

## **VOYAGE OF LEARNING: CRUISE SHIPS WEATHER ROUTING AND MARITIME EDUCATION**

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**Abstract.** The cruise ship companies place the highest emphasis on the safe operations of the vessels and safety of both crew and passengers. The ship's captains are subsequently encouraged to use weather routing services for optimum route throughout the intended voyages. By providing guidance on the safest and most efficient routes, these systems help prevent accidents caused by unpredictable weather conditions.

In this regard, the implementation of weather routing systems in maritime education and training has become crucial in ensuring the safety of cruise ships and their passengers. Moreover, weather routing systems have helped improve fuel efficiency, which is essential in the current environmental climate. Maritime education and training programs have adapted to include courses on these systems, ensuring that future captains have the knowledge and skills necessary to navigate through the ocean safely and efficiently.

*Keywords:* cruise ships; weather routing; shipping, safety; ship management

### **Introduction**

Cruise ships have been a big part of the tourism industry for many years, providing people with the best vacation experience. While cruising, the ship's crew must ensure the safety of the passengers while also making sure they have a great time (Biolcheva, Valchev 2023). However, one of the most crucial parts of managing a cruise ship's journey is weather routing.

Weather routing is the process of choosing the best possible route for a ship, considering the weather conditions such as winds, waves, and currents. The importance of weather routing for cruise ships cannot be overstated. The safety of the passengers and crew greatly depends on the decisions the captain makes when choosing the ship's route.

The operating cruise lines also prioritize environmental preservation and protection, so responsible ship captains must use their best judgment in assessing ways to reduce fuel consumption and, consequently, carbon emissions, as well as in choosing the most time- and fuel-efficient routes to their destinations.

The trustworthy weather routing services step in at this point, acting as an advisory service and effectively addressing the necessary information for safety and efficiency by creating, upon request, an ideal track for ocean voyages based on forecasts of weather, sea conditions, and ship's unique characteristics for a particular transit. Based on this equation, the term "optimum" is used to refer to the greatest passenger, crew, and vessel safety, as well as the least amount of fuel used, and time spent at sea.

Depending on the details of the potential voyage and the ship's captain's request, the operations department will suggest an effective weather routing organization in accordance with the cruise line's weather routing policy (Chen et al. 2021). According to the instructions of the ship's operator, the ship's captain must create a detailed journey plan from the quay of the port of departure to the quay of the port of arrival (Bui et al. 2008; Gancheva 2021). The "Bridge Team Management" brochure from the Nautical Institute and the "Bridge Procedures Guide" document from the International Chamber of Shipping must be read while creating the trip plan (ICS, 2022, Nautical Institute, 2018).

All the weather conditions, both anticipated and actual over the duration of the voyage, must be mentioned and considered when creating the voyage plan. The weather routing services give all this data.

Cruise ships have different routes for different seasons, and the weather factors play a significant role in determining these routes. The captain must have the latest weather forecast information and use it to make decisions. Routing the ship through rough waters, high winds, or intense storms can lead to significant safety risks for the crew and passengers.

Furthermore, the importance of weather routing for cruise ships is evident in the level of comfort that passengers enjoy while cruising. Nobody wants to be on a ship that thrashes around in choppy waters. By routing the ship away from rough weather, passengers will enjoy a smoother ride, allowing them to relax and enjoy their vacation without feeling seasick.

Incorporating weather routing systems also allows cruise ships to save fuel, time and reduce emissions. The ship's crew can use technology to monitor the weather and route the ship, ensuring it uses the least amount of energy possible while still arriving at the destination within the planned timeframe.

The implementation of these systems in maritime education and training has become increasingly important, as it is necessary for captains and crew members to have an in-depth understanding of weather patterns and how to navigate through storms.

### **Weather-routing technique**

A weather routing system involves the use of satellites and advanced computer programs to monitor weather conditions. These programs use real-time data to

provide guidance on how to avoid storms, reduce fuel consumption, and improve safety. The technique is a strategic approach used to calculate the shortest and the most efficient route for a ship based on the prevailing weather conditions (ocean- weatherservices.com). It accounts for the vessel's speed, its defined route, and the developing weather patterns. The technique relies on weather forecasts received from various sources, including satellite images, buoys, and weather stations located along the ship's planned route. This information is combined with ocean current data, vessel performance information, and other factors to recommend the most optimal route for a particular voyage.

To do effective weather routing the following steps must be considered:

- You must be able to construct ship performance curves and comprehend a wave chart.
- Create the shortest track you can.
- Obtain the track that takes the least amount of time;
- Verify the track's viability in light of navigational and safety risks.

Three different sea conditions are used to draw the performance curves:

- waves on the following sea;
- waves on the beam sea;
- and waves on the head sea.

To plot these curves, information on ship speed in various wave conditions must be taken from the logbook of the ship or from a sister ship. The curves are interpolated using the available data if there is insufficient data. A wave diagram is displayed on Figure 1.



**Figure 1.** Wave chart (<https://knowledgeofsea.com>)



Weather routing systems are crucial for cruise ships, as they help prevent accidents caused by dangerous weather conditions. This is especially important considering the unpredictable nature of the ocean and the possibility of encountering storms that can cause damage to ships and pose a threat to passengers and crew members.

### **The application in the methodology of the educational process**

Maritime students are taught how to take into account factors, such as ship routing regulations, vessel performance, and other relevant considerations while planning a route. The training program prepares students for dynamic situations, ultimately leading to safer and more efficient vessel operations (Tsonev, 2021; Narleva, Gancheva 2023).

While weather routing services may not be directly relevant to every university subject, the principles behind them can be applied to many areas of study (Mednikarov et al. 2019). Here are some ways in which the ideas behind weather routing services could be incorporated into a university subject:

- Operations management: Weather routing services are all about optimizing routes and schedules to improve efficiency and reduce costs (Dimitrakiev et al. 2023). This approach can be applied to many areas of operations management, such as logistics, transportation, and supply chain management.
- Engineering: The safety and efficiency benefits of weather routing services are directly relevant to the engineering field. For example, engineers can use weather data to optimize the design of structures, vehicles, and equipment to withstand extreme weather conditions.
- Environmental science: Weather routing services have a direct impact on the environment, as they can help to reduce fuel consumption and emissions. Students studying environmental science could explore the impact of weather routing services on sustainability and climate change.
- Geographical studies: Weather patterns and ocean currents are key factors in weather routing services. Students studying geography could explore the relationship between these factors and their impact on shipping routes and navigation.
- Data analytics: Weather routing services rely on complex data analysis to provide real-time insights to users. Students studying data analytics could explore the algorithms and programming languages used to process and visualize this data.

The benefits of weather routing services can be applied to a wide range of university subjects, from management to engineering to environmental science and beyond (Molodchik et al. 2018). By incorporating these concepts into the teaching, the students could develop a holistic understanding of how different disciplines intersect and collaborate to solve complex problems (Stereov 2023; Conev, Dimitrakiev 2023).

- Incorporating the principles behind weather routing services into university subjects can have several benefits, including:

- Interdisciplinary learning: Weather routing services require expertise from multiple fields, including engineering, meteorology, and computer science.
- Real-world relevance: Weather routing services are used in a variety of industries, including shipping, transportation, and logistics. By studying these services in a university setting, students can gain a better understanding of how they are applied in real-world contexts.
- Improved problem-solving skills: Weather routing services require an analytical approach to problem-solving, as users must consider a variety of factors in order to optimize routes and schedules. By incorporating these concepts into university subjects, students can develop critical thinking and problem-solving skills that can be applied in a variety of contexts.
- Career preparation: Understanding the principles behind weather routing services can be valuable for students pursuing careers in industries such as transportation, logistics, and supply chain management. By incorporating these concepts into university subjects, students can gain practical skills that can help them stand out in the job market.
- Overall, incorporating the principles behind weather routing services into different curriculums can provide students with practical, interdisciplinary, and real-world skills that can enhance their academic and professional development.

### **Conclusions**

In conclusion, weather routing is an essential component of the planning and execution of a successful cruise ship journey. By supporting safety, increasing comfort and reducing costs it's clear why the use of weather routing has become a standard in the cruise ship industry. The services provide numerous benefits in terms of safety, efficiency, and cost savings for the shipping industry. Some of the key advantages of weather routing services are:

- Enhanced safety: With weather routing services, shipping companies can avoid adverse weather conditions that can pose a risk to the ship and crew. By receiving up-to-date weather forecasts and guidance on the safest and most efficient routes, ships can navigate around storms, high winds, and other hazards, reducing the risk of accidents and damage.
- Fuel savings: By using weather routing services, ships can optimize their routes to take advantage of favorable currents and winds. This can result in significant fuel savings, which translates into cost savings for shipping companies.
- Reduced voyage times: Weather routing services can help ships to reduce their voyage times by finding the most efficient routes and avoiding delays caused by adverse weather conditions. This can help to improve the overall efficiency of the shipping industry and reduce costs.

The ability to incorporate weather routing systems has made it easier for cruise ship operators to plan better and well-balanced itineraries for their vessels while taking into consideration the interests, safety and comfort of their passengers and crew at the same time. Weather routing thus facilitates the smooth flow of operations in the cruise ship industry by ensuring that the journey remains not only safe but also enjoyable for all those involved.

Its application in maritime education is important because it equips future seafarers with the knowledge and skills to navigate safely and efficiently in various weather conditions. Students can better understand the importance of route planning, the impact of weather on vessel operations, and the use of technology to make informed decisions. This can help to prevent accidents and increase efficiency, ultimately benefiting the safety and profitability of the maritime industry.

## REFERENCES

- BIOLCHEVA, P.; VALCHEV, E., 2023. Safety through Artificial Intelligence in the Maritime Industry. *Strategies for policy in science & education-Strategii na Obrazovatelna i Nauchna Politika*, vol. 31, no. 3, pp. 270 – 280. <https://doi.org/10.53656/str2023-3-3-saf>.
- BUL, V. P.; KIM, Y. B.; CHOI, Y. W. AND KAWAI, H. 2009. A study on automatic ship berthing system design. *2009 International Conference on Networking, Sensing and Control, Okayama, Japan*, pp. 181 – 184. doi: 10.1109/ICNSC.2009.4919268.
- CHEN, H.; BALLOU, P. *Art and Science of Ship Voyage Optimization: A Critical Review*. Available from: [https://www.researchgate.net/publication/349289736\\_Art\\_and\\_Science\\_of\\_Ship\\_Voyage\\_Optimization\\_A\\_Critical\\_Review](https://www.researchgate.net/publication/349289736_Art_and_Science_of_Ship_Voyage_Optimization_A_Critical_Review) (accessed Apr 29 2021).
- CONEV, I.; DIMITRAKIEV D., 2023. Use of modern technologies at Naval Academy Varna. *Proceedings of the International Association of Maritime Universities (IAMU) Conference, Helsinki, Finland 18 – 21st of October 2023*. ISSN: 2706-6762 (Electronic)
- DIMITRAKIEV, D.; GILEV G., 2021. *Green ports – environmental challenges and economic demands*, *Pedagogika-Pedagogy*, vol. 93, no. 7s (Education and Maritime Transport and Information Systems). <https://doi.org/10.53656/ped21-7s.11gree>.
- DIMITRAKIEV, D.; MILEV, D.; GUNES E., 2023. The risk analysis of chemical tankers passing through the Turkish straits between 2010 – 2022. *Strategies for policy in science & education-Strategii na Obrazovatelna i Nauchna Politika*, vol. 31, no. 3s, pp. 45-55. <https://doi.org/10.53656/str2023-3s-3-the>.
- GANCHEVA, Y., 2021. Some problems related to the exploitation of automated container terminals. *Pedagogika-Pedagogy*, vol. 93, no. 7s. <https://doi.org/10.53656/ped21-7s.10cont>.
- INTERNATIONAL CHAMBER OF SHIPPING. *Bridge procedure guide*. Sixth Edition, ISBN 978-1-913997-07-6, 2022.

- NARLEVA, K.; GANCHEVA, Y., 2023, *The Role of Maritime Education in Digitalization, Pedagogika-Pedagogy*, vol. 95, no. 6s, pp. 132 – 141. <https://doi.org/10.53656/ped2023-6s.12>.
- NAUTICAL INSTITUTE, 2018. *Bridge team management*. Second edition, ISBN 978-1-870077-66-8,
- MEDNIKAROV, B.; TSVETKOV, M.; KARADENCHEVA, A., 2019. Challenges for the education of marine specialists in the Republic of Bulgaria. *Proceedings of the Symposium “Strategic Alliances – a factor for the development of economic corridors”, 2019*. ISBN 978-619-7428-42-1 (print) ISBN 978-619-7428-43-8 (online).
- MOLODCHIK, A.; DIMITRAKIEV, D., 2018. Digital Platforms as Factor Transforming Management Models in Businesses and Industries. *International Conference Information Technologies in Business and Industry, 2018 IOP Publishing IOP Conf. Series: Journal of Physics: Conf. Series 1015 042040*. doi:10.1088/1742-6596/1015/4/04204.
- STEREV, N., 2023. Pre-Incubation Toolkits for Academic Entrepreneurship Fostering: Bulgarian Case. *Strategies for policy in science & education-Strategii na Obrazovatelnata i Nauchnata Politika*, vol. 31, no. 3s, pp. 90 – 103. <https://doi.org/10.53656/str2023-3s-7-pre>.
- TSONEV, I., 2021. Utilizing Simulator-Based Training in Nikola Vaptsarov Naval Academy for Enhancing Students’ Knowledge and Skills Regarding Safety. *Varna Free University, e-Journal VFU*, Issue 16.

**Internet resources:**

[www.knowledgeofsea.com](http://www.knowledgeofsea.com)

[www.oceanweatherservices.com](http://www.oceanweatherservices.com)

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