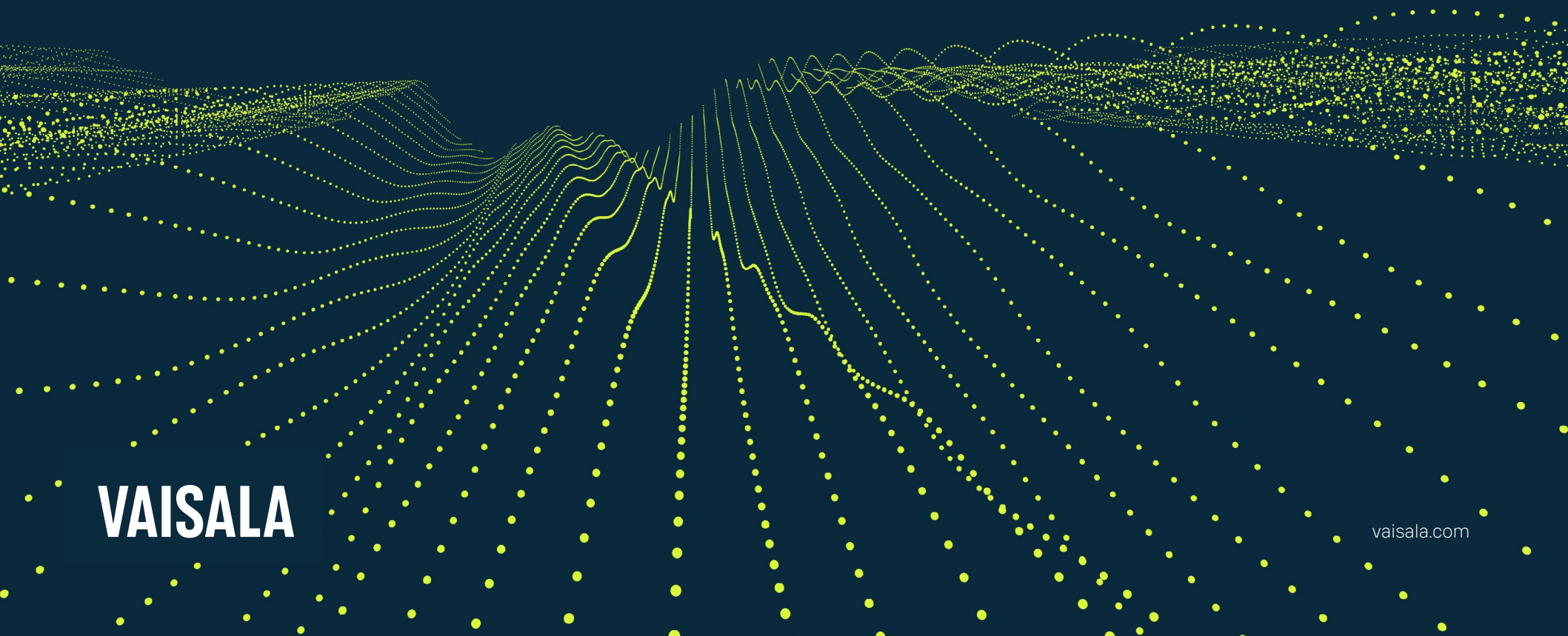
2024 survey analysis: Wind observation & optimization on WASP vessels

Industry Insights



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WASP technology insights: growth and challenges

At Vaisala, we are committed to advancing sustainable maritime solutions. Wind-assisted ship propulsion (WASP) is one the key technologies in decarbonizing the future of maritime shipping. Accurate, reliable wind and weather sensing technologies play an important role in helping to ensure wind-assisted propulsion is harnessed to its fullest potential.

Two years ago, we conducted a survey together with International Windship Association (IWSA) on wind measurement technologies for wind-assisted vessels. The survey revealed critical insights into the industry's challenges and needs, including:

- The demand for accurate and undisturbed wind data
- Operational efficiency improvements through remote wind monitoring
- Wind nowcasting to optimize WASP system performance

These insights have influenced our approach to developing more effective solutions for maritime operations, supporting the industry's transition towards sustainability.

In our 2024 follow-up survey, we assessed how these challenges have evolved over years and explored emerging trends. This helps us better innovate and support the optimal use of wind monitoring technologies to maximize the potential of wind propulsion systems.

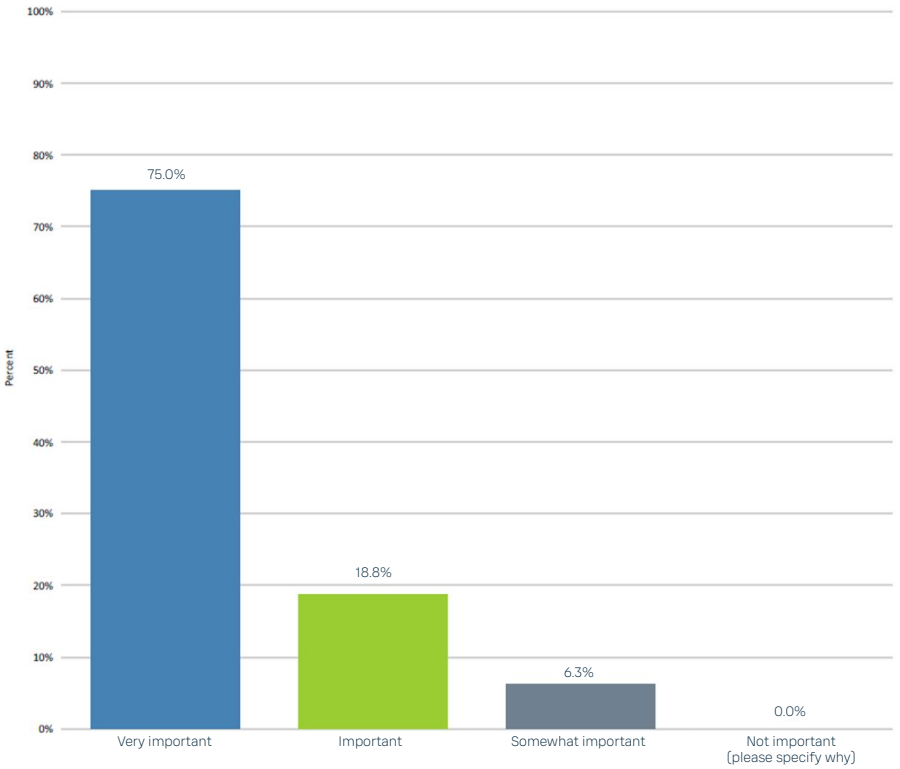
Explore this Industry Insight guide for key findings about how industry professionals view WASP optimization challenges — with some notable trends over the 2022 survey — and what wind and weather observations will help address these challenges the most, now and in the future.

Survey conducted in collaboration with International Windship Association

Background of industry respondents

Three-fourths of survey respondents are WASP system suppliers of the different WASP technologies: wings, soft sail, rotors, rigid sail, and suction sail. The other fourth of respondents represent shipping companies, including roll-on, roll-off (RoRo), bulk carriers and tankers.

Local wind measurement

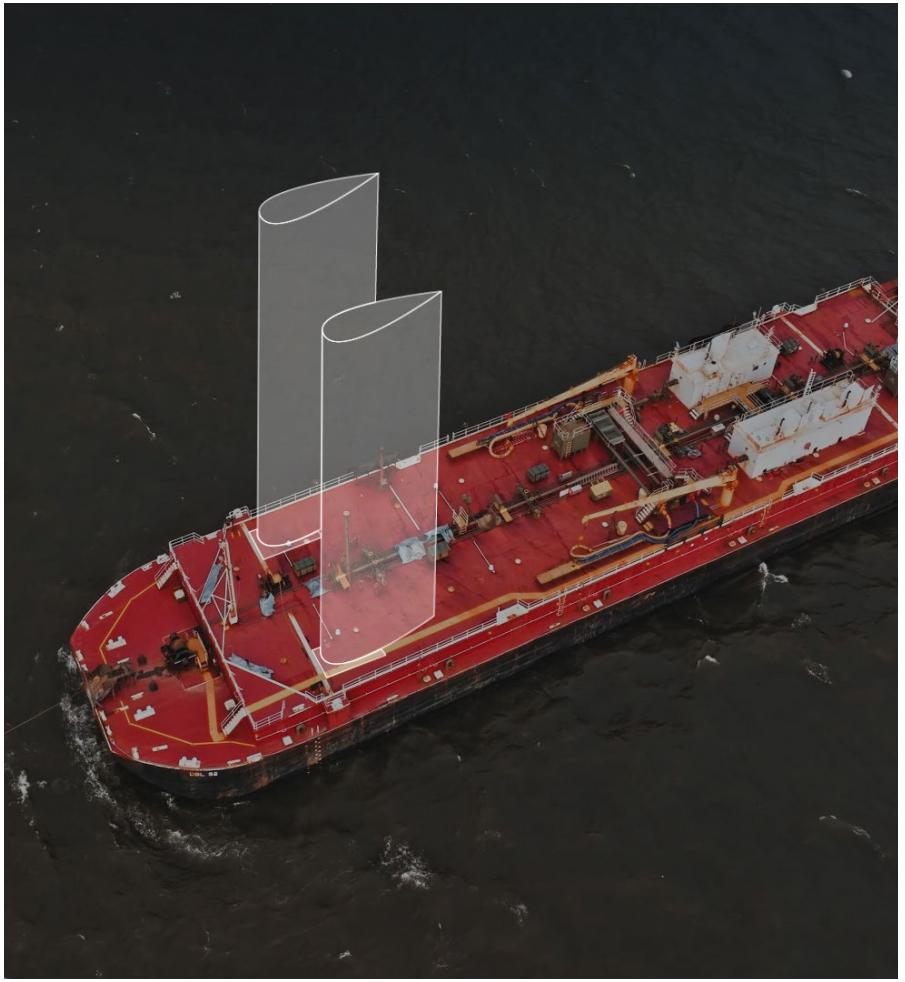


Q: How important is the local wind measurement for the optimal performance of your wind propulsion technology?

Ultrasonic anemometers are the most typical instruments for getting local wind measurements. 75% of respondents rated local wind measurements as very important, with another 20% rating them as important. Those who thought local wind measurement wasn't very important might work in areas with predictable winds or use other data sources to make decisions.

Notable trend: This is a significant increase in the rate of importance from 2022, where only 20% rated local wind measurements as very important.

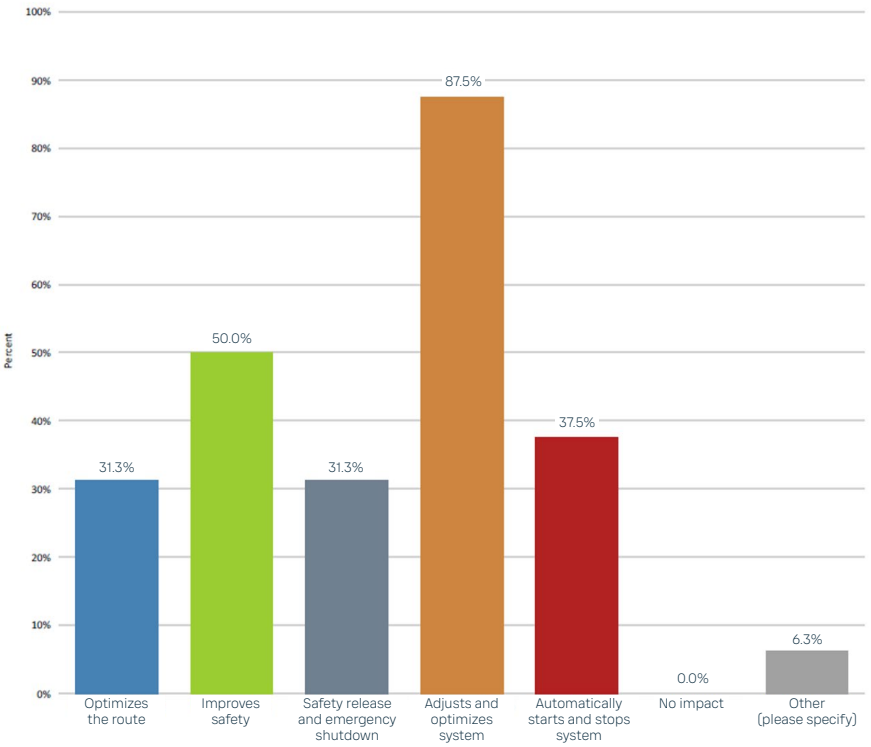
Q: What kind of effect does the wind measurement have in your wind propulsion system?



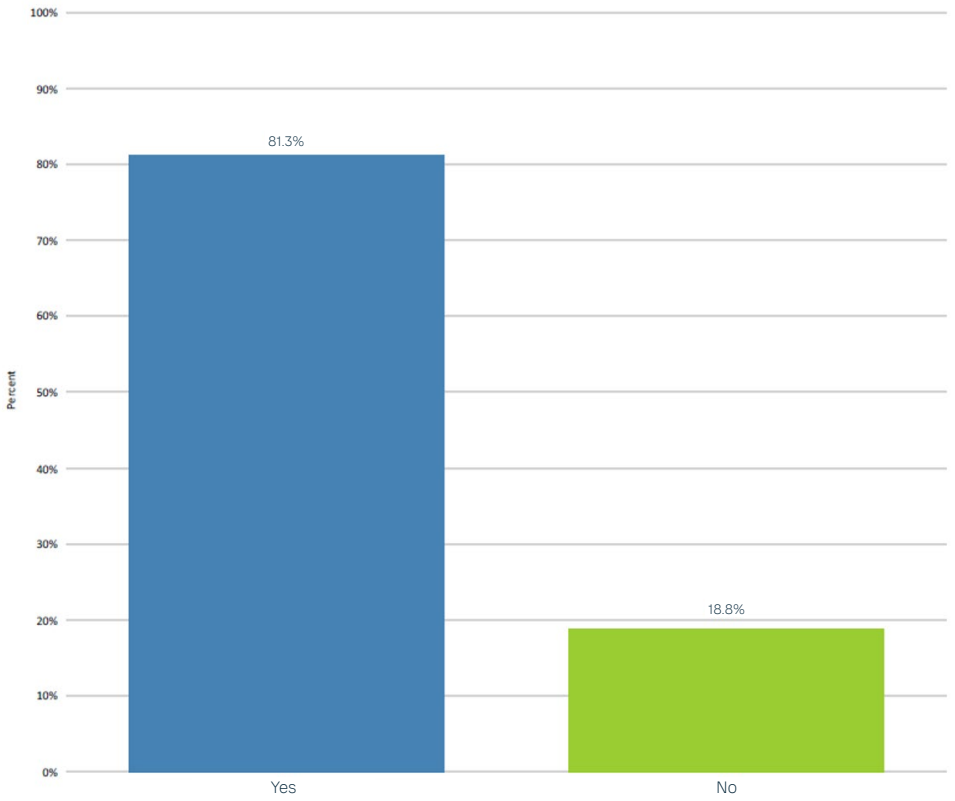
Over **87% of respondents** agree that wind measurements help them adjust and optimize their WASP systems.

Most respondents say wind measurement helps adjust and optimize their wind propulsion systems. This suggests that wind measurement's main role in propulsion technology is to make real-time adjustments, which improves efficiency and effectiveness.

Half of the respondents believe wind measurement improves safety, and that wind data helps avoid dangerous conditions and operate safely. Nearly 40% of participants use wind data to control their systems' operational states, ensuring systems are only active in optimal wind conditions.



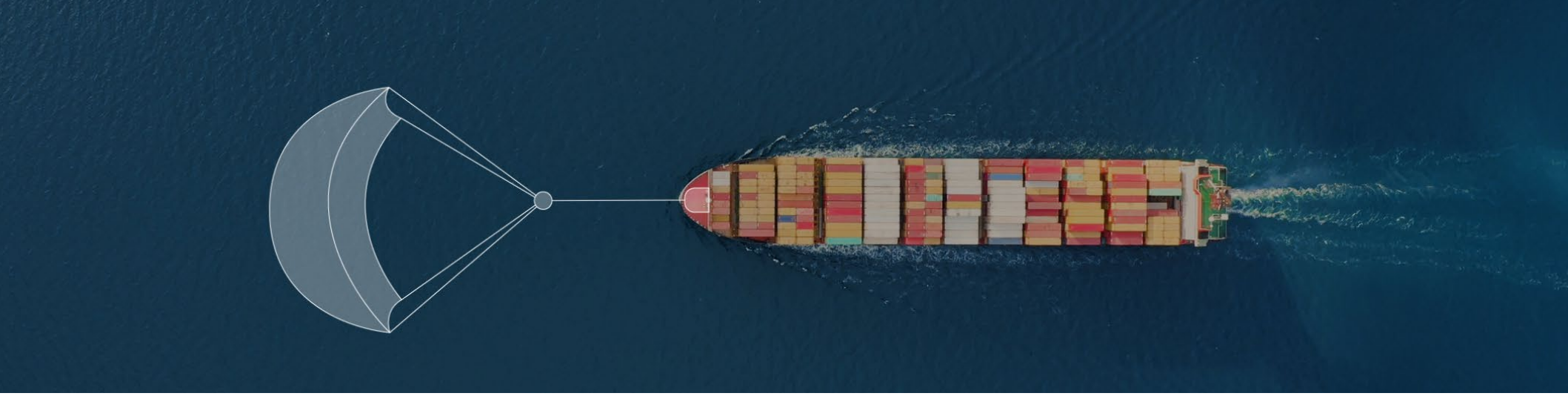
Weather forecasts



Q: Do you use weather forecasts in the optimization of your wind propulsion technology?

More than 80% of respondents use weather forecasts to optimize their wind propulsion technology. This underscores the importance of weather forecasts in optimization.

Those who do not use forecasts may operate in environments or applications where wind conditions are relatively stable, or they may rely on real-time wind measurements rather than forecasts.

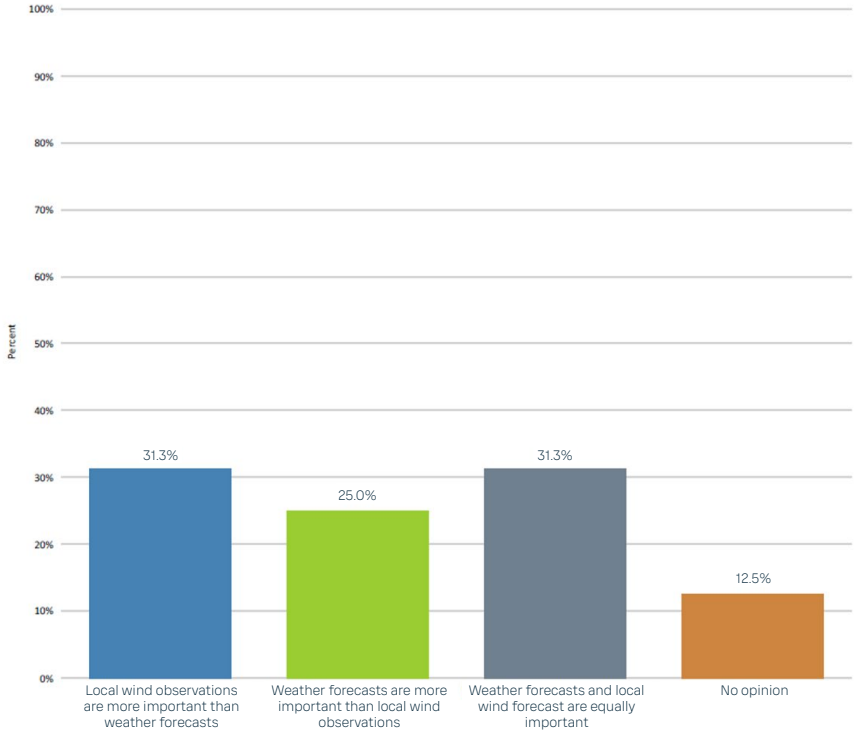


Q: How important do you rate weather forecasts vs. local wind observations for optimizing your wind propulsion technology?

Over 30% favor local wind observations over weather forecasts. They find real-time wind data more accurate and critical for immediate adjustments and decisions.

Different wind data needs reflect varying operational requirements. Real-time local data helps with immediate adjustments, while weather forecasts guide planning.

Notable trend: Many survey respondents value both data sources equally, showing a trend toward integrating real-time and predictive data for holistic optimization.



Key challenges and further measurement needs

Q: What do you think are the key challenges in wind measurement and/or wind optimization related to your wind propulsion technology?

Many people are concerned about the accuracy of wind measurement systems, because inaccurate wind data can cause problems and even be dangerous. This suggests that the current systems aren't reliable in all conditions.

Responses revolve around the accuracy, reliability, and comprehensiveness of wind measurement systems. Respondents seek more sophisticated technologies that can handle environmental complexities while being affordable and compliant with industry standards.

Answers

- Accuracy and reliability
- Low fidelity in forecast data, and very noisy measurements
- Flow interference, turbulence, ship motions influence on apparent wind direction. Implementation of technology for Gathering upstream data (LiDAR) to effect preemptive trim. Knowledge of Air mass instability and gusting
- Get an idea of the complete wind field around the WPS with all its turbulence, shear, and interaction effects without singular local effects experienced by a single-point measurement
- Measuring wind field speed/direction at a very close range i.e. nearby or between the wind propulsion systems
- Continued operational quality
- Class approval
- ATEX
- Price
- For validation, getting undisturbed wind by LiDAR is paramount
- For operating wings, getting the undisturbed angle as input to wing trim is mainly important.
- Precision and correct
- To get the most accurate wind measurement related to the actual performance of the wind propulsion device

5 key challenges in wind measurement for WASP optimization

1. High-fidelity, reliable wind data that minimizes noise and interference
2. Use of technologies like wind lidar to capture more precise and upstream data for predictive adjustments
3. Comprehensive wind field analysis that captures all relevant environmental effects, rather than relying on limited or single-point data
4. Strategic placement of measurement systems to avoid disturbed airflows and obtain accurate wind readings
5. Solutions that not only meet regulatory requirements but are also cost-effective for broader implementation

In their words: Key wind data/optimization challenges

"For validation, getting undisturbed wind by lidar is paramount"
"to get the most accurate wind measurement related to actual performance of the wind propulsion device"
"accuracy and reliability"

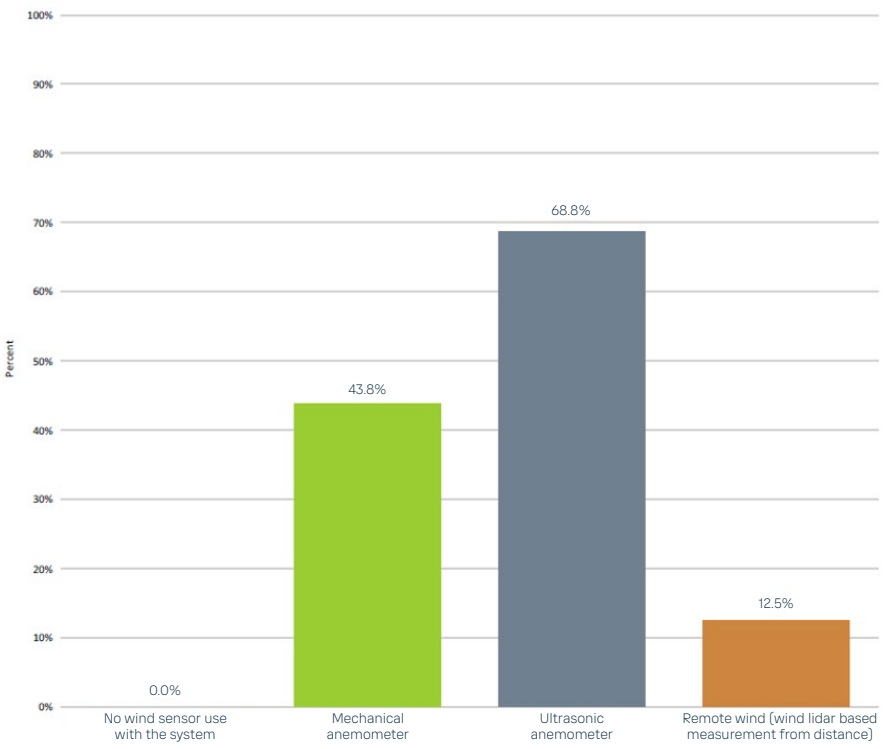
Strengths and weaknesses of wind sensors

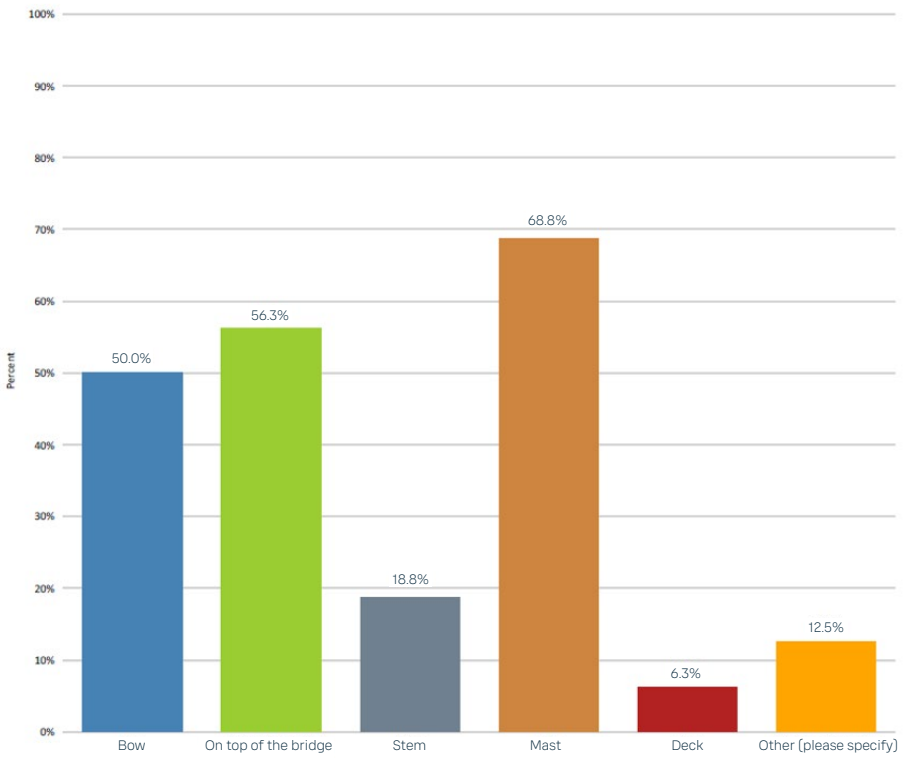
Q: What kind of wind sensor(s) do you use today in connection to your wind propulsion system? (Select all that apply)

Most respondents use ultrasonic anemometers to measure wind. These instruments are popular because they're precise, require little maintenance, and can withstand harsh marine conditions.

However, many still use mechanical anemometers, indicating cost-effectiveness or gradual transition to ultrasonic sensors. Remote wind sensors like lidar offer advanced wind measurement capabilities, and their adoption may increase as costs and technical barriers decrease.

More than two thirds of survey participants use ultrasonic anemometers to measure wind.





Q: Where is/are the wind sensor/s located in connection to your wind propulsion system? (Select all that apply)

The mast and bridge are the best spots for wind sensors because they're high up and away from obstacles. This allows for more precise wind data, which is essential for optimizing wind propulsion.

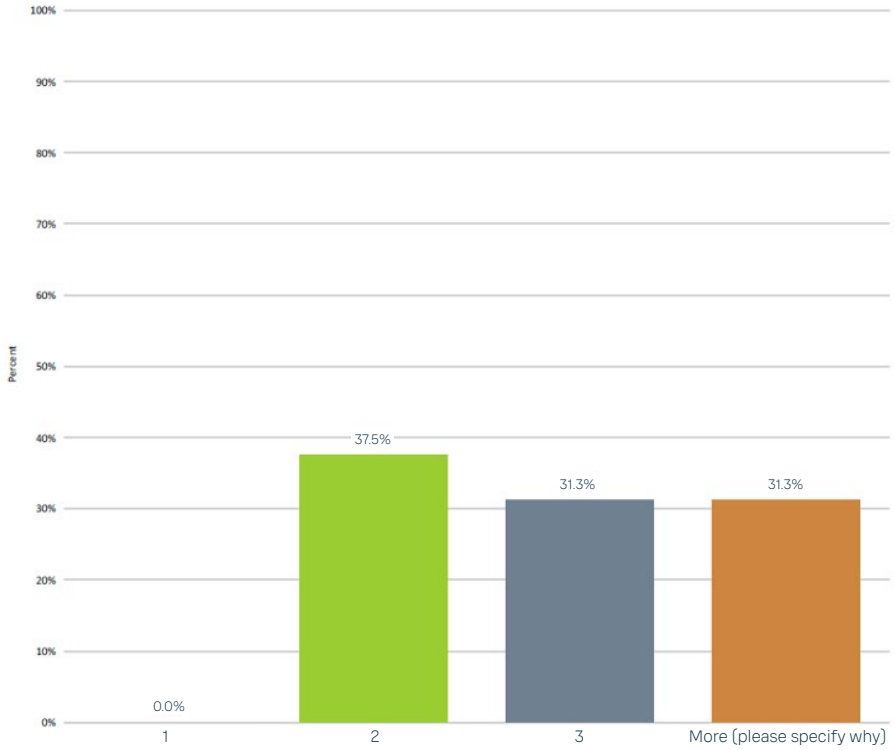
The bow is also a popular spot because it helps anticipate wind conditions as the vessel moves forward. The deck and stern are less ideal due to structural interferences and turbulent airflows but may still be used for specific reasons.

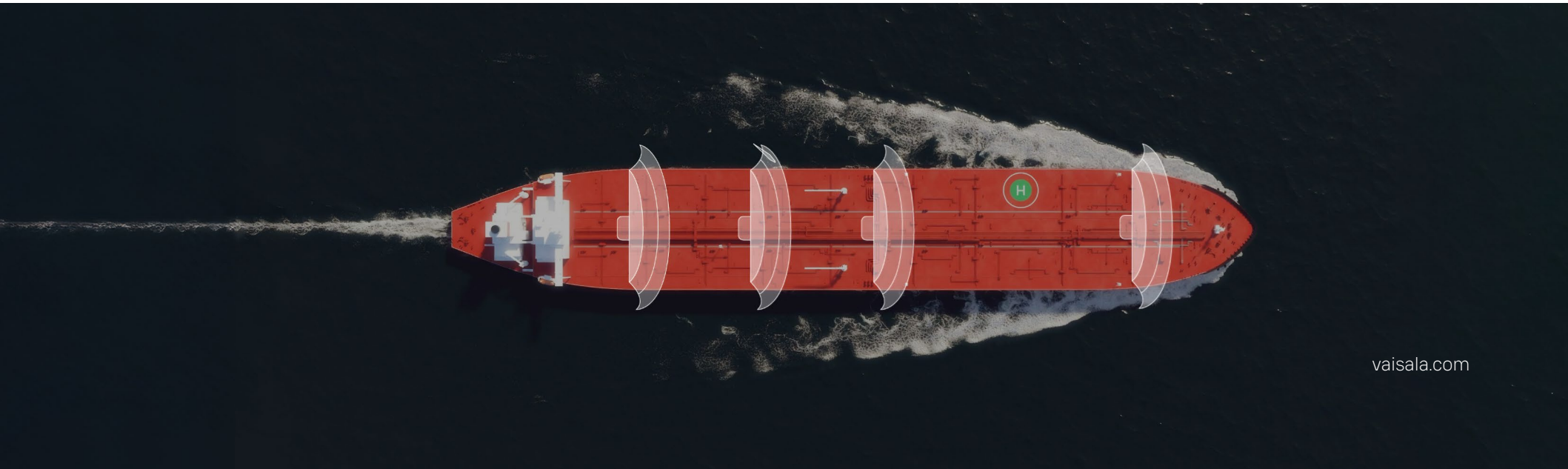
Q: How many wind sensors would you prefer on a ship that is using your wind propulsion system?

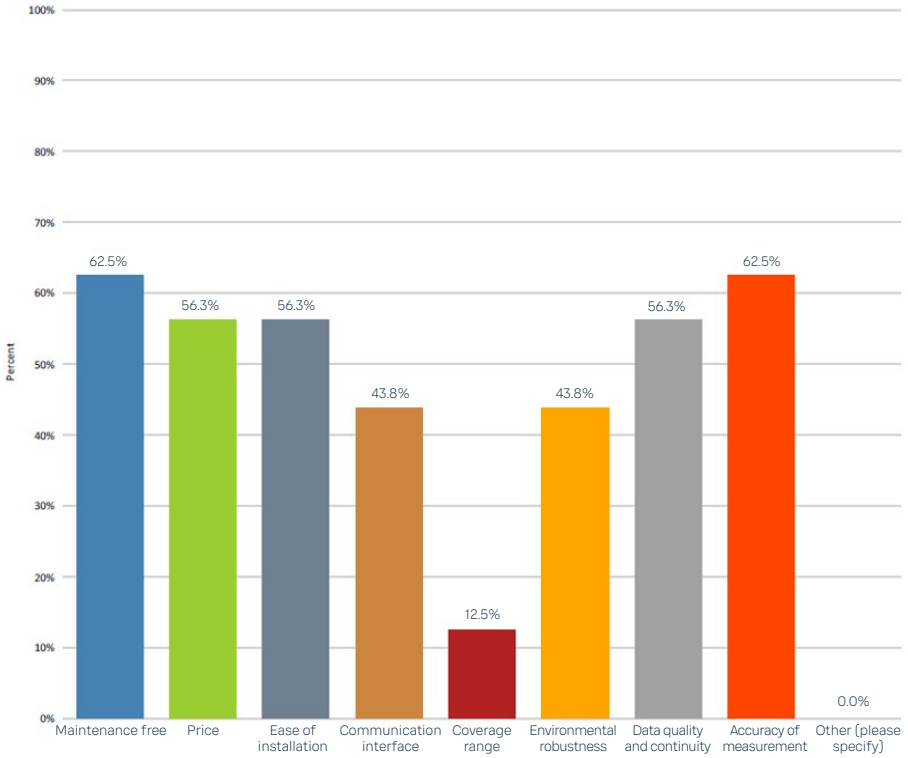
The survey shows a clear preference for multiple wind sensors, with the industry trending towards capturing wind data from various perspectives for improved accuracy and redundancy. Most respondents prefer 2 sensors for a balanced approach, providing sufficient coverage without excessive complexity.

Notable trend: In 2022, most respondents just wanted 2 wind sensors on their ships. Today, nearly 63% prefer 3 or more — indicating a strong desire for extensive data collection, especially in challenging wind environments.

A third of respondents want more than 3 wind sensors on their vessels.







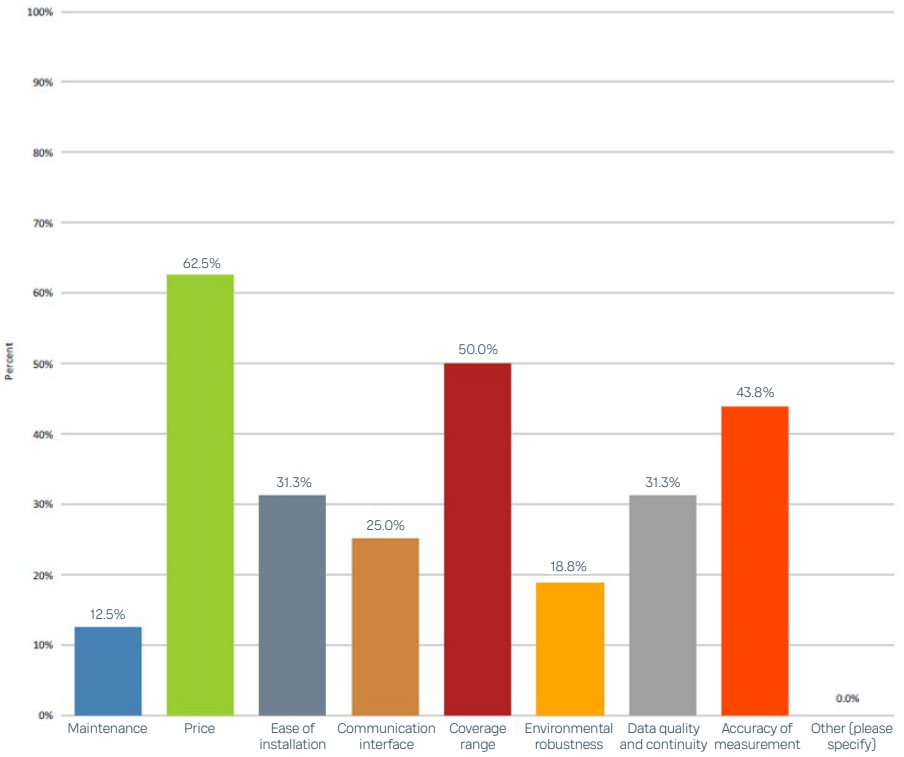
Q: What in your opinion are the strengths of today's wind sensor solutions? (Select all that apply)

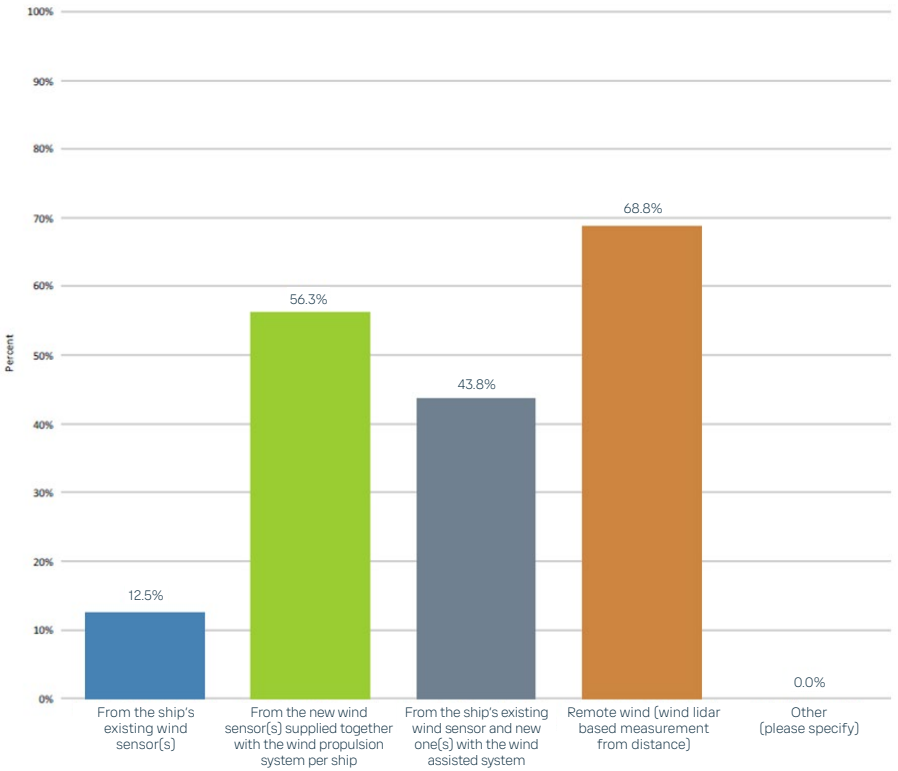
Operators value accurate, reliable and low-maintenance wind sensors that stand up to harsh marine environments. They prefer affordable and easy-to-install sensors, which could reflect budget constraints within the industry or a general desire to minimize installation and maintenance overhead.

Vaisala WINDCAP® Ultrasonic Wind Sensor WMT700

Q: What in your opinion should be improved in today's wind sensor solutions? (Select all that apply)

44% of respondents see accuracy of measurement as an area for improvement. Although accuracy was also listed as a strength, this response shows that some still feel there's room for improvement in precision. Enhanced accuracy could help operators make better real-time adjustments, leading to more efficient and effective use of wind propulsion technology.





Q: In your perspective, where do you think the wind-assisted vessels should utilize wind data from? (Select all that apply)

Nearly 70% selected remote wind data from lidar-based measurements as a preferred source.

This preference highlights the perceived value of obtaining wind data from a distance, as remote wind measurements can capture upstream wind conditions — allowing for predictive adjustments in the wind propulsion system.

Wind lidar data offers the advantage of detecting changes before they reach the vessel, providing valuable time to optimize propulsion settings. The high interest in remote wind data reflects a trend towards advanced, forward-looking data solutions that improve operational efficiency and performance.

Notable trend: In 2022, zero respondents indicated a desire to obtain wind data from lidar. This is a clear shift toward specialized high-tech solutions.

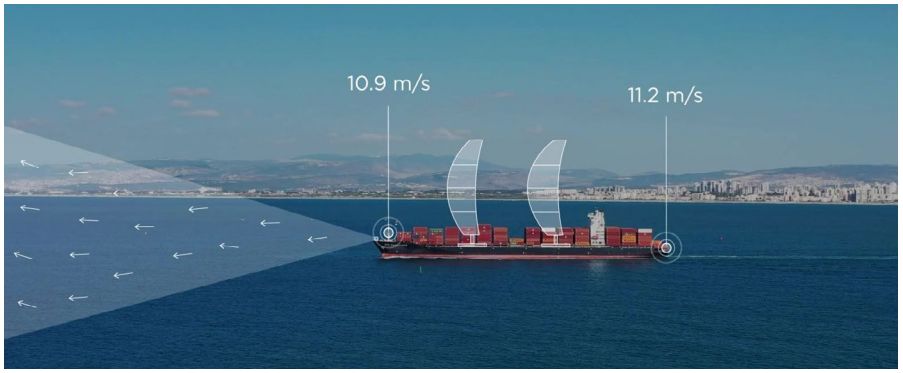
Remote wind monitoring

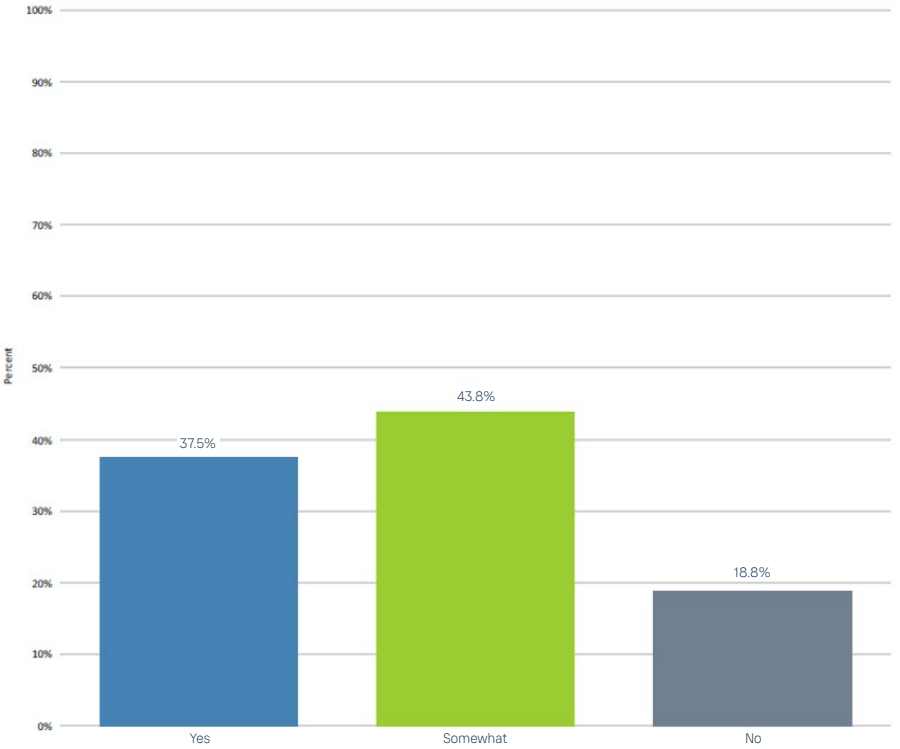
Q: Are you familiar with wind lidar/wind remote monitoring technology?

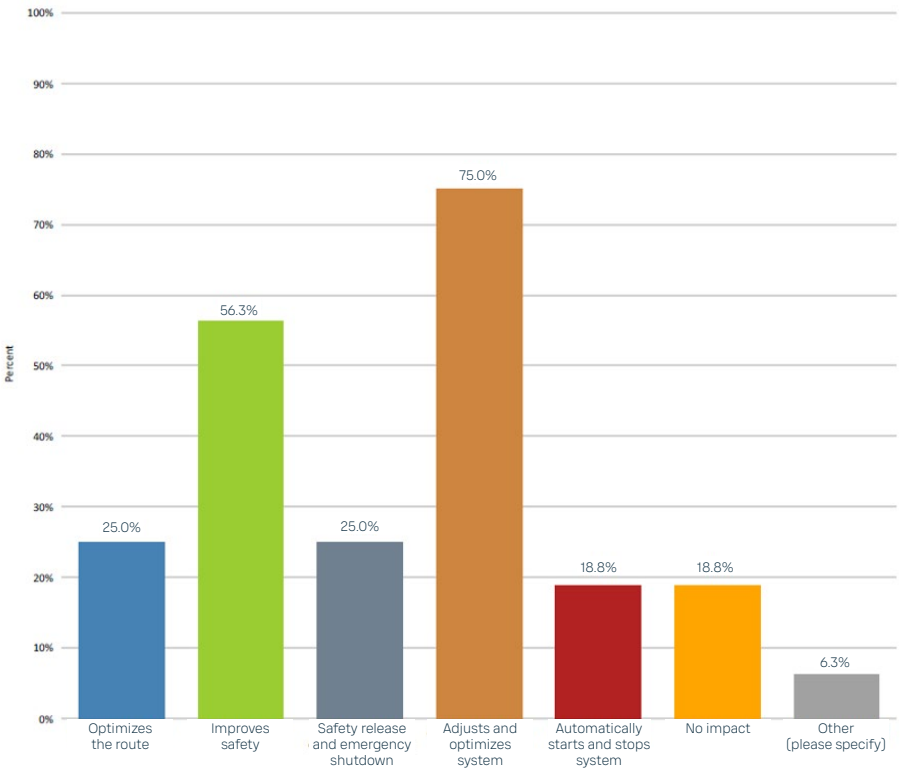
Over 80% of respondents are at least somewhat familiar with remote wind monitoring technology such as wind lidar.

There is a strong base of knowledge within the group, as almost 40% of respondents likely understand the technology's applications and advantages, such as remote measurement capabilities and predictive data for wind propulsion.

Some might see value in the technology but need additional information to fully appreciate its capabilities and applications. There is a foundation of knowledge that could support broader acceptance and adoption of the technology with further education and outreach.







Q: What would you see as the main benefits for wind lidar/wind remote monitoring? (Select all that apply)

The most widely recognized benefits are the ability of wind lidar or remote monitoring to adjust and optimize the wind propulsion system and improved safety.

Real-time WASP adjustment boosts efficiency, while improved safety aligns with industry priorities. Route optimization and emergency protocols are still valued, though less often selected. These functions show remote wind data value for strategic route planning and as a failsafe. Those who see no impact may not perceive its value or may not fully understand its benefits for their operations.

"Vaisala WindCube® Nacelle lidar

Conclusion: a bright future for WASP technology and sustainable shipping

The survey on Wind observation & optimization on WASP-enabled vessels emphasizes the essential role of precise and dependable wind measurement technologies in enhancing the efficiency of wind-assisted propulsion systems. It highlights the industry's strong demand for sophisticated wind sensing solutions, particularly those that provide remote data access and integrate sensors to boost operational efficiency and safety.

WASP industry professionals are optimistic about the future of the technology, particularly in relation to system optimization. The survey reveals a strong interest in enhancing environmental monitoring and data collection, with a significant majority recognizing the importance of accurate local wind measurements and the integration of advanced technologies to optimize WASP systems.

Vaisala is dedicated to promoting sustainable maritime solutions — a commitment you can see from our cutting-edge wind measurement technologies to our insights gained from surveys and industry partnerships. Let's take every measure to ensure a bright future for WASP and other innovative solutions.

Why Vaisala?

Weather and environmental insights are the greatest catalysts for successful maritime operations— from sensors to systems and digital services, Vaisala provides actionable insights that empower stakeholders to confidently meet challenges and harness new opportunities.

Our globally trusted maritime weather solutions enable remarkable efficiency gains, digital transformation, the protection of people and investments while supporting sustainable and responsible operations.

We are scientists and explorers driven by passion, relentless curiosity, and the desire to create a better world. Backed by nearly 90 years of unmatched scientific leadership, our solutions increase maritime weather awareness and drive innovation.

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