Current thinking

Richard Brown of Applied Weather Technology looks at how weather routing can help to optimise ships' fuel consumption

With soaring fuel prices around the world, shipowners and operators are continually looking for ways to reduce the fuel consumption of their vessels. With the average weather routing fee equivalent to only one metric tonne (mt) of bunker fuel, it is a very small risk for one of the largest returns on investment available with regards to fuel savings.

For liner companies where each vessel has a fixed schedule, **Applied Weather Technology** (**AWT**) has developed its *Fuel Optimization Service* (*FOS*). For these vessels, the biggest impact on fuel consumption once they have left port is the route they select and their sailing speed. AWT uses the latest technologies in combination with an experienced team of weather routing experts and other variables such as the weather forecast, currents, vessel type, age, stability, cargo, speed, client requirements, etc., to determine the optimum route. Each vessel is continuously monitored and provided with updated information regarding its individual forecast, recommended route and optimum speed setting. The aim is to help ships make their scheduled arrival time, while minimising fuel consumption and keeping the crew, cargo and vessel safe.

The weather routing experts use the *AWT Route Optimization System* (*AROS*), which employs artificial intelligence to monitor the vessels continuously and alert the route analyst when action is needed. These alerts are prioritised so the analyst can quickly address those that are in the most need. These alarms cover all facets of the voyage from administrative details, data quality, vessel and voyage performance, route selection and safety. A few examples are the potential of encountering freak waves, icebergs, tropical cyclones, explosive deepening storms and sensitive cargo at risk. These types of alarms allow AWT to find the most efficient route while keeping the ship safe. The system also automatically notifies the route analyst when the recommended speed significantly changes from the speed provided in our last message to the captain. The route analyst can then quickly update the captain with the latest forecast and speed recommendation, thereby minimising fuel consumption.

Severe motion alerts

AWT is the only shore-based weather routing company to use vessel and voyage specific severe motion alerts based on the vessel size, draft, stability, speed, heading and wave conditions. These alerts provide both strategic and tactical guidance to our experienced route analysts when evaluating a vessel's route. The alerts show where severe motions are most likely to occur at a specific time along the route and also indicate what headings and/or speeds could be used to avoid these areas, thereby minimising the potential of heavy weather damage.

New ship resistance technology

When they are unsure of what weather to expect on their voyage, ships' captains will often choose a conservative route, adding needless miles to the journey. They will often start a sea passage at, or near, maximum speed, and then reduce their speed significantly during the second half of the voyage once they are confident they will make their required arrival time. This is not the most efficient way to manage the vessels' speed and consumption, so AWT has created new proprietary technologies to assist the ship captains in this area. To minimise the uncertainty over the weather, AWT has create two types of ship resistance. The first is *Climatological Ship Resistance* (*CSR*), which is the speed loss due to historical wind and wave data since 2000 for different ship types and weather patterns such as *El Niño* and *La Niña*. AWT has also created *Forecast Ship Resistance* (*FSR*), which can use the resistance based on the forecast from multiple global weather models or take the resistance for a specific area from the model that performs best in that region of the world. These technologies give AWT the capability to select the optimum route consistently, more accurately predict the weather impact, and give better advice on speed recommendations, thereby minimising fuel consumption.

The images on page 27 show the ship resistance for a vessel heading westbound across the North Pacific in mid-January. The first image is for *El Niño* weather pattern years, which shows the resistance being much stronger over the Central

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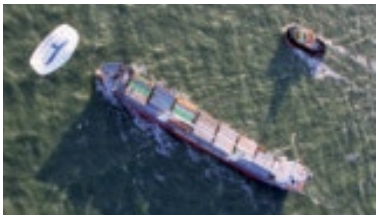

Pacific when compared to *La Niña* years, indicated in the second image. The image for the *El Niño* years also shows significant resistance extending all the way to the Hawaiian Islands, while in the Bering Sea the resistance is significantly lighter. These resistance patterns indicate that during an *El Niño* year the optimum route from the west coast of North America to Asia is by far the best via the Bering Sea. While historically during the *La Niña* years the Bering Sea route will be more difficult; and the further south the departure port is, the more likely a southern route option becomes more viable.

Optimisation for sail-assisted vessels

As new technologies emerge such as the use of kite sails or aerofoils, AWT is working closely with its clients to develop new optimisation algorithms for minimum cost or least time that will take into account the impact on the vessel's speed and consumption, based on the type, height and size of the sail, along with the wind speed and relative direction to the vessel.

NCOM currents

AWT also uses the latest technology in ocean currents: the *Naval Coastal Ocean Model* (*NCOM*). This data is available daily with a resolution of an eighth of a degree, which is far better than the monthly averages from the pilot charts. This data gives the ship's captain and AWT the capability to fine tune the voyage to maximise the effects of the current. So significant savings in time and fuel are now even possible on shorter or coastal voyages.

Fuel optimisation example voyage

On a voyage from Bremerhaven to Veracruz, the ship's captain intended to sail along a southern route via the English Channel, but followed the recommended northerly route. The northern route avoided significant delays that would have occurred while passing and exiting the English Channel due to a severe storm that moved over the southern UK. Throughout the voyage, AWT kept the captain advised of the optimum route and speed to maintain his schedule. Had the captain sailed his intended route, he would have needed a speed of 19.5 knots to maintain his schedule, requiring an additional consumption of nearly 10 metric tonnes (mt) a day. So on one voyage the captain was able to save 123 mt of bunker fuel, reduce greenhouse gases (GHG) by nearly 400 mt and save $73,800.

	Actual route	Intended route
Required speed to meet ETA	18.65 Knots	19.50 knots
Daily fuel consumption rate	75.94 mt a day	85.00 mt a day
Overall voyage consumption	1,030.5 mt	1,153.5 mt
Voyage fuel costs (@$600 a tonne)	$618,300	$692,100
Voyage fuel savings	$73,800	

With the daily operating costs of a vessel being so high, owners and vessel operators can realise significant savings from the *FOS* at a very low cost. They can also reduce their carbon footprint and improve the safety of the crew, cargo and vessel. With the improvements in the weather routing technologies and the overall reduction in seagoing experience due to manpower shortages, it is now imperative that the ships' captains are provided with as many tools as possible to complete their voyages safely and efficiently.