

by Aiste Hoffbeck

PORT OUT, STARBOARD HOME

How the world's largest container carrier uses met data to save fuel

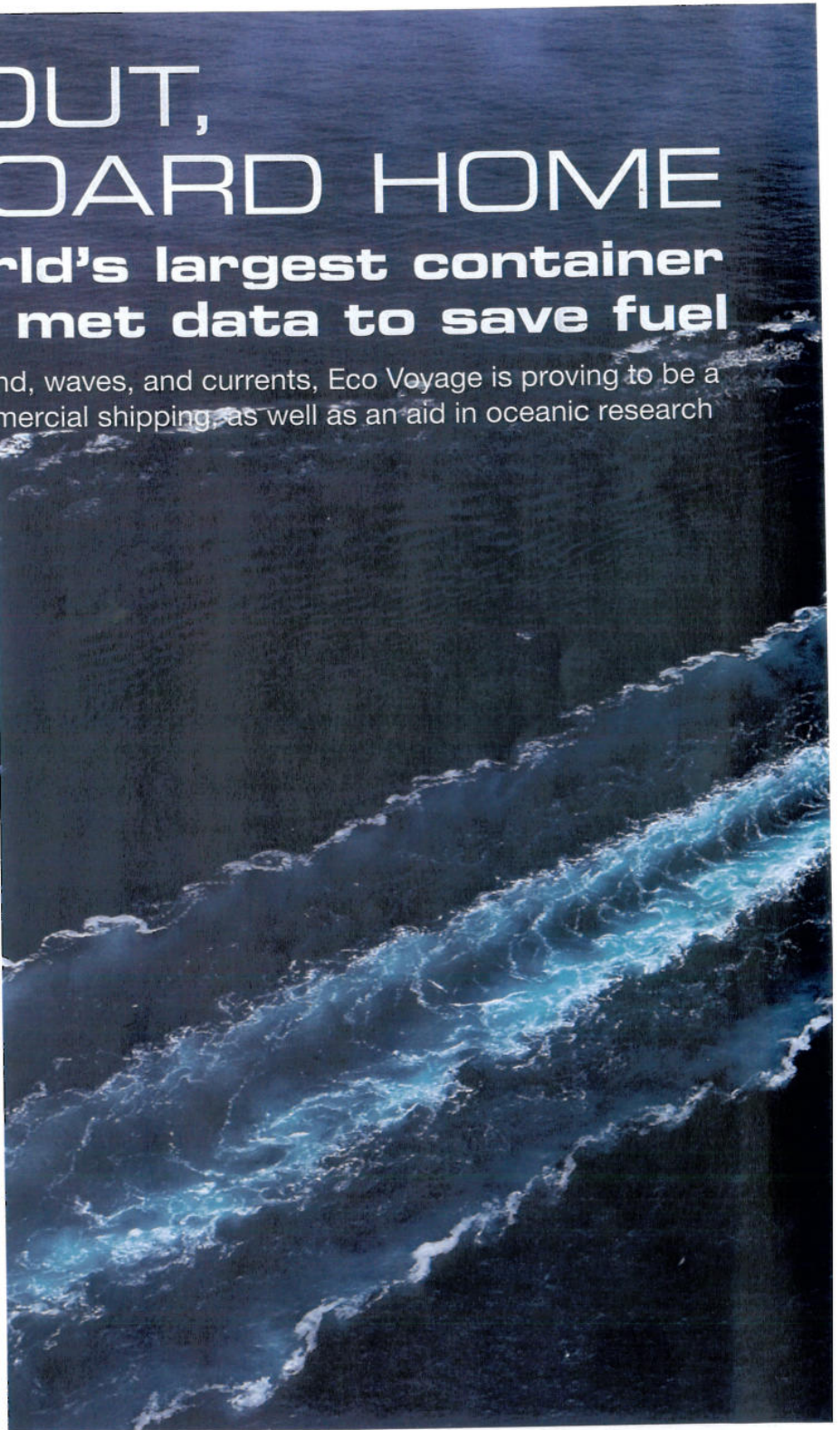
By analyzing information on wind, waves, and currents, Eco Voyage is proving to be a useful cost-cutting tool in commercial shipping, as well as an aid in oceanic research

Eco Voyage is a tool that was designed to provide the planner of a trans-ocean voyage with information on optimal speed through every part of the journey. This enables the propulsion power to remain as constant as possible to obtain the lowest possible fuel consumption and CO₂ emissions. Based on vessel particulars and detailed up-to-date information on expected currents, wind, waves, and depth restrictions along the planned route, the optimal power and revolutions/minute (rpm) profile can be chosen. This way unwanted oscillations in the ship's power can be avoided while still maintaining a fixed estimated time of arrival. The improved tool has an impressive potential: by utilizing environmental information fuel savings of 0.5-1% are expected.

The project was developed by the Vessel Performance section in Maersk Maritime Technology (MMT), in cooperation with Maersk Line Vessel Management (MLVM) and Maersk Tankers (MT). The development is supported by The A. P. Moller Foundation.

Eco Voyage functions in a way that updated sea current information is received from other vessels on the same route through a central server. In addition, the weather forecast program provides wind, wave, and current forecasts. This information is used to plan the most optimal and efficient route for every vessel.

Testing of the system is almost finished and the Vessel Performance section in Maersk Maritime Technology is now ready to evaluate the results. To illustrate how the program works, Kim Henriksen, the Eco Voyage prime mover in the vessel performance section of MMT, prepared an exclusive simulation of calculating and planning a voyage for one of the company's



Voyage case study



“The improved tool has an impressive potential: by utilizing environmental information fuel savings of 0.5-1% are expected”

vessels. The voyage is from Hong Kong to Tanjung Pelepas in Malaysia with one alternative route following the Vietnam coast and the other one in open sea.

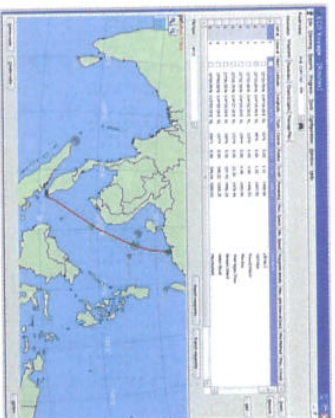
Focus on currents

The first step in preparing the voyage plan is looking at the navigational requirements – the shortest route at deep water. However, there are restrictions, such as traffic zones, that need to be followed correctly. For each voyage a passage plan needs to be made that describes the route and that route must be checked within an electronic chart display and information system (ECDIS). “We need to be aware of all points where the route will change and these points need to be included in route description,” explains Henriksen.

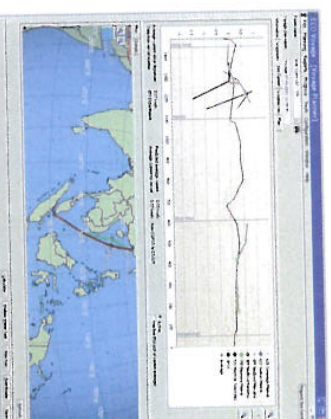
“We call them waypoints.”

This is where the weather comes in. When creating an overview of waypoints, one should look into the weather forecasts for the period of the voyage. Of course, it is especially bad weather that is of most interest, but sea currents also get a fair share of attention as avoiding a head current can significantly save on the amount of fuel.

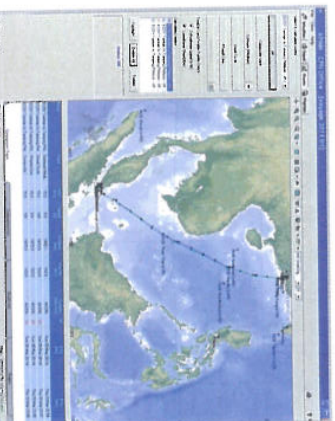
After the route is defined in the ECDIS, it gets transferred into Eco Voyage program, where additional information such as speed restrictions, shallow water or planning restrictions can be added. A map function shows the route and a number of hub points that are used for segmenting the voyage and for sharing sea current information with others. The observations of currents from



Hub points are used to segment the voyage and make information sharing more precise



Vessels can receive updated current information from sister vessels that are on the same route



Shortest way on the map does not mean the most efficient voyage, therefore routes are optimized



Voyage planning includes weather forecasts and prediction of sea currents

sister vessels are received from a server located in Copenhagen.

The latest update of the program also includes zones with increased pirate activity. This is important as vessels are required to sail faster through such areas, as speed remains the best method for preventing pirate attacks. In this case Eco Voyage calculates the higher speed in pirate-populated areas that need to be matched with lower speed later in the journey to compensate for increased fuel consumption.

Calculations for passing shallow water are similar, but in this case, lower speed is advised that need to be made up for at a later stage in order to stick to the schedule.

Many route choices

Most of the voyages follow a fixed schedule where arrival and departure is known, and to save fuel, Maersk vessels try to avoid wasting time that is caused both by late departure and early arrival. Therefore speed needs to be carefully calculated and that is done with regard to the effects of currents.

After it is done, the route description is transferred to the route planning program in which the weather forecasts can be seen,

including a prediction of ocean currents.

This program does have a relatively simple model for calculating speed loss due to wind and waves. It is possible to calculate up to four route alternatives of which three follow navigational lines: Rhumb Line (direct line), Great Circle (shortest distance) or a combination of both.

“There is one more alternative and that is an optimal route where an algorithm optimizes the balance between extra distance and speed loss,” says Henriksen. “Sometimes the longer way might take less time and vice versa. But voyages are not equally easy to optimize, as the waypoints of the original route are kept and the more waypoints there are the less optimization is possible.”

After calculation, the influence of the weather on the speed will be available in the Eco Voyage program. Eco Voyage has an advantage as it is working on the same database and models as the vessel performance monitoring system and therefore all information of vessels performance is up-to-date. Therefore weather predictions are important, but their influence can vary, depending on the overall condition of the vessel.



Eco Voyage is a flexible program that can benefit both performance and science because of the data collected

"If a voyage allows alternative routes like being close to the coast, then they will be calculated in a similar manner," says

Henriksen. "The captain can then compare what effect relevant weather and currents have to additional distances. In some cases it might be possible to save 2-3% fuel."

He shows how it is possible to compare the current for two different routes with a diagram. In this case there is a favorable current along the Vietnamese coast.

The voyage plan is never final, as it is recalculated when changes in plans or weather forecasts occur. If any impact on reducing fuel consumption can be made, plans can be easily readjusted. All voyages are evaluated afterward to see if they have been executed in the most fuel-efficient way and whether weather predictions were confirmed.

Learning from each other

One of the most useful features in the program is the possibility for sister vessels to learn from each other. Since their routes are usually very similar, they can use each other's observations to determine whether weather and current predictions were accurate enough. This information cannot be overlooked since it can significantly influence vessel performance.

"On average, weather accounts for 10% of fuel consumption and currents can account for similar numbers," explains Henriksen. "One also has to take into consideration that the same wind can generate higher waves in the middle of the ocean than by the coast. That's why we need to get our hands on as much information as possible."

Eco Voyage enables the vessel's progress to be seen with regard to speed, power, and rpm compared to the planned voyage. Officers can then easily evaluate whether the

HELP FOR UN

In the likely absence of any political agreement at COP16, the UN's climate change conference in Cancun, Mexico, in December 2010, the UN asked key industries and companies to give their ideas on how to combat climate change.

Maersk, representing the global transportation industry, has been invited to present its views on how best to make the world less carbon-dependent, yet still with room for trade and growth, wealth and development. "To tap into shipping's low carbon potential, COP16 should create carbon transparency and embrace

vessel is ahead or behind and make the relevant adjustments, if necessary.

For any vessel

Eco Voyage is a very flexible program that many types of vessels could benefit from – theoretically almost any ship. However, for the moment it is only used in Maersk vessels.

"There are similar systems, but ours stands out by being linked directly to performance system, so its data is always up-to-date – and one has to be very accurate when there is talk of savings," says Henriksen.

He reveals that until now Eco Voyage was run only on 13 test vessels, including several of the fleet's largest (P5-class), but that the roll-out procedure has now been started for 220 more. Further potential lies in a possible roll-out on charter vessels, provided the tests are successful on the company's own vessels. There are also plans to install the system on 75 handy tankers.

the concept of 'carbon distance'," says John Kornrup Bang, lead climate advisor for the A.P. Møller – Maersk Group.

"The actual distance traveled by a product is not important. What's important is the CO₂ emissions resulting from the transport and the societal value of the service provided. That is the essence of carbon distance."

To be invited into the UN program is a boon to Maersk's efforts. Maersk is not only a huge emitter of CO₂, but also a part of the solution, along with industries such as biotechnology and IT.

"In the old days seafarers were completely dependent on currents and wind," says Henriksen. "With the development of technology, people started building larger and sturdier vessels that could survive any kind of weather. But now we are ready to turn back to nature and learn as much as we can from it, as it serves our best interests."

Data for science

The Eco Voyage system is not only useful for route planning, fuel savings, and cutting down emissions. A by-product is gathering and saving huge amounts of data on weather forecasts and current predictions. This data could easily be used in oceanic and meteorological research and Maersk is willing to make it available for joint projects with other interested parties.

It would not be the first time that the company has collaborated with scientists. One of the examples could be Maersk's collaboration with University of Las Palmas, Grand Canaries. In this case Lars Maersk is being used as a platform for equipment that measures CO₂ concentrations in the ocean.

"It was a very successful collaboration and now we are discussing installation of pH measuring equipment to get even more detailed information on effects of climate change on oceans," explains environmental manager in the Maersk sustainability department, Eskild Lund Sorensen. Lars Maersk doesn't cost the university a penny, since the company itself is very interested in oceanic research.

"I think that Eco Voyage presents a great opportunity to gather even more environmental data," says Sorensen. According to MMT, potential fuel savings from the Eco Voyage tool are 0.5-1.0% per year. ■

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Maersk is to build 10 of the world's largest and most efficient vessels