

Virtual Arrival

Optimising Voyage Management and Reducing Vessel Emissions - an Emissions Management Framework



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The INTERTANKO mission is to provide leadership to the tanker Industry in serving the world with the safe, environmentally sound and efficient seaborne transportation of oil, gas and chemical products

The OCIMF mission is to be the foremost authority on the safe and environmentally responsible operation of oil tankers and terminals, promoting continuous improvement in standards of design and operation

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Glossary of Terms and Abbreviations

For the purposes of this document, the following terms and abbreviations apply:

Virtual Arrival	A process that involves an agreement to reduce a vessel's speed on voyage to meet a Required Time of Arrival when there is a known delay at the discharge port.
ETA	Estimated Time of Arrival. The date and time a vessel is expected to arrive at a named destination based on a stated speed.
Virtual Arrival Time	An estimation of a vessel's time of arrival at a named destination at normal service speed, taking into account anticipated weather.
Required Time of Arrival (RTA)	A mutually-agreed time for a vessel to arrive at a named destination.
Actual Time of Arrival	The time a vessel arrives at a named destination.
Deemed Arrival Time (DAT)	An adjusted 'Virtual Arrival Time' that takes into account actual weather experienced on passage. The DAT may be used as the time laytime starts when considering demurrage exposures.
Virtual Arrival Decision Point	The time and place on a voyage where the decision to implement Virtual Arrival is taken and the vessel is instructed to reduce speed or maintain a constant RPM to achieve a Required Time of Arrival.
Voyage Weather Factor	The Weather Factor is the amount of speed loss which is attributed to the effect of the weather on the passage in question
Weather Analysis Service Provider (WASP)	An entity that can be trusted by both parties to undertake the voyage calculations and the reports in connection with a virtual arrival voyage.
SOSP	Start of Sea Passage
EOSP	End of Sea Passage
SCBRA	Speed Reduction and Bunker Consumption Algorithm
SEEMP	Ship Energy Efficiency Management Plan
TMSA	Tanker Management Self Assessment

1 Introduction

Virtual Arrival is a process that involves an agreement to reduce a vessel's speed on voyage to meet a revised arrival time when there is a known delay at the discharge port. The reduction in speed will result in reduced fuel consumption, thereby reducing greenhouse gas (GHG) and other exhaust gas emissions.

It is inherently wasteful for a vessel to steam at full speed to a port where known delays to cargo handling have already been identified. By mutually agreeing to reduce speed to make an agreed arrival time, the vessel can avoid spending time at anchor awaiting a berth, tank space or cargo availability. Emissions can thus be reduced, congestion avoided and safety improved in port areas.

Virtual Arrival involves adapting the freight contract to enable the vessel's speed to be reduced on passage in order to achieve an agreed arrival time at a port.

This manual is intended to provide guidance to charterers, vessel operators, vessels and terminals on the practical implementation of Virtual Arrival. The pre-conditions for Virtual Arrival are detailed, the overall process is explained and information is provided on practical measures to be taken to verify voyage data. Although commercial issues are not explored in detail, brief information is provided on elements that should be considered by owners and charterers when entering into a Virtual Arrival agreement.

The Virtual Arrival process, by reducing emissions and costs, is of mutual benefit to vessel owners and charterers. Furthermore, by minimising vessel waiting times, additional emissions and safety within port areas is also improved.

2 Benefits Associated with Virtual Arrival

2.1 Environmental Benefits

By adjusting a vessel's speed to achieve an agreed arrival time, overall bunker consumption will be reduced and an associated absolute reduction in emissions for the voyage will be realised, as depicted in Figure 1:

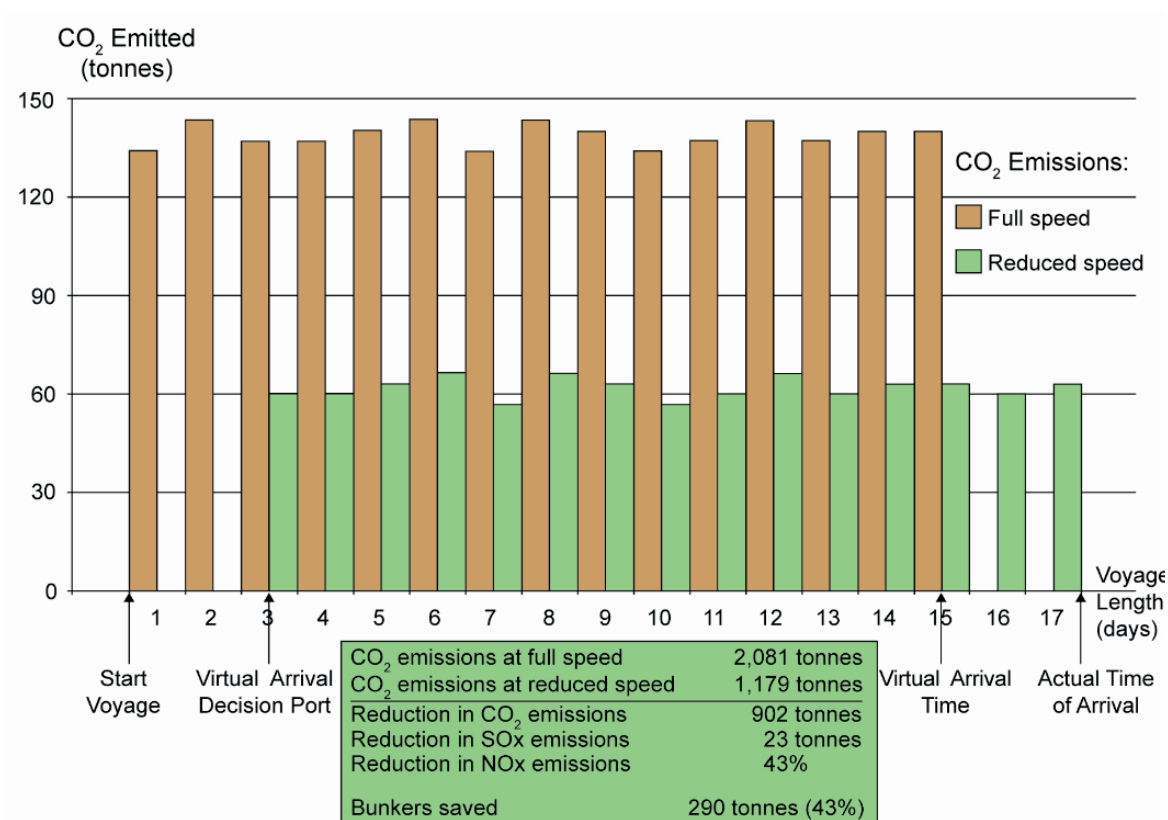


Figure 1: Impact of Virtual Arrival on Reducing Exhaust Gas Emissions

The implementation of Virtual Arrival supports many of the elements detailed in a Ship Energy Efficiency Management Plan (SEEMP), particularly with regard to Section 4 of the Plan which refers to fuel efficient operations through improved voyage planning. Reference should be made to Appendices E and F for further information on SEEMPs. Appendix G provides information on the Energy Efficiency and Fuel Management component of OCIMF's Tanker Management Self Assessment (TMSA) process which may be used by operators to assess and improve their management systems. This document is available from the OCIMF Secretariat upon request.

In addition to reducing vessel emissions on voyage, the adoption of Virtual Arrival, by minimising a vessels waiting time in port, will also serve to reduce emissions in port areas, leading to improvements in local air quality. Appendix H provides information of typical delays experienced at North American ports during 2007 – 2010 by vessels in the dry bulk trade and illustrates the potential opportunities to reduce in-port emissions and port congestion.

2.2 Other Benefits

The adoption of Virtual Arrival has benefits beyond those associated with emission reductions and fuel savings. Its effective implementation requires good cooperation and dialogue between the vessel owner/operator and the charterer and this will serve to remove many of the commercial obstacles to reducing emissions that have hampered some past initiatives. Such obstacles have been associated, for example, with third party and contractual implications, the fact that the party paying for the fuel may not be the technical operator of the ship and a lack of clarity as to which party is liable for paying for waiting time in port.

The improved cooperation between vessel owners/operators and charterers will also have benefits associated with overall voyage planning. For example, parties can agree that some of the available time may be used for planned maintenance activities, statutory surveys, crew changes or vessel storing.

The improved planning of in-port activities that is possible through the early identification of an agreed arrival time may also assist in reducing crew fatigue. Operations can be planned well in advance and uncertainties associated with waiting times and periods at anchor are reduced.

In addition to environmental benefits, the reduced waiting time in port will also improve safety within the port area, for example, by reducing congestion and vessel movements in anchorages.

3 Pre-Conditions for Virtual Arrival

The pre-conditions for Virtual Arrival are:

- A known delay at the discharge port
- A mutual agreement between the ship owner/operator and charterer. Other parties may be involved in the decision making process, such as terminals, cargo receivers and commercial interests.
- An agreed Charter Party clause that establishes the terms for implementing Virtual Arrival
- An agreement on how to calculate and report the performance of the vessel
- An agreement on how to assign benefits between the involved parties.

At all times the safety of the vessel remains paramount and the authority of the vessel's Master remains unchanged when implementing Virtual Arrival.

To reduce post-fixture disputes, it is important that there is a clear understanding of, and agreement to, the method of calculation of the vessel's voyage performance, the speed and other data to be used, the reports to be issued and the timing of these reports before the Virtual Arrival portion of the voyage commences. Weather Analysis Service Provider (WASP) may be employed. Their role would be to ensure the accuracy and independence of the calculation of a vessel's voyage performance. A Weather Analysis Service Provider is an entity that specialises in weather and or vessel performance analysis which is entrusted by both parties to provide analytical services for the voyage undertaken regarding the voyage analysis and physical conditions encountered.

These Weather Analysis Service Providers may eventually operate to an industry-approved standard, having been certified according to a recognised Quality System by a recognised Classification Society.

Virtual Arrival is intended to be a dynamic and flexible process and, if conditions change on voyage, the orders can be revised to enable the ship to achieve, for example, a new arrival time.

4 Overview of the Virtual Arrival Process

The following summarises the steps that are typically involved when implementing the Virtual Arrival process:

- 1 Before a vessel's departure from the load port, or while en route to the discharge port, a delay is identified at the discharge port, for example, due to congestion at the berth or lack of receiving space
- 2 in view of the known delay, the vessel owner/operator and the vessel charterer may agree to consider entering into a Virtual Arrival agreement for the voyage
- 3 the ship owner/operator is requested to provide ship performance information to enable an initial assessment of the voyage to be made based on the service speed of the ship
- 4 Charterer and owner/operator agree a Required Time of Arrival at the destination port and agree the methodology for calculating voyage data and the associated reporting requirements, or alternatively agree on a WASP to be used for calculating voyage data and to provide supporting reports.
- 5 agreement to undertake Virtual Arrival is implemented using an agreed Charter Party Clause
- 6 the initial report should include:
 - methodology to be used to determine speed and consumption calculation
 - calculated ETA, based on normal service speed
 - calculated ETA, based on normal service speed and anticipated weather, the 'Virtual Arrival' ETA
 - Required Time of Arrival (RTA)
 - speed or RPM to achieve RTA
 - bunkers on board at the Virtual Arrival decision point
- 7 the vessel reduces speed in order to make the Required Time of Arrival
- 8 on completion of the voyage if agreed, a WASP or an entity that specialises in weather and or vessel performance analysis, produces a final report providing post-voyage analysis and data to support confirmation of the vessel's Virtual Arrival time and calculations of fuel saved and emission reductions
- 9 in finalising the Virtual Arrival time, an assessment will be made of the impact of the weather sea and current conditions on the voyage by comparing the actual weather encountered with that anticipated when establishing the provisional Virtual Arrival ETA
- 10 the agreed time of Virtual Arrival, the 'Deemed Arrival' time, is used as the time when considering demurrage exposure.

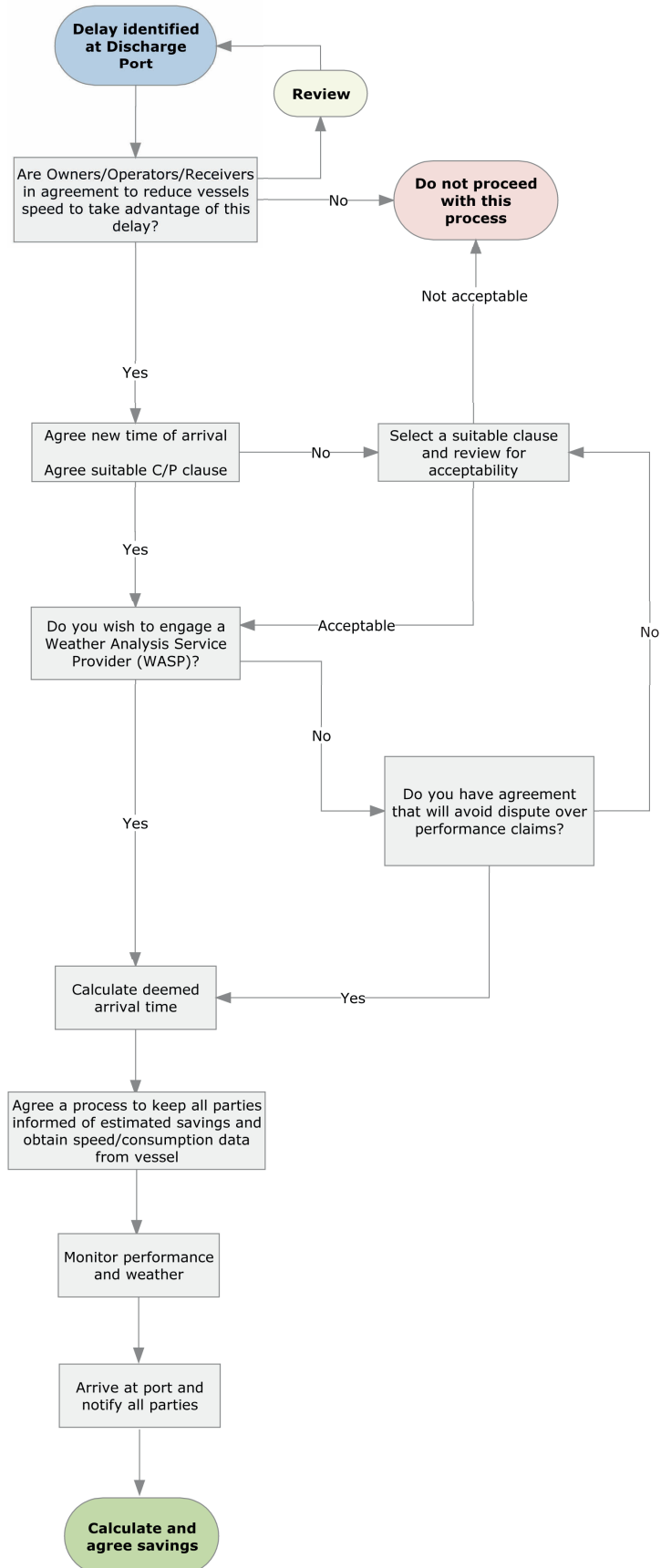


Figure 2: Overview of the Virtual Arrival Process

In Figure 2, on being advised of lack of ullage at the discharge port, parties agree to implement Virtual Arrival with the aim of the vessel arriving at 1200/ 18th (the Required Time of Arrival). Speed is adjusted accordingly and the vessel owner/operator and charterer agree a provisional Virtual Arrival Time of 1200/ 15th and the vessel actually arrives at the port at 1100 on the 18th.

Following completion of the voyage, the WASP undertakes an analysis of weather experienced on voyage and calculates a Deemed Arrival Time (DAT) which, in the example, is 1300/15th. The agreed time of Virtual Arrival, the 'Deemed Arrival' time, is used as the reference point for the calculation.

Examples of Virtual Arrival reports, containing a summary of voyage data and analysis, are attached as Appendix D.

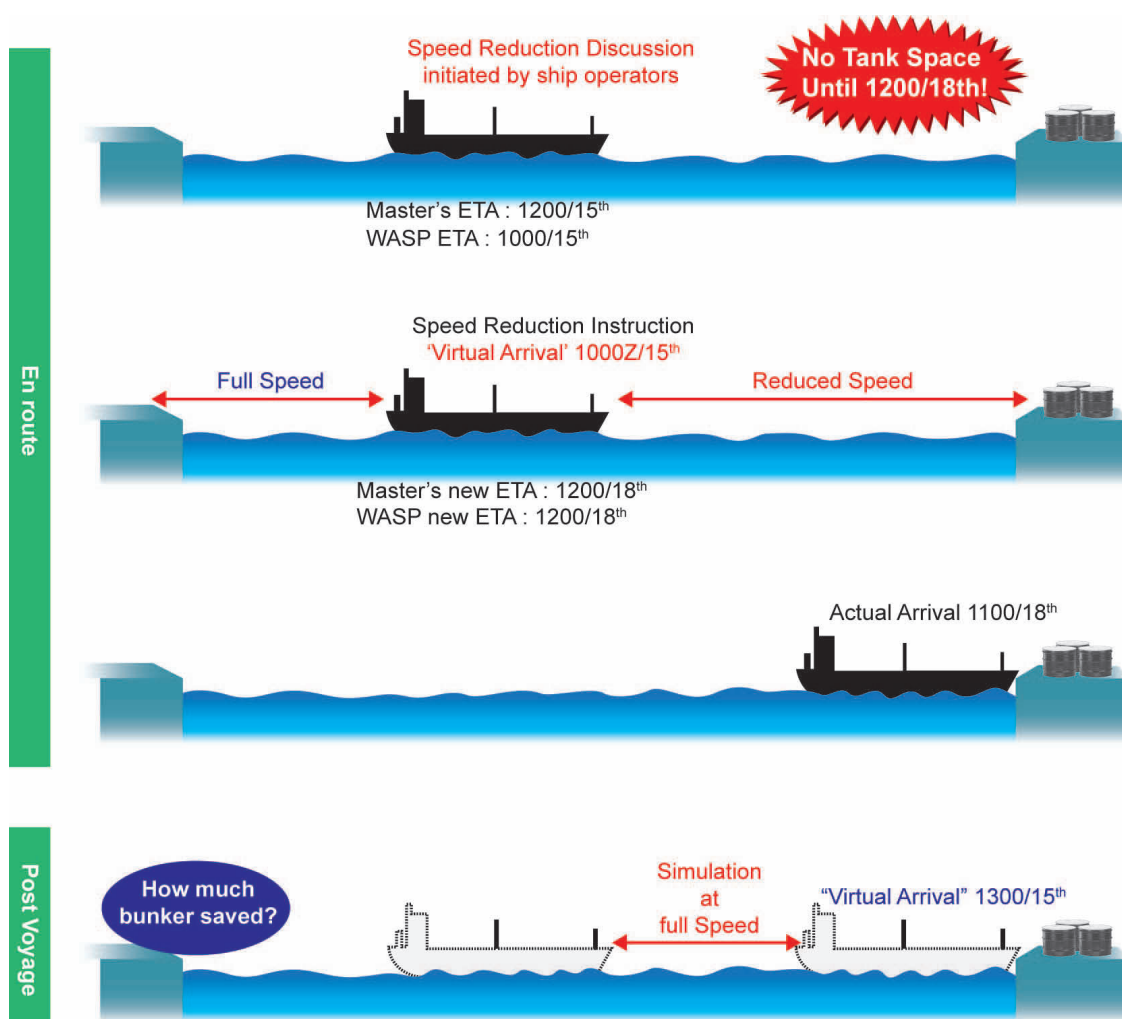


Figure 3: Visual Demonstration of Virtual Arrival Process

5 Issues Associated with Virtual Arrival

Traditionally, Voyage Charter Parties have stipulated the speed that a vessel must attain throughout the voyage. However, the vessel's actual speed will be influenced by the weather and current encountered which will make it difficult for the vessel to maintain the contracted speed on a daily basis. The Charterer typically has no say in the route taken by the vessel or the actual speed at which the voyage is progressed. Under the terms of the charter party, the vessel is duly contracted to proceed at the stated speed.

The adoption of Virtual Arrival provides the opportunity for the ship owner/operator and charterer to discuss and mutually agree adjusting a vessel's speed if it is likely that the vessel will arrive at the discharge port sooner than required. The mutual agreement of a required time of arrival enables vessels to be instructed to reduce speed with the potential to save fuel and reduce emissions.

Although OCIMF and INTERTANKO are primarily concerned with the safety and environmental benefits associated with Virtual Arrival, it is recognised that commercial issues also need to be addressed to facilitate acceptance of the process. Some issues that may be considered when entering into a VA Agreement are included in Appendix A.

It is anticipated that the commercial benefits that accrue from the adoption of Virtual Arrival will be shared between the vessel owner/operator and the charterer.

Although developed for the tanker trade, the principles of Virtual Arrival are suitable for adoption in other trades where the required time of arrival at the discharge port is not fixed or is subject to change due to operational or commercial reasons. In order for the process to be robust and the data to be verifiable, there should be:

- Mutual agreement and acceptance of the vessel owner/operators data for information that includes fuel consumption, speed and ETAs, or
- The engagement of an independent third party service to act as Weather Analysis Service Provider (WASP) to undertake the voyage calculations and reports.

Appendix B provides information on the use of the above two methodologies.

The adoption of Virtual Arrival requires effective collaboration across the industry and consideration of issues that include:

- The legal basis for agreements between vessel owners/operators and charterers
- An understanding of potential impacts on legal agreements between trading parties including the liabilities of late delivery,
- The need for cooperation with Port Authorities, cargo receivers and other parties
- A mutual understanding of the operational limits and performance of the vessel involved
- Agreement on the need for verification of associated data, including that used to calculate voyage savings.

6 Summary

Virtual Arrival is not a short-term speed reduction measure introduced in response to market and economic demands. Virtual Arrival is on the contrary a long term, sustainable and practical process that rationalizes the transportation chain and provides real benefits such as fuel saving and thus reduction in vessel emissions, as well as improved safety

In order to capture all experiences from those who undertake virtual arrival voyages, OCIMF and INTERTANKO have provided the opportunity to feedback to the co-authors via a designated feedback document as contained within appendix I of this manual.

Feedback received that falls within the remit of the two organisations will be coordinated and periodic updates to this manual will be made as necessary. Feedback that does not fall within the remit of the organisations will not be dealt with.

7 Appendix A - Issues for Consideration by Parties Entering into a Virtual Arrival Agreement

The following are amongst issues that may be considered by parties when entering into a Virtual Arrival agreement:

- confirmation that the adoption of VA process has absolutely no impact on the Master's discretion for safety
- agree principle that owner's consent should not be unreasonably withheld
- identification of the vessel's operational envelope and the parameters of the engine with regard to power and consumption
- clear identification of the optimal speed to achieve savings/benefits
- identification of the vessel's baseline efficient slow speed
- any technical or navigational issues associated with establishing a minimum speed, for example, impact on hull fouling
- frequency of variations of speed and operational implications
- identification and agreement on any additional vessel reporting requirements
- whether the VA voyage is to be based on a reduced service speed/RPM or a timed arrival. If based on speed/RPM, how often are changes to be advised
- identification of entities that have the right to instruct the vessel and the nature of instructions to be given
- how to verify and agree voyage data e.g.
 - Master's verification
 - use of Weather Analysis Service Provider: speed or RPM based
- if Weather Analysis Service Provider is used:
 - approved and certified entity?
 - who pays?
 - is data provided binding on both parties?
 - mechanism for dispute resolution
- means of identifying and calculating benefits associated with reduced emissions
- means of identifying potential cost savings and impact of any potential additional costs
- basis of calculating cost of bunkers
- how to apportion cost benefits between Parties
- clarification as to basis of time calculations, e.g. compensation at demurrage rate, whether there is to be a right of offset and method/time for payment
- consideration to be given to any potential 3rd party liabilities, e.g. P and I, BoL holders, cargo insurers, terminals
- quantification and apportionment of carbon credits (future).

Other considerations:

- implications on vessel's next employment
- impact on other operational issues at discharge port, e.g. crew changes, surveys, planned maintenance.

Appendix B - Verification of Voyage Data

Background and Common Requirements

In 2009, OCIMF and INTERTANKO, together with representatives from shipping companies, marine law firms, P & I Clubs, Port Authorities and technical WASPs, met to examine the challenges and opportunities associated with Virtual Arrival. A key task facing the group was to assess the technical methodology required to ensure the credibility of data obtained with regard to the quantification of time, emissions and fuel saved.

Two possible methodologies were developed: RPM based and speed based which are in general terms similar.

B1: Voyages Verified without a Weather Analysis Service Provider

There is presently no industry experience of undertaking a Virtual Arrival voyage without the use of a Weather Analysis Service Provider (WASP). The following guidance is provided to highlight some of the issues that may need to be considered.

Should parties not use a WASP, they should jointly agree on the methodology to be employed in verifying voyage data and for assigning benefits. They should agree to accept data provided by the vessel which may include the following:

- The Master will provide an initial report at the Virtual Arrival decision point confirming:
 - bunkers on board at Virtual Arrival decision point
 - estimate of bunkers that would be consumed at service speed to arrival discharge port
 - ETA at service speed
- the Master will be instructed to adjust speed to achieve the Required Time of Arrival (RTA)
- the Master will provide daily reports summarising voyage data, providing similar information as that provided in Table B3, Example of a Routine Noon Report
- on arrival at the discharge port, the Master will confirm the actual bunkers consumed on voyage.

From the above information, the owner/operator and charterer will jointly agree on a Virtual Arrival Time based on the original ETA at service speed, the amount of fuel saved and emissions reduced and the assignment of benefits.

The following disadvantages are associated with this option:

- The Master is responsible for adjusting speed to achieve the Required Time of Arrival without necessarily having full knowledge of future weather conditions
- there is limited opportunity to take account of the impact of weather on both the virtual and actual voyages
- the lack of independent third party verification of data to a recognised standard could lead to an increased risk of contract disputes
- the lack of a WASP's input to the overall management of the voyage could lead to an increased risk of vessels missing their Required Time of Arrival, with associated potential for further delays.

B2: Voyages Verified without a Weather Analysis Service Provider

In order that the processes associated with Virtual Arrival are demonstrated to be verifiable and auditable, it is recommended that an independent third party is engaged. A WASP, specialising in expert weather and vessel performance analysis, should be considered for this task.

It should be noted that the term 'Weather Analysis Service Provider' is used throughout this document to describe entities that work to an industry-approved standard.

An outline specification for a WASP is included as Appendix C.

Voyage Management Options

The Weather Analysis Service Provider can employ one of two primary methods to manage the vessel's progress on passage to achieve a Required Time of Arrival, namely, speed-based or RPM-based. If speed-based, the vessel will be instructed to maintain a fixed Calm Sea Speed, If RPM-based, the vessel will be instructed to maintain a fixed RPM. Both the Calm Sea Speed and the RPM would ordinarily only be adjusted in accordance with advice from the WASP.

Voyage Verification

When it is decided to initiate a Virtual Arrival voyage, the WASP will initially calculate the optimum Calm Sea Speed or RPM setting for the voyage and the vessel will be instructed accordingly. As the voyage progresses, the ordered speed or RPM will be routinely monitored and a prediction of the effect of the forecast weather on the vessel's performance calculated. Advice will be passed to the vessel Master and any necessary recommendations made for adjusting the vessel's Calm Sea Speed or RPM to maintain the Required Time of Arrival (RTA).

The WASP will monitor the following aspects of the vessel and voyage:

Vessel

- Optimum calm sea speed or RPM.
- Track for the remainder of the voyage
- Consumption during the passage.

Voyage

- Feedback to the charterer and other relevant parties on the required speed and anticipated consumption for the Virtual Arrival voyage.
- Monitor speed loss due to weather, current and sea condition encountered.
- Provide feedback to all interested parties.
- On completion of the voyage, calculate the vessel performance.
- Assess savings associated with fuel consumed and emissions reduced compared to completing the passage on the basis of the initially instructed speed.

The RPM based service requires the provision of a greater amount of data prior to or during the voyage as it involves the calculation of a Speed Reduction and Bunker Consumption Algorithm (SRBCA). The Calm Sea Speed service requires less data from the vessel as it does not require the WASP to determine the RPM to be used to attain a certain Calm Sea Speed. That calculation is left to the crew onboard as they will have a better understanding of what RPM is required to attain a specific calm sea speed for their particular vessel and load condition.

It will be the responsibility of the WASP to request and obtain from the Master/Owner/Charterer the required information for their preferred service.

Example documentation and reporting formats

Once a decision has been made to apply Virtual Arrival to a specific voyage, whether speed based or RPM based, the ship operator should provide the WASP with an initial service request form:

Company Name	
Ship Name and Call Sign	
IMO Number	
Vessel Communication details (telex/Fax/e mail)	
Voyage Number	
Departure Port	
Arrival Port	
ETD Pilot Station	
RTA (Required Time of Arrival)	
Max/Min operable RPM	
Calm Sea Speed	
Expected Draft Fwd/Aft	
Expected GM	
Sailing Intention	
Loading Condition	
Remarks/ Special Requirements	
Pre-Planning Deadline	

Table B1: Example of a Service Request Form

The WASP will review the intended passage and will provide the vessel Master/Owner/Operator with the following information;

- General discussion of the weather pattern for the passage
- Confirmation of the intended passage plan/provision of recommendation(if required)
- Calm Sea Speed or RPM to achieve Required Time of Arrival (RTA)
- Detailed forecast of the weather and sea conditions along the intended track
- Estimate of Fuel Consumption en route.

This information should be made available to the vessel some 12 – 48 hours prior to departure.

If the Required Time of arrival (RTA) is not available before the vessel departure, the service provider will not provide a recommended Calm Sea Speed or RPM for the voyage but will estimate total fuel oil consumption and ETA based on the earlier provided information relating to the vessel and voyage. Once the RTA is advised to the WASP, the WASP will provide a recommended Calm Sea Speed or RPM to meet the RTA, together with details of expected total fuel oil consumption.

It is the responsibility of the WASP to ensure all of the information required to complete the Virtual Arrival process is obtained from the vessel Master/Owners/Charterer.

It should be noted that Virtual Arrival may not be suitable for implementation on short voyages, for example, those of 5 days or less duration.

If it is decided to implement Virtual Arrival once the vessel is on passage, the initial service request should be forwarded to the WASP, together with all previous Noon reports and any other relevant information.

The following are examples of the type of reporting that is anticipated from/to the vessel undertaking virtual arrival:

	Speed Based	RPM Based
Ship Name and IMO Number		
Date/Time of SOSP (UTC)		
Position at SOSP (Lat & Long)		
ETA at Warranted Speed (state speed)		
RTA (Required Time of Arrival)		
Speed to Achieve RTA		
RPM to Achieve RTA		
Sailing Draft Fwd/Aft		
GM		
Fuel Remaining on Board at SOSP		
Diesel Remaining on Board at SOSP		
Destination		
Remarks		

Table B2: Example of a Start of Sea Passage (SOSP) Report

The SOSP report will be submitted by the Master and will be followed-up by routine position reports providing information, such as the following:

	Speed Based	RPM Based
Ship Name and IMO Number		
Date/Time of Position Report (UTC)		
Position (Lat & Long)		
Sailed Distance since last PR		
Steaming Time since last PR		
Average Speed since last PR		
RTA (Required Time of Arrival)		
Set RPM		
Average RPM		
Slip (%)		
Fuel Consumption since last PR		
Diesel Consumption since last PR		
Average Wind Direction and Force since last PR		
Average Wave Direction and Height (m) since last PR		
Average Swell Direction and Height (m) since last PR		
Destination		
Calculated ETA		
Remarks		

Table B3: Example of a Routine Position Report (PR)

If, during the voyage, the vessel's route, speed or RPM is changed, the Master will submit a report providing details in a format such as the following:

	Speed Based	RPM Based
Ship Name and IMO Number		
Report Date/Time (UTC)		
Date/Time of Route/RPM Change		
Route Details		
Revised Speed		
Set RPM		
Reason		

Table B4: Example of a Change of Route, Speed or RPM Report

Finally, on completion of the voyage, the Master will submit an End of Sea Passage (EOSP) Report, as in the following example:

Ship Name and IMO Number	
Report Date/Time (UTC)	
Time of EOSP	
Position of EOSP (Lat & Long)	
Sailed Distance since last PR	
Steaming Time since last PR	
Total Distance since SOSP	
Total Steaming Time since SOSP	
Average Speed (kts)	
Average RPM	
Slip (%)	
Fuel Consumption since last PR	
Diesel Consumption since last PR	
Fuel Remaining on Board	
Diesel Remaining on Board	
Remarks	

Table B5: Example of an End of Sea Passage (EOSP) Report

During the voyage, the ship owner/operator should monitor the data submitted by the vessel to confirm that voyage instructions are being adhered to. Parameters monitored may include ETA, RPM, weather, speed and fuel consumption and data may be graphically presented, as depicted below:

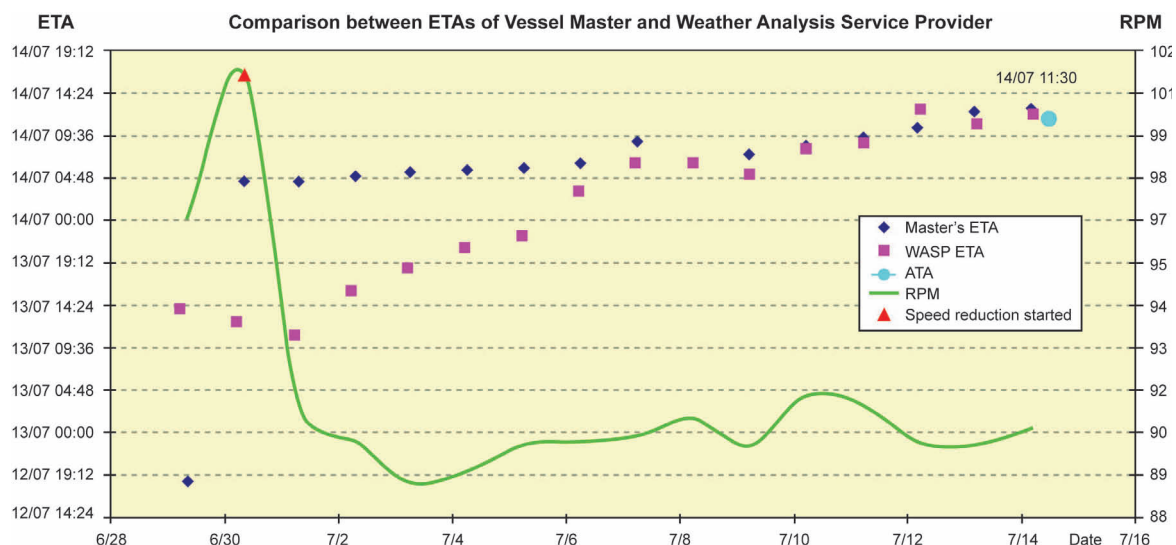


Figure B1: Example of En-route Monitoring of Vessel ETAs and RPM

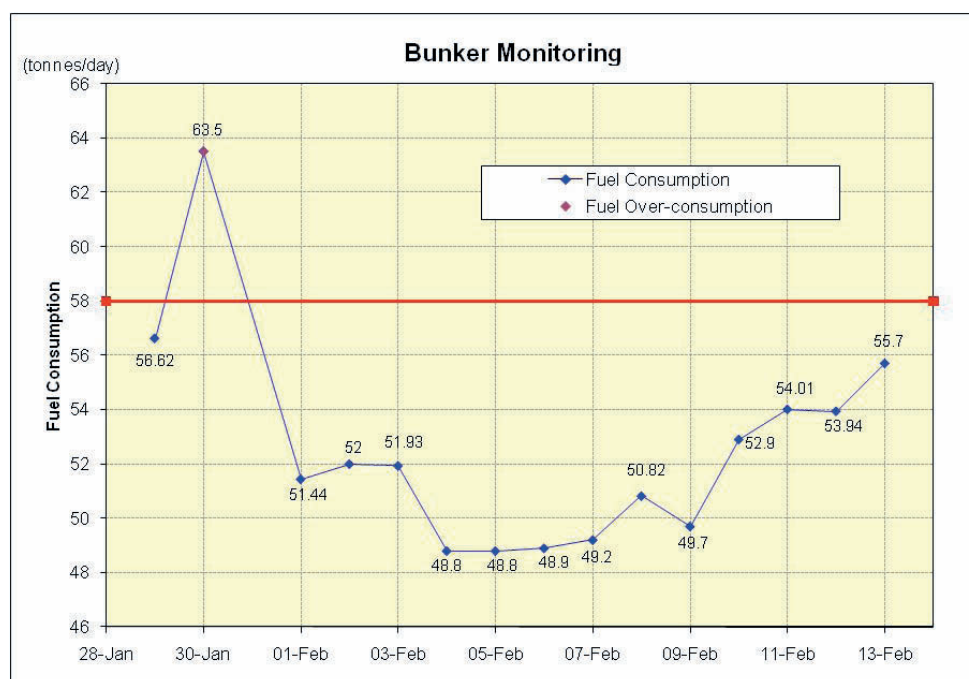


Figure B2: Example of En-route Monitoring of Vessel's Bunker Consumption

A working group consisting of two classification societies, three service providers and a representative of INTERTANKO and industry, undertook testing of the calculations of the service providers based on real voyages.

Appendix C - Outline Specification for a Weather Analysis Service Provider

Background and Common Requirements

The following outline specification for a weather analysis service provider (WASP) has been developed with the aim of:

- Defining a set of requirements that WASPs would need to meet when providing Virtual Arrival services
- Defining minimum standards to be used to provide assurance that the output of the WASP, with regard to Virtual Arrival, is reliable and consistent with defined levels of accuracy with professional independence.

Outline Specification for Weather Analysis Service Provider

Scope:

This specification covers the requirements needed to be considered before contracting a WASP to undertake the Virtual Arrival calculations and reports.

Requirements:

a) Company criteria

The Weather analysis service providers will be required to demonstrate that they have policies and procedures in place covering issues that include:

- Ethics
- Use of data from globally renowned and credible sources, e.g. WMO, Global Forecasting System
- Data protection standards
- Global service standards, e.g. provision of 24/7 service
- Independence
- Confidentiality
- HSE
- Quality Assurance.

b) Communications

Details of communication paths and links to be provided, possibly in the form of a flow chart.

c) Voyage data

Information on voyage data required to support the Virtual Arrival service. This could include:

- Qualifying voyage criteria (e.g. excluding stoppages, etc)
- Identification of 'Go/No Go' decision points, or agreed fallback options
- Speed and fuel oil consumption data
- Basis of calculating reports
- Routine vessel reports – e.g. Start of Sea Passage (SOSP), Noon and End of Sea Passage (EOSP) reports
- Poll data.

The agreed time of Virtual Arrival, the 'Deemed Arrival' time, is used as the time when considering demurrage exposure

d) Weather routing models and post-voyage calculations

To include information, such as:

- The number of model runs, and associated information updates to the vessel
- Source(s) of real-time current data
- Means employed for data resolution
- Use of satellite data
- Tropical storm forecasting
- Wave models
- Verification process for assuring accuracy of algorithms.

e) Final reporting

Details of the final report to be submitted by the WASP, which should be in a non-editable format and should include, as a minimum:

- Basis for calculating speed and consumption
- calculated ETA
- Virtual Arrival ETA
- Deemed Arrival Time (DAT)
- Actual Time of Arrival
- Bunkers at Virtual Arrival decision (mts)
- Calculated emissions (CO₂, NO_x, SO_x)
- Details of fuel saved and reductions in emissions
- Route map
- Details of daily interaction with vessel

f) Service enhancements

A statement confirming that the WASP in support of Virtual Arrival should encourage the identification of future service enhancements with the aim of achieving continuous improvement.

g) Caveats

To include, for example, statements relating to the following:

- That the Virtual Arrival processes and requirements will not contravene any safety or other international regulations or established marine practices.
- Acceptance that it may be necessary to revise plans en route due to changing circumstances, such as, navigational hazards and weather patterns.
- Limitations associated with calculation methodologies.
- Legal agreements or restrictions.
- Confirmation that the vessel's Master retains overriding authority.

Appendix D - Examples of Virtual Arrival Reports

Example 1


Virtual Arrival Report Post Voyage Analysis and Comparison

Vessel Name :
 Departure : BATUMI
 Arrival : SUNK
 Reduction Point : 40.03N 26.15E (Sep 6, 2009 0048Z)
 Voyage Number :2009083552

Sep 2, 2009 1900GMT
 Sep 16, 2009 1000GMT



1. Voyage Analysis

Voyage Analysis			
From / To	BATUMI to Bosporus	Dardanelles to SUNK	
Ship Speed			
	Full Speed (actual)	Economical Speed (actual)	Full Speed (simulated)
Distance Sailed (nm)	557	3003	
Time En Route (hours)	40.3	249.2	222.0
Ordered Speed (knots)	14.0	12.0	14.0
Average Speed (knots)	13.8	12.1	13.5
Weather Factor	0.0	-0.3	-0.3
Current Factor	0.0	0.0	0.0
Entire Voyage Performance Speed (knots)	13.8	12.4	13.8
Average Daily Fuel Consumption (mt/day)	29.54	20.65	29.54
Entire Voyage Fuel Consumption (mt)	49.60	214.40	273.23
	(a)	(b)	(c)

2. Slow Steaming Effect Analysis

Fuel saved	(c) - (b)	58.83 MT
CO2 decreased	(Fuel Consumption x 3.114)	183.2 MT
NOx decreased :	(Fuel Consumption x 0.07455)	4.39 MT
SOx decreased :	(Fuel Consumption x 0.059)	3.49 MT

Figure D1 - Example of Virtual Arrival Report.

Example 2**Virtual Arrival Report****Final Voyage Performance Analysis
Comparison Report****Vessel Name:** MT Flying Tanker**From:** Europort (52.5N 004.1E) May 18, 2009**To:** Port Everglades (26.25N 079.42W) May 31, 2009**Presented to:** BBB Tankers**Reference:** 123456789**Final Voyage Summary**

Speed Description	Actual Full Speed	Actual Economical Speed	Full Speed Simulation
Voyage Description	Departure Port to VAD*	VAD* to Arrival Port	VAD* to Arrival Port
Distance Sailed	1650	2650	2650
Time En Route	114.98	196.29	184.02
Average Speed	14.35	13.50	14.40
Speed Loss due weather/current	0.50	0.40	0.45
Performance Speed	14.85	13.90	14.85
Ordered Speed	16.00	14.00	15.00
Daily IFO Consumption (Per C/P)	76.00	63.00	75.00
Daily IFO Consumption (Actual Average)	73.60	62.90	73.50
Actual Consumption (MT)	352.13	514.44	563.56

Final Virtual Arrival Savings

Fuel Saved (MT)	49.12 MT
CO₂ Saved	156.35

*VAD — Virtual Arrival Decision

Figure D2 - Example of Virtual Arrival Report.

Appendix E - Ship Energy Efficiency Management Plan (SEEMP)

Background and Common Requirements

There are around 70,000 ships engaged in international trade and the industry is responsible for carrying 90% of the world's trade. Sea transport has a justifiable image of conducting its operations in a manner that creates minimal impact on the global environment. Compliance with the MARPOL Convention and other IMO instruments and the actions that many companies take beyond the mandatory requirements serve to further limit the impact. It is nevertheless the case that enhancement of efficiencies can reduce fuel consumption, save money and decrease environmental impacts for individual ships. While the yield of individual measures may be small, the collective effect across the entire global fleet will be significant.

In global terms it should be recognised that operational efficiencies delivered by a large number of ship operators will make an invaluable contribution to reducing global carbon emissions.

A Ship Energy Efficiency Management Plan provides a possible approach for monitoring ship and fleet efficiency performance over time and provides a formal structure for use when seeking to optimise the performance of the ship.

The purpose of a Ship Energy Efficiency Management Plan (SEEMP) is to establish a mechanism for a company and/or a ship to improve the energy efficiency of a ship's operation. Preferably, the ship-specific SEEMP is linked to a broader corporate energy management policy for the company that owns, operates or controls the ship, recognising that no two shipping companies or ship owners are the same, and that ships operate under a wide range of different conditions.

Section 4 of the SEEMP refers to fuel efficient operations by improving voyage planning. Virtual Arrival provides a key process in support of delivering fuel efficiency and the associated reductions in green house gases emitted from the vessel. The relevant section from the MEPC circular is reproduced below.

SEEMP Section 4 on Fuel Efficiency: IMO Circular MEPC.1/Cir 683, 17th August 2009

Fuel Efficient Operations

Improved voyage planning

- 4.2 The optimum route and improved efficiency can be achieved through the careful planning and execution of voyages. Thorough voyage planning needs time, but a number of different software tools are available for planning purposes.
- 4.3 IMO resolution A.893(21) (25 November 1999) on voyage planning provides essential guidance for the ship's crew and voyage planners.

Weather routing

- 4.4 Weather routing has a high potential for efficiency savings on specific routes. It is commercially available for all types of ship and for many trade areas. Significant savings can be achieved, but conversely weather routing may also increase fuel consumption for a given voyage.

Just in time

- 4.5 Good early communication with the next port should be an aim in order to give maximum notice of berth availability and facilitate the use of optimum speed where port operational procedures support this approach.
- 4.6 Optimized port operation could involve a change in procedures involving different handling arrangements in ports. Port authorities should be encouraged to maximize efficiency and minimize delay.

Speed optimization

- 4.7 Speed optimization can produce significant savings. However, optimum speed means the speed at which the fuel used per tonne mile is at a minimum level for that voyage. It does not mean minimum speed; in fact sailing at less than optimum speed will consume more fuel rather than less. Reference should be made to the engine manufacturer's power/consumption curve and the ship's propeller curve. Possible adverse consequences of slow speed operation may include increased vibration and sooting and these should be taken into account.
- 4.8 As part of the speed optimization process, due account may need to be taken of the need to coordinate arrival times with the availability of loading/discharge berths, etc. The number of ships engaged in a particular trade route may need to be taken into account when considering speed optimization.
- 4.9 A gradual increase in speed when leaving a port or estuary whilst keeping the engine load within certain limits may help to reduce fuel consumption.
- 4.10 It is recognized that under many charter parties the speed of the vessel is determined by the charterer and not the operator. Efforts should be made when agreeing charter party terms to encourage the ship to operate at optimum speed in order to maximize energy efficiency.

Optimized shaft power

- 4.11 Operation at constant shaft RPM can be more efficient than continuously adjusting speed through engine power (see 4.7). The use of automated engine management systems to control speed rather than relying on human intervention may be beneficial.

Appendix F - INTERTANKO's Best Practice on Tanker Emissions and Energy Efficiency

Background and Common Requirements

The Best Practice on Tanker Emissions and Energy Efficiency is based on experience gained from members of the INTERTANKO Safety, Technical and Environmental Committee (ISTEC) and Environmental Committee. This experience reflects actual on board implementation of the efficiency measures on existing tankers. The information is from a broad spectrum of tanker types and sizes and as such the applicability and effectiveness of each recommended measure will have to be assessed based on a company's particular fleet characteristics. Furthermore, it is recognised that the variation in operational parameters and fleet characteristics may yield varying savings in energy use.

It is intended that each identified measure can be implemented directly by an operating company. However, it is important that charterers and other external parties are involved when implementing, measuring and monitoring a tanker's efficiency over time.

Detailed definitions of each of the measures suggested in the Best Practice guide are provided in INTERTANKO's Guide for a Tanker Energy Efficiency Management Plan. The Management Plan relates directly to the six listed measures and provides detailed guidance to tanker operators on how the measures may be implemented based on current experience.

The following elements are addressed in the Best Practice guide:

- 1 Programme for Measuring and Monitoring Ship Efficiency
- 2 Voyage Optimisation Programme
 - 2.1 Speed selection optimisation
 - 2.2 Optimised route planning
 - 2.2 Trim optimisation
- 3 Propulsion Resistance Management Programme
 - 3.1 Hull resistance
 - 3.2 Propeller resistance
- 4 Machinery Optimisation Programme
 - 4.1 Main engine monitoring and optimisation
 - 4.2 Optimisation of lubrication as well as other machinery and equipment
- 5 Cargo Handling Optimisation
 - 5.1 Cargo vapours control procedure on all crude tankers
 - 5.2 Cargo temperature control optimization
- 6 Energy Conservation Awareness Plan
 - 6.1 On board and on shore training and familiarisation of company's efficiency programme
 - 6.2 Accommodation-specific energy conservation programme

Further details may be obtained from the INTERTANKO Secretariat.

Appendix G - Energy Efficiency and Fuel Management (OCIMF)

Background and Common Requirements

The Energy Efficiency and Fuel Management booklet has been prepared by OCIMF as management guidance with the aim of encouraging companies to implement CO₂ reduction practices and technologies as part of a culture of fostering continuous improvement.

The guidance, which utilises the standard framework of Tanker Management Self Assessment (TMSA), identifies methodologies available for consideration and elements of these may be included in TMSA at a future date.

The guide provides operators with a basis for assessing, modifying and improving their management systems with the aim of maximising Energy Efficiency. Best practices for achieving that aim are identified.

To be effective, the Energy Management Plan needs to comprise of more than just procedures. The company Leadership/Management are encouraged to define and communicate the company's values and aspirations and detail how the company intends to achieve the objectives of their Energy Management Policy, including identification of roles and responsibilities, setting of targets, and monitoring performance.

Virtual Arrival may assist in achieving the company's objectives and is recommended for consideration when producing a company Energy Management Plan.

Further details may be obtained from the OCIMF Secretariat.

Appendix H- Port Congestion Data

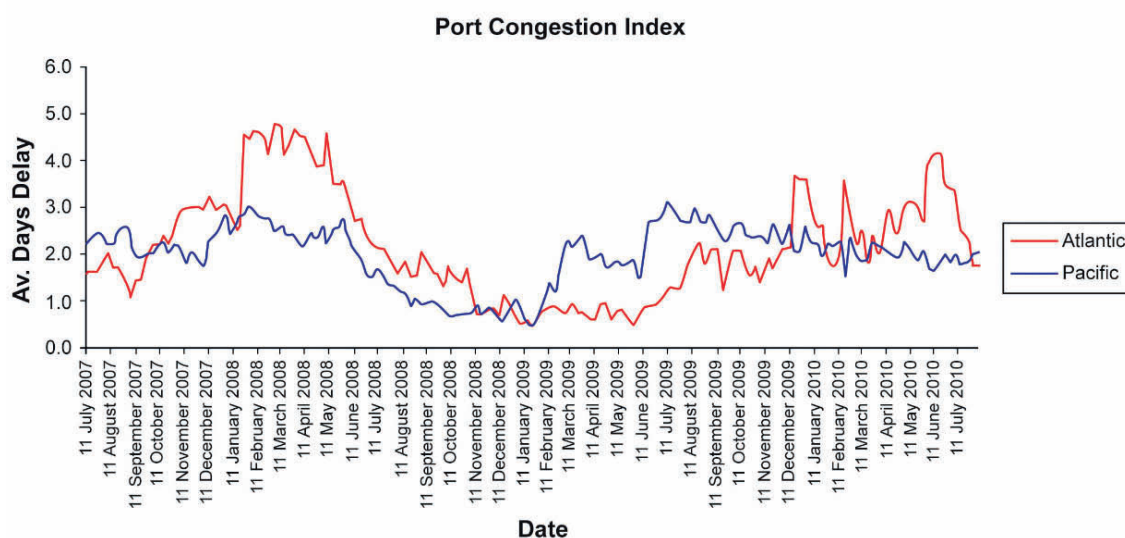


Figure H1: Port Congestion Index

(Source: G-ports/Simpson Spence and Young)

The above graphic depicts the average port delays experienced by dry bulk carriers at North American Atlantic and Pacific ports from July 2007 to July 2010.

The data shows that the average delay for the Atlantic ports varies between approx. 1 and 5 days; and for Pacific ports 1 and 4 days. It should be noted that, in both cases, the 1 day average delays occurred at the lowest point in the corresponding economic cycle and higher levels of delay are more normal.

The data depicts average figures and some ports are known to suffer from increased congestion and incur considerably longer delays.

The information indicates that real opportunities exist to reduce port congestion through the adoption of Virtual Arrival. Virtual Arrival will also serve to reduce the degree of green house gas emissions in the port anchorage and vicinity, thereby having a positive impact on the local atmosphere and upon the health of the population living in the coastal region.

Appendix I- Feedback on the undertaking of virtual arrival voyages

In order to capture all experiences from those who undertake virtual arrival voyages, OCIMF and INTERTANKO have provided the opportunity to feedback to the co-authors via the designated feedback document below.

Feedback received that falls within the remit of the two organisations will be coordinated, and periodic updates to this manual will be made as necessary. Feedback that does not fall within the remit of the organisations will not be dealt with.

Feedback report for virtual arrival voyages	
Was the explanation of the concept of virtual arrival useful?	
Are there any experiences you would like to share on your virtual arrival voyage?	
Are there any areas of improvement you would like to highlight?	
Was there any guidance you would have liked to have received prior to entering into your virtual arrival voyage?	
Is there anything associated with the virtual arrival process you would like reviewed?	

Please email or fax a copy of this sheet to:

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