

# UNDERSTANDING YOUR DECARBONIZATION OPTIONS: JUST-IN-TIME SHIPPING

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# ABS





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### INTRODUCTION

There are many options available to ship owners and operators for achieving compliance with the IMO's 2030 and 2050 emissions reduction targets, whether it is using low- and zero-carbon fuels or using innovative technologies for improving the energy efficiency of vessels. Other options, which can be combined with the above, are operational procedures such as speed optimization and Just-in-Time (JIT) shipping.

In order to achieve optimum ship routing (OSR), the method of developing the “best route” for a ship based on the existing weather forecasts, ship characteristics, and geographical data, both speed optimization and JIT can be used. For the purposes of this whitepaper we will focus on the topic of JIT.

### WHAT IS JUST-IN-TIME?

The definition of JIT originates from the automotive industry. The concept originated in Japan, developed during the 1960s and 1970s, championed by Toyota and based on an inventory system that aligned orders of raw materials from suppliers directly with production schedules.

Companies employed this strategy to increase efficiency and decrease waste by receiving goods only as they need them for the production process, which reduces inventory and depreciation costs.

It required producers to forecast demand accurately and modernized ‘just-in-case’ strategies, wherein producers held sufficient inventories to absorb maximum market demand.

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Download one of our guidance documents focused on each of the fuel types available to achieve decarbonization at [eagle.org/sustainability](https://eagle.org/sustainability).

- LNG as Marine Fuel
- Ammonia as Marine Fuel



The aviation industry also adopted JIT, although their focus was on operational processes rather than manufacturing. Today, most airlines and airports are involved in a symbiotic collaboration that, through JIT, aims to minimize the time airplanes spend on land or waiting to land, thus avoiding passenger waiting times, maximizing the use of aviation assets, and lowering fuel consumption and emissions.

The shipping industry can significantly benefit from the efficiency of JIT. Recent reports by Marine Traffic indicate that ships spend roughly 50% of their time in berth, anchoring, or maneuvering; this represents more than 15% of their annual fuel consumption.

Adoption of JIT operations would reduce the time spent waiting for berths or trade, maximize the utilization of ports, and reduce the fuel costs and others associated with port stays. Moreover, it would substantially reduce the emission of GHGs and other gases.

## WHY JUST-IN-TIME SHIPPING?

Key agents of the shipping industry have identified JIT arrival as an operational improvement that could generate wide benefits by reducing vessels' GHG emissions when approaching and berthing at ports.

JIT operations limit the amount of time that ships spend idling outside the ports. This can be achieved by optimizing the vessel speed during voyage to ensure that it arrives and departs without unnecessary delay.

Implementing the JIT arrival concept requires a holistic view of the voyage, including the port operations section of the voyage, because it may require occasional increases in vessel speed during the voyage (with the associated increase in fuel consumption). But if this negates enough of the waiting time at port (with the associated fuel consumption), it may result in lower overall consumption.

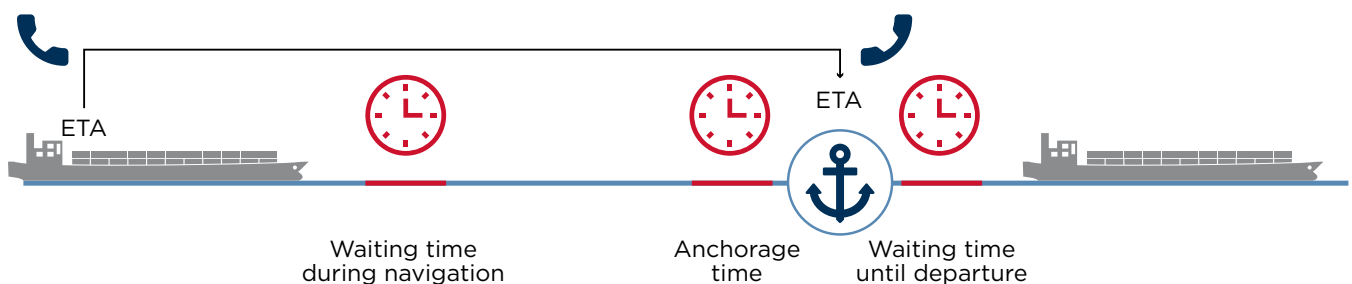


Figure 1. Normal arrival process

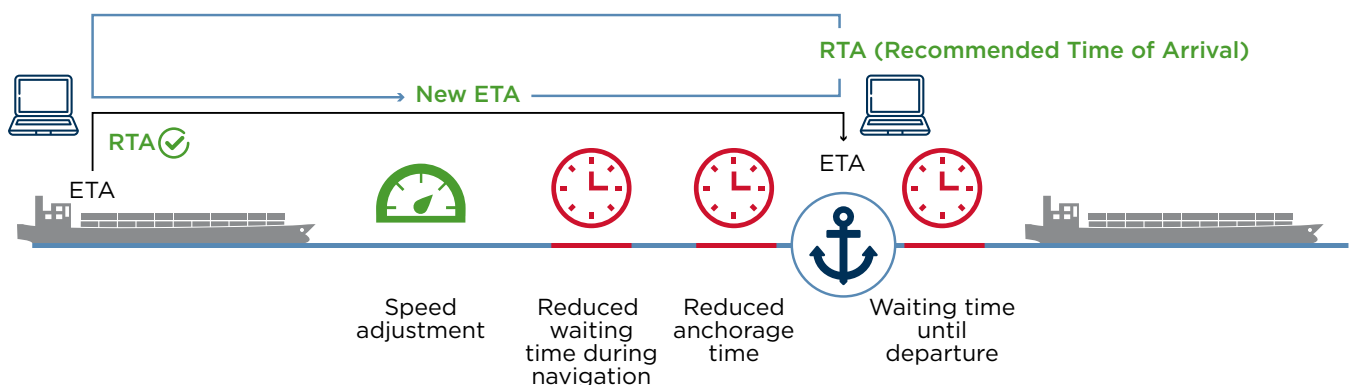


Figure 2. JIT arrival process

Despite its theoretical benefits, JIT has yet to be widely adopted by shipping or the port sector. Practitioners agree that JIT would lessen their businesses' impact on the environment and can reduce costs, but there are multiple operational and contractual barriers to overcome.

A full implementation of JIT shipping implies a commitment between ships and ports and the related agents (shipping companies, cargo owners, port authorities, terminal operators, nautical service providers, etc.). 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.

### WHAT ARE THE BARRIERS AND CHALLENGES?

Modern vessels use various services to estimate the time it will take to reach a destination, taking into account aspects such as weather conditions. These estimations are not without challenges.

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 optimize the associated fuel consumption or GHG emissions.

Without this information, mathematical modeling 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 OSR.

### AT PORTS

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 to 48-hour timeline. A standardization of the format for the information is required for automation and further optimization to be possible.

In addition, the concept of JIT involves adapting the freight contract to allow the ship to reduce its speed on passage and meet the scheduled arrival time. JIT adoption requires cooperation between the ship owner/operator and the charterer to overcome third party contractual obligations; and provide benefits that go beyond emission reductions and fuel savings and extend to voyage planning.

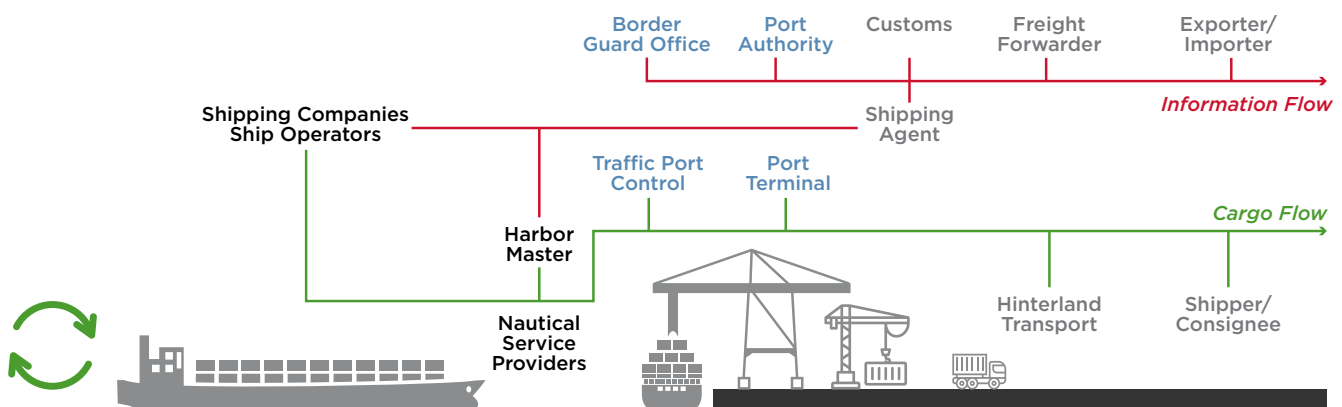


Figure 3. Different partners involved in a JIT operation

A commitment between ports, ships, manufacturers, and other industry agents is required to make JIT shipping possible.





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## WHAT IS CURRENTLY BEING DONE?

The European Commission and the governments of South Korea – as well as several port authorities such as Rotterdam, Valencia, and Algeciras – are funding initiatives to improve synchronization 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 R&D 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 European Commission, and it aims to validate the technical, environmental, and financial feasibility of the concept by testing new navigation services onboard 300 ships in collaboration with ECDIS3 suppliers.

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

For ports, the STM Validation initiative is working on an ambitious set of pilots involving several European ports: Goteborg, 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.

## WHAT IS THE POTENTIAL IMPACT ON CARBON REDUCTION?

Maritime Strategies International (MSI) was commissioned by ABS to assess the potential impact of JIT on the industry's carbon footprint.

As a base case, MSI assumed the following compound annual growth rates for each of the major vessel types during the period 2019-2030:

- 0.9% for dry bulk
- 0.9% for oil tankers
- 3.9% for containerships

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 estimated time of arrival, the arrival port, draught, and navigational speeds, etc.

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 effective 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 optimize marine traffic, with all the commercial and environmental benefits.

MSI modeled the effect of potential improvements in efficiency created by JIT shipping by presuming an average 5% reduction in speed, assuming no impact on cargo-carrying capacity and no adjustment to the size of the fleet. Based on that basic analysis, the CO<sub>2</sub> emissions savings are around 10-11% annually.

### CO<sub>2</sub> Emissions – Just-in-Time vs. MSI Base

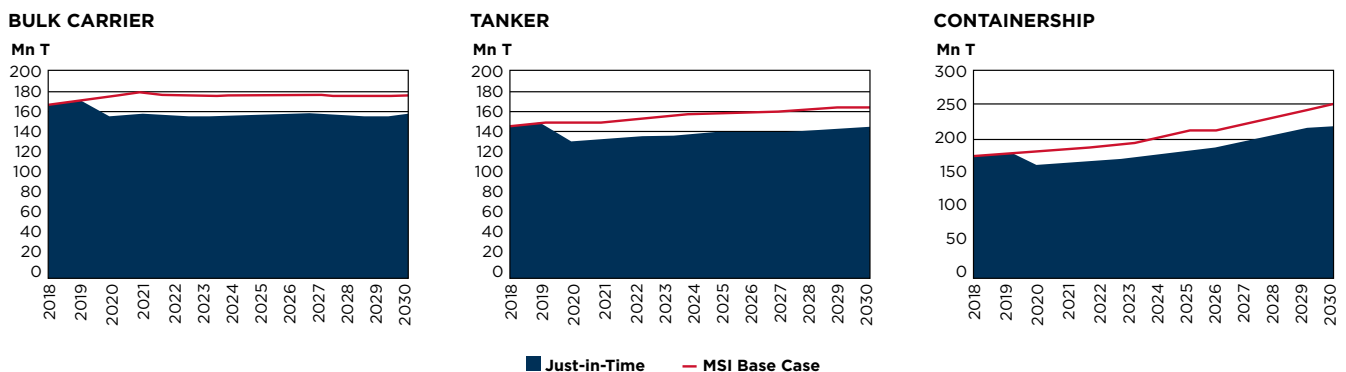


Figure 4. Potential reduction of emissions with JIT

## HOW DOES IT ALL CONNECT?

Adoption of digitalization across the marine industry, coupled with the IMO's GHG emissions regulations and the global pandemic, has seen a dramatic uptick among owners and operators. With the majority of the industry moving to a virtual way of operating, digitizing processes such as voyage or route optimization, has evolved from a "nice to have" to a necessity for business continuity. This newfound agility is allowing companies to conduct business and operations in new, efficient ways, becoming the catalyst for implementing JIT shipping strategies.

Though many software applications exist specifically to address an individual vessel's voyage plan, this only creates a short-term fix, when what is needed in the long run is a connected ecosystem that aggregates not only vessel-specific data, but also data sets across the entire supply chain, such as, terminals, ports, charterers and other stakeholders (see Figure 3).



## INTRODUCING ABS MY DIGITAL FLEET™.

The ABS My Digital Fleet™ is the only customizable risk management platform that provides real-time data-driven insights to improve fleet efficiency, reduce costs and, manage risks.

To learn more about My Digital Fleet and how it can be leveraged to navigate decarbonization initiatives like JIT shipping, contact an ABS Digital Specialist at [ABSDigital@eagle.org](mailto:ABSDigital@eagle.org) or visit [eagle.org/mydigitalfleet](http://eagle.org/mydigitalfleet).



Today, ports like Rotterdam and Singapore are experimenting with open information systems that may lack the functionality to view and manage critical insights like port congestion and delays. This results in a disconnected data infrastructure but is easily avoided through the power of the fully connected digital platform, which captures and aggregates data sets from multiple sources like ports and terminals.

Implementation of a digital platform not only simplifies operation but provides a risk-informed output that is easily accessible across an organization and its stakeholders. Insights such as vessel performance and health, as well as daily voyage plans, are then centralized and visualized for improved decision support.

The connection between JIT shipping and digitalization requires communication and transparency across the industry. It is achieved through the utilization of one digital platform, such as a fully customizable, risk management platform that provides both commercial and operational insights to successfully enforce a JIT shipping regimen.

## CONCLUSION

JIT shipping paired with other decarbonization options can be utilized to reduce emissions and ultimately meet the IMO's 2030 and 2050 greenhouse gas emissions reduction targets. However, achieving JIT shipping will require an industry-wide effort. Knowledge and data sharing from all stakeholders will play an important role in its implementation and operation. Therefore, having a single platform to connect data and to ultimately provide the insights needed to make decisions to support JIT shipping will be critical.

Interested in learning more about the other options available to achieve decarbonization? Download your copy of any of the below publications.



For additional guidance or to speak to one of our sustainability specialists visit, [eagle.org/sustainability](http://eagle.org/sustainability).



## ABOUT THE AUTHORS



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Sotirios Mamalis is the Manager of Sustainability for Fuels and Technology in the ABS Houston Global Sustainability Center. His expertise lies in the fields of internal combustion engines, fuels, and emissions control. In his current role, Sotirios is responsible for promoting fuels and technologies that can help shipowners and operators to reduce the carbon footprint of their vessels and fleets, and thus promote the environmental and commercial sustainability of their business. Sotirios holds a Ph.D. degree in Mechanical Engineering from the University of Michigan.



### **GURINDER SINGH**

Currently, Gurinder is the Director of Digital Solutions, with a focus on the ABS Sustainability Portfolio of Products. In this role, he supports new product development and continuously delivers innovative solutions to marine and offshore clients that support decarbonization initiatives, as well as asset management and risk reduction strategies. He holds a bachelor's in Mechanical Engineering and a Master's in Engineering Management from the University of New Orleans.

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