Proposal for improving Charter Party practice

Jeppesen, a Boeing Company

support.mps@jeppesen.com

December 2013

Executive summary

According to the International Chamber of Shipping (ICS) at the 2013 United Nations Climate Change Conference (UNFCCC), lowering emissions by improving fuel efficiency is an economic "no brainer" for the shipping industry. The high cost of fuel, coupled with environmental concerns, already provides ship owners with ample justification to continue improving fuel efficiency and reducing CO_2 emissions.

To support this transformation, structural impediments such as outdated charter party practices need to be addressed, and the use of applicable new technologies embraced.

This fits well with the current IMO focus on developing a mandatory global system for monitoring and reporting vessel fuel consumption and CO_2 emissions. Such a monitoring system could be cost-effectively implemented as an extension of the existing shipboard VDR (data recorder). Similar to the aircraft "black box" flight data recorder, this provides an ideal platform to host other applications such charter party performance verification, condition-based maintenance scheduling, voyage optimization, and e-Navigation.

Global trends in IT-driven business transformation

Today we are observing a world that is increasingly being measured, quantified, and optimized. Information technology-driven business processes are transforming all industries.

In the airline industry, for example, thousands of sensors are connected to and recorded by the aircraft's flight data recorder. Computers coordinate passengers, crews, baggage, and airplane maintenance. Real-time passenger information, weather data, and air traffic data drive airline dispatching and pilots' flight plans on digital charts. Dynamic ticket pricing, mobile travel alerts/updates – all of these are part of the extremely intelligent technology infrastructure behind air transportation.

One might think that the multi-billion dollar maritime industry, which carries 90% of the world's traded cargo, would be trending in this direction too. In reality, the maritime industry, traditionally a late adopter of technology, has yet to catch up, despite what is being advocated by International Maritime Organization (IMO), International Chamber of Shipping (ICS), and the press.

While today's consumers typically measure their daily activities through connected devices like Nike FuelBands and Jawbone UPs, ship owners use decades-old tools to measure fuel consumption and performance. They use the equivalent of an electronic dipstick to sound the fuel tanks to determine how much fuel was consumed – and even then they only do this once per day so that they can fill in the numbers in their so-called "Noon Report", which also includes distance run and average speed, shaft horse power, and propeller revolutions per minute. These daily averages cannot indicate the true performance of the engine, hull, and propeller, let alone be used to detect trends over several months, because of variations in weather, current, loading conditions, and speed throughout each 24-hour period.

Outdated charter party agreements impede improving fuel efficiency and reducing greenhouse gas emission

More than 50% of the world's shipping fleet is under charter in one form or another. Unlike the airline industry, which owns or leases the aircraft, operates, maintains, and crews their equipment, and pays the fuel bill, the shipping industry involves many stakeholders, among them financial institutions, ship owners, ship managers, crewing agencies, and charterers, each of whom has their own business objectives.

During the last decade, we have seen significant increases in ship's fuel efficiency due to improvements in hull, engine, and propeller designs, as well as better anti-fouling coatings that keep the hull clean until the next drydocking. Ship owners are beginning to invest in "green technology" toward improving their fleet's energy efficiency design index (EEDI) to reduce operating costs driven by high fuel prices and to lower carbon dioxide (CO_2) emissions as mandated by IMO.

Yet when these efficient ships enter into service under charter, the advantages of their better performance cannot be fully realized. The charter party agreement, with concepts that date back to before accurate weather forecasting, sensor technology, GPS and satellite communication between ship

and shore were available, frequently leads to wasted fuel and increased greenhouse gas emissions, not to mention risking the safety of the ship and its crew.

Under typical time charter party agreements, both the ship owner and the charterer agree to a “minimum ship performance level”, which essentially means the ship owner guarantees the ship to meet an ordered speed, for example, of “about 12.5 knots”, at which it will consume no more than “65 tons of fuel per day”. However, this minimum ship performance level is only applicable during vaguely defined “good weather conditions”, stated in approximate terms using such measures as the Beaufort Scale, regardless of wind or wave direction or wave period and how they affect the speed and fuel consumption. The word ”about”, if included in a charter party agreement, often means half a knot of leeway for speed and 5% for fuel, regardless of the ship’s loading condition or whether the ship was in an adverse current. Weather routing companies provide charter party reports for speed/fuel claims based on a compilation of noon reports received from the ship, validated with their own assessments of good or bad weather days and ocean currents. Any disputes or claims are settled by a lengthy and expensive arbitration procedure.

As such, a ship under charter would not slow down in order to let an upcoming storm pass because the charter party performance claims. Rather, the ship must either be diverted around the storm (longer distance equals more fuel), or head into the heavy weather so it can slow down under the Weather Safety Navigation Permitting (WSNP) clause, thereby also consuming more fuel as well as exposing the ship to greater risk of damage. Furthermore, a ship under charter would not increase speed to outrun a storm in order to achieve a strategically better position for the rest of the passage.

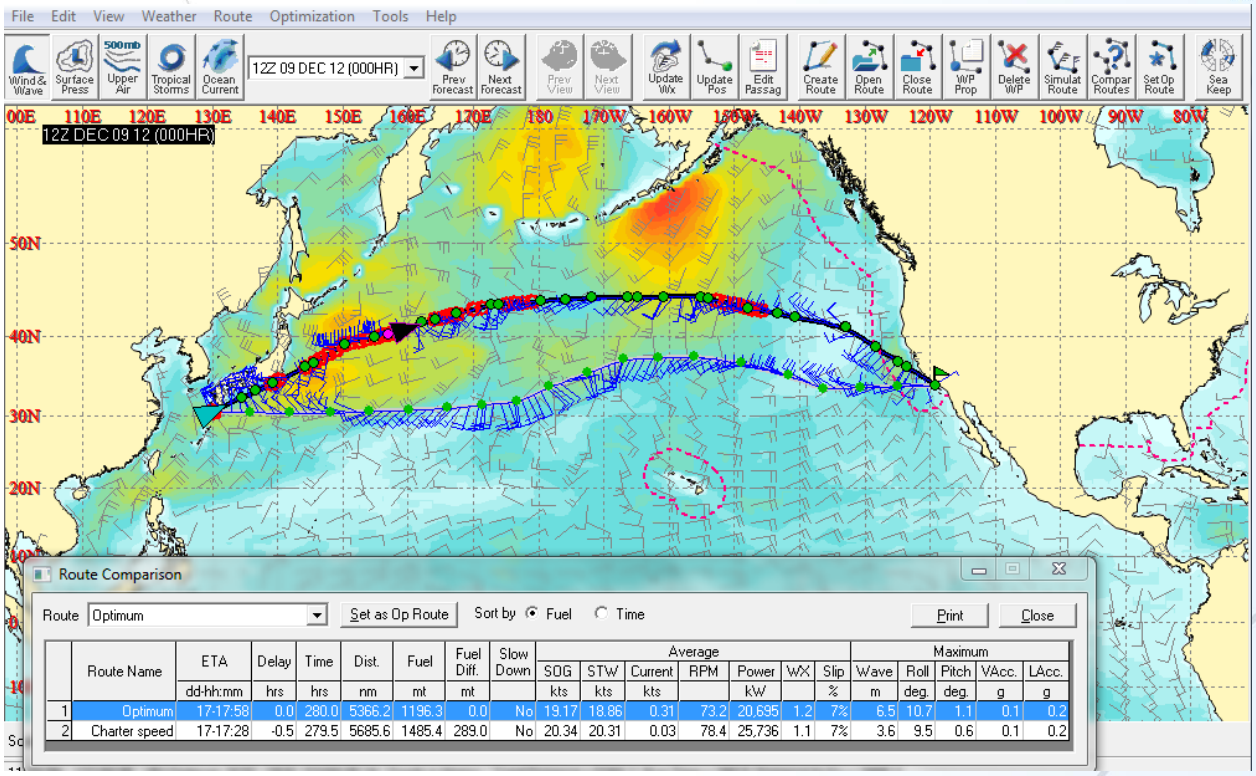
The economics of such a legal agreement also create incentives for “creative accounting and reporting” between the ship owner/operator and the charterer. The owner may be motivated to under-report fuel consumption in good (non-exempt) weather conditions, and then inflate fuel consumption in bad (exempt) weather conditions to make up the difference of over consumption in adverse current or under performance due to propeller/hull/engine issues. He also benefits by over-estimating sea states, and even intentionally heading into heavy weather. And in favorable heavy weather conditions, such as following winds and seas, the owner has the

opportunity to “double-dip”, over-reporting fuel consumption compared to the “good weather daily terms”, and also consuming less fuel than he would in calm seas. On the other hand, in many charter party agreements, the ship can be operating in dead calm weather against a significant head current, thereby having to burn more fuel to maintain the ordered speed without any relief or compensation from the charterer. The situation gets even more complicated in an owner/operator pooling arrangement, where performance claims are levied against the pool, and ship owners have to figure out their fair share of cost and revenue.

By comparison, the charterer is typically only interested in desired transit time and ETA, and, of course, overall charter cost, including extra fuel for exempt weather days, demurrage fees, etc. However, without proper monitoring and voyage optimization for the desired ETA, the charterer is completely ignorant of how much fuel is being wasted. Not only is this inefficiency very costly, it also is not good for the shipper’s public image in an era where consumers are increasingly seeking “greener” transportation services.

Comparison of an optimized voyage versus a voyage under time charter party terms

The following figure shows one example of a typical story of a container ship sailing across Pacific Ocean during winter. The ship owner is operating the vessel under a time charter party agreement to maintain an ordered speed about 20 knots in Beaufort Force less than 5. Even when the wind and sea were mostly from behind, the ship was diverted to the south, taking a much longer route from Yokohama to Los Angeles. Adding almost 320 nautical miles at 20.3 knots resulted in 289 tons of fuel (19%) being wasted compared to the optimized Great Circle route, which would have required traveling at only 18.8 knots to arrive at the same time. While the maximum wave height encountered along the southern route was lower, the resulting ship motions on both routes were similar, well within the safe operating limits of this class of vessels.



	Route Name	ETA	Delay	Time	Dist.	Fuel	Fuel Diff.	Slow Down	Average SOG	Average STW	Average Current	Average RPM	Average Power	Average WX	Average Slip	Maximum Wave	Maximum Roll	Maximum Pitch	Maximum VAcc.	Maximum LAcc.
		dd-hh:mm	hrs	hrs	nm	mt	mt		kts	kts	kts		kW		%	m	deg.	deg.	g	g
1	Optimum	17-17:58	0.0	280.0	5366.2	1196.3	0.0	No	19.17	18.86	0.31	73.2	20,695	1.2	7%	6.5	10.7	1.1	0.1	0.2
2	Charter speed	17-17:28	-0.5	279.5	5685.6	1485.4	289.0	No	20.34	20.31	0.03	78.4	25,736	1.1	7%	3.6	9.5	0.6	0.1	0.2

Although most ships under time charter are slower tankers and bulkers that consume less fuel, the percentage figure in this example demonstrates the potentially huge quantities of fuel unknowingly wasted by the industry because of current charter party terms. This translates into millions of dollars wasted every year, and over three tons of needless greenhouse gas emissions for every ton of wasted bunker fuel.

Virtual Arrival and hull fouling issues for ships under voyage charter

To reduce lay time due to port congestion and save fuel, the Oil Companies International Marine Forum (OCIMF) promotes a concept called “Virtual Arrival” (VA) for ships under voyage or spot charter. Under the charter party agreement, the charterer can propose that the ship reduce speed and arrive later because of port congestion. However, the ship owner must agree to split the savings in fuel cost with the charterer. The amount of savings is computed based on the fuel that the ship would otherwise have consumed if it had “virtually arrived” on time according to the originally agreed speed and fuel consumption per day. Now a problem arises when fuel consumption rates at the reduced speeds are not properly documented or warranted. Weather routing companies are increasingly put into a position to simulate the VA

passage using ambiguous ship performance models and uncertain wind and wave forecast for the rest of the passage. The task is even more daunting to backtrack actual and virtual arrival fuel performances at the end of a voyage, taking weather and current into consideration in order to convince both parties before money changes hands.

Again, because the rigid ordered speeds in charter party agreements, any voyage optimization using speed management or weather routing cannot be utilized to save fuel. In fact, experience shows that not every VA ends up saving fuel for the desired arrival time.

If the ship owner decides not to exercise VA and arrives early by continuing the voyage at the original charter party speed the ship may have to wait for a long time to discharge due to berth availability. Although the owner will be compensated by demurrage charges, the charterer will not pay hull-cleaning costs should the prolonged stoppage result in fouling on the hull and propeller. Unless the cleaning is carried out, the owner has to pay additional fuel costs on subsequent voyages. The shipping association BIMCO attempts to address this issue by setting limits on the maximum number of days in port, but it does not address the issue of fouling caused by slow steaming. This may be another problem if a new hull coating requires a minimum speed to remain effective.

[SEE: http://www.marinelink.com/news/charterer-cleaning-fouled361521.aspx]

The proposed solution

The solution to these problems begins with a comprehensive overhaul of the charter party agreement itself, in which outdated clauses are replaced with new terms that motivate taking advantage of today's relevant technologies. Advanced voyage planning and optimization, coupled with modern ocean weather forecasting, GPS and AIS ship tracking, ship seakeeping and motion response modeling, and satellite communications (email, short burst data, telephone, internet, etc.) enable accurate characterization of ship performance in both good and bad weather.

The addition of real-time shipboard sensors and software tools would allow both ship owners and charterers to be fully informed of ship performance and the specific conditions of that performance, such as wind, wave and drafts, as well as engine/propeller output.

Flow meters that measure real-time fuel consumption and torque meters that measure real-time horsepower would accurately capture the true conditions under which the ship is operating. Motion sensors measuring roll, pitch, and accelerations would confirm if the ship were encountering severe storm waves. These sensors could be further supplemented with real-time local environmental (wind, pressure, humidity, etc.) reporting, which would give additional insight into ship performance under the specific conditions. This additional massive amount of data could be recorded and stored in addition to the existing incident-related data by the shipboard "black box" Voyage Data Recorder (VDR) to allow post-voyage performance analysis and data mining.

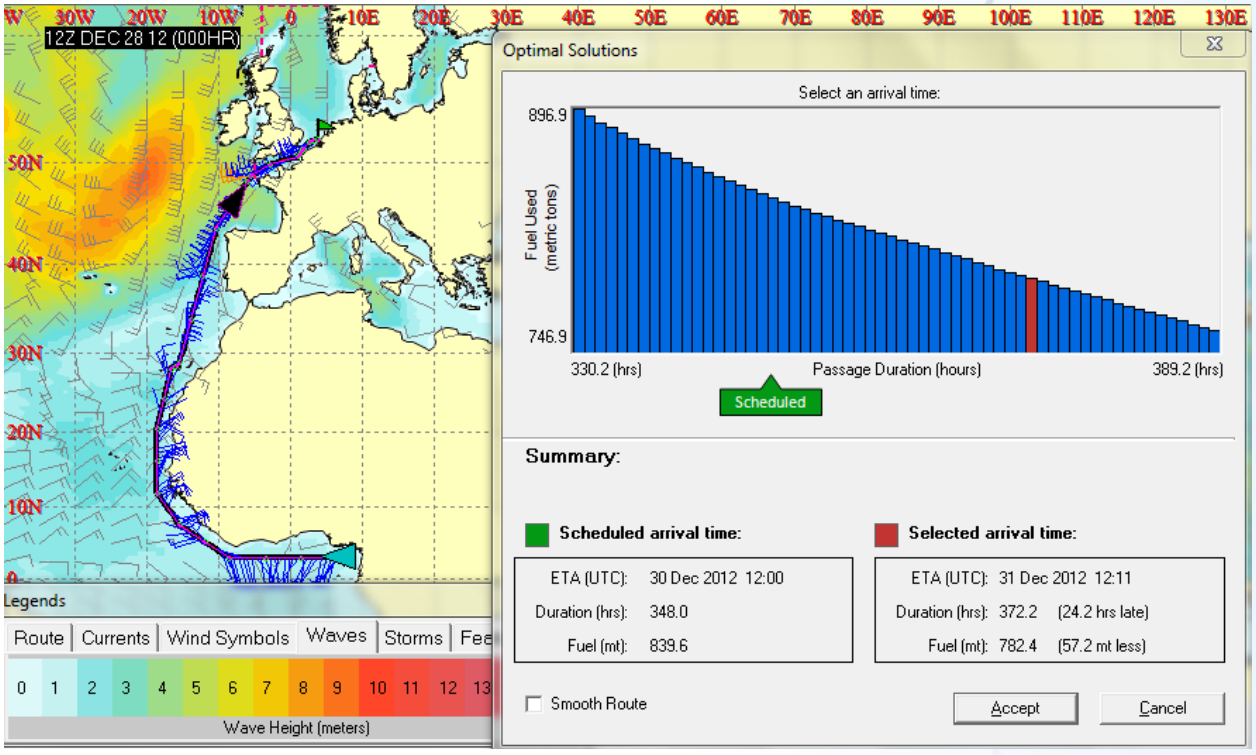
A software suite could provide a Google Analytics-like dashboard that would advise the ship's crew and shore side management on ship performance issues in real time. The software would be able to detect and provide alerts to anomalous performance. For example, if the ship was consuming above-normal fuel levels but sensors determined that the weather and wave conditions were calm, this combination over several months could indicate that the ship engine/hull would benefit from maintenance or cleaning. This kind of "Big Data" application is already widely used in other industries – why not in the shipping industry?

In this solution, which is especially relevant in time charter agreements, both ship owner and charterers would agree on a set of baseline performance standards for speeds and consumptions in calm weather. This minimum performance standard can be validated periodically by third parties such as classification societies or the use of the software tools which "data mines" the recorded sensor data. The transparency of the data would reduce the "creative accounting" that is widely practiced today. Ship owners would proactively detect maintenance issues and avoid paying penalties for underperformance. Charterers would be less worried about whether ship owners are properly maintaining their ships and concentrate optimizing the voyage for reliable just in-time arrival using the latest technologies in voyage optimization.

One example of applying today's technology in charter party agreements would be to abandon altogether the concepts of ordered speed and exempt versus nonexempt weather days. Weather forecasts are now very accurate up to at least 3-5 days, with reasonable predictions accompanied by estimates of

probability reaching as far as 15 days. Ship motion response theory can accurately predict a vessel's seakeeping performance depending on wave height, direction, and period. High-resolution outputs from global current models based on real-time satellite measurements can also be used to optimize fuel economy. Advanced route optimization using today's personal computers can determine the most fuel efficient route, given a vessel's load condition and performance characteristics, from origin to destination for a range of ETAs, with associated predicted fuel consumption for each one. Communication between the weather routing provider, ship owner, ship master, and charterer can be accomplished via satellite based broadband connectivity.

For spot and voyage charters, the ship owner could use advanced voyage optimization tools to quote fixed charter rates in advance of the passage. For example, pricing could be based on a range of arrival times selected by the charterer. The following figure shows a typical example of fuel consumptions for a range of arrival times for a VLCC delivery crude oil from Akpo terminal, Nigeria to Rotterdam during winter. According to simulations of the ship's passage in forecasted weather, the earliest arrival, 18 hours earlier than the planned schedule, would cost 57 tons more fuel, whereas arriving one day later would reduce fuel consumption by a similar amount.



If it is determined during the course of the passage that the destination port is congested and berth is not available, the ETA could be adjusted en route and a revised price agreed to at that time. The charterer could make a decision to change to the new later ETA at a lower cost, or keep the original one.

The resulting benefits

This proposed solution would provide many benefits to both the ship owner and the charterer:

- The ship master can optimize vessel speed and route to minimize fuel consumption and avoid heavy weather and severe ship motions without being penalized.
- Predetermined fixed charter rates would remove incentives for the ship owner to give misinformation about weather conditions or fuel consumption.
- Ship owners will have greater incentive to invest into fuel efficiency improvements and to retire older inefficient ships in order to compete, since fuel efficient ships will be rewarded with lower operating costs and higher charter rates.
- The charterer benefits by improved reliability of ETA, and of course reduced fuel cost
- The charterer can manage transportation costs by trading charter rates against arrival times depending on urgency, sensitivity of ETA, or when port congestion is anticipated.
- Automated validation by shipboard instrumentation of the vessel's local weather and operating conditions would provide an additional level of comfort to the charterer.
- The transparency of the process would reduce arbitration and litigation costs for both parties.
- An overall reduction in fuel and legal costs will result in the ship owner being able to provide more competitive pricing to the charterer.
- Consumers could choose shippers that use this kind of agreement as a way of supporting "green" transportation services.
- An overall reduction in fuel consumption reduces greenhouse gas emissions so the global environment benefits as well.

The time is right for change

According to the International Chamber of Shipping (ICS) at the 2013 United Nations Climate Change Conference (UNFCCC), lowering emissions by improving fuel efficiency is an economic "no brainer" for the shipping industry. The high cost of fuel, coupled with environmental concerns, already provide ship owners with ample justification to continue improving fuel efficiency and reducing CO_2 emissions. In support of this transformation, structural impediments such as outdated charter party clauses need to be removed, and the use of applicable new technologies embraced. One thing is certain: in today's (and tomorrow's) fiercely competitive globalized economy, only the most efficient shipping companies and modes of transportation will survive.

The immediate focus at IMO, pending the conclusion of a replacement to the Kyoto Protocol in 2015, is the development of a mandatory system for the monitoring and reporting of the fuel consumption and CO_2 emissions by every individual ship in the commercial world fleet. This could be cost-effectively implemented as an extension of the existing shipboard VDR.

Such a monitoring system, similar to the airplane "black box" flight data recorder, provides an ideal platform to host other applications such charter party performance verification, condition-based maintenance scheduling, voyage optimization, and e-navigation.

Reflecting on past experiences of adopting double bottom hull designs, the unification of class society rules, and mandatory carriage of ship VDR, the maritime industry is better off being proactive than reactive. The concurrence of skyrocketing fuel prices, growing environmental concerns, increasing regulation, and advancements in relevant technologies, further underline that now is the time for more efficient and intelligent approaches in ship operations and chartering. Proven technology from the airline industry is available and can be adapted for use in marine. Working together with shipping organizations such as BIMCO, INTERTANKO, and OCIMF to update charter party agreements based on rational thinking and proven technological innovations, the outcome will be win-win-win for the ship owner, charterer, and the environment we all live in.