INTERNATIONAL MARITIME ORGANIZATION

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MARINE ENVIRONMENT PROTECTION COMMITTEE
75th session
Agenda item 7

MEPC 75/INF.22
24 January 2020
ENGLISH ONLY
Pre-session public release: ☒

REDUCTION OF GHG EMISSIONS FROM SHIPS

Just In Time Arrival Guide – Barriers and Solutions

Note by the Secretariat

SUMMARY

Executive summary:	This document informs the Committee of the recently finalized *Just In Time Arrival Guide* that has been developed by the Global Industry Alliance to Support Low Carbon Shipping (GIA) established under the framework of the GEF-UNDP-IMO GloMEEP Project
Strategic direction, if applicable:	3
Output:	3.7
Action to be taken:	Paragraph 9
Related documents:	MEPC 74/INF.34 and MEPC 75/12/4

Introduction

1 The Global Industry Alliance to Support Low Carbon Shipping (GIA) was officially launched on 29 June 2017 in the margins of the first ISWG-GHG meeting at IMO Headquarters. The aim of the GIA is to develop innovative solutions to address common barriers to decarbonizing the shipping sector. The GIA was established under the framework of the GEF-UNDP-IMO GloMEEP Project*. A full update of the work of the GIA is set out in document MEPC 75/12/4 (Secretariat).

2 This document provides an update of the work of the GIA on the Just In Time Arrival (JIT) of ships. JIT Arrival is a concept in which a ship maintains the optimal operating speed to arrive at the Pilot Boarding Place when the availability is ensured of: 1. berth; 2. fairway; and 3. nautical services (pilots, tugs, linesmen). The JIT Arrival concept has been identified by the GIA as a feasible opportunity to reduce GHG emissions. Further information on the GIA's work on JIT Arrival is set out in document MEPC 74/INF.34.

* https://glomeep.imo.org/global-industry-alliance/global-industry-alliance-gia/

3 Following research and discussions undertaken by GIA members, as well as a series of roundtables to which key industry stakeholders from more than 50 companies, organizations and industry associations were invited to contribute, the GIA developed a Guide, summarizing all findings. The full *JIT Arrival Guide* is set out in the annex to this document.

Purpose of the Guide and its contents

4 The purpose of the Guide is to provide information to ports, terminals and shipping on how to facilitate JIT Arrival of ships – with a view to reducing GHG emissions by optimizing the port call process and providing a sustainable solution to the maritime industry as a critical node in the end-to-end supply chain.

5 In particular, the Guide will provide a useful toolkit for port authorities, terminals, shipping, nautical services providers, and other relevant port stakeholders who ultimately play a key role in implementing the necessary changes and facilitating the exchange of communication required to realize JIT Arrival.

6 The Guide explains the concept of JIT, identifies key event data which are required to be exchanged to facilitate JIT Arrivals and identifies existing contractual and operational barriers which may be faced in its implementation. The Guide also considers in detail the port call process and presents potential solutions to the barriers faced and suggestions on how the exchange of key information and data that is required for JIT Arrival can be improved.

7 While the document provides guidance for all shipping segments, it suggests that efforts of ports, terminals and shipping are intensified to implement JIT Arrival for the container segment first, as there are less contractual barriers and as, due to the nature of the trade, liner services have more predictable schedules than tramp services. Then, scale-up efforts should focus on implementing JIT Arrival in the wet and dry bulk sectors, considering how solutions can be replicated and adapted to the nature of these trades. And as a final step, JIT Arrival opportunities should be explored for other sectors.

Next steps for the GIA JIT Arrival work

8 The GIA will continue work in this area, focusing on several action items outlined in the Guide, reaching out to relevant stakeholders to support its implementation and working towards a real time trial with several GIA members in 2020.

Action requested of the Committee

9 The Committee is invited to take note of the information provided.

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ANNEX

Just In Time Arrival Guide – Barriers and Potential Solutions

GLOBAL INDUSTRY ALLIANCE
TO SUPPORT LOW CARBON SHIPPING

GloMEEP
Global maritime energy efficiency partnerships

gef

UNDP
Empowered lives.
Resilient nations.

IMO

Published in 2020 by the
GloMEEP Project Coordination Unit
International Maritime Organization
4 Albert Embankment London SE1 7SR, United Kingdom

Please cite this document as: GEF-UNDP-IMO GloMEEP Project and members of the GIA, 2020: Just In Time Arrival Guide – Barriers and Potential Solutions.

The GloMEEP Project is a cooperative initiative of the Global Environment Facility (GEF), the United Nations Development Programme (UNDP) and the International Maritime Organization (IMO) to assist developing countries in the uptake and implementation of energy efficiency measures for shipping, with the aim of reducing greenhouse gas emissions and preventing air pollution from ships.

The Global Industry Alliance to Support Low Carbon Shipping (GIA) was officially launched on 29 June 2017. The aim of the GIA is to develop innovative solutions to address common barriers to decarbonizaing the shipping sector. The GIA was established under the framework of the GEF-UNDP-IMO GloMEEP Project.

For more information, please visit http://glomeep.imo.org.

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List of abbreviations

ABS	American Bureau of Shipping
AIS	Automatic Identification System
APP	Application – Software that performs a specific task
ATA	Actual time of Arrival
B2B	Business to Business
B2G	Business to Government
BIMCO	Baltic and International Maritime Council
BMPH	Berth Moves Per Hour
CCR	Cargo Control Room
CIP	Calling In Point
CO_2	Carbon Dioxide
ECDIS	Electronic Chart Display Information System
EDI	Electronic Data Exchange
ETA	Estimated time of Arrival
FAL	IMO Facilitation Committee
GHG	GreenHouse Gas
GIA	Global Industry Alliance
GMDSS	Global Maritime Distress and Safety System
JIT	Just In Time
MEPC	Marine Environment Protection Committee
MSI	Maritime Strategies International
Nm	Nautical Miles
NOR	Notice of Readiness
NOx	Nitrous Oxides
PBP	Pilot Boarding Place
PEC	Pilot Exemption Certificate
PM	Particulate Matter
PTA	Planned Time of Arrival
RTA	Requested Time of Arrival
RW Buoy	Red/White buoy (in this context, the fairway buoy)
SEEMP	Ship Energy and Efficiency Management Plan
SMS	Safety Management System
SOLAS	Safety of Life at Sea Convention
SOx	Sulphur Oxides
TEU	Twenty Feet Equivalent Unit
TOS	Terminal Operating System
VHF	Very High Frequency Radio
VTS	Vessel Traffic Service

List of definitions

Berth	The space assigned to or taken up by a vessel when anchored or when lying alongside a wharf, jetty, or other structure
Port as Geographical Entity	Any port, terminal, offshore terminal, ship and repair yard or roadstead which is normally used for the loading, unloading, repair and anchoring of ships, or any other place at which a ship can call
Port Authority	Persons or corporation, owners of, or entrusted with or invested with the power of managing a port. May be called a Harbour Board, Port Trust, Port Commission, Harbour Commission, Marine Department etc.
Terminal	A number of berths grouped together and provided with facilities for handling a particular form of cargo, e.g. oil terminal, container terminal
Shipping Industry	The Shipping Industry incorporates all of the entities involved in the operating life of a ship such as shipowners, charterers, cargo owners, port authorities, terminals, pilots, tugs, agents, regulators, Class etc.
Virtual Arrival	The concept whereby a vessel is requested to arrive later to a port than she could reach steaming at full speed. The charterer agrees to accept the vessels NOR at the time that the vessel would have arrived at the port had she steamed at full speed but the vessel is allowed to steam at a lower speed, saving fuel, and arriving at the port at a designated time which will normally be when the port/berth is ready to receive the ship. This avoids a port anchorage filling up with ships, reduces collision risks in the anchorage area and reduces emissions in the port area

Acknowledgements

This Guide is the product of a collaboration between the GEF-UNDP-IMO Global Maritime Energy Efficiency Partnerships (GloMEEP) Project and the Global Industry Alliance to Support Low Carbon Shipping (GIA), established in the framework of the GloMEEP Project.

Particular thanks are due to the entire GIA membership, as well as key industry stakeholders from more than 50 companies, organizations and industry associations that were invited to contribute to this work and provided important input and support. A list of all contributing entities is set out below.

Great thanks are also due to:

- Captain Ben van Scherpenzeel (Port of Rotterdam), the GloMEEP Project Coordination Unit (Astrid Dispert and Minglee Hoe), Dr. Alexandra Ebbinghaus (Shell International Trading and Shipping Company Limited), Captain Andreas Maria Van Der Wurff (AP Moller-Maersk A/S), Ingrid Romers (European Harbour Masters' Committee), and Ian Reed (Shell International Trading and Shipping Company Limited), for drafting the content of this document.

- The MarineTraffic team (Argyris Stasinakis, Stellios Stratidakis, Dimitris Mitrodimas, and Miluse Tichavska) for providing data and analysis as referenced in this Guide.

- The International Taskforce Port Call Optimization for providing inputs and materials (https://portcalloptimization.org).

- The IMO Marine Environment Division (Jose Matheickal, Edmund Hughes, Camille Bourgeon, Michel Ardohain, Ava Jaeggi) and the IMO Facilitation Division (Julian Abril Garcia and Martina Fontanet Solé) for providing inputs to the development of this Guide.

The views expressed in this Guide are those of the authors and do not necessarily represent the opinion of the organizations they work for, or any organization that provided inputs as per list of contributing entities below.

List of entities that provided inputs (GIA members are highlighted in **bold**):

ABB Engineering (Shanghai) Ltd.
APM Terminals
Baltic and International Maritime Council BIMCO
BP Shipping
Bureau Veritas Marine & Offshore SAS
Cargill
Digital Container Shipping Association (DCSA)
DNV GL SE

EMO
Euro Nordic Logistics B.V.
European Harbour Masters' Committee (EHMC)
Exmile Solutions Ltd.
Federation of National Associations of Ship Brokers & Agents (FONASBA)
Grimaldi Group
Hill Dickinson LLP
Inchcape Shipping Services
International Association of Dry Cargo Shipowners (INTERCARGO)
International Association of Ports and Harbors (IAPH)
International Cargo Handling Co-ordination Association (ICHCA)
International Chamber of Shipping (ICS)
International Federation of Shipmasters' Associations (IFSMA)
International Harbour Masters' Association (IHMA)
International Marine Contractors Association (IMCA)
International Maritime Pilots' Association (IMPA)
International Parcel Tankers Association (IPTA)
International Port Community System Association (IPCSA)
International Shipsuppliers and Services Association (ISSA)
Kotug Smit Towage
Lloyd's Register EMEA
Louis Dreyfuss
Maasvlakte Olie Terminal N.V.
A.P. Moller-Maersk A/S
MSC Mediterranean Shipping Company S.A.
North Sea Port
Oil Companies International Marine Forum (OCIMF)
Oldendorff Carriers
Panama Canal Authority
Port of Amsterdam
Port of Gothenburg
Port of Newcastle (Australia)
Port of Rotterdam
Port of Tanger Med
Port of Valencia
Ricardo UK Ltd.
Riverlake Group
Royal Caribbean Cruises Ltd.
Shell International Trading and Shipping Company Limited
Silverstream Technologies (UK) Limited
Stena AB
STM Group
Terntank Ship Management
Total Marine Fuels Pte Ltd.
Verenigde Tank Rederij (VTR)
Vopak Agents
Wärtsilä Corporation

Preface

IMO, in April 2018, adopted resolution MEPC.304(72) on *the Initial IMO Strategy on reduction of GHG emissions from ships*, setting out a vision to reduce GHG emissions from international shipping and phase them out as soon as possible in this century.

The Strategy includes candidate short, mid and long-term measures which the IMO could further develop with a view to achieving the ambitious targets as set out in the Strategy. As part of the list of candidate short-term measures, the Strategy calls for the encouragement of port developments and activities globally to facilitate reduction of GHG emissions from shipping, including provision of ship and shoreside/onshore power supply from renewable sources, infrastructure to support supply of alternative low-carbon and zero-carbon fuels, and to further optimize the logistics chain and its planning, including ports.

It is recognized that the goals of the Strategy will only be achieved through a combination of measures: operational, technical, as well as the use of alternative low-carbon and zero-carbon fuels. Furthermore, it will require collaborative efforts from all stakeholders in the maritime industry.

There is increasing awareness of the important role of ports in the wider supply chain and the action that ports can take to facilitate the reduction of GHG emissions from shipping. This has been recognized through the adoption of resolution MEPC.323(74), in May 2019, which encourages voluntary cooperation between the port and shipping sectors to contribute to reducing GHG emissions from ships. The resolution also invites IMO Member States to facilitate, among others, actions that support the industry's collective efforts to improve quality and availability of data and develop necessary global digital data standards that would allow reliable and efficient data exchange between ship and shore as well as enhanced slot allocation policies thereby optimizing voyages and port calls and facilitating Just in Time (JIT) Arrival of ships.

The concept of JIT Arrival of ships allows for ships to optimize their speed during the voyage in order to arrive at the Pilot Boarding Place (PBP) when the availability of berth, fairway and nautical services is ensured. Therefore, since JIT Arrival allows the ship to adjust and optimize its speed during the voyage, it has been identified as a feasible opportunity to reduce GHG emissions from ships and support the goals of the Initial IMO GHG Strategy.

A prerequisite for JIT Arrival is the optimization of the port call. This will also increase competitiveness of the port, as there is an opportunity for optimal utilization of its assets. Considering that maritime trade is expected to grow,[1] a port could improve its turnover due to better utilization of assets and better planning of resources. Furthermore, as ports are increasingly understanding that their economic function is to benefit those whose trade passes through them,[2] there is growing interest in being able to provide an optimized service and facilitate JIT Arrivals.

Today's maritime supply chains have become increasingly complex – it is a world where a large number of stakeholders interact every minute of every day to manage vessels as they depart, travel and arrive at ports across the globe. To operate effectively and efficiently in complex, customer-centric value and supply chains, all stakeholders require visibility of the vessels and ports they visit. Imagine a major chocolate products manufacturer awaiting a shipment of cacao as raw materials for his manufacturing process. It is extremely expensive to have to stop chocolate manufacturing for lack of cacao. Manufacturers like these have a

1 UNCTAD, Review of Maritime Transport 2019 https://unctad.org/en/PublicationsLibrary/rmt2019_en.pdf

2 Goss, R.O. (1990) Economic policies and seaports: The economic functions of seaports

very keen interest in the whereabouts of their inbound shipments. Stakeholders across the supply chain need to share up-to-date, reliable information about each vessel's location, its speed and the shipments it carries – as well as data on the terminals and locations where the shipments may be collected (or delivered) in order to efficiently connect maritime vessels with other modes of transport such as road, rail or inland waterways.

Terminal operators, barge operators, freight forwarders, road hauliers as well as rail operators will all be able to improve their operations when their activities can be synchronized (Just In Time) with the operations for the vessel that carries the shipments that are relevant for them. E.g. road hauliers waste more time waiting at locations to load/unload than any other cause (including road congestion). To deliver this visibility across supply chains involving maritime transport, the industry clearly needs global data standards.

Purpose of the JIT Arrival Guide

The purpose of this JIT Arrival Guide is to provide information and proposals to the port and shipping sectors as well as port and maritime administrations on how to facilitate JIT Arrival of ships – with a view to reducing GHG emissions by optimizing the Port call business process and providing sustainable solutions to customers in the end-to-end supply chain.

In particular, this JIT Arrival Guide provides a useful toolkit for shipowners, ship operators, charterers, ship agents, shipbrokers, port authorities, terminals and nautical services providers, and other relevant stakeholders who ultimately play a key role in implementing the necessary changes and facilitating the exchange of communication required to realize JIT Arrival from a port perspective.

While this document provides guidance for all shipping segments, it suggests that efforts are intensified to implement JIT Arrival for the container segment first, as there are fewer contractual barriers, and due to the nature of the trade, liner services have more predictable schedules than tramp services. Following this initial stage, scale-up efforts should focus on implementing JIT Arrival in the wet and dry bulk sectors, considering how solutions can be replicated and adapted to the nature of these trades. As a final step, opportunities should be explored for implementing JIT Arrival for other sectors.

Recognizing that port call optimization is a prerequisite to enabling JIT Arrival, this Guide considers in detail the Port call business process, and how the exchange of key information and data that is required for JIT Arrival can be improved. Ultimately, it is the incoming ship that is the receiver of the most up-to-date information on when to arrive and has a deciding authority, either via the Marine Team (onshore) or the Master whether to take the decision to adjust speed in order to arrive JIT which usually depends on the charter party terms. Whilst not all ships will decide to reduce speed to arrive JIT, the incentive here is obvious – GHG emissions reduction due to bunker savings!

This JIT Arrival Guide has been developed by the Global Industry Alliance to Support Low Carbon Shipping (GIA), a public–private partnership originally established under the framework of the GEF-UNDP-IMO Global Maritime Energy Efficiency Partnerships Project (GloMEEP Project). The GIA was launched with the aim to identify and develop innovative solutions to address common barriers to the uptake and implementation of energy efficiency technologies and operational measures.

This document is based on research and discussions undertaken by members of the GIA, as well as several industry roundtables to which key industry stakeholders from almost 50 companies and organizations were invited to contribute. Data presented in this document were provided and analysed in-kind by two GIA members (MarineTraffic and the Port of Rotterdam).

The explanations given of ship operations, contracts etc. are of a general nature and should not be considered as applying definitively to all sectors of the industry. For example, the illustrations in respect of tankers are not necessarily relevant for chemical/parcel tankers, which may carry numerous different cargoes simultaneously and engage in multi-port, multi-berth loading and discharging operations.

The GIA also developed an animation explaining the JIT Arrival concept and barriers to its implementation which can be accessed at:
https://www.youtube.com/watch?v=ioUpqZUNSlg&feature=youtu.be

This document frequently references the Port Information Manual (PIM),[3] a publication which resulted from discussions with the industry on how data for port operations can be exchanged, based on existing nautical and supply chain standards. The PIM is a joint publication of the International Taskforce Port Call Optimization (ITPCO), the International Harbour Masters' Association (IHMA) and the International Association of Ports and Harbors (IAPH). The PIM is also aligned with definitions set out in the Mariner's Handbook (NP100), a publication by the United Kingdom Hydrographic Office (UKHO) that is available on the bridge of most SOLAS ships.

Introduction to JIT Arrival

The process of a port call nowadays is not generally optimized. Ships may "hurry" to the next port, only to find out that the berth is not available because e.g. another vessel is alongside, cargo is not available for loading, or no tank is available for discharging. This results in either having to "wait" outside the port at anchorages for many hours, days or even weeks, or manoeuvre at very low speeds in the port area while waiting for the availability of berth, fairway and nautical services. This "hurry up and wait" mode of ship operation has many disadvantages and from a safety, environmental and economic perspective can be improved significantly.

In an example of today's operation below (Figure 1), a ship leaves the port at full speed with an original Requested Time of Arrival at the Pilot Boarding Place (RTA PBP)[4] scheduled for day 14. In reality, in most cases, no RTA PBP is provided at all. However, three days into the voyage, delays in the port result in a change of the RTA PBP from originally day 14 to day 17. Nowadays, the RTA PBP is not transmitted frequently to the ship and without that up-to-date information the ship is unable to adapt its speed. Consequently, the ship continues to sail at full speed to arrive at the port as per original RTA on day 14. As the berth is not available, the ship anchors for 3 days before getting into berth.

3 https://portcalloptimization.org/images/Port%20Information%20Manual%201.4.4%20-%20final%20(2).pdf

4 RTA PBP is calculated by the Port Authority, taking into account:

- Maximum size of the ship
- Maximum conditions for the ship
- Cross check on berth availability
- Availability of the fairway
- Availability of the nautical services
- Clearances of other authorities e.g. customs, immigration etc.

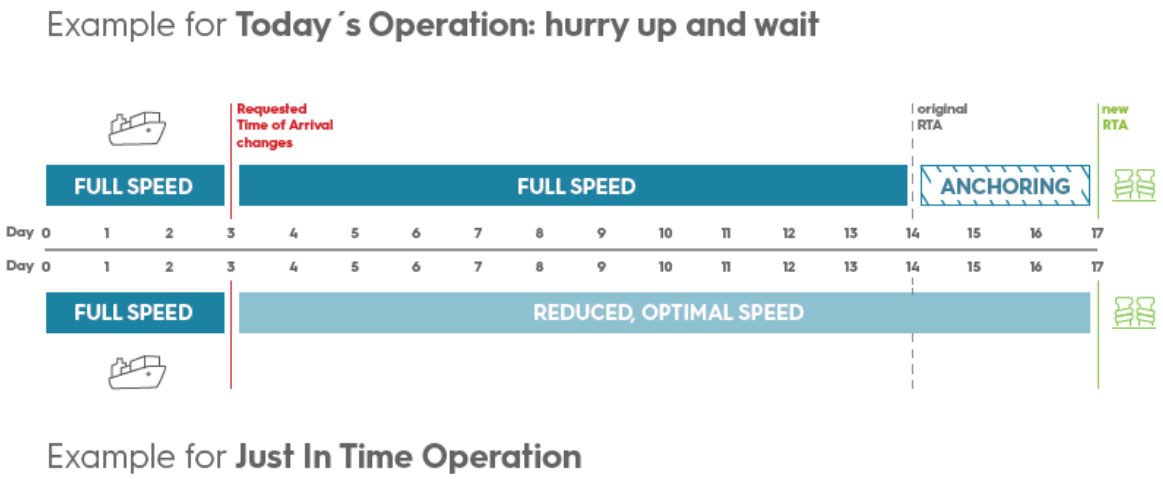

FIGURE 1: TODAY'S OPERATION VS. JIT ARRIVAL

On the contrary, the JIT Arrival of ships allows a ship to maintain the optimal ship operating speed to arrive at the Pilot Boarding Place when the availability of: 1. berth; 2. fairway; and 3. nautical services (pilots, tugs and linesmen) is ensured. This may still include anchor time as the optimized speed may take the ship to Pilot Boarding Place before the RTA Pilot Boarding Place. In a JIT Arrival scenario, the RTA PBP is communicated frequently to the ship, thereby enabling the master to take a decision to optimize the ship's speed. Again, in the example set out in Figure 1, the change in the RTA PBP on day 3 was communicated to the ship, allowing it to reduce speed and arrive at the destination point at that new RTA (day 17).

JIT Arrival is not to be confused with slow steaming or an average/absolute speed limit. Through the application of JIT Arrival, the overall length or duration of a voyage is not impacted and remains the same. Instead the voyage overall is optimized – the ship may spend more days sailing, but the aim is to minimize and preferably eliminate waiting time and enable sailing at a speed which gives reduced fuel consumption per mile steamed.

Through the application of JIT Arrival, GHG emissions and air pollutants can be reduced in a twofold manner:

1. for the ship voyage through the optimization of the sailing speed and hence more optimal engine efficiency resulting in lower fuel consumption;
2. for the port area as time of ships manoeuvring in the approaches or waiting at anchorage is reduced.

Emissions reduction en route

Preliminary analysis undertaken by the GIA (Port of Rotterdam – in collaboration with the Netherlands Organisation for Applied Scientific Research (TNO)) shows that if all incoming containerships calling at the Port of Rotterdam in 2018 had known their RTA PBP 12 hours in advance, shipping emissions in the last 12 hours of the voyage could have been reduced by 4% (or a total of 134,000 tonnes of CO_2 in 2018). Even bigger emissions savings opportunities exist if berthing times are communicated more than 12 hours prior to arrival.

A desktop exercise conducted by the GIA also demonstrated that JIT Arrival can reduce GHG emissions considerably. The exercise considered the voyage of a containership between Bremerhaven and Rotterdam (247 nm distance) and simulated different potential scenarios. In the business as usual scenario, the ship received an RTA PBP update at the first Calling In Point (when the ship is in VHF radio range, around 30nm from port). In the JIT Arrival scenario,

the ship received several updates on the RTA PBP much sooner en route to Rotterdam, allowing optimization of the ship's speed. The subsequent emissions calculations showed that 23% less fuel was consumed in the JIT Arrival scenario, a significant reduction in fuel and therefore emissions and costs to the shipowner. A summary and details of the desktop exercise is set out in Annex 3.

Emissions reduction in port anchor areas

Analysis of global AIS data undertaken by MarineTraffic shows that ships, on average and depending on the ship type, spend up to 9% of their time waiting at an anchorage (Figure 2). Data used for this analysis was filtered to remove any ships that, after waiting at an anchorage, did not call at the immediate port, i.e. ships that spent time at anchorage for other reasons (such as waiting for the next orders) were excluded from the analysis. The waiting time therefore represents the actual time ships wait at anchorage before getting into berth. It is important to note that, although main engines are not running when waiting at anchorage, ships utilize auxiliary engines and boilers (e.g. for cargo heating and cooling) so are creating emissions in the port area.

Today, ships may spend 5% to 10% of their time waiting to get into port, either dropping anchor or manoeuvring at low speeds in the port approaches – highlighting the existing potential that JIT Arrival could have, if effectively implemented.

It is important to note that there are other reasons for ships to anchor, besides waiting for a berth, and therefore the goal of JIT Arrival is not to eliminate anchorage completely. For example, containerships may choose to build in a time buffer to an ocean crossing. Bulkers and tankers may have additional reasons to anchor such as hull inspections, ship maintenance and repairs, preparations for port operations or waiting for cargo price fluctuations etc. However, JIT Arrival aims to assist in reducing the unscheduled ad hoc time at anchorage, rather than eliminate it completely.

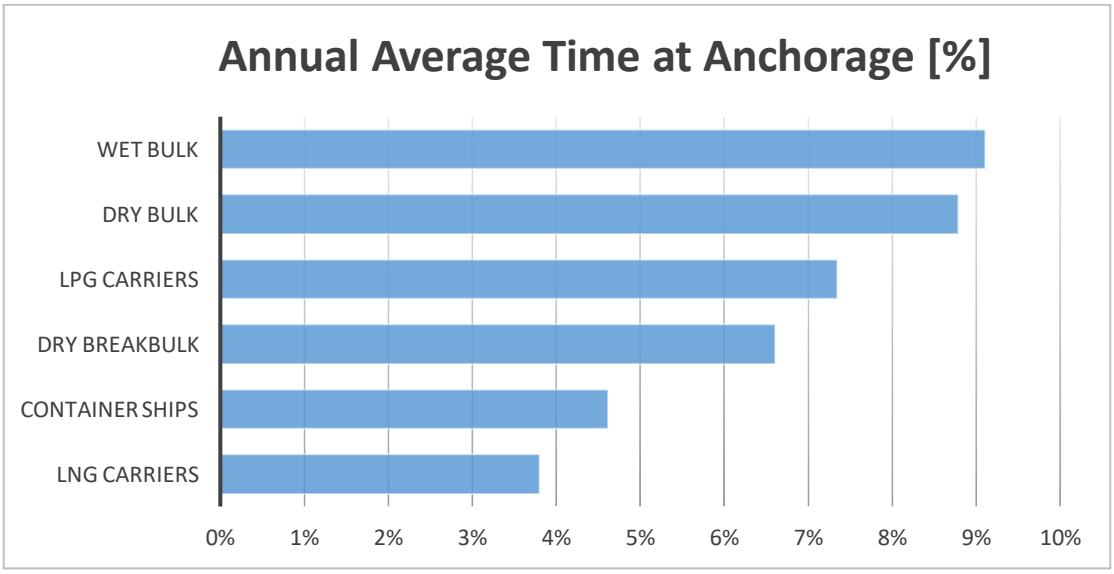

FIGURE 2: ANNUAL AVERAGE TIME AT ANCHORAGE

The reference global dataset includes all ships (with IMO numbers) of 5,000 GT and above with completed port call cycles (Arrival at anchorage – departure from port) and excluding In Transit calls. The timeframe was: 1 January – 31 December 2018. The ships included are part of the core commercial markets (dry bulk, dry breakbulk, wet bulk, containers, LNG carriers and LPG carriers). Calculations are based on the total waiting hours of all applicable ships that spent time waiting at anchorage areas outside inner port limits before performing their

operations based on geofencing. Total time has been averaged out to come up with a per ship percentage of waiting times over the course of the reference year (2018).

The reduction of waiting time at anchorage can in itself result in additional potential benefits:

- Less congestion and traffic in the anchorage areas
- Reduced risk of accidents/collisions
- Reduced risk of attacks in areas prone to robbery or piracy (as these occur more frequently at anchorage than en route)

Interestingly, further research undertaken by the GIA shows that some ships are reluctant to drop anchor. Instead they choose to manoeuvre outside ports/sail in circles to avoid any risks associated with anchoring e.g. collisions with other ships at anchorage (especially during rough weather/sea conditions) or due to bad or foul holding ground of the anchorage area, and risk of losing anchor or not being able to retrieve it. This behaviour may warrant further study.

Figure 3 shows an example of a containership calling at the Port of Rotterdam and manoeuvring/sailing circles in the approaches for a duration of approximately 12 hours before getting into berth. The graph also shows that if the ship had sailed with JIT Arrival from 2 March 2019 onwards (green dotted line with a constant speed) when up-to-date berth information was available (red dot above graph), the ship could have reduced speed approaching the port as well as avoided wasting time manoeuvring/sailing circles at low speeds – resulting in potential fuel savings of 14.3 tonnes of fuel or 15% for this voyage.

Analysing one week of data (26 February – 5 March 2019) of all deep sea containerships (feeders excluded) calling at the Port of Rotterdam shows that, of a total of 61 ships calling at the port, 11 ships waited at anchorage and 19 ships manoeuvred in the approaches (sailing circles or dropping speed below 10 knots before arriving at the Pilot Boarding Place). The remaining 31 ships arrived without manoeuvring or dropping anchor. Noted: ships that dropped anchor might also have optimized speed but anchored as the speed to maintain was below the optimized speed.

Box 1: Research on the potential of fuel and emissions reduction from JIT Arrival

AIS analyses undertaken by DNV GL[5] indicate that about 15% of marine fuel consumption for the world fleet occurs under port stays, anchorage and when ships operate at very low speed, below 1 knot. There is a wide variation between different ship types.

Analysis undertaken by Maritime Strategies International (MSI) for ABS[6] in order to assess the potential of the main operational options available to shipping, modelled the effect of potential efficiency improvements 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_2 emissions savings are around 10% to 11% annually.

5 DNV GL, Maritime Forecast to 2050, Energy Transition Outlook 2018, https://eto.dnvgl.com/2018/maritime

6 ABS, Setting the Course to Low Carbon Shipping, 2030 Outlook | 2050 Vision, https://ww2.eagle.org/en/innovation-and-technology/sustainability-for-the-maritime-sector.html

FIGURE 3: CONTAINERSHIP MANEUVERING IN THE APPROACHES BEFORE CALLING AT THE PORT OF ROTTERDAM

Although much focus is given on the reduction of GHG emissions, less time at anchorage would also reduce the emissions of harmful air pollutants in the port area and thereby improve local air quality. These air pollutants, such as NOx, SOx and PM, are of particular concern in port and coastal areas where there is a high level of maritime and industrial activity.

Port optimization and competitiveness

In order to implement JIT Arrival, relevant stakeholders in the Port call business process will need to work closely and collaboratively, to ensure that information and updates are always communicated to the necessary parties. It is this efficient exchange of information that optimizes the Port call process.

The optimization of port calls and all the related processes would increase the competitiveness of the ports concerned. As the industry increasingly looks for ways to lower GHG emissions, shipping lines/charterers may favour ports which can provide more accurate and reliable information about the availability of its services, enabling ships to arrive Just In Time, thereby reducing fuel consumption. If delays and inefficiencies in the port are minimized, it would improve the port's reputation and possibly lead to growth in turnover and trade.

Additionally, with more transparent information and exchange of data and timestamps, ports would be able to plan more effectively the provision of their nautical services and capacity of berths. JIT Arrival builds upon this, as it requires the communication of reliable and accurate information relating the availability of tugs, pilots, berth etc.

Other advantages and disadvantages of JIT Arrival

The advantages and disadvantages of JIT Arrival for the different stakeholders are summarized in the table below:

Party	Advantages	Disadvantages
Shipowner/ Charterer	• Reduced fuel consumption • Reduced lube oil consumption • Reduced cost for fuel and lube oil • Prefer certainty above uncertainty • Less accidents in anchorages • Less hull fouling • Better GHG emissions behaviour • Sustainability • Less risk of piracy in affected areas • Early notice of an RTA Berth / Pilot Boarding Place allows to plan e.g. maintenance, bunkers or crew change without taking the ship off-hire and may even allow rescheduling with the next charterer resulting in less idle time. • Better certainty allows the freight traders / ship brokers to market the ship off tighter dates and could potentially allow the laycan to be narrowed	• Less time at anchor to undertake maintenance work such as repairs or preparing vessels for cargo intake, vetting etc. However, nothing stops the ship arriving earlier to do repairs • There may be times when a ship needs to speed up to arrive JIT – although this is less likely than in cases of reducing speed • Without change of contracts shipowners of ships under voyage contract could lose out on demurrage
Port	• Optimized port processes • Better capacity planning of nautical services (pilots, tugs and linesmen) • Increased safety and reduced risk of collisions	• More workload to provide updates (if not already automated)
Terminal operator	• Better capacity planning of berths • Better capacity planning of resources	• More workload to provide updates (if not already automated)
Environment	• Lower GHG emissions and reduced air pollution attributable to ports (in approaches and at anchorages)	
Shipper	• Enhanced supply chain visibility due to improved predictability of cargo whereabouts • Optimized stock management • Better planning of type and timing of hinterland modalities	
Seafarer	• Improved compliance to Maritime Labour Convention (MLC) due to improved rest hour planning	Less opportunities for seafarers for shore leave
Hinterland modalities	• Optimized planning as most modalities depend on planning of the deep-sea vessel	

Introduction to the Port call business process, key timestamps and locations

From an operational perspective, JIT Arrival is dependent on the exchange of reliable timestamps, and in particular, the Requested Time of Arrival at the Pilot Boarding Place, which is the time the port requests the ship to arrive at the Pilot Boarding Place. In order to obtain this timestamp accurately and sufficiently in advance to allow a ship to adjust speed, communication of information amongst stakeholders in the port needs to be optimized and facilitated in an easy way. This optimization of the Port call business process is therefore a prerequisite to allow JIT Arrival and is subsequently one of the biggest challenges faced in its implementation.

As a starting point, six key timestamps were identified as the most important in bringing a ship into port.

The six key timestamps for a port call are:

1. Estimated Time of Completion (ETC) – Terminal
2. Estimated Time of Completion (ETC) – Bunkers
3. Estimated Time of Departure (ETD) – Berth
4. Requested Time of Departure (RTD) – Berth
5. Requested Time of Arrival (RTA) – Berth
6. Requested Time of Arrival (RTA) – Pilot Boarding Place

Timestamp	**Official Definition**[7]
ETC	When a service provider estimates the completion of a specific service
ETD	When a vessel estimates it departs from a specified location
RTD	When a vessel is requested to depart from a specified location
RTA	When a vessel is requested to arrive at a specified location

The two key locations for a port call are:

- Pilot Boarding Place – This is the first location where a ship meets nautical services (i.e. the pilot).
- Berth position – This is ultimately the position in the terminal where the ship will berth.

7 From the Port Information Manual.

Figure 4 illustrates the connectivity between these timestamps and their importance in bringing a ship into port.

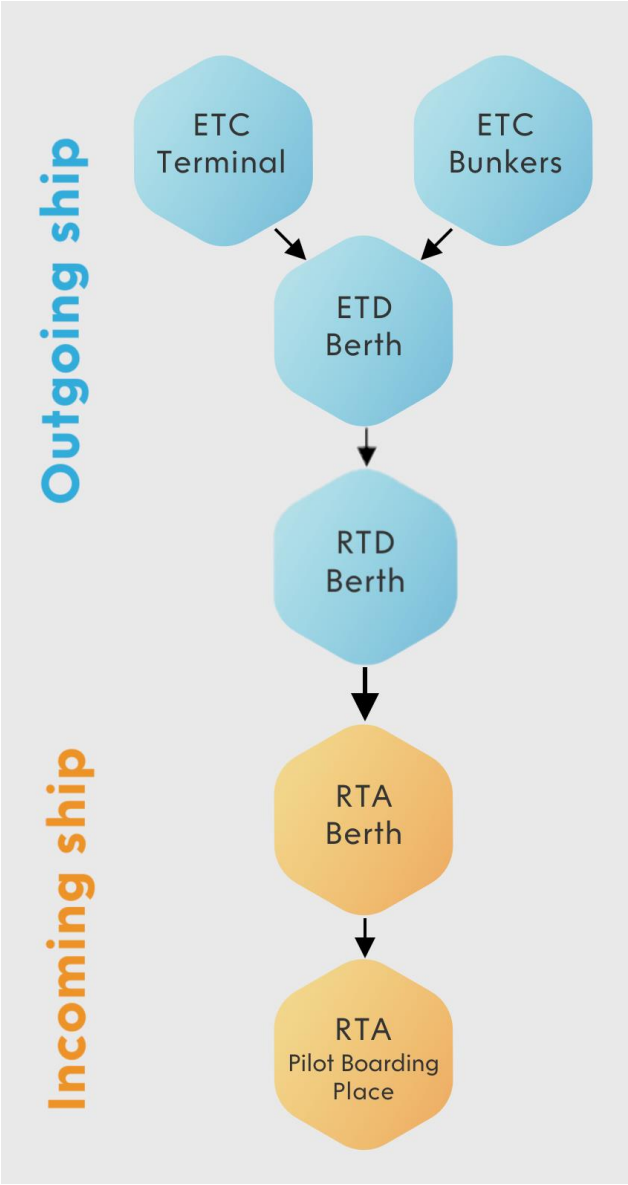

FIGURE 4 KEY TIMESTAMPS FOR A PORT CALL

Estimated Time of Completion (ETC) – Terminal
The time at which the terminal operator estimates that all terminal operations, related to the ship, will be completed.

Estimated Time of Completion (ETC) – Bunkers
The time at which the bunker barge estimates that the bunker operation will be completed.

Estimated Time of Departure (ETD) – Berth
The time at which the ship or agent estimates to depart from the berth. The ETD Berth is based on the completion time of cargo operations and all other critical services to the ship (for example bunkers, provisions, waste disposal, clearances). Note: Focus is on ETC terminal and Bunkers as these services are critical and normally cause most delays.

Requested Time of Departure (RTD) – Berth
The time at which the local authority/Harbour Master requests the ship to leave the berth. This timestamp is based on the ETD Berth and is a confirmed time for departure based on the availability and planning of nautical services, wind, tide, fairway conditions and planning.

Requested Time of Arrival (RTA) – Berth
The time at which the terminal operator requests the ship to arrive at the berth, based on the terminal/berth planning. Note: RTA Berth depends on the RTD Berth of the previous vessel.

Requested Time of Arrival (RTA) – Pilot Boarding Place
The time at which the local authority/Harbour Master requests the ship to arrive at the Pilot Boarding Place in order to meet the RTA Berth. This time is closely linked to overall port planning and planning of nautical services. Note: RTA PBP depends on the RTA Berth.

In order to realize JIT Arrival, the incoming ship would need to know in advance when the berth would be available. Of all ships calling at a container port 80% will exchange berth with a ship alongside and hence will have to wait for a ship to vacate the berth. Therefore, in most cases, the Requested Time of Arrival of the incoming ship will be dependent on the Estimated Time of Departure of the ship currently alongside at berth (ETD Berth).

The Estimated Time of Departure of the ship alongside will, on the other hand, depend on the completion time of the services (e.g. cargo and bunker operations) that are provided to the ship (ETC Terminal and ETC Bunkers). In essence, ETD Berth is a ship's indication of its readiness to leave berth; it is the moment when the cargo operations will have ended, the bunkering will have been completed as well as the other services, including clearances to the ship during its stay alongside.
Based on the ETD Berth communicated from the ship (via the ship's agent) to the Port Authority, the Port Authority calculates the Requested Time of Departure from berth (RTD Berth). RTD Berth will depend on wind, tide and traffic conditions, as well as the availability of tugs and pilots. The availability of these nautical services is normally dictated by other ship movements, stressing the need to make the planning of ships a port community issue, rather than a trade specific issue.
RTD Berth will subsequently dictate when the incoming ship will be able to come alongside (RTA Berth of the incoming ship). The most crucial timestamp and the real prerequisite to JIT Arrival is the Requested Time of Arrival at the Pilot Boarding Place (RTA PBP). Once the ship is informed when it is requested to arrive at the PBP, it has the information at hand to be able to take the decision to implement JIT Arrival and optimize its speed.

Port call business process

Considering the RTA PBP as the key timestamp required by the ship in order to arrive JIT, and understanding how the port operations impact on this timestamp, much of enabling JIT Arrival hinges on optimizing the Port call business process. Whilst the identification of the six key timestamps provides a high-level overview for a port call, the process is, of course, more complex.

For this purpose, the International Task Force for Port Call Optimization[8] has mapped out a high-level business process, which is port and trade agnostic. It has been developed based on existing BIMCO contracts and IMO resolutions – which are widely used by every port and every trade.

The business process has two main phases:

The contractual phase, which includes:

- Contract for sale of goods (bulk) or carriage (container)
- Contract for hiring ships
- Contract for hiring terminal service

The operational phase, which includes:

- Passage planning
- Berth planning arrival
- Port planning arrival
- Vessel and cargo service planning
- Port planning departure

The Port call business process can be found in Figure 5. Each phase is described in more detail below, with particular reference to the three main ship types (bulkers, tankers and containerships). Further details can be found in the Appendix to the Port Call Process.

8 https://portcalloptimization.org/

International Taskforce Port Call Optimization

Port Call Optimization

Lower costs, cleaner environment, more reliability and safety for shipping, terminals and ports.

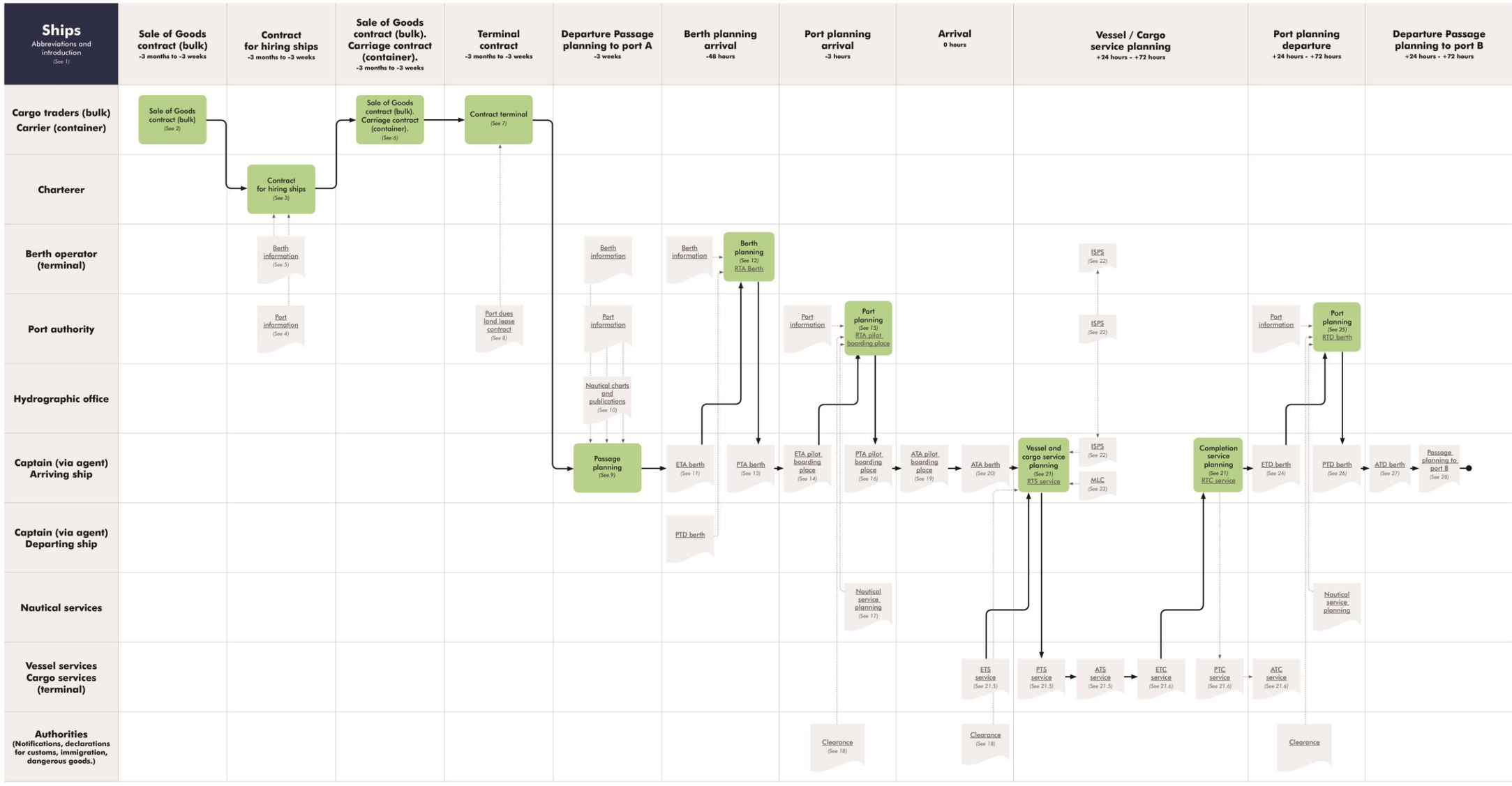

FIGURE 5 PORT CALL BUSINESS PROCESS

Contractual phase

Sale of goods contract (bulk/tanker) or carriage contract (container)
This refers to the moment that a buyer and seller agree on the sale of goods. This might be bulk cargo, such as grain or oil, or customer goods, transported by container.

About 85% of global shipping (in cargo ton miles) is related to the carriage of bulk cargoes, being commodity goods. Normally, this trade is dominated by trading, i.e. an agreement between a cargo seller and a cargo buyer.

The sales or purchase contract between cargo buyer and seller specifies:

- Price
- Quantity
- Quality
- Load/discharge window
- Load/discharge port

The contract may be absolute, meaning that the sale occurs on agreement of the contract, or it may be conditional, i.e. dependent on certain conditions such as chartering a ship for transportation. The type of contract (absolute or conditional) will depend on the desire of the contracting parties.

Based on the Incoterms,[9] the party responsible for transport of the cargo (this could be either the buyer or the seller) needs to charter a ship or space on a ship, if a ship is needed. The search for available and suitable ships might be undertaken by a (chartering) broker.

About 15% of shipping (in cargo ton miles) is related to containerized cargo trade. Some goods are commodity goods, but most are customer goods. Normally this trade is dominated by a consignor, the owner of the goods, who offers the containerized goods to be transported to a carrier.

The contract of carriage between the carrier of goods or passengers and the consignor, consignee or passenger specifies:

- Rights, duties and liabilities of parties to the contract
- Topics such as acts of God and includes clauses such as force majeure

When a product has to be moved from the factory to the quay in a port, the whole transportation has to be arranged. Usually the consignor will assign a freight forwarder, who will take on this responsibility of transporting the goods. The freight forwarder will procure the actual transportation to one or more “performing carriers”, the ones who ultimately transport the goods. In such case, there is a forwarding contract between the consignor and freight forwarder, and a contract of carriage between the freight forwarder (on behalf of the consignor) and carrier.

Contract for hiring ships
If the party responsible for transport does not own a ship, a ship needs to be hired (chartered). The charterer (who could be either the buyer or the seller) needs to sign a contract with the shipowner or disponent operator, the so-called charter party.

[9] Incoterms are a set of rules which define the responsibilities of sellers and buyers for the delivery of goods under sales contracts.

There are many different types of charter party, the most common types are shown in Figure 6.

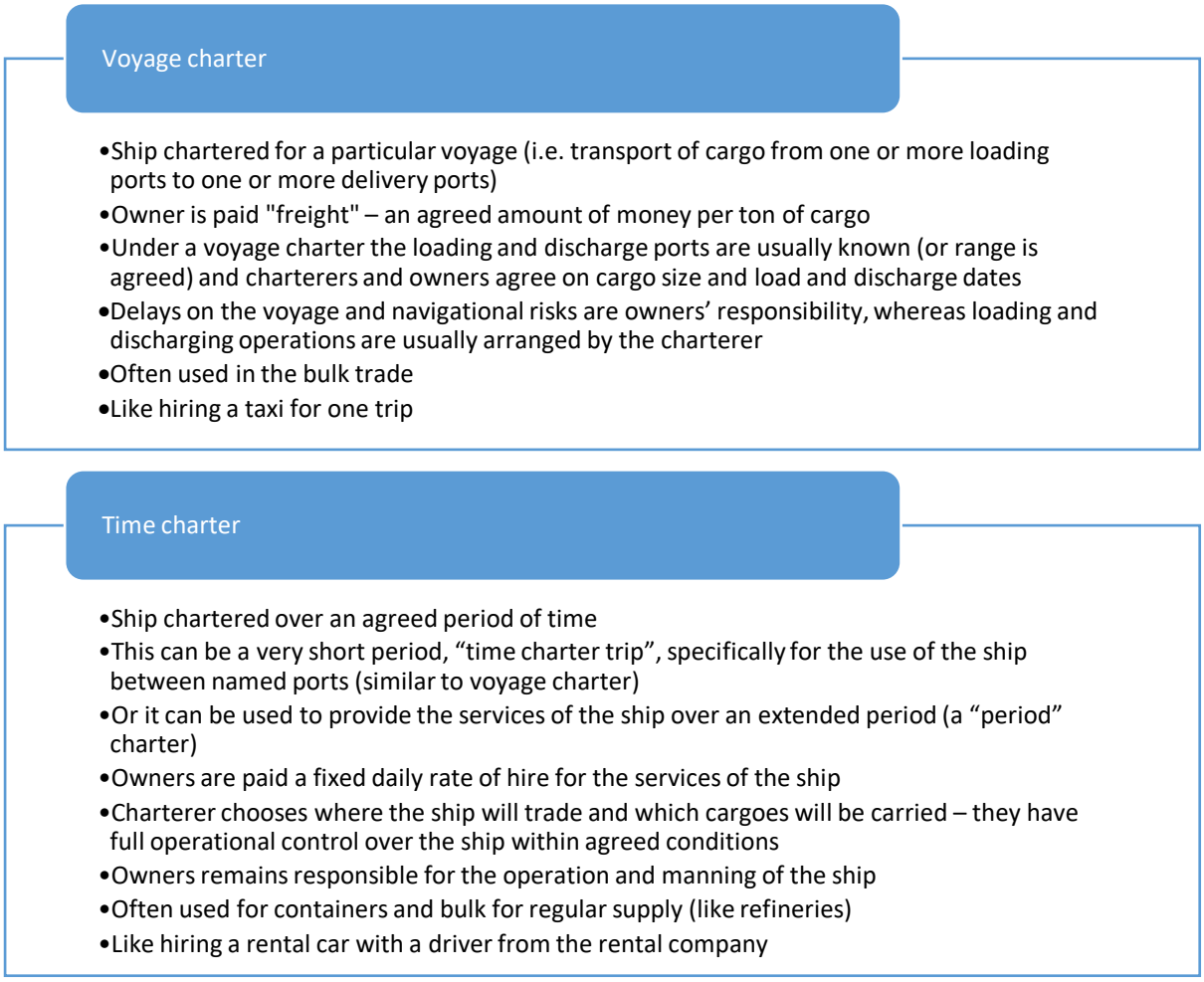

FIGURE 6: TYPES OF CHARTER PARTY

Every charter party can be different in terms of the clauses it includes, and more information about each specific clause can be found in the Appendix to the Port Call Process (Section 3). For JIT Arrival, the most important clauses are as follows, but they do not necessarily apply to every type of charter:

Delivery/redelivery of the ship

The agreement on when the ship needs to be delivered by the owner to the charterer is referred to as the laycan (laydays cancelling).

This means that the ship must arrive at an agreed location specified in the charter party before the laycan ends and tender a Notice of Readiness (NOR) to the charterer; meaning the ship is ready in all respects to load the nominated cargo. This is the so-called "approach or ballast voyage". If the ship does not arrive within the agreed period, the charterer has the right to cancel the charter party and look for another ship. The location of where the ship should tender the NOR will differ depending on whether it is a port charter party or a berth charter party. For a port charter party, the NOR will be tendered when the ship arrives in the port area (e.g. anchorage), and for a berth charter party, the NOR will be tendered when the ship arrives at the berth.

At the end of the charter party contract, after arriving at the discharge port (depending on the terms), tendering the NOR and completing the last discharge (last hose or arm for tanker trade), the ship will be redelivered by the charterer to the owner, so the ship can proceed to the next charterer, to arrive again between the agreed time period (laycan).

For time charters the delivery and redelivery may be at a specific point of time rather than a location.

Due despatch

After loading the cargo in the load port under English law, in most other jurisdictions, and under most charter parties, the master has an obligation to proceed on the voyage to the discharge port with due despatch, i.e. without reasonable delay and without deviating unless there is an exception clause. After arriving at the location as agreed in the charter party, the master tenders the NOR. Even when the master is informed that the berth will be occupied for days or even weeks to come, the master must still stick to this procedure. Clear wording in charter parties, bills of lading[10] (B/Ls) and other contracts of carriage is needed to protect owners from claims of breach of the due despatch obligation.

Time allowed for loading/discharging

The time allowed for loading/discharging cargo after tendering a NOR, specified in hours or days, is agreed in the voyage charter party. This is known as laytime or laydays. If more hours or days are needed for loading/discharging, demurrage costs need to be paid by the charterer to the owner. If fewer hours are required, despatch costs may be paid by the owner to the charterer, if agreed in the contract.

The figure below illustrates how many ships currently operate under voyage charter party.

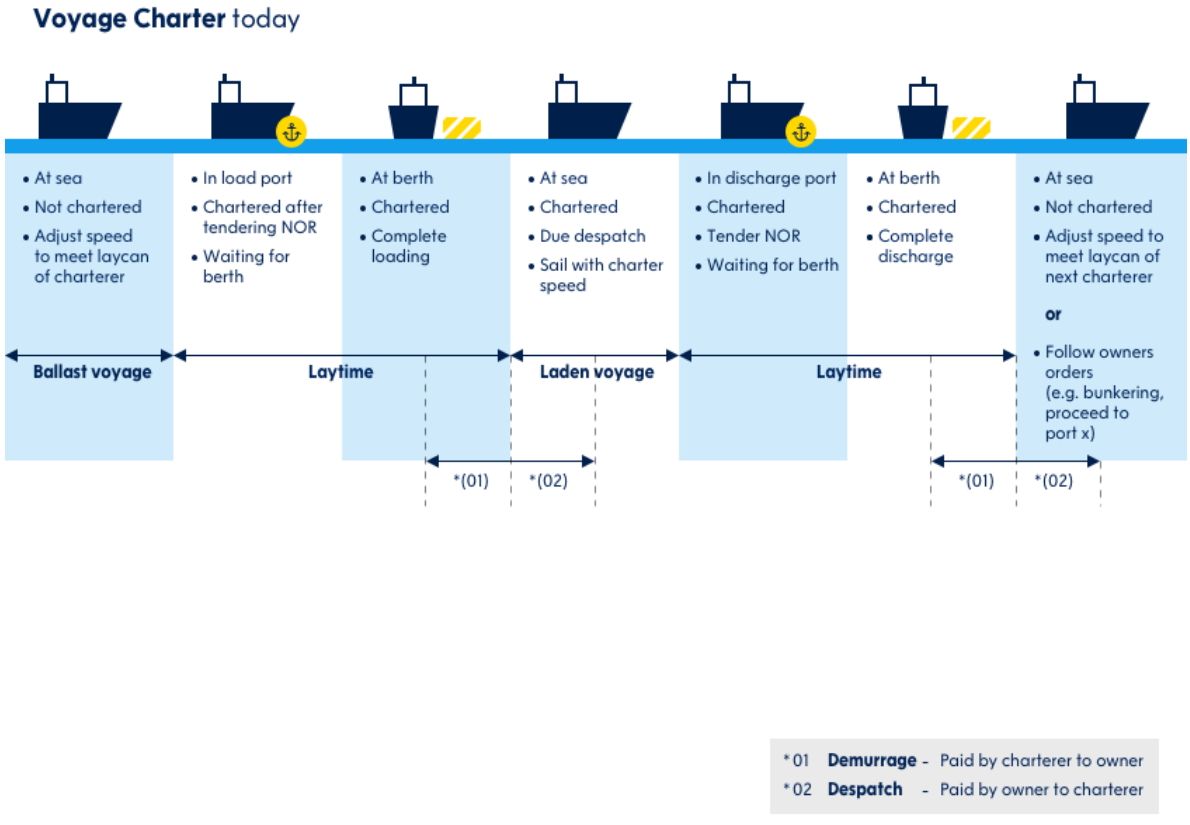

FIGURE 7: VOYAGE CHARTER PARTY

10 A receipt detailing the cargo received on board given by the master of ship to the consignor.

Contract for hiring terminal service

 In the bulk and tanker sectors, in case there is no fixed contract with the discharge terminal, a tank storage contract or terminal service agreement needs to be signed between the cargo buyer or seller and the terminal.

The terminal service contract specifies:

- Tariff per m^3 for services to be provided
- Quantity of goods to be stored
- Number of calls or hours alongside
- Communication procedure to provide a berthing window xx hours before arrival

 In the container sector, the carrier has a contract with the terminal. The terminal contract specifies:

- Windows per service, ETA Berth and ETD Berth
- Expected Berth Moves Per Hour (BMPH)
- Tariff per container
- Number of hours before ETA Berth containers can be delivered to the terminal (cargo cut)
- Number of hours after ETD Berth containers may remain at terminal
- When stowage list must be available to the terminal

Operational phase

Once the relevant contracts have been agreed and established, the operational phase begins in which the ship plans its voyage to arrive at the agreed location.

Passage planning

SOLAS Chapter V, Regulation 34 states:

> **Regulation 34**
> *Safe navigation and avoidance of dangerous situations*
>
> 1 Prior to proceeding to sea, the master shall ensure that the intended voyage has been planned using the appropriate nautical charts and nautical publications for the area concerned, taking into account the guidelines and recommendations developed by the Organization.‡

This results in the development of the “passage plan” or “voyage plan”, which sets out the planned passage from berth to berth.

Planning the speed from berth to berth depends on the charter party and any restrictions in the port transit which may require masters/pilots to adjust speeds accordingly.[11]

 For bulkers and tankers under voyage charter:

- On ballast voyages, the owner can adjust speed to meet the laycan
- On laden voyages, the shipowner needs to comply with the “due despatch” clause and maintain a service speed (within an agreed bandwidth) up to the location as agreed in the charter party (normally the anchorage) and tender the NOR

11 http://www.imo.org/en/KnowledgeCentre/IndexofIMOResolutions/Assembly/Documents/A.960(23).pdf

- ETA Berth/Pilot Boarding Place is based on that service speed, regardless if the berth is available or not
- During the voyage, the discharge port may change frequently

 For containerships under time charter:

- Containerships sail according to their fixed rotation schedule
- ETA Berth/Pilot Boarding Place is based on that schedule, adjusted for tidal effects
- Normally, as the ship gets closer to the port, the ship receives information whether the berth will be available, allowing the ship to adjust speed

Berth planning arrival

Berth planning is organized by the terminal. The terminal requests the ship to come alongside at a particular berth at a particular time, known as the Requested Time of Arrival at the Berth (RTA Berth), and is based on the planning of multiple ships at the berths of the terminal. A reliable RTA Berth, 80% of the time, dictates a reliable pick up time of the containers, depending on customs.

 Bulk and tanker sectors

The terminal has no contract with the carrier and so the normal practice is “first come, first served”. However, the charterer has a service contract with the terminal (terminal service contract). If the loading or discharging operation takes longer than specified in the terminal service contract, the charterer can claim demurrage against the terminal, even though ultimately the demurrage claimed would be passed through to the owner. Therefore, the terminal operator might prioritize a ship which causes less demurrage costs versus another ship and for this reason, terminal planning can be considered as commercially sensitive.

In the case of traded cargoes in the bulk and tanker sectors, when a trader decides to sell the cargo right before arriving at port, the new buyer may dictate another port or berth at the last minute. Traders always want a maximum amount of flexibility in their choice of a terminal until the last moment of cargo sales. It is the buyer who then dictates which terminal to go to and the seller has to adapt. This makes the berth planning more challenging; however, the new sale will likely be for delivery on realistic dates depending on the ship’s current position.

 Container sector

The terminal has a contract with the carrier and again the normal practice is “first come, first served”. If the terminal is only serving one customer, the planning is normally not commercially sensitive. However, if the terminal is serving more customers (i.e. a “multi-user terminal”), the information can become commercially sensitive if the terminal prioritizes a ship which causes less costs (e.g. a ship which is owned by the same operator as the terminal or a ship whose on board cargo is about to deteriorate).

Port planning arrival

Port planning is organized by the Port Authority (or delegated to e.g. pilots and tugs or VTS) and is based on the berth planning of terminals in the port areas. In a landlord configuration, which is the most common operational model in the world, the Port Authority[12] has limited control over the berth planning of a terminal (as this is done by the terminal), whilst at the same time, port planning is dependent on the planning of the individual terminals. In this respect, the Port Authority’s ability to plan a ship’s arrival at the port depends on good information from the terminals.

[12] NB In the case of an integrated service port, the terminals and Port Authority would be the same entity.

Based on the berth planning of the various terminals, the Port Authority provides the incoming ship with a Requested Time of Arrival at the Pilot Boarding Place (RTA PBP), taking into account:

- Maximum dimensions of the ship
- Maximum conditions for the ship (wind, tide, visibility)
- Cross check on berth availability
- Availability of the fairway – planning of other ships on the fairway and harbour basins
- Availability of the nautical services (e.g. pilots, tugs and linesmen)
- Clearances of other authorities (e.g. customs, immigration etc.)

Cargo and vessel service planning

Cargo services refer to the loading and discharging of cargo or containers, whilst vessel service planning refers to bunkers, waste collection, provisions, repairs, maintenance etc. When the ship is alongside, the departure time is dependent on the completion time of all critical services. Critical services are services that need to be completed before departure. Non-critical services might be rendered in the next port. In other words, the completion of all critical services will determine the Estimated Time of Departure from the Berth (ETD Berth).

Cargo services

 In the bulk and tanker sectors, cargo services are often ordered by the charterer. As mentioned previously, in the charter party there is an agreement on laytime which sets out the allowed number of days, hours or tons per day to load and/or discharge after the NOR has been tendered.

Another important service for the bulk trade is the cargo survey, which is necessary after the loading and discharge of bulk commodity goods. The cargo surveyor determines the quantity and quality of the cargo loaded or discharged as per sales of goods contract.

 In the container sector, cargo services are ordered by the carrier. In the terminal service contract, the expected Berth Moves Per Hour (BMPH) is specified. Another important service for the container sector is the lashing service, which is necessary before unloading and after loading containers on board.

Vessel services

Many different services might need to be rendered to the ship: bunkers, fresh water, waste collection, provisions, consumables, medicines, repairs, maintenance etc. Services might be ordered through the owner or the charterer, depending on the type of charter party. The following are some examples of vessel services and who is responsible for them:

- Bunkers are ordered by the owner for ships under voyage charter party, and by the charterer for ships under time charter party.
- Spare parts for main engines are normally ordered by the owner (via the superintendent).
- Consumables and provisions might be ordered by the superintendent (on behalf of the owner) or by the master.

Depending on whether the agent represents the owner or the charterer and if services are ordered directly or via the agent, the agent may or may not be informed about these services and when they are expected to arrive at the ship. If services are not ordered via the agent, as

the agent is not representing either the owner or charterer, the service provider might not be updated on arrival or departure times, or conflicting services.

On all ships whose flag is Party to the Maritime Labour Convention (MLC), the master has to comply with the provisions of the Convention, taking care of wages, food, outfitting of cabins, but of most relevance when considering the Port call business process: the rest hours of the crew. Therefore, it is important for the ship to understand which services are coming when, avoiding unnecessary waiting hours for the crew. In turn, it benefits the service provider if the crew is standing by on their arrival.

Port planning departure

In line with local port regulations, the ship must advise the Port Authority of the ship's Estimated Time of Departure from the Berth (ETD Berth)– which depends on the Estimated Time of Completion of all services.

The ship (via the agent) must also order nautical services, like pilots, tugs and linesmen, and customs and immigration. These services might need a minimum amount of notice in advance. Changing the time after this minimum notice period might result in financial consequences or the unavailability of services at the intended time of departure.

Based on the ETD Berth, the Port Authority provides a Requested Time of Departure from the Berth (RTD Berth), taking into account:

- Maximum dimensions of the ship
- Maximum conditions for the ship (wind, tide, visibility)
- Availability of the fairway – planning of other ships on the fairway and harbour basins
- Availability of the nautical services (e.g. pilots, tugs and linesmen)
- Clearances of other authorities (e.g. customs, immigration etc.)

The RTD Berth is a request of the Port Authority to the ship to depart from the berth.
With this understanding of the Port call business process, the next chapter looks into the main barriers and solutions to implementing JIT Arrival, in the context of the various stages of the Port call business process.

Barriers and proposed solutions to JIT Arrival

Whilst JIT Arrival is conceptually simple to understand, in practice it can be challenging to implement. JIT Arrival requires enhanced collaboration among many stakeholders, including port authorities, terminals, shipping companies, service providers etc. Importantly, JIT Arrival requires active communication (i.e. data exchange) between all the stakeholders involved in the organization and efficient execution of a port call.
Barriers to JIT Arrival can broadly be categorized into contractual and operational barriers. Contractual barriers mainly apply to the ability of the data receiver to use the data. For example, the master may not be able to adjust speed without being in breach of contractual clauses. Operational barriers refer mainly to the exchange of high-quality or reliable data between stakeholders in the port, and to and from the ship.
This chapter seeks to highlight and address some of the potential barriers faced when implementing JIT Arrival.

Contractual phase

Barriers
For ships on time charter the owner–charterer relationship is not a problem, as the charterer has the right to direct the ship to proceed at any speed. The charterer pays all the bunkers so directly profits from fuels savings.
Therefore, contractual barriers primarily apply to those ships that operate under voyage charter (i.e. most bulkers and tankers) during the laden voyage. This is because voyage charter parties include a Due Despatch clause which obliges the ship's master contractually to proceed to the next port with utmost despatch, regardless of whether a berth is available or not.

An additional complication is added when a ship carries several different cargoes. For example, a parcel tanker may carry 20 or more different cargo parcels. Per parcel, multiple parties are involved in the commercial agreements e.g. seller, buyer, broker, charterer and shipowner, and the shipowner may have different obligations to different cargo owners.

Furthermore, cargoes may be traded many times between the load and discharge port. This means that each party in that sales chain must redraft the owner–charterer cargo contract after each trade agreement. Currently, there is no widely used industry standard clause for JIT Arrival that is included by default in the charter party (and widely accepted by all parties). On the contrary, several different clauses exist, e.g. BIMCO has published a Virtual Arrival Clause for Voyage Charter Parties and also shipping companies have developed their own clauses for JIT Arrival implementation that differ from the BIMCO clauses (e.g. SHELLVOY6 and BPVOY4). But since there is limited application of JIT and parties do not understand the liabilities JIT Arrival could potentially impose, every sales contract could take days to agree. By that time, the ship would have arrived at the discharge port, with no application of JIT Arrival.

Finally, even if contractually an agreement is sought for all cargoes and among all parties involved, how to calculate and share any costs/revenues from the implementation of JIT Arrival may be complex. For example, in a voyage charter delays due to the weather are paid by the shipowner whereas delays in the loading and discharging of cargo are paid by the charterer.

Due to these contractual complexities, stakeholders are not very likely to make an effort to implement JIT Arrival unless there are significant financial gains to be achieved. Furthermore, a reduced demurrage rate for the delay period does not provide sufficient incentive as the sales contract between charterer and the terminal often includes a provision for demurrage as well,

which allows the charterer to pass any demurrage costs down to the terminal (as the terminal is considered to cause the delay).

Apart from these complexities, shipping is a highly competitive and conservative industry that avoids changes in terms of contracts that have been tried and tested through the courts and have been in place for decades.
In general, the shipping industry is rather reluctant to make amendments to charter parties as substantial efforts are required to draft, agree on, sign, conclude and administer new clauses, as well as clarify how to handle potential disputes and gain certainty as to how the courts will interpret the new clauses in the event of a dispute.

Proposed solutions
Since the contractual barriers mainly relate to those ships that operate under voyage charter, proposed solutions mainly aim to improve existing voyage charter party agreements:

- Include a JIT Arrival standard clause in the voyage charter party to allow the ship's master to optimize speed, without being in breach of contract.
- Adapt charter party to allow the vessel to arrive at the Requested Time of Arrival at the Pilot Boarding Place (RTA PBP) whilst tendering her NOR at the time that she would have arrived had she proceeded on voyage at full speed using due despatch (virtual arrival) and physically arrived at the PBP.
- Include a JIT Arrival standard clause in the charter party contract that can be passed through the sales chain like any other clause. Standard clauses, since they automatically come into effect, are normally not challenged by any party. Applying a standard clause does not mean that by definition costs/benefits are fairly distributed, but the distribution is accepted, and no time is lost in re-negotiating terms.
- For the calculation and sharing of the financial benefits of slowing down the ship, some charter parties prescribe that the Virtual Arrival time (i.e. time the ship would have tendered its NOR based on RTA PBP) must be determined by an independent third party which party should be agreed upfront by both the ship owner and charterer.
- Fuel savings could also include a split with terminal (in addition to the shipowner and charterer) such that all three parties receive an equal share of the fuel saved through JIT Arrival. This requires a check and adjustment of the entire contractual chain.

In general, because of the barriers set out above, contractually the implementation of JIT Arrivals could work best if enforced top-down, e.g. through the Port Authority. If the Port Authority makes a change, everyone will be forced to make a change; the Port Authority can only implement a rule without making a distinction between parties. Also, where traders are decisive in the port call, a mandatory scheme may work; traders will not bother because it will apply equally to everyone and no one has an unfair advantage to make more money. The Port Authority would also be best placed for the Requested Time of Arrival at the Pilot Boarding Place to the ship: "one voice to the ship". The mandate from the Port Authority can be two-fold: 1) to require the ship to be at a berth at a specific time, and 2) to prohibit the ship from arriving earlier. The only assumption is that there are no alternative options (i.e. if there are other ports nearby where contractually it will be simpler to conduct operations, then the ship may just go to the other port, destabilizing fair competition).

The trader does not mind if the owner saves money on fuel (when prices are low). Most important for the trader is that receiving parties are not facing delays and that the number of days on hire and demurrage is the same. The interest of the owner is that the next charter is not delayed.

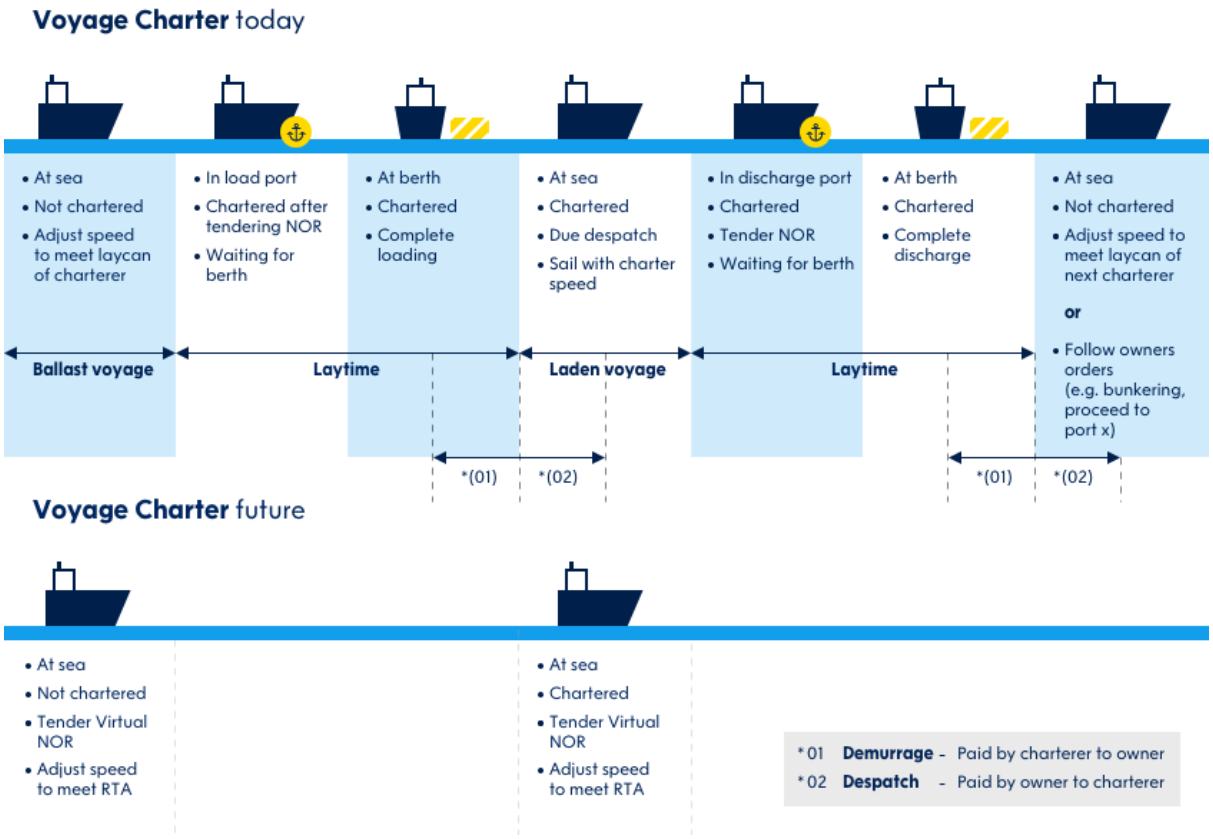

FIGURE 8: VOYAGE CHARTER INCLUDING JIT ARRIVAL

Operational phase

When it comes to the operational phase of the port call, the main barriers faced are in relation to the exchange of key timestamp data. These barriers will apply to the majority of ships (regardless of whether they are owned/time chartered or operating under a voyage charter party) and in particular when berth exchange is required.
As can be deduced from the Port call business process, there are many stakeholders involved in a port call, thus making JIT Arrival challenging to organize. It requires close collaboration between ships, shipping agents, port authorities, terminal operators, nautical services (e.g. tugs, pilots and linesmen) and vessel services (e.g. bunker barges and waste collectors). Currently, up-to-date and reliable information may be being exchanged irregularly between those stakeholders. For this to change, there is a need to establish the necessary timestamps and locations which are most crucial for JIT Arrival.
This section aims to provide a general overview of the various operational barriers in relation to the exchange of these key timestamps. For a more detailed explanation of the barriers and solutions related to each of the key timestamps, please refer to Annex 2.

Data definition

Barriers
Although the six key timestamps (and corresponding locations) have all been identified by the industry in the Port call business process, globally these definitions are not systematically and consistently applied in all ports and by all shipping companies.
For example, instead of the “Requested Time of Departure” (RTD) often an “Updated ETD” is used as terminology which creates confusion. Strengthening the implementation of clear timestamps can prevent confusion, greatly streamline port planning and hence reduce unnecessary waiting times.

Also, if a timestamp is not defined, the timestamp can never be accurate. For example, if the understanding of arrival times is different from party to party, it cannot be accurate. One user might understand the definition of "ETC Terminal" for containers to include the moving of cranes to midships, but another user might not include this movement in the definition of ETC Terminal.
Similarly, if the location of the timestamp is not defined, the timestamp can never be accurate. For example, if a ship provides an ETA but does not specify the location to which this timestamp refers, it could cause confusion as this could refer to either ETA Pilot Boarding Place or ETA Berth. This discrepancy can result in a time difference of several hours in some ports.

Proposed solutions

- Definitions of timestamps: for notifications and declarations, timestamps are defined within IMO's Convention on the Facilitation of International Maritime Traffic (FAL Convention), Compendium on Facilitation and Electronic Business.[13] Nomenclature of timestamps needs to be aligned with nomenclature in charter parties. For contracts the definition may be defined in the guidance for e.g. BIMCO contracts. For operations the definition may be different from port to port or may even lead to discussions within the port. Ideally these definitions should be aligned and consistent with one another.
- Arrival and departure times of ships and starting and completion times of services should all follow the same sequence of "Estimated", "Requested", "Planned" and "Actual" to provide clarity to the data user. For more information on this sequence of timestamps, see Annex 1.
- Definitions of locations: for improved planning, the location to which the timestamp refers is important. An indication of the location (e.g. 'Pilot Boarding Place or Berth') is not sufficient; a specific geographical position is required to enable JIT Arrival (i.e. either Pilot Boarding Place or Berth, not both).
- For both time and location data, it is important that standards are being applied and maintained by robust standardization bodies.
- Both have been published in the Port Information Manual[14] and UKHO's Mariner's Handbook (NP100).

Data owner

Barriers

Timestamps without ownership make trusting these timestamps difficult. There needs to be one party who is responsible for a particular timestamp. The owner of each key timestamp (the data owner) can be deduced from the Port call business process which clearly identifies the single actor that has ownership and responsibility over the individual timestamp (and hence is responsible for compiling and sharing this data). Whilst each timestamp can have multiple receivers, it should only have one owner.
Also, if data is not maintained by the data owner, data becomes corrupt sooner or later.

[13] The IMO Compendium on Facilitation and Electronic Business is a tool for software developers that designs the systems needed to support transmission, receipt and response via electronic data exchange of information required for the arrival, stay and departure of the ship, persons and cargo to a port. By harmonizing the data elements required during a port call and by standardizing electronic messages, the IMO Compendium facilitates the exchange of information ship to shore and the interoperability of single windows, reducing the administrative burden for ships linked to formalities in ports. The IMO Compendium consists of an IMO Data Set and IMO Reference Data Model agreed by the main organizations involved in the development of standards for the electronic exchange of information related to the FAL Convention: WCO, UNECE and ISO (publication in HTML is available in https://svn.gefeg.com/svn/IMO-Compendium/Current/index.htm).

[14] https://portcalloptimization.org/images/Port%20Information%20Manual%201.4.4%20-%20final%20(2).pdf

The ability of port authorities to organize data ownership and data sharing varies per port, and depends on:

1. The power of the Port Authority in general. Ports may be controlled by:
    - Local community or state
    - National or federal authority
    - A mix of local/state community and national/federal authority
    - Private parties

2. Whether nautical and vessel services are privately or publicly governed.

    Nautical services: data sharing with e.g. tugs, pilots or linesmen may be easier if these parties are employed by the Port Authority (as a public service), than if these parties are independent private parties.

    Vessel services: data sharing with e.g. terminals is much easier if the port is a service port (i.e. the port operates the terminals) versus a landlord or tool port (i.e. the Port Authority leases land or equipment out to terminals). Other vessel services, e.g. bunker operators or waste collectors might be controlled through e.g. “License to Operate” or assignment as “Internal Operator”.

Proposed solutions

- Clear clarification of data ownership as per Port call business process.
- It is important to note that the responsibility of the data owner is to compile and share data, and hence should not be held accountable for the accuracy of the data (as the timestamp may be affected by many factors that are outside of the control of the data owner).

Data user

Barriers

It is also important to clarify who needs to receive the data. Whilst each timestamp has an owner and receiver(s), there may be other stakeholders in the port who could benefit from certain timestamps for their planning purposes, even if they are not the direct recipient. For example, RTD Berth is a request issued by the Port Authority to the ship, but it would be beneficial if it is simultaneously shared with the terminal (so that the terminal is aware of when the ship alongside has been requested officially to leave the berth).
Whilst the data might be communicated to multiple receivers, not all of them will need to act on the data. Some users may even face barriers to using the data. For example, the ship may receive the RTA Pilot Boarding Place from the Port Authority but may have orders from the shoreside not to reduce speed.

Proposed solutions

- Clear clarification of data users as per Port call business process.

Timestamp	**Owner**	**Receiver**
Estimated Time of Completion (ETC) – Terminal	Terminal operator[15]	Ship, ship agent
Estimated Time of Completion (ETC) – Bunkers	Bunker operator	Ship, ship agent, in some ports also PA, customs

[15] In container and bulk shipping, the terminal is responsible for the loading and discharge operations. In the tanker sector, the terminal is only responsible for load operations, not discharge.

Estimated Time of Departure (ETD) – Berth	Ship (via agent)	PA, in some ports also terminal
Requested Time of Departure (RTD) – Berth	Port Authority	Ship, ship agent, service providers, terminal operators
Requested Time of Arrival (RTA) – Berth	Terminal operator	Ship, ship agent
Requested Time of Arrival (RTA) – Pilot Boarding Place	Port Authority	Ship, ship agent, service providers

TABLE 1: TIMESTAMPS

Ease of Data sharing

Ease of Data sharing: is it easy to share data (technically) or is it very labour intensive?

Barriers

At sea

For communication at sea between the port and ship (for example, to communicate the RTA Pilot Boarding Place), currently the first point of contact is at the first Calling In Point (CIP) where the ship will contact Vessel Traffic Services (VTS) via Very High Frequency (VHF) radio. VHF has a range of approximately 30 nautical miles which is too short a distance for ships to optimize speed and take full advantage of JIT Arrival potential to arrive at port when the berth and all required services are available.

In port

Today, ship agents need to collect information from all sources, usually by phone, which is very labour intensive and inefficient. There is a huge dependency on the manual follow-up of any unforeseen changes in port operations delivered to the ship, terminal completion, completion of bunker provisions, booking of pilots and tugs etc. The process of updating all parties involved is fragmented and extremely manual in terms of manpower. Whilst shipping is a 24/7 operation, not all crucial stakeholders might be available around the clock. The absence of a digital way of exchanging the data acts as a substantial barrier.

If there could be a digital way of exchanging data, the next barrier is the access to such data on board the ship. E.g. while at berth, the bridge of the ship is normally not manned and even if it is, it may not be equipped with a computer. The Cargo Control Room normally is only equipped with VHF radio and a basic mobile phone from the ship agent, depending on the agency.

Most port communication systems offer exchange of notifications and declarations, as per IMO FAL Convention, to authorities (e.g. customs, immigration, health authorities, port authorities) through EDI. However, this is semi-static data and not operational data which is required for JIT Arrival. Furthermore, it is one to one communication to exchange documents.

Proposed solutions

At sea

- A relatively simple solution could be to communicate via Inmarsat-C, an existing technology utilized by on-board SOLAS equipment (GMDSS Station) to allow exchange of information outside 30 nm / VHF radio range, and early enough to allow ships to implement JIT Arrival.

In port

- Within the port, web-based port community systems may help facilitate the exchange of information, using existing 4G/5G networks. Some of these digital solutions can accommodate

potentially all stakeholders in the port to connect and provide updates on their service completion times, which will in turn automatically calculate estimated times of departure. Port community systems may be in a good position to facilitate this.

- There is a need for a global platform to exchange information between ports, particularly when they are located near each other because the timestamp of the ship leaving one port immediately affects the planning of that same ship in the next port.
- For port-to-port solutions those systems should have inter-operability, which requires the use of global standards.
- If web-based data is available at the port, the Cargo Control Room should be equipped with internet access through e.g. a smartphone of the agent, or the shipowner's supplied smartphone.

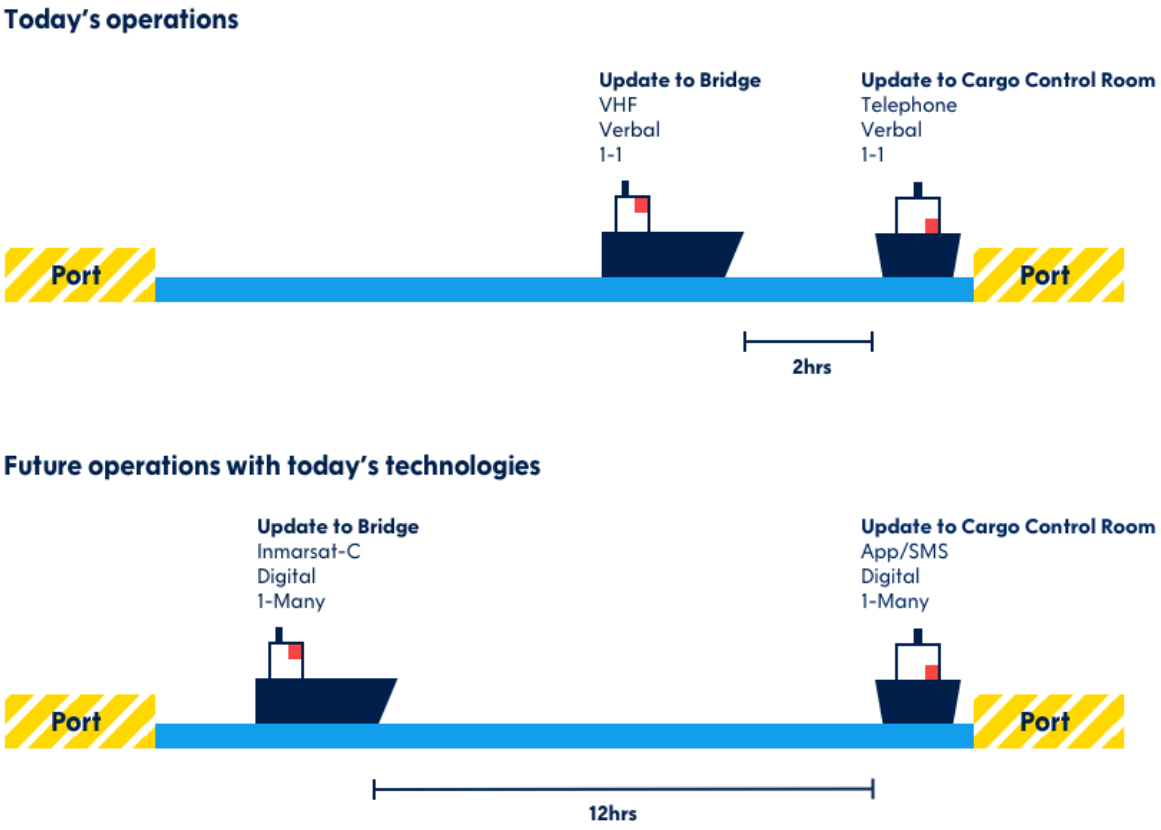

Figure 9: JIT using Inmarsat-C and App/SMS for communications

Data sharing – willingness

Barriers

Nowadays, and in most ports, stakeholders are not equally eager to share information. This may be because of concerns that third parties could deduce commercially sensitive information (e.g. berthing windows, terminal productivity, type/location of commodities loaded and discharged, and which ships are given berth priority at which terminals). In general, the nearer in time to the event (e.g. port call), the less commercially sensitive the information becomes – as the event becomes more transparent.

Clearly, to enable JIT Arrival a certain set of information is required, and stakeholders therefore need to have an appetite to exchange data. In particular, frequent updates and sharing of the departure time of the ship occupying the berth is required to allow JIT Arrival, so that any delays in the outgoing ship's departure can be communicated in a timely manner

to the Port Authority, which in turn is responsible for communicating to the incoming ship the RTA Pilot Boarding Place. Nowadays, there are no requirements for terminals or vessel services to provide frequent updates of the completion times of the services rendered to the ship to the relevant stakeholders.

Furthermore, there may be a lack of trust between charterers and terminals: in many ports a ship could risk losing its place in the berth waiting queue, if applying JIT Arrival.

Proposed solutions
Enhance data sharing through collaborative / regulatory mechanisms such as:

- Social/bilateral agreements: especially in smaller port communities agreeing on data sharing over a cup of coffee may be the quickest way to increase data sharing.
- Code of conduct: formalizing agreements without enforcement – both parties will mutually agree to share data.
- Contractual: formalizing agreements through private law with enforcement. This could be undertaken by amending existing contracts (e.g. land lease contracts) or agreeing on new contracts (e.g. data sharing contract). Amending e.g. land lease contracts may take a lot of time, as the contracts are bilateral and have long lead times. On top of this, not every port is a landlord/has a land lease contract.
- Port regulations: formalizing agreements through public law with enforcement.
- Port licence to operate: licence for service providers with minimum conditions.
- Provision in sales contracts for goods.

Should any data sharing be mandated through a regulation, it is important that a level playing field is ensured. E.g. if a terminal in a port is mandated to share information, all terminals should be mandated so as to avoid a terminal being competitively disadvantaged. The downsides of mandating data sharing through a regulation are the need for enforcement, necessity of judging non-compliance, possibly penalizing non-compliance and the risk of a claim culture.

By securing data:

- Leave it up to the data owner if data should be shared with other parties too.

Enhance data sharing through incentives:

- A clear understanding and visualization of what the different events exactly mean and how they improve the port call will help boost the appetite for, and ultimately incentivize, data sharing. Sharing of information will be easier if all stakeholders involved benefit from the exchange by for example, better resource planning.
- Port priority management: port authorities can give priority to ships and terminals that apply JIT Arrival.
- Port authorities could offer a discount to terminals that perform well and/or lower port fees to shipowners as an incentive and encouragement to arrive JIT.
- Explore whether a reduced waiting time at anchorage could be an incentive for JIT Arrival. In that case time at anchorage could be limited by regulation or made more expensive. Charging the use of anchorages, the time at anchorage outside an allowed time period, or the too early arrival at the anchorage could trigger demand for data that enables ship to slow down. National authorities are in charge of regulating

anchorages that lie within 12 nm of their coastline and could pose charges on their use. However, many anchorages are outside the 12 nm zone, and not under direct control of the national authority.

Data quality – accuracy

Barriers

Even if data is exchanged, it will be of no use if it is of low accuracy. For each timestamp, and depending on which shipping trade, different factors influence the accuracy of the data. For example, the accuracy of ETC Terminal for containerships may be affected by containers getting stuck or a breakdown in the loading/unloading machinery; whereas in the dry bulk sector, ETC Terminal may be more affected by weather conditions (e.g. under rainy conditions, cargo hatches must be closed for some types of cargo).

Proposed solutions

- In the container sector the accuracy of ETC Terminal can be improved by locking the number of container moves 12 hours prior to departure, or not change the number of cranes operating on a particular ship (also 12 hours in advance).
- In the ship services, the accuracy of ETC Bunkers can be improved by using historic bunkering data and in the bunkering contracts agreeing on certain conditions (e.g. minimum tons of fuel bunkered per hour or rest hours of the crew). The use of bunkering mass flow meters for the transfer can avoid delays close to bunkering completion due to discussions about discrepancies in the fuel quantities delivered.
- Make provision of information in a systemized way mandatory (thereby ensuring a level playing field) whilst incentivizing data quality improvements

Data quality – frequency

Barriers

For timestamps that are difficult to predict because they are prone to changes, the update frequency is very important. The optimal frequency at which data should be exchanged not only depends on the number of changes in the process but also on the ability of the receiver to act upon the change in the plan.
It is labour intensive to update the ETC Terminal frequently. Especially for e.g. container terminals, with thousands of moves to go through and changing number of cranes.
Automatic reminders per ship will help the particular service provider of the particular ship to provide updates regarding ETC. If the ETC could automatically be calculated and shared this would be the ideal situation.

Proposed solutions

- Automation of calculation of ETC Terminal
- Automated updates to stakeholders

Prioritization of JIT Arrival

Recognizing that the global implementation of JIT Arrival will not happen overnight and requires some transition, this chapter aims to outline how the implementation of JIT Arrival could be rolled out. Based on all the findings explained above, it is proposed that the roll out takes into consideration shipping trade, ship sizes and other factors, and prioritizes on the maximum environmental benefit and biggest potential for emissions reduction.

Trade
It is advisable to roll-out JIT Arrival in the container segment first, as contractually it is much simpler to apply. Even though container shipping only represents about 15% of the international shipping fleet, it accounts for 35% of all shipping emissions. On top of this, terminals normally have more digital means to exchange data versus bulk and tanker terminals.

 Container sector

Considerations as to why container trade is best to target as a priority:

- Contractually, containerships (being on time charter or owned) can reduce speed without any contractual barriers
- Containerships sail at relatively higher speeds (in comparison to bulkers and tankers) – this means there is more potential for speed reduction
- Containerships travel relatively shorter distances between ports (in comparison to bulkers and tankers) – therefore a shorter notice period of berth availability will have a higher impact on emissions reduction on the overall voyage from port to port (see Figure 3)
- Containerships have more powerful engines (in comparison to bulkers and tankers) – therefore speed reduction will have a greater impact on emissions
- Containerships currently sail on fixed rotation schedules and have berth planning schedules completed well in advance
- As container lines have contracts with terminals (versus most parties in bulker and tanker industry) it is easier for them to push for data exchange
- Relatively high impact on hinterland transport, as container shipping uses relatively more trucks and barges (environmental impact on trains is limited)
- Consolidation of container lines can lead to quick adoption of standards across industry
- Container shipping requires predictability for users of containerized goods or parts for customer goods

 Bulk and tanker sectors

Considerations as to which segments can already be prioritized in tanker and bulker trade:

- Contractually, tankers and bulkers that sail under time charter party can reduce speed without any barriers that are not easily resolved, e.g. the overarching premise of proceeding with due despatch. Some companies might already have processed a “Just In Time Arrival” or “Virtual Arrival” clause in their contracts for ships sailing under voyage charter party: therefore the shipowners and charterers can agree that the Requested Time of Arrival at the Pilot Boarding Place of the Port Authority can be accepted as the Notice Of Readiness (NOR)
- Tankers and bulkers sail at relatively lower speeds (in comparison to container ships) – this means they need more notice to realize the same CO_2 savings
- On average tankers and bulkers travel relatively greater distances between ports (in comparison to containerships) so need longer notice of RTA in order to maximize fuel savings.

However, there are still trades that sail regularly to ports which are relatively close by; one could first focus on these ports

- Tankers and bulkers have less powerful engines (in comparison to containerships) – therefore speed reduction will have limited impact per hour
- Tankers and bulkers normally do not sail on fixed rotation schedules – however, there are ships with regular services (e.g. to refineries or LNG carriers dedicated to a liner trade); focus on these ships first
- Impact on hinterland transport depends on the modality. If transport to the hinterland is by rail, the impact on emissions is limited. If transport to the hinterland is by truck or barge, there is potential for CO_2 savings through better planning
- Especially for refineries, Just In Time Arrival is also important as closing down a terminal is very expensive
- Due to the fragmentation in the bulker and tanker industry it is more difficult to pull together for industry best practices and standards. However, in the oil and gas sector there is much more scope than in the dry bulk sector

Ports and terminals

Within the network of ports of a shipping company, choose:

- Ports with short intermediate distances (e.g. in Asia/Europe)
- Ports with high berth occupancy – as this has more potential for reduction of emissions. If there are not many ships calling at that port, the berth is likely to be available
- To ensure that, at all times, a level playing field is maintained. For example, JIT Arrival should be rolled out in all container terminals of a port to avoid any competitive disadvantage to the terminal or service providers that introduce JIT Arrival, and absorb additional workload/use of resources

Ship

It is suggested to focus on the larger ships as they:

- Require larger anchorage and manoeuvring space
- Need pilots – port planning is more important: bigger ships always need pilots, smaller ships might have a Pilot Exemption Certificate (PEC)
- Need tugs (more manoeuvrable) – bigger ships always need tugs, smaller ships need fewer tugs, if at all
- Need berths – bigger ships are more limited in options to call at a berth whilst smaller ships can call at any berth (have more options)
- Have a greater impact on the planning of the fairway traffic when compared to smaller ships

Notice

Prioritize on a 12-hour notice for container sector.

A 12-hour notice is proposed:

- To manage expectations and start with a realistic window – given that nowadays ships are only informed approx. 1.5 to 3 hours prior to reaching the port (i.e. first calling-in point) about their RTA PBP
- As it will, in the container sector, already have a significant effect on emissions (see page 12) and reduce anchorage time
- As reliability and accuracy of ETD of the ship alongside is sufficient 12 hours before departure (i.e. uncertainty of availability of a berth will significantly increase if the time is longer)

- As weather and water level predictions are already accurate enough 12 hours in advance to enable planning of the fairway and nautical services (in particular planning of the exact number of tugs)

Today there is little trust by shipowners in ports and terminals planning, and a 12-hour notice can already prove that arriving JIT will not jeopardize the priority of the ship in the queue.

For all sectors the bigger the notice window, the longer the period that the ship can adjust its sailing speed, hence the bigger the emissions reduction opportunities. However, notice windows will have to differ depending on trade and its specificities. E.g. for tankers and bulkers that sail at lower speeds, have lower engine power and sail longer distances, the emissions reduction potential of a 12-hour window will have a limited effect.

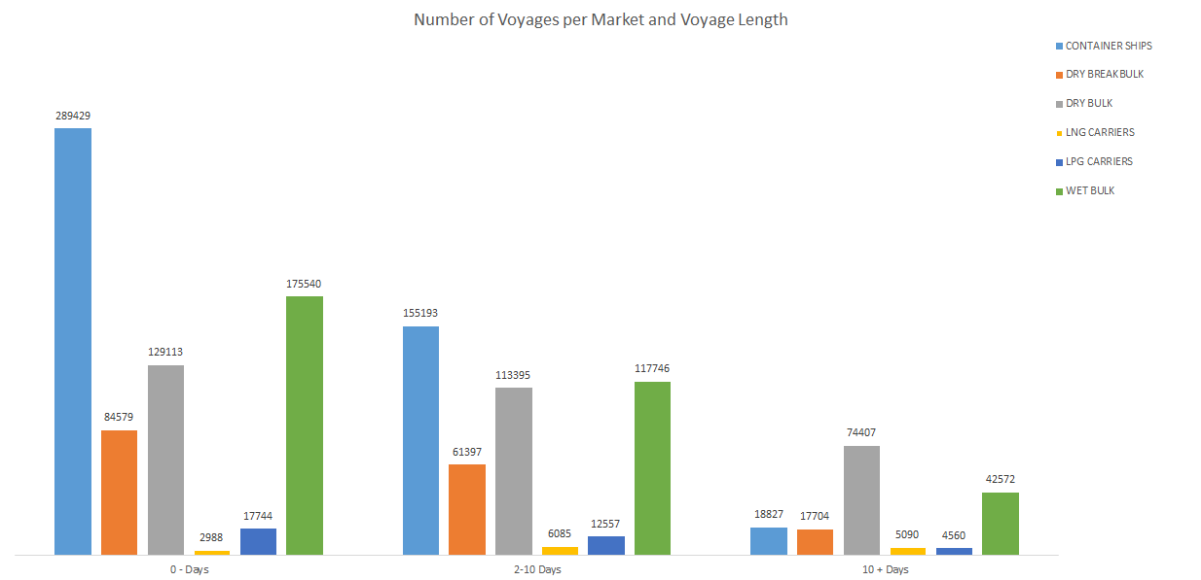

FIGURE 10: AVERAGE VOYAGE LENGTH PER SECTOR (DATA AND ANALYSIS BY MARINETRAFFIC)

Market segmentation used: Dry Bulk, Dry Breakbulk, Wet Bulk, Containers, LNG Carriers, LPG Carriers. Timeframe: January to December 2018. All vessels of Gross Tonnage > 4999 departed from a Port/Anchorage Area and subsequently calling a different port are included. Any In-Transit calls are excluded.

GIA recommendations: Actions per party to enable JIT Arrival

The realization of JIT Arrival requires a collaborative effort by all stakeholders. Port call optimization does not only involve the Port Authority, it includes all actors in the ship to shore interface that are involved in the process of a ship calling a port.
The table below sets out actions per party to enable JIT Arrival, taking into consideration information in Annex 2 on the barriers and solutions per timestamp.

IMO	• IMO to consider adoption of guidance on JIT Arrival for ports, terminals and shipping • Consider whether Just In Time Arrivals could be made part of the SEEMP. Via the SEEMP the vessel is required to consider how to make best use of the information for the speed decision[16]
IMO GIA	• Further explore the need for a global digital platform for the sharing of port planning information • Explore development of data sharing agreement • Facilitate trials of JIT Arrival • With a focus on container sector, encourage container sector to endorse common set of data standards (DCSA), Terminal 4.0 Project • Further work into developing, adapting and replicating solutions for bulk/tanker sector, zooming in on contractual barriers • Analyse the global emissions reduction impact from JIT Arrival • Develop concepts of incentives for ports and terminals to implement JIT Arrival best practices and standards
National authority	• Encourage reach out to local port authorities to make JIT Arrival part of the corporate strategy
Port Authority (national / local / private / combination) and nautical services	• Adopt higher level corporate strategy to promote JIT Arrival • Should assume their role in compiling and sharing the new timestamps of requested times of departure to the outgoing ship and requested Arrival time for the incoming ship. The Harbour Master is in the best position to issue these times • Connectivity with bridge at sea, e.g. using Inmarsat C • Connectivity with the CCR in port • Provide more frequent updates of RTD Berth to the departing ship, with narrowing down closer to the time of departure (e.g. -12, -8, -4, -2, -1, -0.5 hours before departure) • Provide more frequent updates of RTA PBP to the incoming ship, with narrowing down closer to the time of departure (e.g. -12, -8, -4, -2, -1, -0.5 hours before departure) • Consider the implementation of a web-based port community system to share event data, taking into consideration data sensitivity concerns • If ship alongside ETD is delayed by more than 0.5 hours, reschedule pilots and tugs in order to avoid cascading delays to other ships • Port regulation to mandate data sharing • Port incentive to improve data quality
Terminal / Cargo services	• Investigate which port stay information and/or cargo terminal operation information is already publicly available, e.g. through AIS data, in order to balance the decision of sharing data

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	• Ensure accuracy of ETC Terminal improves closer to time of completion (e.g. -12 hours: 2.0; 9hours: 1.5; -6 hours: 1.0; -3 hours: 0.5) • Adapt an updating frequency of 12, 8, 4, 2, 1, 0.5 hours before completion of cargo • Terminal should identify 12 hours in advance which ship will come alongside and at which berth position • Terminals should provide berthing windows and a minimum berth planning accuracy for Harbour Masters to do the port planning more effectively
Shipping line (Container sector)	• For a reliable cargo completion time, the number of cargo moves or number of containers should be fixed and not changed in the last 12 hours before departure. If the RTD is delayed, the ship may load additional containers • Provide more frequent updates of ETD Berth to the Port Authority, with narrowing down closer to the time of departure (e.g. -12, -8, -4, -2, -1, -0.5 hours before departure) • ETD Berth should take into consideration ETC of all critical services, and not just ETC Terminal (cargo operations). It should therefore be fixed, allowing enough time for all parties to complete their services before departure • Stipulate for all critical ship services to be completed 3 hours before departure • Request number of tugs required to the Port Authority, in sufficient time for them to be mobilized – this should not be changed last minute • Ensure connectivity with the cargo control room in port
Freight forwarder and beneficial cargo owners	• Can push terminal operator to provide reliable data that would allow JIT Arrival

Summary and next steps

The Just In Time (JIT) Arrival concept enables the ship master to base his speed decision on the correct information and adjust the ship's speed, if necessary, in order to arrive Just In Time when the berth, fairway and nautical services are available. JIT Arrival is not about slow steaming or compulsory speed limits.

As reflected in resolution MEPC.323(74), adopted in May 2019, IMO agreed on the need to encourage further cooperation between ports and shipping to facilitate the reduction of GHG emissions from ships. In this regard, IMO invited Member States to facilitate, among others, actions that support the industry's collective efforts to improve quality and availability of data and develop necessary global digital data standards that would allow reliable and efficient data exchange between ship and shore as well as enhanced slot allocation policies thereby optimizing voyages and port calls and facilitating JIT Arrival of ships.

JIT Arrival is indeed an important practice in the wider logistics supply chain. For example, in the automotive industry, parts for vehicle production are produced and delivered Just In Time with minimum stock levels. Today, good information exchange presents a challenge in the end-to-end supply chain in terms of predictability and reliability. Within the port many modalities come together and the ship to shore interface normally dictates the planning of other modalities. Therefore, enabling the JIT Arrival of ships is an important starting point to optimize the end-to-end supply chain.

JIT Arrival presents a feasible opportunity to reduce fuel consumption, and hence both CO_2 emissions and fuel costs. In particular for ships that operate on relatively high speeds and sail relatively short distances between ports (e.g. container shipping), a relatively short advance notice on the berth availability can already result in a substantial savings. JIT Arrival is a 'free tool' which can generate savings and may be industry driven (another reason why it may be most worthwhile adopting it). JIT Arrival may change the way of operating in the supply chain; better information, more transparency, more efficiency in the port. Other advantages include e.g. increased navigational safety in port approaches and anchorages; improved resource planning of pilots, tugs and berths; reduced ship hull fouling, less exposure of ships to piracy, and improved rest hour planning of crews and port personnel.

Barriers and proposed solutions to JIT Arrivals

Whilst JIT Arrival is conceptually simple to understand, in practice it can be challenging to implement. JIT Arrival requires collaboration among many stakeholders including port authorities, terminals, shipping companies, service providers etc.
Barriers to JIT Arrival can be broadly categorized into operational and contractual barriers. Operational barriers refer mainly to the exchange of high-quality or reliable data between stakeholders in the port, and to and from the ship. Contractual barriers mainly apply to the ability of the data receiver to use the data, e.g. to optimize the ship speed en route.
Barriers to JIT differ for different shipping trades, with those being operated on a time charter (i.e. container shipping) experiencing less contractual barriers than those under voyage charter (i.e. bulkers and tankers).

Barriers and proposed solutions in contractual phase

<u>Shipping</u>
In container shipping there are normally no contractual barriers to adjust speed. Often containerships are owned ships or operate under time charter allowing the ship master to take speed decisions.

Contractual barriers faced in the implementation of JIT Arrival primarily apply to those ships under voyage charter. This applies in the majority of cases of bulkers and tankers. Given slim margins in the market and complexity to adapt back-to-back contracts, it is not expected that there will be industry wide adoption unless forced by public authorities.[17] Further research is required to assess the impact of contractual barriers in these sectors.

Ports
If JIT Arrival is already an added value in the business process of the customers (e.g. in container shipping), then it is only to the port's advantage to offer such service.

However, if it is not an added value (e.g. in tanker and bulker shipping) and the Port Authority makes a change, everyone will be forced to make a change, assuming that there are no alternative options. Therefore, to create a level playing field between ports such implementation needs to be international.

Terminals
In the port, the Port Authority should create a level playing field within a specific trade. E.g. if JIT Arrival is offered for container shipping, it should be applied to all container handling terminals within the jurisdiction of that particular Port Authority.

Barriers and proposed solutions in operational phase

Key timestamps
In order to implement JIT Arrival for container shipping it is important to predict the availability of the berth, as approximately 80% of delays in container shipping are caused by berths being occupied (versus e.g. bulk or tanker sector, where availability of cargo or cargo storage can also be an issue). This explains the focus on availability of berth first in the selection of six key timestamps in the business process:

- ETC Terminal
- ETC Bunkers
- ETD Berth
- RTD Berth
- RTA Berth
- RTA Pilot Boarding Place

It must be noted that the completion time of many services may be critical for the ship's departure, which also explains the complexity due to the large number of parties involved. Therefore, the sharing of timestamps between all these parties should be easy.

Data definition, data owner, data use and data governance

Ease of data sharing of timestamps
In port, many timestamps are shared by one to one communication means, e.g. telephone or radio. This makes the sharing of timestamps very labour intensive and prone to error. Facilitation of a public platform, allowing one to many sharing, yet respecting business to business data access, will be a big step forward.

Data sharing willingness of timestamps
Most container terminals are not eager to share the berth planning or the completion time of terminal services, as this data may be commercially sensitive – certainly if the terminal serves

[17] The port of Newcastle in Australia already requires arriving vessels to adjust their ETAs so as not to have to wait in the anchorage.

multiple customers. Ensuring that this data remains “business to business” is a first step forward to improve data sharing willingness.

Another factor to improve data sharing willingness is that the owner of the timestamp data is not held responsible for optimizing the efficiency of the process that leads to the time; many unknown events may occur that are not under his or her influence but that do have an effect on the accuracy of the timestamp. His or her responsibility is to compile and to release and update the time. Hence JIT Arrival is less about planning itself, but more about consistently and timely updating concerned parties about changes in the plan.

Finally, the Port Authority may mandate to share data based on public interests such as nautical safety and environment – provided that the platform is public. Today, in most ports there is no data sharing regulation or agreement regarding timestamps of e.g. terminals or other services. Yet these timestamps are the cornerstone under the planning of the traffic in the port. Mandating data sharing together with incentivizing data quality seems to be the best way forward.

Data quality of timestamps

Data accuracy of timestamps starts with the definition of the timestamp and the location of it. If one of them is not defined, the timestamp itself is not accurate. E.g. Arrival time with the incorrect Pilot Boarding Place or Berth may lead to an inaccuracy of up to several hours. Or an arrival time at the berth may be defined as first line, last line, all mooring lines secured, gangway down etc. – which leads to inaccuracies. Definitions for both times and locations should come from a sustainable standardization body with a proven track record, ensuring that investments made by ports or shipping lines to adapt to these standards are also sustainable.

Data accuracy of timestamps also starts with updates from the data owner. Data becomes corrupt sooner or later if it is not maintained by the data owner. The more dynamic data is, the sooner it becomes corrupt. Allocation of one data owner per timestamp is therefore important.

Annex 1: Sequence of timestamps

Arrival Time Berth

ETA BERTH	RTA BERTH	PTA BERTH	ATA BERTH
Estimated Time of Arrival Berth	Requested Time of Arrival Berth	Planned Time of Arrival Berth	Actual Time of Arrival Berth

Arrival Time Pilot Boarding Place

ETA PBP	RTA PBP	PTA PBP	ATA PBP
Estimated Time of Arrival Pilot Boarding Place	Requested Time of Arrival Pilot Boarding Place	Planned Time of Arrival Pilot Boarding Place	Actual Time of Arrival Pilot Boarding Place

Alongside

ETS/ETC ...	RTS/RTC ...	PTS/PTC ...	ATS/ATC ...
Estimated Time of Start / Completion Services	Requested Time of Start / Completion Services	Planned Time of Start / Completion Services	Actual Time of Start / Completion Services

Departure Time Berth

ETD BERTH	RTD BERTH	PTD BERTH	ATD BERTH
Estimated Time of Departure Berth	Requested Time of Departure Berth	Planned Time of Departure Berth	Actual Time of Departure Berth

Arrival and departure times of ships and starting and completion times of services all follow the same sequence of “Estimated”, “Requested”, “Planned”, “Actual”. It should be noted that each timestamp has one owner. Nowadays, this sequence is not used consistently across ports, terminals and service providers. For global port to port operations, it is important to use the same nomenclature.

Annex 2: JIT Arrival relevant timestamps – how to improve data quality

Issues per timestamp		
Definition		If the timestamp is not defined, the timestamp can never be accurate. E.g. if the understanding of arrival times is different from party to party, it cannot be accurate. Timestamp definitions have been discussed and tested for several years, and are based on existing timestamps within IMO FAL, BIMCO contracts, ECDIS systems. The results of these discussions have been published in the Port Information Manual and Mariner's Handbook.
Data owner		Can be deduced from the Port call business process. The business process clearly identifies the single actor that has ownership and responsibility over each individual timestamp (and hence is responsible for compiling and sharing of this data). If data is not maintained by the data owner, data becomes corrupt sooner or later.
Data user		Can be deduced from the Port call business process. The importance of describing a user is that every single user may have its own specific barrier of using the data.
Data governance		Is data Business to Business (B2B) or Business to Government (B2G)? This can also be deduced from the Port call business process. It is important to understand whether data should be accessible to the public or not, because B2B data might contain commercially sensitive data.
Data barriers		
Data sharing	**Ease of use**	Is data sharing intensive to reach x number of parties?
	Willingness	Is data sharing difficult for motivational, economic, political, legal reasons?
Data quality	**Accuracy**	If the data quality is low, the data won't be used.
	Frequency	If the update frequency is low, the data also won't be used.
Data use		If the data cannot be used due to e.g. decision-making process or contracts.
Data solutions		
Data sharing	**Ease of use**	Can it be facilitated? e.g. can it be made less labour intensive to share data?
	Willingness	Can it be incentivized or regulated to share data?
Data quality	**Accuracy**	Can the operator be facilitated with automatic calculations?
	Frequency	Can the operator be facilitated with automatic reminders for updates?
Data use		Can the data be used after e.g. organizational changes or clauses in contracts?
Other relevant information		Other information that is relevant to this timestamp.

Estimated Time of Completion – Terminal (ETC Terminal)		
Definition		When a service provider estimates a specified service will be completed. Indicates completion of all terminal operations so the ship is ready to depart – including e.g. moving of container cranes to midships.
Data owner		Terminal
Data user		Ship (via agent)
Data governance		B2B or B2G
Data barriers		
Data sharing	**Ease of use**	Many ship agents and service providers call the terminal for each ship by telephone. Answering each telephone call is very labour intensive.
	Willingness	Data sharing is normally not incentivized or regulated.
Data quality	**Accuracy**	Accuracy is up to 12 hours in advance: ±2.0, up to 9 hours: ± 1.5, up to 6 hours: ± 1.0, up to 3 hours: ± 0.5. I.e. more accurate information nearer to completion time. It is dependent on the type of terminal. E.g. dry bulk terminals are more affected by weather, because during rain cargo hatches must be closed for some types of cargo. E.g. container terminals are more affected by containers getting stuck, or if last moment the number of moves are being changed due to extra booking of containers. Additionally, the large number of containers and the changing number of cranes make it difficult to predict the ETC Terminal. Apart from this, in the tanker and bulk sector, terminals do not always have a vested interest to allow the ship to depart as soon as possible. If the terminal is completing cargo operations within the laytime of the ship contract, and there is no ship waiting at the anchorage, the terminal will not have a financial incentive to complete cargo services more quickly and may benefit from longer stripping to increase outturn.
	Frequency	Normally updates are given after end of the work shift, so every 8 hours (which is not frequent enough considering that e.g. in Europe average sailing times are around 24 hours). If an update is provided, it is normally about the entire berth planning, which includes all ships. A ship specific update is needed, as the ship sailing towards the port only depends on one ship for an available berth.
Data use		The data is used by the ship (via ship agent) to schedule other activities which depend on ETC Terminal e.g. operations that are not allowed simultaneously (e.g. tank washing) or to determine the ETD Berth. However, the person who is in charge to plan these activities might be a different person than the agent who has collected this data.
Data solutions		
Data sharing	**Ease of use**	Make data sharing less labour intensive by allowing updates to all parties electronically versus telephone calls peer to peer. Make ETC Terminal prediction less labour intensive by automated calculation of ETC Terminal.
	Willingness	Incentive to share data could be e.g. by port access priority management. E.g. if ETC Terminal is not correct, the ship could be placed lower on the priority list in the port planning, which effects the berth planning. Regulation to share data could be soft (e.g. Code of Conduct) or more formal (e.g. port regulation). By contract is possible through the terminal service contract or by land lease contract. However, contracts are normally bilateral, taking a lot of time before being implemented. Apart from this not every port has a land lease construction. Quickest way forward is to make it a port regulation that applies to every terminal, thus creating a level playing field for all terminals.

Estimated Time of Completion – Terminal (ETC Terminal)		
		ETC Terminal is difficult to predict. Hence any regulation should only mandate data exchange and not data accuracy to avoid claims to be raised against terminal for inaccurate timestamps. The latter might result in terminals taking precautions and big time buffers to be on the safe side, which in turn would again lead to a unreliable timestamp.
Data quality	**Accuracy**	Terminal operators could be facilitated by automated calculations of ETC by the terminal operating system. Terminals should not receive last minute changes in the number of containers or tons to be loaded or discharged.
	Frequency	Automated reminders to update ETC Terminal per ship would help the terminal operator.
Data use		For scheduling other activities related to the ETC Terminal of a particular ship, other parties related to the operations of that particular ship should have access to allow efficient planning.
Other relevant information		Some ports charge a fee to those service providers that delay a ship e.g. for pilot services – but penalties are too low to have an impact on the behaviour, or the costs of changing the pilot planning are higher than the costs of a pilot waiting for the originally communicated time. This is an example of a penalty system that has an opposite effect, notably in ports where the pilotage capacity is limited.

Estimated Time of Completion – Bunkers (ETC Bunkers)		
Definition		When a service provider estimates a specified service will be completed. Indicates completion of bunker operations so the ship is ready to depart – including e.g. disconnecting hoses and signing documents.
Data owner		Bunker operator
Data user		Ship (via agent) In some ports also the Port Authority and/or customs receives this information.
Data governance		B2B In cases where bunker operator has to inform local Port Authority or customs, also B2G.
Data barriers		
Data sharing	**Ease of use**	Normally peer to peer by VHF or telephone.
	Willingness	Normally there is no incentive for bunker services to provide updates; agents may have difficulty reaching them.
Data quality	**Accuracy**	In theory most bunker suppliers today have enough information at hand to accurately predict bunkering completion time, based on the contractually agreed pumping rate. However, in practice, there are various influencing factors that can cause delays. Accuracy of completion times may be dependent on external factors such as season, weather (e.g. if too much swell, bunker barge cannot get alongside). Accuracy might also depend on readiness of the ship to receive bunkers, or on the bunker rate. E.g. chief engineer might want to slow down bunker operations to ensure crews' rest hours are met. Another complication factor is e.g. the environmental licence of the berth: if the smell due to loading bunkers exceeds a limit, the supplier is forced to slow down the pumping rate. Closer to the completion time, normally the accuracy goes up.

Estimated Time of Completion – Bunkers (ETC Bunkers)		
	Frequency	Currently no guidance on required frequency of updates but probably closer to the completion time, the more frequent updates will be useful.
Data use		Data is used to schedule activities related to the ETC Bunkers (e.g. other bunker barges which bring other products such as different grades or collect e.g. slops). However, the person who is in charge to plan these activities might be a different person than the agent who has collected this data.
Data solutions		
Data sharing	**Ease of use**	Allowing bunker operators to share data with all parties in one go would facilitate the bunker operations.
	Willingness	Data sharing can be organized through e.g. a “licence to operate” with minimum service requirements or through port regulations.
Data quality	**Accuracy**	Accuracy of bunker completion times can be improved by using historical data. Mass Flow meters fitted to all bunker barges can minimize disputes/delays over delivered quantities and save time, which in turn reduces uncertainties of the completion time of the bunker operation.
	Frequency	A “narrowing down” procedure for updates would be good.
Data use		N/A
Other relevant information		Some bunker operators deliberately deliver bunkers close to departure time, leaving the chief engineer only little time left to properly check any discrepancy in figures before signing the document of delivery. In ports where ships call for bunkering only, or where bunkering takes place outside of the port (e.g. in anchorage area): this timestamp is not relevant to JIT Arrival as no berth is occupied (so no impact on departure time of ship alongside). However, there could still be demands on other services such as tugs and pilots. Cruise ships have a strict schedule which service providers do not risk jeopardizing as it might impact their business. Services rendered to the ship are therefore carefully planned. Services to cruise ships are easier to plan anyway, as their arrival time at the berth is normally very accurate.

Estimated Time of Departure – Berth (ETD Berth)		
Definition		When the vessel alongside estimates it will depart from the berth.
Data owner		Ship (via agent)
Data user		Port Authority, other authorities (e.g. customs, immigration) and nautical service providers.
Data governance		B2G
Data barriers		
Data sharing	**Ease of use**	Normally peer to peer, via telephone calls, VHF or EDI.
	Willingness	Normally mandated via port regulations to update the ETD Berth.
Data quality	**Accuracy**	Since the ETD Berth is dependent on the ETC of all services, the accuracy of this timestamp is dependent on the accuracy of ETC of all services (e.g. terminal service, bunker service, etc.).
	Frequency	Update frequency may not be specified in the port regulations.
Data use		No barriers identified.
Data solutions		
Data sharing	**Ease of use**	Some agents do not have 24/7 service. If ETC Terminal changes e.g. 2 hours, it is very labour intensive, certainly at night time, to update the ETD Berth. Automatic update of the ETD Berth based on small changes of e.g. ETC Terminal would facilitate the agent. Ships cannot update their ETD Berth in most port community systems. However, if the activities on board the ship (e.g. repair of main engine) would impact the ETD Berth, the ship should be able to intervene. Need for a data portal where terminals and service providers can update information on completion times but also agents upload information on departure times.
	Willingness	Already regulated; however, difficult to enforce if it is not known when updates of completion times are provided.
Data quality	**Accuracy**	Related to the ETC of services.
	Frequency	Ensure frequency of updates of ETD Berth are parallel to ETC of all services, i.e. narrowing down updates between ship and port authority. Some ports will have agreements with the ship (via agent) to be in regular contact with the port and terminal in order to be able to update the ETD Berth in the port management and information systems. For example, the frequency of updates is 2 hours.
Data use		N/A
Other relevant information		Depending on the notice needed for planning nautical services, the ETD becomes the order time for services xx hours before ETD – being the contractual time for which nautical services are ordered and which time can be used to calculate extra service time of nautical services in case of delay.

Requested Time of Departure – Berth (RTD Berth)		
Definition		When the vessel alongside is requested to depart from the berth.
Data owner		Port Authority When the Port Authority is not involved in the planning of the departure, the ownership lies e.g. in the Vessel Traffic Service (VTS) or in the planning of pilot and tugs.
Data user		Ship (via agent) Providers of vessel and cargo services may use the data to ensure service is completed before this time.
Data governance		G2B
Data barriers		
Data sharing	**Ease of use**	Like other events, data sharing is normally peer to peer through telephone, VHF or EDI.
	Willingness	Normally no incentive to share this data, nor regulated.
Data quality	**Accuracy**	Dependent on meteorological data, nautical service planning and clearance of other authorities. Challenges in establishing the RTD Berth may arise firstly in the planning of tugs, and, secondly, the pilot planning. Capacity planning of tugs is the leading factor because tug assets are expensive, hence limited, and relatively slow to mobilize. Whilst the RTD Berth will be agreed and established with the planning of nautical services, there may be many last-minute requests for additional tugs by the master or pilot, due to mainly weather conditions, which will affect the accuracy. Most ports do not use this timestamp yet so a clarification and identical understanding of the RTD Berth timestamp is important to make the timestamp accurate.
	Frequency	No prescribed update frequency.
Data use		No barriers identified.
Data solutions		
Data sharing	**Ease of use**	Need for a data portal where terminals and service providers can update information on completion times but also agents upload information on departure times.
	Willingness	Sharing of RTD Berth should be mandated if Port Authority has delegated this timestamp.
Data quality	**Accuracy**	Normally the accuracy of meteorological data should be a good 12 hours in advance, so a first start could be to share RTD Berth not more than 12 hours in advance. The nautical service planning is dependent on the planning of many other ships – stressing the need to make this a port community solution versus a terminal or trade specific solution. Planning of tugs can be made more accurate if the number of tugs is determined before the pilot boards the vessel.
	Frequency	RTD Berth should be fixed at a certain moment for the tugs to be planned and rest hours not to be disturbed. At a certain point the departure time should no longer be changed; also not in case of earlier departures because leaving earlier frustrates other service providers.
Data use		N/A

Requested Time of Departure – Berth (RTD Berth)	
Other relevant information	Ship agents order tugs/pilots and have a contractual relationship with them – but it is the Port Authority that, together with the nautical service providers, decides when the ship can depart. A delayed departure may result in missing the slot at the next port. The ship has the flexibility to decide, in consultation with the terminal, to use the extra time for additional work or commercial activities alongside, such as putting empty containers on board or changing cargo plans. If RTD Berth is delayed, many resources might have been spent by the terminal to meet this time, being wasted in hindsight.

Requested Time of Arrival – Berth (RTA Berth)		
Definition		When a vessel is requested to arrive at the berth.
Data owner		Terminal operator
Data user		Ship (via agent)
Data governance		B2B or B2G
Data barriers		
Data sharing	**Ease of use**	Normally peer to peer through telephone calls by agents to the terminal.
	Willingness	Today there is no obligation to share the berth planning of the terminal. Some terminals publish the berth planning on their website.
Data quality	**Accuracy**	Accuracy often depends on accuracy of departure time of the ship alongside, especially at container terminals.
	Frequency	Also, frequency depends often on frequency of updates of departure time of the ship alongside.
Data use		The ship may not be able to use the data if the ship is required to follow only speed instructions of the shore side organization, or if the ship is breaching an obligation in the charter party (especially in voyage charter parties).
Data solutions		
Data sharing	**Ease of use**	Make the terminal part of the port community system to share the berth planning.
	Willingness	Mandate sharing of berth planning, but respecting B2B data exchange.
Data quality	**Accuracy**	As the departure time often dictates the berth planning, and departure time is often dictated by completion of all services, the focus should be on making completion times of all services more accurate.
	Frequency	The update frequency of the departing ship must be linked to the updates of the RTA Berth.
Data use		Allow the ship to reduce speed based on the 12-hour notice – either through authorizing the ship via the shore side organization or by providing clauses in the charter party.
Other relevant information		Idea of charging terminals for using anchorages (i.e. increase anchorage dues and reduce port dues) to incentivize terminals to share information would only be feasible when anchorages lie within 12nm zones (territorial waters). However, in many ports, anchorages are located outside the 12nm zone where countries have limited jurisdiction. Even if terminals could be charged, any cost incurred is likely to be passed down to shipowner.

Requested Time of Arrival – Pilot Boarding Place (RTA PBP)		
Definition		When a vessel is requested to arrive at the Pilot Boarding Place.
Data owner		Port Authority
Data user		Ship (via agent)
Data governance		G2B
Data barriers		
Data sharing	**Ease of use**	Normally this time is communicated to the ship by VHF after contacting VTS, normally not more than 30 nautical miles from the Pilot Boarding Place.
	Willingness	Normally ports try to avoid crowded anchorages and areas close to Pilot Boarding Places for safety reasons. Therefore, normally the willingness to share this data is not a problem.
Data quality	**Accuracy**	Dependent on berth planning, meteorological data, nautical service planning and clearance of other authorities. Especially the planning of tugboats is more difficult because the number of tugs required is often uncertain, the time at which they are required is often unreliable, and they are slower to mobilize than e.g. pilots. Most ports do not use this timestamp yet, so a clarification and identical understanding of the RTA Pilot Boarding Place is important to make the timestamp accurate.
	Frequency	Today none. Only common in ports with JIT Arrival procedure or e.g. locks.
Data use		The ship may not be able to use the data if the ship is required to follow only speed instructions of the shore side organization, or if the ship is breaching an obligation in the charter party (especially in voyage charter parties).
Data solutions		
Data sharing	**Ease of use**	Current SOLAS equipment on the bridge would allow early contact with the ship.
	Willingness	N/A
Data quality	**Accuracy**	Normally the accuracy of meteorological data should be pretty good 12 hours in advance, so a first start could be to share RTA Pilot Boarding Place not more than 12 hours in advance. The nautical service planning is dependent on the planning of many other ships – stressing the need to make this a port community solution versus a terminal or trade specific solution. Planning of tugs can be made more accurate if the number of tugs is determined before the pilot boards the vessel.
	Frequency	RTA Pilot Boarding Place should be fixed at a certain moment for the tugs to be planned and rest hours not to be disturbed.
Data use		Allow the ship to reduce speed based on the 12-hour notice – either through authorizing the ship via the shore side organization or by providing clauses in the charter party.
Other relevant information		Shipowners may not wish any RTA Pilot Boarding Place to be used, it being said that they make more money with demurrage (a compensation to shipowners for lost time) than by arriving on time. The demurrage may be higher than the savings in fuel and hence will constitute a disincentive for owners, certainly for those owners who have demurrage as a business model.

Annex 3: Outcome of the GIA JIT Arrival desktop exercise

Identification of terminals, berths and berth positions on the nautical charts
From:

- Port: Bremerhaven
- Terminal: Terminal 1
- Berth: 7
- Berth position: 2000 metre mark

To:

- Port: Rotterdam
- Terminal: APM
- Berth: APM
- Berth position: bollard 25

Currently terminals, berths and berth positions may not be properly displayed on nautical charts, making berth to berth passage planning more difficult for a ship.

Identification of wind farm developments between Bremerhaven and Rotterdam
The quick development of wind farms in the approaches of ports and on the North Sea seem to be a surprise to many stakeholders, including the impact on safe navigation.

Evaluation of scenarios
Ship represents 80% of traffic: medium size in TEU, medium draught (allowing arrival/departure without tidal restrictions), sailing at medium sea speed (19 knots simulated, maximum speed is 25 knots).

Port situation represents current practices: containerships need to exchange berth with another ship 80% of the time.

Evaluation of business process
Business process represents current way of executing port calls.

Challenges for the key events

1) Estimated Time of Completion Terminal – ETC Terminal

Difficult to get, depending on willingness of terminal and the software installed. If the TOS (Terminal Operating System) cannot provide ETC automatically, the Terminal Operator must find an alternative solution for providing timely and accurate ETC on requested interval basis. The ETC is a “must have”.

2) Estimated Time of Departure Berth – ETD Berth

Depending on all services rendered to the vessel, including immobility of the vessel itself due to maintenance or repairs.

3) Requested Time of Departure Berth – RTD Berth

Depending on availability of fairway and nautical services. The latter is highly impacted by a reliable number of tugs ordered by agent / captain / pilot.

4) Requested Time of Arrival Berth – RTA Berth

Difficult to get, depending on willingness of terminal to update berthing plan frequently.

5) Requested Time of Arrival Pilot Boarding Place – RTA Pilot Boarding Place

Depending on RTA Berth, fairway and availability of nautical services. The latter is highly impacted by a reliable number of tugs ordered by agent / master/ pilot.

Communication with ship to relay RTA Pilot Boarding Place

Today this communication is by VHF radio at the first Calling In Point (CIP) in the approaches to the port.
The official way of communication that could be used, which is available on every SOLAS vessel, is the Inmarsat-C – available to the Officer On Duty.

The transit from Bremerhaven to Rotterdam allows for use of smart phones. An app for port to port information would be preferred. App should be able to run with low data consumption, as at sea or in the port (with cranes blocking signals) signal might be poor.

Ideally the Electronic Chart Display Information System (ECDIS) informs the Officer On Duty about the Requested Time of Arrival Pilot Boarding Place – however, this requires cyber security protocols to protect the ship's navigation system against cyber-attacks.

The shore based marine team coordinating the ship is the party giving speed or port rotation instructions. However, getting closer to port, it is the master who needs to take immediate decisions after an update of the RTA Pilot Boarding Place.

General

To allow for Just In Time Arrivals real time data exchange is required. For real time data exchange there is a need for standards. These standards should be able to connect with the supply chain industry / hinterland connection, allowing for the most efficient choice of mode of transport and consequently efficient planning of that particular mode – as most emissions per TEU/mile are generated by the hinterland modalities. E.g. the timely choice between hinterland connection by barge or by truck.

Post meeting findings

The difference between scenario 1 (representation of update of RTA Pilot Boarding Place at first Calling In Point) and 2 (representation of update of ETC Terminal every 8 hours) is 23.9%.
The difference between scenarios 1 and 3 (representation of IMO GIA JIT Arrivals) is 24.3%.
This underlines the need for early updates of the RTA Pilot Boarding Place, especially when distances between ports are short and speeds are relatively high – even when sailing at medium sea speeds like in the exercise scenario.
If the ship had sailed at a higher speed, e.g. 22 knots, then the result would have been a theoretical saving of 43.4%. Depending on sufficient Under Keel Clearance, at full sea speed (25 knots) the result would have been 64.9%. Both would also result in more impact on safety, as the ship while waiting for berth availability would need to maintain position below steering speed in vicinity of the Pilot Boarding Place, where normally traffic density is high.

Scenario 1 – representation of update of RTA Pilot Boarding Place at first Calling In Point
Today the ship is informed about the availability of pilots and tugs after reaching the first CIP.
Ship A:

- Exchange with ship B
- Update ETC Terminal: no delays
- Update ETD Berth: no delays
- Update RTD Berth: no delays

Ship B:

- Update RTA Berth: no delays
- Update RTA Pilot Boarding Place: at first Calling In Point, delay 3 hours

Waypoint Hourly recording	Speed Knots	Fuel consumption Main Engine Tons / Hour	Fuel consumption Auxiliary Engine Boiler Tons / Hour	Fuel consumption Main Engine Auxiliary Engine Boiler Tons / Hour
0 (Berth)				
	10.0	1.42	0.63	2.05
1				
	15.0	3.17	0.42	3.59
2				
	15.0	3.17	0.42	3.59
3 (RW buoy)				
	19.0	6.04	0.00	6.04
4				
	19.0	6.04	0.00	6.04
5				
	19.0	6.04	0.00	6.04
6				
	19.0	6.04	0.00	6.04
7				
	19.0	6.04	0.00	6.04
8				
	19.0	6.04	0.00	6.04
9				
	19.0	6.04	0.00	6.04
10				
	19.0	6.04	0.00	6.04
11				
	19.0	6.04	0.00	6.04
12				
	19.0	6.04	0.00	6.04
13 (CIP)				
	4.2	0.50	0.63	1.13
14				
	4.2	0.50	0.63	1.13
15				
	4.2	0.50	0.63	1.13
16				
	4.2	0.50	0.63	1.13
17 (Pilot)				
Total		70.16	3.99	74.15

Scenario 2 – representation of update of ETC Terminal every 8 hours
Showcasing importance of providing early update of berth availability by the terminal.
Ship A:

- Exchange with ship B
- Update ETC Terminal: every 8 hours, delay 3 hours
- Update ETD Berth: delay 3 hours
- Update RTD Berth: delay 3 hours

Ship B:

- Update RTA Berth: by agent to ship
- Update RTA Pilot Boarding Place: at first Calling In Point, no delays

Waypoint Hourly recording	Speed Knots	Fuel consumption Main Engine Tons / Hour	Fuel consumption Auxiliary Engine Boiler Tons / Hour	Fuel consumption Main Engine Auxiliary Engine Boiler Tons / Hour
0 (Berth)				
	10.0	1.42	0.63	2.05
1				
	15.0	3.17	0.42	3.59
2				
	15.0	3.17	0.42	3.59
3 (RW buoy)				
	19.0	6.04	0.00	6.04
4				
	19.0	6.04	0.00	6.04
5				
	19.0	6.04	0.00	6.04
6				
	19.0	6.04	0.00	6.04
7				
	12.0	1.83	0.50	2.33
8				
	12.0	1.83	0.50	2.33
9				
	12.0	1.83	0.50	2.33
10				
	12.0	1.83	0.50	2.33
11				
	12.0	1.83	0.50	2.33
12				
	12.0	1.83	0.50	2.33
13 (CIP)				
	12.0	1.83	0.50	2.33
14				
	12.0	1.83	0.50	2.33
15				
	12.0	1.83	0.50	2.33
16				
	10.0	1.42	0.63	2.05
17 (Pilot)				
Total		49.81	6.60	56.41

Scenario 3 – representation of Industry Roundtables of IMO GIA JIT Arrivals
Proposal for a uniform approach for all terminals and ports.
Ship A:

- Exchange with ship B
- Update ETC Terminal: -12, -8, -4, -2, -1, -0.5
- Update ETD Berth: -12, -8, -4, -2, -1, -0.5
- Update RTD Berth: -12, -8, -4, -2, -1, -0.5

Ship B:

- Update RTA Berth: -12, -8, -4, -2, -1, -0.5
- Update RTA Pilot Boarding Place: -12, -8, -4, -2, -1, -0.5

Waypoint Hourly recording	Speed Knots	Fuel consumption Main Engine Tons / Hour	Fuel consumption Auxiliary Engine Boiler Tons / Hour	Fuel consumption Main Engine Auxiliary Engine Boiler Tons / Hour
0 (Berth)				
	10	1.42	0.63	2.05
1				
	15	3.17	0.42	3.59
2				
	14.7	3.04	0.42	3.46
3 (RW buoy)				
	14.7	3.04	0.42	3.46
4				
	14.7	3.04	0.42	3.46
5				
	14.7	3.04	0.42	3.46
6				
	14.7	3.04	0.42	3.46
7				
	14.7	3.04	0.42	3.46
8				
	14.7	3.04	0.42	3.46
9				
	14.7	3.04	0.42	3.46
10				
	14.7	3.04	0.42	3.46
11				
	14.7	3.04	0.42	3.46
12				
	14.7	3.04	0.42	3.46
13 (CIP)				
	14.7	3.04	0.42	3.46
14				
	14.7	3.04	0.42	3.46
15				
	14.7	3.04	0.42	3.46
16				
	10.0	1.42	0.63	2.05
17 (Pilot)				
Total		48.57	7.56	56.13