Three Essential Factors for Weather Routing Success
Plotting a course from A to B is not so hard; getting from A to B, while managing costs, meeting KPIs, and maintaining safety is more of a challenge.

Overcoming this hurdle is where optimized weather routing comes into play. It enables you to develop the optimal route for every voyage, based on your unique KPIs. It brings together the weather forecasts, sea conditions, and the ship’s characteristics and cargo (both below- and on deck) to calculate the most efficient and effective route.

Importantly, an optimized route is not always the shortest route. Sailing the shortest distance between two ports isn’t necessarily the quickest or most fuel-efficient route. Instead, optimum means maximizing the safety and comfort of the crew, while minimizing fuel consumption, managing time underway, ETA/Lay-can or any desired combination of these factors, all within the specific constraints the weather and sea condition limits on each voyage.

Vital to all of this are Three Essential Factors for Weather Routing Success: the perfect combination of weather routing, the weather-optimized route network, and the experience of Master Mariners.

By combining the experience of Master Mariners and the advantages of the weather-optimized route network with weather routing, it’s possible to offer a genuinely optimized service - a real strategy for success.

**Let's explore these Three Essential Factors for Weather Routing Success in more detail.**
Weather Routing: Four Advantages of an Optimized Solution

Today, weather routing is not only crucial for avoiding adverse weather conditions but also to ensure each ship runs at peak performance. From pre-voyage planning to compliance and beyond, weather routing supports sustainable, cost-effective shipping.

Onboard and onshore: how weather routing can be used

Optimum weather routing is the art and science of developing the “best route” for a ship based on the current weather forecasts, ship characteristics, and cargo requirements. For most voyages, this will mean the minimum transit time, and so the least cost, while avoiding significant risks to the vessel, crew, and cargo.

The goal is not to avoid all adverse weather but to find the best balance to minimize the time of transit and fuel consumption without placing the vessel at risk to damage or crew injury. The savings in operational costs come about through reduced transit times, fuel consumption and cargo and hull damage, as well as more efficient scheduling of dockside activities. Additional savings also come from increasing the service life of the vessel and reduced insurance costs.

Charterers, shipping companies, and ship owners can elect to use weather data both onboard and onshore:

- Onboard routing systems enable the captain to calculate the optimum route without compromising on safety
- Onshore monitoring systems use aggregated vessel data to provide fleet operators, operations managers and performance managers performance analysis
- Onshore dedicated-routing teams can also provide optimal route guidance with vessels thanks to the expertise of experienced master mariners

The four benefits of optimized weather routing

1. Reduce costs

What’s the scenario: Strong competition in shipping means profit margins thin. For ship owners, charterers, and shipping companies, vessel efficiency is essential to maximize their return. In particular, reducing fuel consumption can help them make important savings.

Their priority, therefore, is to minimize both transit times and fuel consumption, without placing the vessel at risk. The savings in operational costs come about by reducing transit times, reducing fuel consumption, and minimizing cargo and hull damage.

How weather routing helps: Weather routing can reduce fuel consumption, without missing ETAs, breaking charter party agreements, or impacting on safety.

Optimal weather routing can offer fuel savings between 2-5%, depending on the type of vessel, the season, and the conditions. Taking a fuel saving of 5% and a bunker price of $5000/ton, a ship burning 50 tons of fuel per day would see savings over $8500 on fuel costs during a seven-day transit.

The risk of not using optimized weather routing: Vessels that are not taking advantage of optimized weather routing can end up sailing a less efficient (and, therefore, more expensive) route.

For example, with optimized solutions, variable speed algorithms can be used to lock in the appropriate speed to arrive on time avoiding serious weather.
2. Improving efficiency

What’s the scenario: Route planning is complex. Whether managed onboard or onshore, teams need the right tools to help support their decisions and ensure they’re sailing the optimal route for their voyage.

How weather routing helps: Onboard, captains have to manage safety, efficiency, fuel consumption, ETAs, speed ranges, and additional constraints, including trim and seakeeping. Onboard tools can give them more confidence in their decisions by helping them to calculate the route that will help them meet their KPIs.

Alongside this, charterers, owners, and vessel managers also want detailed weather information. They need it to pre-plan routes before a voyage, but also to adapt during the passage, and to analyze post-voyage. By recalculating the optimal route, using the latest weather forecasts, onshore teams can support captains to save time, fuel, and reduce emissions.

The risk of not using optimized weather routing: Accurate weather data and advances in technology mean that captains can have more data onboard than ever before. Add-ons, such as the trim advisor, specifically help reduce fuel consumption and increase the utilization of your fleet.

Adverse weather alerts can let you know if conditions are changing on your planned route. This insight enables you to plot an alternative route before it affects the performance of the voyage or becomes a safety risk.

3. Reduce the environmental impact

What’s the scenario: Reducing emissions is a priority for the shipping industry - especially as over 3% of global carbon dioxide emissions can be attributed to ocean-going ships. While regulations, such as IMO 2020, will help, shipping companies can implement other approaches, like speed reduction and weather routing, to help manage and reduce their emissions.

How weather routing helps: Studies show the shipping industry can reduce emissions by up to 55% through measures to reduce fuel consumption. Specific techniques, like speed reduction and weather routing, can reduce emissions by 17-34% and 1-4% respectively and save up to €280 per ton of fuel.

The risk of not using optimized weather routing: Reducing emissions through speed reduction does have limitations because time is always a key consideration for shipping. However, full knowledge of circumstances can allow a vessel to slow down. For example, if adverse weather at a terminal means it cannot handle the cargo, relaying this information to the captain means he can reduce the speed. Otherwise, the vessel has to wait outside port until the weather improves. The same can also apply if the lay days and the canceling clause in a charter party allow.

4. Improve safety

What’s the scenario: Adverse weather poses a safety risk to the crew, as well as to the ship itself from excessive ship motion, slamming, or seas washing over the decks. When ships enter gale force or higher wind fields, this strongly impacts the ability for the Master to maneuver the vessel.

How weather routing helps: While shipping companies want vessels to take the optimal route, to save time and money, they need to know that their vessel will withstand the conditions along their chosen route, and ensure the safety of your crew and cargo. Seakeeping helps to plan the best route, taking into consideration the dimensions, draft, and loading conditions of your vessel.

The risk of not using optimized weather routing: In extreme weather, it’s obvious you cannot maintain the same route. The conditions are too dangerous. But what about conditions that are close to the edge. It’s a difficult decision because avoiding all adverse weather adds costs and can result in ships arriving late to port. Confidence in your weather forecast helps you make the right call at the right time.
Master Mariners: The Secret to Weather Routing Success

In weather routing, accurate weather data is only part of the puzzle. You also need to know what to do with the information. This is where Master Mariners, who have navigational knowledge and are familiar with the characteristics of vessels in various wind and sea conditions, can add real value. Their knowledge and skills enable the shipping team to deliver premium route advice.

They are aware of the navigational features, including the obstacles, sea currents, and waters affected by pirates. Plus, they understand the processes onboard the bridge. So, for example, they know when it is feasible and practical to issue new routes or speed.

**Why master mariner expertise is so valuable in shipping operations**

There are many variables in shipping, which makes it hard to compare two journeys. However, the choice of route can make a massive difference to the profitability of a voyage. For example, when vessels are passing Skagerrak on their way to the east coast of the United States, they will typically ask for advice on the next part of the route. They can either pass just above the British Isles or sail through the English Channel. In theory, a ship can knock 35 hours off its journey if it doesn’t go through the English Channel, but the weather can be worse on the alternative route, so this mitigates the time-saving. Knowing which route is best will vary depending on conditions, which is why accurate route guidance from experts that know the conditions is crucial.

**Routing advice in action: Hagibis**

Rugby Union fans may recall the impact Typhoon Hagibis had on group stage games during the 2019 World Cup. But it wasn’t just the world of sport impacted by the most powerful typhoon to hit Japan since 1958. Vessels operating in the area had to take measures to avoid severe weather conditions.

One client, operating a 50,000-ton deadweight LPG tanker in the area, was due to sail from the port of Yokkaichi on the South coast of Japan to Chiba in the Tokyo Bay at the same time that Hagibis was expected to pass the area.

Even for a vessel of this size, the typhoon conditions presented a significant safety threat. But the vessel had to make the voyage. But, due to conditions, it couldn’t proceed directly to Chiba. The tanker had to deviate from its course to avoid a close encounter with the super typhoon.

The typhoon was expected to proceed north towards the port where the tanker departed. Then, just before reaching Yokkaichi, Hagibis turned to a North-East course to pass almost straight across the Bay of Tokyo, towards the vessel’s destination port.
The master mariners and weather experts at DTN advised the vessel to sail away from the path of the typhoon and wait for the weather system to pass and clear the destination area.

During the voyage, the vessel was far enough away and reached a spot where it could wait out the typhoon. The experts advised the vessel to find a spot and wait for the system to pass. Of course, the decision on what route to take ultimately lies with the captain onboard the vessel. In this situation, the Master sailed away from the area with the worst conditions. It was not so much the wind - though it was quite strong, but not to the extent that it was a problem for the vessel - but the swell being kicked up by this super typhoon, which caused issues for the tanker.

Once the system moved away from the vessel's destination, the vessel could return to the Japanese coast.

The vessel moved back towards the Tokyo Bay Area, as the system was tracking away. At this stage, the typhoon increased speed, tracking in a North-East direction. It was pulling away very fast. For the weather experts, this was a sign that the vessel could start proceeding back.

When the captain turns back and chases the typhoon is ultimately the Master's decision. He is the one there; he can see the conditions. If he thinks it’s too severe, he can wait longer and keep more distance.

The route would usually take half a day’s sailing, but due to the extreme weather, and alternative route the vessel needed to follow, it took four days. Importantly, though, this action meant the vessel arrived safely in Chiba.
Interpreting the complex weather data to advise customers

In extreme weather events, like typhoons or hurricanes, the standard model data alone is not enough. To combat this, the typhoon data is overlaid onto the standard Marine Forecasting System data, to enhance the view.

There is uncertainty in the forecast of the system; the development of travel is not guaranteed because the wind strength, the speed of the system, and the development of intensity are uncertain. These factors need to be taken into account by the experts when advising the Master. As there is a risk, the weather system might follow a different course, so routing options need to ensure the vessel doesn’t become trapped by the direction of the system. It’s a risk assessment that has to be made with all routing advice.

Increasing update in heavy weather

The experts usually advise vessels once per day. But if they think the situation needs more attention (like this scenario), then they will be added to the heavy weather list. The list ensures the ship has additional checks and means additional updates could be sent, based on what the experts in shipping operations think is necessary.

Strength of experience helping clients optimize their routes

The Master Mariners and ex-seafarers are a real strength. They speak the same language as the crews onboard the vessels and understand the realities of life at sea, as well as and the responsibilities of the Master.

They are aware of the routes at sea, the obstacles, sea currents, straits controlled by pirates, and they understand the processes onboard. They know very well how the bridge is being used to change routes or change fuel or speed. They are also conscious that it’s impractical to advise different speeds and courses all the time, so they provide feasible advisories.

Shipping customers, who use RouteGuard, are in direct contact with the former seafarers at DTN. These Master Mariners consult with the customer, to find out their exact requirements for each voyage - and help them to optimize their routes.

Sometimes this means helping customers to make the fastest crossing, other times the customer needs to arrive at a specific ETA or may need to cover the route as economically as possible. Regardless of the priority, the Master Mariner will use their expertise to guide the ship.

The Master Mariners also learn everything they need to know about a client’s fleet of vessels, to tailor their advice to the ship’s specific capabilities.
Shipping companies can reduce time on voyage planning and improve the quality of the route, with the weather optimized route network. It’s an ECDIS route network that plans port-to-port routes, including navigational constraints and port approaches.

The Weather-Optimized Route Network optimizes passage planning, reducing time on voyage planning, and improving the quality of the route. It is one of three key components for optimal weather routing, alongside Master Mariners and weather data.

A brief history of weather routing

In the early days of modern shipping, Master’s relied on Radio Operators (Sparks or Sparky) to receive some information about the weather on the ocean where you were sailing. If you were lucky, you could get one weather bulletin per 24 hours.

A few decades later brought the weather fax to shipping companies. Various land-based weather offices issued a weather bulletin for the area they covered. You would be able to receive 2 to 4 updates per day, but that also was highly depended on your location at sea: the closer you got to a coastline, the bigger the chance that you would receive a readable bulletin. These bulletins and faxes produced static overviews of the weather patterns but contained no prediction whatsoever.

Two decades ago, Masters of oceangoing vessels were introduced to new onboard routing software. This was able to optimize their voyages by making use of specific onboard software, such as SPOS, which contained weather information. The weather information used by the software was not static; it moved and became forecasts! Now the mariner could play the time bar scrolling through the coming days and see how a predicted weather system would move over the big oceans.

Future versions of the application allowed the creation of an anticipated route and speed, while a small dot represented your position on a particular day and time in the future. Weather overlays showed you the weather conditions at and around your anticipated location at any given time. A Master equipped with such a system could plan a voyage with precision and avoid adverse weather.

A few years ago saw the introduction of the “weather optimization tool.” This tool looks for an alternative route to avoid adverse weather by an embedded algorithm that uses weather parameters that are set by the Master. The algorithm embedded in the software makes numerous calculations and provides one or more alternatives for the Master to optimize a route. The choice is for the Master to decide which alternative route to take.
Optimizing weather routing with the route network

Embedding the Route Network within SPOS is a revolutionary feature, which treats large oceans and coastal areas as broad highways. This insight gives the Master the possibility to navigate safely from A to B. This Network was created and is continually being refined, by Master Mariners. It enables safe navigation around the globe, with 20-meter safe water depth and a 1-mile safe distance from coastlines. The hyper-accurate Route Network safely navigates through shallow areas and mid-sea obstructions.

The incredible value of this "Weather-Optimized Route Network" comes from opening the larger navigable waters for routing. Similar to your car, where your GPS navigation routes you around a vehicle accident by recommending an alternate side road, the Route Network enables the Routing Algorithm to route a ship around significant weather safely.

How does the weather-optimized route network work in practice

The green line in fig.1 shows the boundary of the Route Network. The entire sea area outside the green-lined border of the continent is freely navigable. The algorithm will suggest the most optimum route to navigate through this area, taking weather (speed loss) and currents/tides into account.

The Route Network also contains the Traffic Separations Schemes (TSS) and guides your passage safely through these areas (fig.2), or if the Mariner chooses to close these passages, the routing algorithm will recommend a route wide around these areas (fig.3).
No-Go areas and areas to be avoided (figure 4) are also embedded in the Route Network to be excluded from the routing algorithm recommended route.

The entire ENC database is captured in the Route Network, enabling safe surface navigation. Also, the Network is kept up to date and adjusted for Notice to Mariners (NtM’s) changes.

By making the free ocean and seas as broad as possible, the algorithm can make nearly unlimited calculations. Almost, because due to the embedded Via-points or Via-areas, the Master can easily block a passage and force the system to make calculations via other routes that the algorithm discards under normal conditions.

For example: by closing the Suez Canal (figure 5 and 6), you force the algorithm to calculate the passage from NW Europe to Singapore via the Cape of Good Hope.

By opening the Suez Canal (figure 7 and 8), the calculation is made using this canal (also against reduced speed and by building in a stop upon arrival).

The algorithm calculates along the preset passage as inserted by the Master or Officer in charge of the Voyage Planning. By closing a journey, the algorithm starts searching for alternatives, which can sometimes be far away from the initially intended route. However, this new route suggestion is as economical as possible, taking weather conditions, currents, and tides into the calculation. This illustrates the fantastic strength of the algorithm, helping Masters and Operators safely and economically navigate the world’s oceans.
Conclusion and About DTN

Knowing what the weather will be, and, more importantly, how it will affect you, relies on the right information. As a company that knows the weather, DTN does everything possible to deliver guidance to shipping companies to optimize their route decisions. Achieving this goal relies on blending the right mix of data, expertise, and insight.

By working collaboratively with our weather experts, and leaning on their combined meteorological and maritime knowledge, shipping companies can unlock key insights. And that’s what it’s really about seeking out those extra nuggets of savings to ensure profitability.

About DTN

At DTN, our mission is to empower you with intelligent and actionable insights. These insights, make sense of the data to help you and your business prosper. We are your trusted partner, an independent source of information that helps you feed, fuel and protect the world.

We provide independent actionable insights to the Nth Degree. Insights that drive some of the world’s largest and smallest companies forward. So they can reduce their risk, drive increased profits and make smarter business decisions. In the end, when our customers prosper, we all prosper.