Mastering the waves: onboard data in offshore operations

The success of large-scale offshore renewable projects relies on precise operations carried out in some of the world's most challenging environments. At the heart of these efforts are specialized vessels and dedicated teams who manage vast amounts of environmental data to ensure both safety and efficiency.

We spoke with Bas Milatz, a marine engineer at Jumbo Offshore, an offshore installation contractor. Bas explained how his team uses a Radac wave radar system aboard one of their vessels, the Fairplayer, to access and interpret real-time wave data. This technology enables them to transform a constantly changing offshore environment into a measurable and controlled workspace.

In our conversation, we explored how the team improves the alpha-factor, validates wave forecasts and optimizes vessel headings, all key to safer and more efficient offshore operations.

Jumbo Fairplayer's niche

The 'Fairplayer' is no ordinary vessel. As part of a small specialized fleet, it operates in a unique niche within the heavy-lift and offshore construction market. Bas explains that the 'Fairplayer' is a hybrid vessel designed with the capabilities of both a heavy-lift transport ship and a highly precise DP2-capable construction vessel. This enables a 'quayside to seabed' approach, where the vessel manages an entire project from loading large components at port to installing them on the ocean floor, all with a single ship.

'We are a bit in a niche,' Bas says. 'What distinguishes us from other offshore installation vessels is the size of the ship. We can transport heavy cargo from the yard to the field quite quickly. We can't carry a huge amount at once but we can do it fast. The distinction mainly lies in that combination.'

This integrated model is a core advantage as it eliminates the need for costly and risky at-sea transfers between multiple vessels, streamlining logistics and improving overall project efficiency.

The dynamic challenge of the offshore environment

For a marine engineer, the primary challenge of any operation is managing the unpredictable forces of the ocean. Wind, currents and waves are constant factors, and their combined effect is the main driver of a project's 'workability': the number of days a vessel can safely operate.

Bas explains that the biggest challenge lies in the combination of these dynamic forces. 'All three separately are not necessarily a problem,' he says, 'but the combination of them is always an issue.' He notes that a vessel might have to maintain a specific heading to counter a strong current, which could force it to face waves from a less favorable direction.

'It really depends on the operation,' Bas says, adding that different projects have different limitations. The team must continuously monitor these dynamic forces to ensure they remain within project limits.


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Onboard intelligence: the wave radar in action

To tackle this challenge, the 'Fairplayer' is equipped with a highly accurate wave radar system. Bas explains that the system is installed under the vessel's helideck in a location that provides a clear, unobstructed view of the sea state directly around the ship. This placement is crucial as it delivers local, real-time data that can be used to validate external weather forecasts.

'We constantly cross-reference our own data with external forecasts,' Bas says. This validation process has become an essential part of their workflow. He notes that in the past they had to rely on a mix of forecasts, visual checks and (occasionally distant) wave buoys, which introduced uncertainty. Now they can build a clear, data-driven picture of the sea state and use that information for critical 'go/no-go' decisions.

The team uses local wave data to optimize their operations in four key ways:

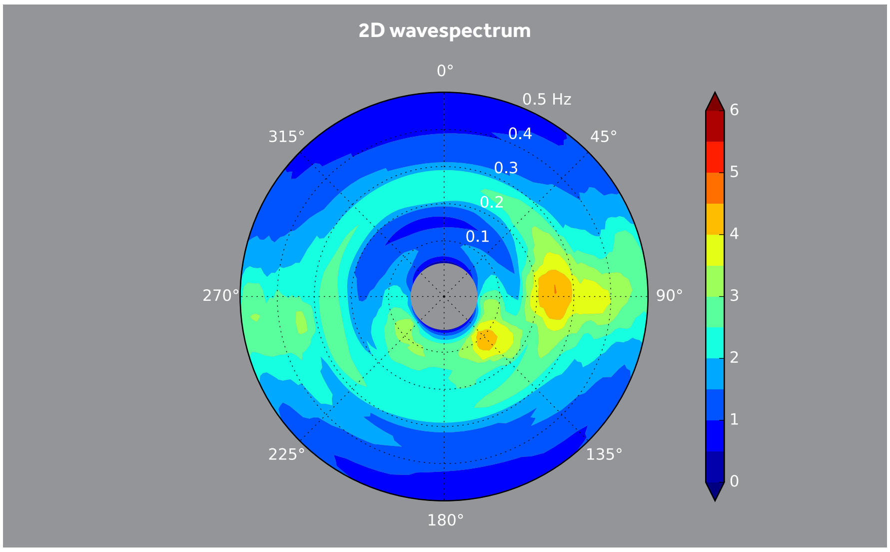
1. **Improving the alpha-factor:** by using the wave radar, the alpha-factor becomes more favorable, bringing the forecasted HsTp closer to the design HsTp. This directly improves workability.
2. **Validating forecasts:** by comparing historical radar data with past forecasts, the team can quantify the accuracy of their weather models. 'If we see that the forecast and our measured data match perfectly over the past few days,' Bas explains, 'we have more confidence in the forecast for the next two days.'
3. **Optimizing heading:** one of the most innovative applications is the use of the radar's 2D wave spectrum data. 'We actually built a tool that takes the radar's data and runs a simulation to find the optimal heading for the least amount of vessel motion,' Bas says. He recalls a memorable instance where a DPO (Dynamic Positioning Officer) chose what he thought was the optimal heading based on visual observation and forecasts. But the radar data revealed a second, less obvious wave system coming from another direction. 'The radar showed us that a different heading was actually optimal for minimizing heave. It showed us something we simply couldn't see with our eyes alone.'
4. **Post-project analysis:** Bas emphasizes that the value of the data doesn't end when the project is complete. The team uses the RadacConnect cloud solution to store all the data, which is then used for in-depth 'hindcast studies.' This allows them to analyze the actual environmental conditions they operated in.

This ability to both validate in real time and analyze after the fact elevates the technology from a simple sensor to a tool that transforms a dynamic offshore environment into a quantifiable and controlled workspace.

A seamless workflow: the value of RadacConnect

The efficiency of the wave radar system is further enhanced by the RadacConnect cloud

The Radac wave radar showed us something we simply couldn't see with our eyes alone.



This plot is an example of the 2D spectrum in the web interface of the Radac WaveGuide Direction Onboard. It shows a situation where wind waves come from the East (90 degrees) at Tp = 4 seconds. And the swell comes from the Southeast (150 degrees) at Tp = 10

solution. Bas highlights that the system's data is easy to work with both onboard and in the office. He notes that instead of the old, time-consuming process of manually downloading data to a USB stick, they can now integrate it directly into a Python tool or other software.

'We can just download it directly into our Python script from RadacConnect itself and then use it immediately on board,' he says. This seamless integration makes it easy to build custom analysis tools and is a key advantage for their onshore team.

We would like to thank Bas for his insightful interview and for offering a glimpse behind the operations of the 'Fairplayer'.

Advancing the industry standard

The experience aboard vessels like the 'Fairplayer' marks a shift in the operational paradigm of the offshore industry. The ability to make confident decisions in an increasingly complex environment depends on a data-driven approach where real-time local wave data is key to mastering ever-changing conditions.

For vessel owners and project developers across the renewables sector, the decision now centers on adopting the best available intelligence. They no longer need to rely on generalized forecasts or, occasionally distant, wave buoys as they can now access local, real-time wave data directly from the vessel.

By integrating advanced wave radar technology, companies can reduce costly weather-related downtime and streamline project timelines. The actionable, verifiable data gathered on board is crucial for validating operational limits and ultimately setting a more efficient and reliable standard for the next generation of offshore installations. The future of offshore success will be defined by those who prioritize local, immediate environmental intelligence.

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The Radac wave radar

The Radac wave radar installed on the 'Fairplayer' is the WaveGuide 5 Direction Onboard 2. This unique motion-compensated system is a reliable and robust device for measuring draught, wave direction, wave height and wave period. The sensor maintains a high level of precision and accuracy in harsh environmental conditions, making it particularly suited to offshore vessels and floating installations.

With an array of three down-looking radars, the elevation of the sea surface is measured at three positions. The radars are mounted so that their footprints form a triangular pattern on the water surface. Knowing the slope of the water surface allows for the calculation of a full set of wave directional parameters. The distances measured are compensated for the heaving, pitching and rolling motions of the vessel by means of a highly sensitive motion sensor incorporated into the system.

Each radar measures the distance to the water surface ten times per second. The wave data is sent to the processing unit via a network link. The processing unit manages data acquisition, processing, presentation and remote servicing. Data can be locally stored on an external USB drive or distributed through two serial ports as well as over the network. Any device connected to the (private) network can access the web-based user interface.

RadacConnect is an optional cloud service for secure data storage. This service enables easy access to long-term historical data, both raw and processed wave parameters.