Reducing waste with digital solutions

Oskar Levander, SVP business concepts at Kongsberg Maritime says the first step to reducing greenhouse gas (GHG) emissions from international shipping is to minimise waste by applying digital technologies.

Oskar Levander, SVP business concepts at Kongsberg Maritime believes that while we need to minimise energy consumption, this alone will not be enough to meet the International Maritime Organization's (IMO's) 2050 GHG emissions reduction target*. A clean energy source and efficient conversion for use onboard a vessel are vital and should be prioritised if international shipping is to play its part in reducing global GHG emissions.

Speaking during a webinar hosted by Kongsberg (April 23), Levander said that today there is an increased need to find and convert cleaner energy sources to meet global GHG emissions targets as, "current fuels available today just won't be able to achieve the reductions that are needed." The first step to reducing the impact international shipping has on the environment is to eliminate waste where possible, stated Levander.

He said that the industry should first look at which activities in the industry bring value and which perhaps add little value but contribute to large quantities of waste. Levander said we should look at those with 'non-value activity.' For instance, "a ship running ballast, transporting water around the world is a type of waste, it doesn't add any value. If you can minimise that, you can reduce the waste."

Another example is a ship arriving in port. Prior to arrival, the ship speeds up and then slows down to make the arrival in time, only to end up waiting a few days before being able to enter the port. This generates waste due to speeding in the beginning and waiting prior to entering the port. "If we can reduce this, then we can definitely reduce the waste," he said.

Levander believes that digital solutions are the key to this. "Digitalisation is not just about optimising vessel efficiency but also about asking – have we got the right tool for the job?"

One example he referred to was an ROV, and the operation that is required for it. "Today, these ROVs are usually supported by a big vessel, maybe 20 people and a lot of power. But what you really need is a power source and a connection to the operator. What if you just had an autonomous surface vehicle there with a genset and a satellite connection to the operator? We could definitely reduce cost and drive down energy demand needed to operate that ROV," he explained.

Levander urges the maritime industry to think about what tools they really need and to use digital technologies to help them perform tasks at sea more efficiently. He went on to say that, "ship intelligence is the great means to reduce some of this waste we have and become more efficient and avoid consuming unnecessary energy."

Oskar Levander, SVP business concepts at Kongsberg Maritime.

*The IMO has set a target of reducing emissions from international shipping by at least 50 per cent by 2050 from 2008 levels. DS

Time charter rate and vessel speed balanced by bunker procurement tool

Danish start-up Bunker Metric has rolled out new functionality under its bunker procurement optimisation tool to assist vessel operators in reducing costs under any market combination of time charter (TC) rate and bunker prices.

Bunker Metric's bunker procurement optimisation tool, BunkerPlanner, calculates attractive bunker port calls that can be induced on a voyage in relation to the costs of bunkers, port calls, barges, and deviations, while also taking into account a speed up of the vessel to meet a fixed ETA at next port call. The bunker price of any additional port call must justify any speed-up, considering the vessels bunker curve and extra distance to be sailed.

This makes sense in most high time charter equivalent (TCE) markets, where the expected TC rates exceed the extra bunker cost of speeding up. However, there is often an attractive trade-off by adding a bunker port call and delaying scheduled ETAs while maintaining a fixed speed. With this approach a bunker buyer would attain a lower TC rate but would save on bunkers – a beneficial strategy in low TC environments.

One example includes a capesize bulker sailing from Port Hedland, Australia to Qingdao, China and returning, at a sailing speed of 13 knots.

At TCEs below $10,000, the most attractive bunker port is Singapore. At very high TCEs, the optimal strategy is to avoid a bunker-only call and lift required bunkers in Qingdao during cargo operations. The total bunker costs change from $ ~460,000 at very low TCE rates to $476,000 at higher TCE rates. By identifying the correct strategy, an operator can potentially save more than $16,000, equivalent to over $200 TCE/day.

"Deciding on the cheapest port to bunker is a complicated calculation, which should not be reduced to choosing the lowest $/mt. Especially interwoven are the trade-offs related to time charter rate, speed/consumption, deviations and price, and are only possible to accurately overview with good system support. With BunkerPlanner's tool you can easily save hundreds of $ in TCE per day, especially in low TC markets," explained Fernando Alvarez, BunkerMetric co-founder.

The bunker prices in the example were locked on the April 8, 2020. In the currently volatile bunker market this rapidly changes and early/mid May, South Korean ports would be preferable on this trade, depending on TC rate. Different loading port in West Australia and discharge in North China, may also give markedly different final results.

Routing, bunker ports and price in BunkerPlanner.

With this new functionality, which is already available to Bunker Metric's customers, BunkerPlanner can better assist vessel operators to attain significant bunker savings.

"By including TCE in BunkerPlanner's calculations, advice can also be given bearing in mind the intricate interplay between the optimal speed for a specified voyage, the TC rate, bunker consumption, bunker costs, banal usage and ECA zones. Considering all these factors together is powerful, and unique for a maritime digitisation tool," said Christian Plum, Bunker Metric co-founder.

ABS offers majority of annual class surveys remotely

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ABS is now able to conduct almost all classification annual surveys remotely on eligible vessels, after moving to further expand its remote offerings.

With the launch of 10 additional remote survey options, ABS now offers a comprehensive set of remote survey options, with a total of 28 surveys and audits able to be delivered remotely.

"The industry is telling us they want our services delivered remotely, particularly in the current challenging environment, and I am proud that we are providing the most comprehensive remote services portfolio in the industry," said Joe Riva, ABS vice president and chief surveyor. "We are delivering the next generation of classification today through surveys conducted anywhere in the world at any time, without interrupting operations for surveyor attendance."

The new remote services include Annual Hull Survey, Annual Machinery Survey, Annual Automation Survey, Annual Dynamic Positioning Survey, Annual Navigational Bridge Layout and Equipment/Systems Survey and Annual Load Line Inspection, when authorised by Flag Administration, for the first time.

Eligible vessels include general cargo vessels, barges (other than tank barges), tugs, offshore support vessels and liquified natural gas carriers under 15 years of age, with a few qualifying criteria. ABS now allows alternate annual surveys to be conducted remotely, except the fifth annual survey, which has special survey requirements.

ABS has also extended its remote survey and audit services to existing equipment manufacturing and external specialist clients enrolled in ABS programs.

The contribution of just-in-time arrival and optimum ship routing to reduce carbon emissions

A combination of optimised voyages and a robust system of Just-in-Time arrival has a role to play in meeting IMO regulatory targets, writes Georgios Plevrakis, ABS.

Decarbonisation of the shipping industry will require the combination of multiple solutions including the adoption of low carbon or zero carbon fuels and new energy efficiency technologies. However, a significant contribution will come from voyage optimisation and vessel utilisation.

Just-in-Time (JIT) shipping is one of the most promising solutions, but despite its quantified benefits, has yet to be widely adopted by shipping or the port sectors. Its advocates contend that JIT would lessen impact on the environment and reduce costs, but there are multiple operational and contractual barriers to overcome.

Achieving JIT also requires the vessel to adopt Optimum Ship Routing (OSR) to reduce time spent waiting for berths or cargo. This can maximise utilisation of ports and reduce costs - it would substantially reduce the emissions of greenhouse gases (GHGs) and other pollutants.

To understand the implications and opportunities for the industry, ABS assessed the potential of JIT on the industry's carbon footprint and considered the impact of both techniques on a typical 105,000 dwt Aframax tanker voyage, including the results in its 2020 'Setting the Course to Low-Carbon Shipping – Pathways to Sustainable Shipping' Outlook.

Barriers and challenges

Despite its quantified benefits, JIT has yet to be widely adopted by the shipping or port sector. A full implementation of JIT sailing implies a commitment between ships and ports, and the related actors (shipping companies, cargo owners, port authorities, terminal operators and nautical service providers). The ship must adhere to estimated times of arrival (ETA) and the port must ensure that the resources for the ship berth are available at that time.

Ship operators face problems such as the nondisclosure of information related to the vessel's construction or its engine performance that would improve the accuracy of estimations and any efforts to calculate and optimise the associated fuel consumption or GHG emissions.

Without this information, mathematical modelling or the creation of 'digital twins' — virtual replicas of physical assets, processes and systems — for ships can be a challenge, thus complicating the task of providing an accurate ETA.

For some types of vessels such as tankers and bulk carriers, contracts may be breached by reducing speed, which renders JIT arrivals impossible. Communication with charterers and a commitment to reducing GHG emissions from them is a prerequisite to JIT and Optimum Ship Routing (OSR).

The concept of JIT involves adapting the freight contract to allow the ship to reduce its speed on passage to meet the scheduled arrival time and cooperation between the shipowner/operator and the charterer to overcome third-party contractual obligations.

The barriers to JIT at ports are equally numerous. Few ports have adequate management systems to estimate the resources (e.g. pilots, tugs or mooring) that will be available beyond a 24–48-hour horizon. A standardisation of the format for the information is required for automation and further optimisation to be possible.

Current JIT initiatives

The European Union and the governments of South Korea — as well as several port authorities such as Rotterdam, Valencia and Algeciras — are funding initiatives to improve synchronisation of port calls and voyage planning, the enablers for JIT in shipping.

These initiatives include the Sea Traffic Management (STM) Program and its related EU co-funded research and development projects (the STM Validation project, Efficient Flow and Real Time Ferries). There are also initiatives such as the PRONTO project promoted by the Port of Rotterdam and the Pit Stop Operations project developed by the Port of Algeciras.

The STM project is one of the largest e-navigation projects funded by the EU and it aims to validate the technical, environmental and financial feasibility of the concept by testing new navigation services on board 300 ships in collaboration with ECDIS suppliers.

The services allow digital transmission of voyage plans and connectivity between these ships, ports and shore centres through large-scale testbeds in the Baltic and Mediterranean Seas. More than 50 partners from 13 countries are participating.

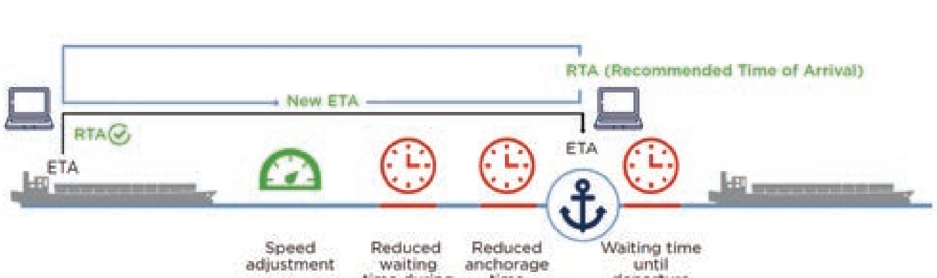


Figure 1. JIT involves adapting the freight contract to allow the ship to reduce its speed on passage to meet the scheduled arrival time.

For ports, the STM Validation initiative is working on an ambitious set of pilots involving several ports in Europe: Gothenburg, Valencia, Stavanger, Barcelona and Limassol, among others. The pilots are oriented to increase the efficiency of coordination of the agents involved in the port-call process by defining a common communication standard that allows them to exchange information in real time. This enables the agents to share the various stages and operations related to the port call and receive timestamps in real time.

Impact on carbon footprint

For several years, the use of data from automated identification systems has made it possible for the industry to operationally benefit from knowing details such as the ETA, the arrival port, draught and navigational speeds.

These data points are being used today to track vessels and to support limited adjustments to voyage planning. However, deeper analyses of the data on vessel positions and berth availability are revealing the type of information that could make JIT shipping more probable. More efficient communications between vessels and ports on the availability of berths and ancillary- service providers such as tug operators would optimise marine traffic, with all the commercial and environmental benefits.

ABS modelled the effect of potential improvements in efficiency created by JIT shipping by presuming an average 5 per cent reduction in speed, assuming no impact on cargo-carrying capacity and no adjustment to the size of the fleet. Based on this analysis, the CO2 emissions savings are around 10-11 per cent annually.

Speed optimisation involves varying the vessel speed to arrive Just-in-Time, thus avoiding idle time outside the terminals and minimising overall fuel consumption. These are both used in OSR, the method of developing the 'best route' for a ship based on weather forecasts, ship characteristics, and geographical data. The aim of creating the 'best route' is subject to so many variables and constraints, it is reasonable to question what can be dependably achieved.

Fuel costs constitute a major part of the operating expenses of any voyage; in some cases up to 80 per cent. With an eye on the IMO's goals, minimising fuel consumption also has a positive impact on the environment because GHG emissions are reduced proportionately to the reduction in fuel consumption.

Methodology for selecting the optimal route

The most common route followed by vessels is the one that connects the departure and arrival points through a straight line (loxodrome). Under ideal conditions, this route would offer the shortest travel distance and time, with the lowest fuel consumption. However, weather conditions, geography and other factors may necessitate a different route to minimise fuel consumption. Identifying this route involves an optimisation task using a numerical algorithm.

As a first step, the operator needs to provide a set of inputs to the algorithm: the departure and arrival points, the geographical data and the weather data. Based on these inputs, the algorithm approximates every possible route as a mathemat-

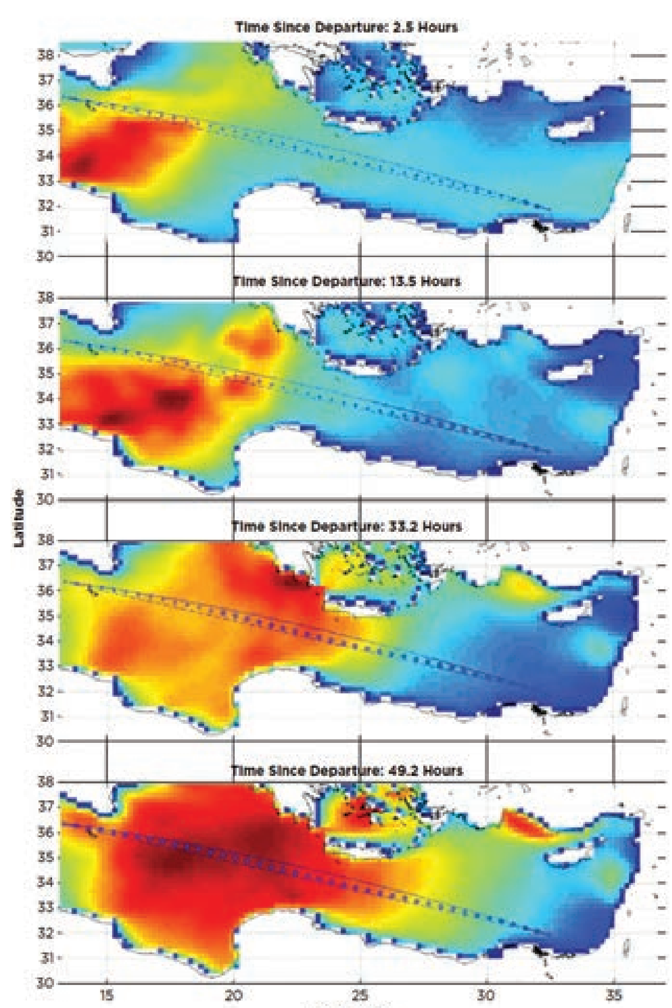


Figure 2. The colour contour in each plot shows the sea severity (wave height) and the cross symbols show the calculated optimum route as compared to the rhumb line or loxodrome (dashed line) and the great circle or orthodrome (solid line).

ical function, as well as the associated fuel consumption with every route.

JIT can be implemented on a single trip by changing the objective of this optimisation task from the total fuel consumption to the total TCE for a voyage and then minimising it. The simplest case for applying this optimisation method is a ship traveling at constant speed in calm water without any effects from waves. In this case, the water resistance remains constant and the route of minimum fuel consumption is equivalent to the shortest distance on the globe.

Application of an Aframax voyage

ABS considered the case of a typical 105,000 dwt Aframax tanker traveling in the eastern Mediterranean Sea, from Port Said to Marseille via Sicily in the presence of a storm. Data is available from seakeeping calculations for the hull, general arrangement, main engine, and ship performance at various speeds, drafts, and weather conditions.

The principal particulars of the vessel are LOA = 238.5 m (overall length), LPB = 234 m (length between perpendiculars), B = 42 m (max breadth) and Ts = 14.9 m (scantling draft). The vessel is equipped with one MAN B&W 6S60MC diesel engine directly coupled to the propeller.

The optimisation objective was to minimise the vessel's fuel consumption as it travels through the storm and the results are shown in figure 2. The colour contour in each plot shows the sea severity (wave height) and the cross symbols show the calculated optimum route as compared to the rhumb line or loxodrome (dashed line) and the great circle or orthodrome (solid line). In this case, using the optimised route results in the minimum fuel consumption; the calculated cost of this route is two per cent lower than the orthodrome.

The application of JIT and OSR are two effective operational measures that can contribute significantly to the reduction of fuel consumption and carbon emissions from future vessels. Such operational measures combined with low- and zero-carbon fuels and technological advancements can provide cost-effective solutions that help vessels to meet the decarbonisation target of IMO to 2030 and 2050. DS

Simulation technology – a vital resource for testing autonomous ship operations

A new generation of training simulators is accelerating the prototyping, development and verification of autonomous systems for the smart shipping of the future, writes Terje Heierstad,business developer, Maritime Simulation, Kongsberg Digital.

A greener, safer, more efficient and more sustainable future for maritime operations, in which autonomous systems will be responsible for handling processes right across the board, is well on the way to actualisation. Kongsberg Digital's advanced simulation technology, K-Sim, is a decisive ingredient of this technological evolution for its key role in predicting, prototyping and verifying autonomous systems while also enabling onshore operators to benefit from full training in safe and controlled conditions.

The gradual but purposeful shift towards more environmentally-responsible shipping practices is already exerting an influence throughout the maritime industry supply chain. More and more companies are seeking to put CO2 reduction plans in place involving, for example, the transportation of goods via electric and/or fuel-efficient vessels on short-haul, inland-waterway routes as opposed to deploying trucks on extensive road journeys. Figures suggest that the deployment of an autonomous barge could take around 7,500 trucks off the roads each year, resulting in a substantial reduction in emissions and easing traffic congestion.

KDI and the AUTOSHIP project

A major initiative in this respect is the AUTOSHIP project, the first of its kind, to which Kongsberg Digital (KDI) is an integral contributor. The four-year project, which has received almost NOK 200 million in funding via the EU research programme Horizon 2020, is being undertaken by KONGSBERG in collaboration with Norway's foremost research organisation, SINTEF, as well as several European partner organisations, and will see KONGSBERG installing and testing autonomous technology on two vessels operating in markedly different environments. The Eidsvaag Pioner transports fish feed to fish farms along the Norwegian coast and in environmentally-sensitive fjord areas, while the other AUTOSHIP vessel is a Belgian pallet shuttle barge which transfers goods to and from large container ports via European canals.

The project is intended to drive the testing and perfecting of integrated, cybersecure, next-generation technology for fully autonomous navigation and machinery systems, self-diagnostics, prognostics and operation scheduling, anticipating the commercialisation of autonomous shipping in a variety of contexts across the EU over the next five years. Advanced simulations and cloud-based communications systems are at the heart of this enterprise. As the AUTOSHIP project will demonstrate, KONGSBERG's scalable, secure and cost-effective Vessel Insight maritime data infrastructure solution will enable digital services to be run on vessels and in the cloud – a vital requirement for vessel autonomy – while its vessel-to-cloud data capture functionality will provide the onshore fleet management and operations centre with instant access to real-time vessel data.

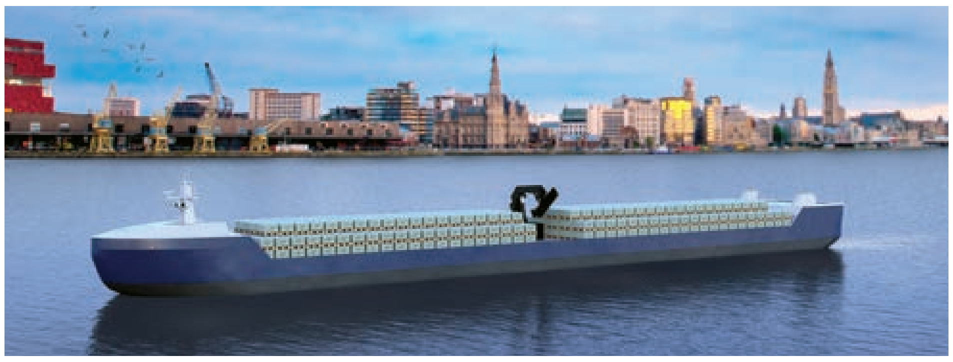
Meanwhile, KDI's advanced simulation technology will provide trainee operators with indispensable, predictive decision support. Digital twin models of the vessels will build competence, enabling trainees to become fully conversant with procedures to control and monitor the autonomous ships from a shore-based control centre.

KONGSBERG, ASKO and autonomy

Another game-changing autonomous vessel project with Kongsberg Digital's simulation technology at its core is currently in the planning stages. ASKO, Norway's principal transport company, has teamed up with Kongsberg Maritime and Massterly to develop the AutoBarge, a fully autonomous craft which will be used to convey 16 semi-trailers at a time across the Oslofjord. When the vessel enters operation, it is estimated that its use will eradicate 2.1 million kilometres of road use and 5,000 tonnes of CO2. KONGSBERG's virtual prototyping capabilities will be a fundamental asset as the project proceeds.

Virtual prototyping of autonomous algorithms and interfaces

Kongsberg Digital's K-Sim simulation platform enables fast and effective virtual prototyping as well as the testing and improvement of autonomous algorithms as part of the development process. The Norwegian Maritime Directorate defines five levels of autonomy at sea: level 4 is the target for many projects, and is defined as when the vessel is unmanned, but direct or indirect remote control can be implemented from an onshore control centre to oversee complex procedures. The simulator may also be used for prediction-based simulation, based on live environmental and ship data. A key benefit here is that scenarios can be initialised quickly and simulated much more rapidly than in real-time in order to provide time-sensitive support on the outcome of commands from the autonomy controller and navigation systems. It can provide route verifications, power/energy consumption predictions, vital information on weather impacts and analyses based on live data derived from onboard sensors.



Figures suggest that the deployment of an autonomous barge could take around 7,500 trucks off the roads each year.

Shore control centres

Autonomous ships will be tightly integrated to control rooms – such as those currently being built in Norway – which are manned on a 24/7 basis for remote monitoring and management. To ensure the highest availability and most efficient running of shore-based control facilities, the K-Sim simulator is being used to test remote interfaces to control centres.

Kongsberg Digital is fully committed to developing new simulator standards aimed at building total competence, providing trainee shore control operators with the most comprehensive and realistic operational experience possible. Key to this is creating simulated prototypes of shore control centres: interfaces between K-Sim Navigation and real shore control centres will not only allow trainees to understand best practice for interfacing functionality, but will also assist training on all scenarios related to autonomous shipping, including familiarisation with fault settings on autonomous navigation systems and dealing with emergencies. Training will also focus on the way shore control centre operators interact with VTS centre operators to ensure optimal communication and data exchange.

Rules and regulations

In the same way that shore interfaces are being standardised, legislation for autonomous ships is still ongoing. The K-Sim platform's ability to simulate any real-life procedure in relation to the safe operation of an autonomous vessel is essential in this respect as in so many others, allowing approval processes to be conducted well before live operations.

It will be possible to create a set of validation scenarios on the simulator to test and verify the correct behavior of autonomous navigation systems and shore control centre functionality, in support of the approval processes.

Making it happen

Autonomous ships will never replace all manned vessels, so situations will inevitably arise wherein mixed commercial traffic as well as all manner of leisure craft will be operating in the same area. Because of the human factor, manned ships, boats and yachts cannot and will not behave as predictably as autonomous ships: people's interpretation of the rules, and the way they react to them, can differ wildly in a variety of contexts.

This is obviously a serious consideration which will have to be factored into the development of navigation, planning and control systems on board autonomous ships and in control centres: but seafarers can be reassured that Kongsberg Digital's simulator technology is already on the case. As the autonomous shipping domain evolves, the K-Sim platform is matching and reflecting this progress every step of the way to take onboard and onshore personnel training to the next level, shaping a new era of safe, efficient and compliant autonomous operations on the world's oceans. DS