major companies within the energy, infrastructure and finance sectors, several prominent shipping companies have committed to the Getting to Zero Coalition – a partnership between the Global Maritime Forum, the Friends of Ocean action, and The World Economic Forum.

Totaling more than 90 companies and by key governments and intergovernmental organizations (IGOs), the coalition is pushing for zero emissions vessels and fuels to be in operation, and supported by the required infrastructure, by 2030.
THE “HOW”

1.3 Zero emission fuels and innovative technology

Two key trends will define the shipping and maritime industries in the next decade: sustainability and digitalization. These two are mutually strengthening forces, each of them dependent on the other to further industry-wide development and enhancement.

Achieving the targets outlined in the IMO’s initial strategy will require the fast tracking of zero emissions fuels and commercially viable ships by 2030, as these vessels will still be in operation in 2050.

When talking about reducing the carbon footprint, discussions often focus on switching to lower carbon or zero emission fuels and finding ways of utilizing renewable energy (e.g. wind-assist). While these measures are undeniably important, the EU have pointed out that there is also a significant potential for cost-efficient reduction of emissions in technical and operational measures such as slow steaming, weather routing, contra-rotating propellers and propulsion efficiency.

In other words, development and innovation within smart ship technology is essential in creating the framework that will facilitate the actualization of the IMO emissions targets.

For shipping companies and ship owners, this means upgrading the fleet by investing in new hybrid and electric vessels, as well as retrofitting current ships with innovative smart ship technology, will be vital to stay relevant in a shipping industry unified by a common ecological goal.

Ship owners who do not leverage technology to optimize the performance of their vessels and fleets risk being left behind.
2.1 Building future-proof smart ship solutions

Technological development is accelerating, and will continue to do so, and the transition time between emerging and mature technologies will be continually shortened. This will lead to an increasing dissonance between the hardware and software lifecycles of ships.

When designing and building a smart ship solution, ship owners and system integrators should operate with a long-term perspective, ensuring that all systems and hardware incorporated in their fleet’s vessels are capable and prepared to support the expected data volumes and processing requirements for at least 7 years into the future.
To design a future-proof smart ship solution, it is important to keep three key principles in mind: Form fit, lifecycle management, and backward compatibility.

2.2 Form Fit

Form fit system hardware ensures that components may be exchanged seamlessly throughout the life span of a ship – whether due to component errors and repairs, or upgrades to keep pace with technological advancements – without the need for a system redesign. This reduces the time and cost of hardware replacement and system upgrades.

As data volumes increase, the system will need an upgrade in performance and processing power. Considering the costs related to refitting a hardware system on the bridge or an automation system, it is crucial that upgraded components fit into the existing casings.

Furthermore, choosing a supplier that can recommend smart hardware solutions that cater to the needs and requirements of today as well as future upgrades, may eliminate the need to spend resources on R&D when replacing end of life components.
2.3 Lifecycle Management

Redesigning critical systems due to changes in electric components is a costly and time-consuming process. Lifecycle management guarantees the continued production and delivery of industrial-grade embedded components in a ship’s critical systems over time.

By choosing a hardware partner that provides lifecycle management you ensure that all networking, data processing, and display hardware and software will be supported throughout 7 years.

An experienced hardware partner may also provide guarantees of certificate maintenance for all critical systems upon the introduction of new and/or upgraded components.

2.4 Backward Compatibility

Backward compatibility eliminates the risk of a software image becoming outdated and unusable due to hardware upgrades.

By integrating backward compatible, marine approved components and providing support for all communication modules (i.e. serial bus, ethernet, rich I/O and modular), new and old, as well as a range of previous OS releases, you extend the life span of your system.

Backward compatibility is especially important if you are implementing a solution in the middle of, or towards the end of, its lifecycle.

2.5 Providing Stability and Security

Working in tandem, these three elements – form fit, lifecycle management and backward compatibility – ensures that your hardware partner will be able to supply the same components, for the same solution, over a 10-year period.

As retrofitted ships will play a key role in reducing carbon emissions at least for the next decade – faced with continuously stricter emissions and environmental requirements will apply for both new designs and existing ships – implementing these elements in your smart ship design will provide stability and security in a rapidly evolving technological environment.
The shipping industry is currently pouring resources into the research, development and application of alternative low-carbon and zero-emissions fuels (i.e. LNG, LPG, biofuel, methanol, hydrogen) and further examining the potential of wind-assisted propulsion, battery systems and fuel cell systems for ship applications.

Instead, your focus should be on to improve your fleet’s energy efficiency by taking advantage of the smart ship technologies already available today – technologies that will define the future of the shipping industry in the coming decades – and building a solid infrastructure to support them.

3.1 Electric power and propulsion systems

When leading figures within the industry discuss ways to improving energy efficiency through smart ship technology, one reoccurring subject is that of electric power generation and propulsion – both when it comes to building new ships and upgrading vessels already in use.

Considered to be an essential factor in reducing carbon emissions, an electric propulsion system consumes significantly less fuel and release fewer greenhouse gases to transport the same tonnage as a mechanical system.

This improved propulsion technology provides a perfect example of the importance of a solid data infrastructure and dependable hardware, as efficient operation of an electric propulsion system is dependent on real-time processing of large amounts of data in order to monitor several processes, ensure continuous operability and provide predictive maintenance.

To handle the data load, you need an industrial grade and maritime-approved gateway computer to take care of initial data processing, a solid network and appropriate bandwidth to transfer data, an industrial PC with sufficient data processing power at your control center and a high definition display with smart dashboard to visualize the data.

Additionally, you would likely need a CCTV setup for visual monitoring of the propulsion system.

The hardware needs of this single system alone, one of several aboard a modern smart ship, highlights the importance and benefits of designing a data infrastructure incorporating form fit, lifecycle management and backwards compatibility – ensuring that your system can adapt to changes and developments in the technology.
3.2 Upgrading Core Systems

Another important measure to improve energy efficiency is upgrading core systems on aging vessels still in operation for better data handling.

One such system, dynamic positioning (DP), have been adapted and improved to not only maintain a fixed position but also ensure that vessels sail on an exact track – maximizing fuel consumption efficiency. Furthermore, predictive software anticipating position variation and limiting thrust changes when keeping a vessel still is contributing to reducing the energy consumption of the DP system itself.

These upgrades and innovations naturally increase data volumes and data processing needs, and, considering the improvements made to DP systems in the last couple decades, we are likely to see further innovations in the field in the coming years. To reduce costs related to upgrades it is important to ensure that your system incorporates form fit hardware components, lifecycle management and backwards compatibility.

3.3 Logistical Efficiency, Automation and Digitalization

Optimizing a ship’s energy efficiency is only possible with the continued improvement of logistical efficiency and through digitalization and automation of critical systems.

The more data you have, the more control you have over all your systems and processes – leading to more energy-efficient decisions and reduced GHG emissions.

At the same time, improving logistical efficiency by implementing information management systems and digitalizing and automating system processes will drive your data volumes and processing needs, once again exhibiting the importance of dependable hardware and a solid data infrastructure.
Generally divided into three categories – current retrofit ships, the upcoming electric ships and the autonomous ships of the future – smart ships share an exponentially increasing requirement for higher data volume and processing capabilities to support technologies that may provide improvements such as smarter navigation, better weather data, higher mission effectiveness, voyage routing, speed management, and predictive maintenance.

The wide range of innovative smart ship technologies developed, or being developed, to improve a ship’s performance and energy efficiency, as well as optimizing operations, are entirely dependent on a solid, marine-approved data infrastructure, comprised of the appropriate hardware to facilitate the data processing requirements of each system task and/or process.

With the implementation of smart technology becoming synonymous with a license to sail, ship owners are turning to system integrators to provide future-proof smart ship solutions, ensuring their place in the ocean-going market in the upcoming decades.
2.1 The Role Of A System Provider

Building a solid smart ship solution requires more than simply finding a way to get all the pieces of a vast network, software and hardware puzzle working together. To be able to offer clients the optimal solution over time, system integrators should aim to harmonize all links in the value chain – ensuring that they all work together.

Whereas ship owners rely on the expertise and experience of system integrators and OEMs, these actors in turn require a component supplier and logistics partner to back up their guarantees.

The role of the system provider is not at stand at the frontline of green innovation, but rather to act as the supporting unit providing stability, and security, handling logistics and shoring up the supply lines.

CONCLUSION

To reach the IMO 2030 and IMO 2050 targets the shipping industry as a whole must come together in a joint effort to reduce GHG and carbon emissions.

While the search for a sustainable, alternative fuel continues ship owners and shipping companies can take action today by implementing zero and low-emission smart ship technologies to reduce emissions and maintain their relevance in the market.

As innovative technologies will drive and exponential increase in data volumes and processing requirements, ship owners rely on system integrators to provide a solution that will not only cater to their current needs, but also provides stability and security for future technological upgrades.

This highlights the need for system integrators and OEMs to find a reliable and future-minded system provider, with the right level experience and expertise needed to offer future-proof solutions regarding hardware components and infrastructure.

Ultimately, it is all about being able to offer safety and security in all parts of the value chain. The end user expects the ship owner to guarantee stability. The ship owner relies on the system integrator, who, in turn, looks to their hardware supplier to provide the best available components for their smart ship technology solution.