MIROS

Enhance your maritime operations

Prioritize safety, sustainability, and performance.

Real-time Ocean Insights

Waves. Currents. Oil Spill Detection.

Miros in a nutshell

40 years of excellence

- **Specialized** in measuring real-time ocean insights for the offshore and maritime industry
- **Pioneering** dry-sensor tech for 4 decades
- **Trusted** provider of advanced ocean surface measurement technology
- HQ in Norway
- Miros systems & solutions can help customers increase operability by up to 15%
- Part of Aircontact Group

Markets

- **Offshore Operations**
- **Offshore Wind**
- **Oil & Gas**
- **Ports & Coastal**
- **Shipping**

Dedication & Expertise

- **Passionate** in providing accurate real-time measurements and predicted ocean surface information
- **Dedicated** to applied intelligence, and data analytics as-a-service
- **Committed** to enhancing maritime operations with highly accurate measurements in all weather conditions from fixed or floating assets
- **Experts** in dry-mounted ocean technology

Scalable applications for all ocean industries

Miros Cloud Home

Data Connector

Data Explorer

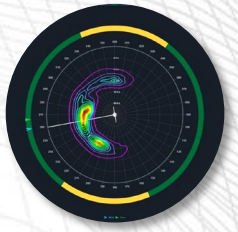
Forecast

PredictifAI

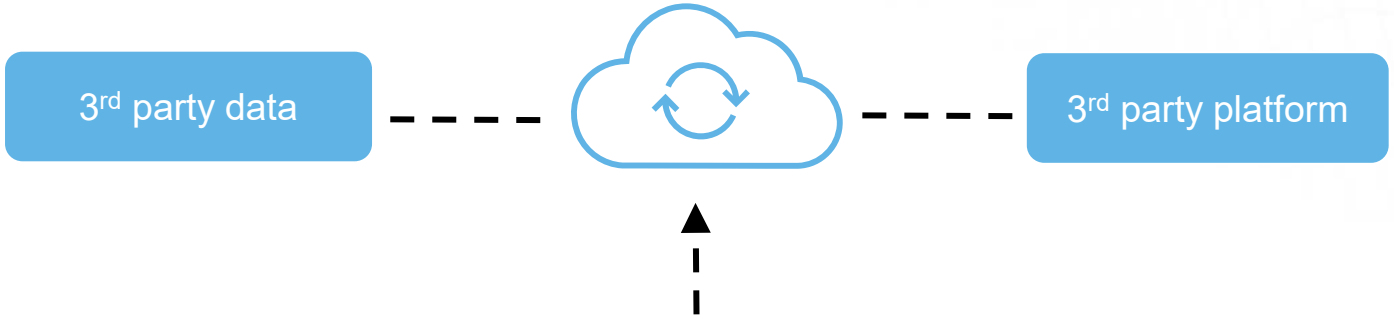
OSD Monitoring

Offshore Wind Map

Heading Advisor



Vessel Performance



IoT-enabled, Cloud-integrated Miros Sensors & Systems

Forecasts vs. Real-Time

- Who wins?

Forecasts

- National providers together with loads of private companies.
  - About 5 companies cover much of the market.
- All offshore operations use one or more forecast services for sea state- updated several times a day.

Accuracy

- Short term wave forecast (1-3 days) : **80-90%**
- Medium term wave forecast (3-7 days) : **70-80%**
- Long term wave forecast (7+ days) accuracy: **50-70%**
- Accuracy also depends on the region:
  - areas with complex coastal geography, may experience greater forecasting challenges
  - extreme wave events, caused by storms or hurricanes, may be more difficult to predict accurately

- Best available tool for planning shorter and longer operations at sea.

Inputs to predicting Vessel Operability

Forecasts

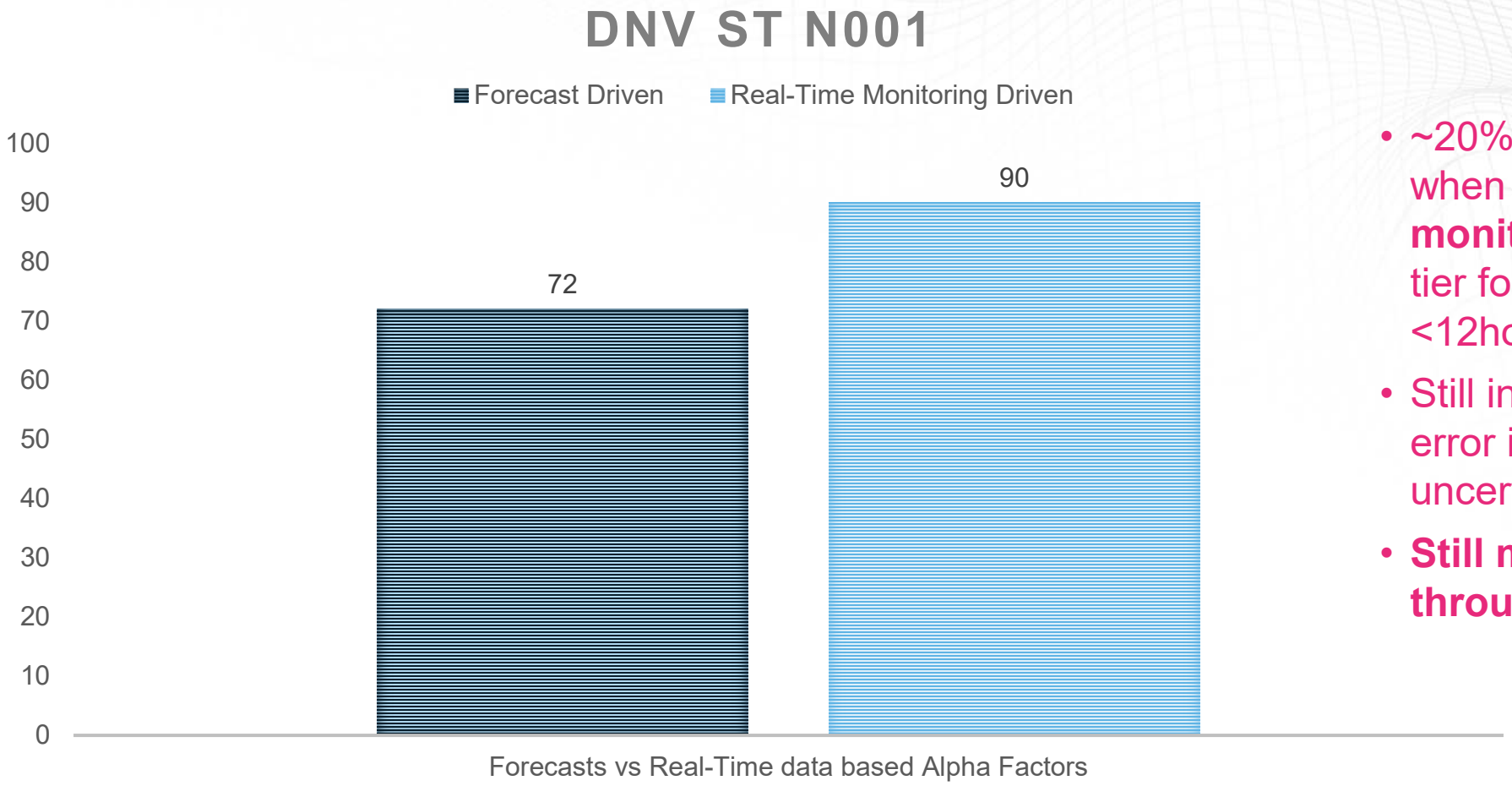
- → Derived from historical observations, models and simulations
- → Accepted accuracy for Alpha factor (DNV):
  - Level A forecast <12 hours = 72%
  - Using in-situ monitoring = 90%

RAO

- → Derived from models and simulations
- → Assume unidirectional waves, ignore changes in loading, ballast and effects of mooring, risers,etc.
- → Tested when vessel is new in Sea Trials
- → Rarely measured or verified again in operating conditions.

Decent levels Conservatism baked into both

How much can you gain using current best practices



- ~20% increase in operability when **using real-time monitoring** together with top tier forecasts for operations <12hours.
- Still includes 10% margin for error in measurements + uncertainties in RAOs
- **Still more to improve through measurements!**

Real-Time Measurements

How can you measure?

Wave radars or Wave buoys

- **Both measure Waves and Currents accurately. BUT…**
- Radar-based measurement is 1/3 of the cost of a wave buoy
- **Reduced installation complexity**, no maintenance, not submerged in water
- While using radars, no need to move equipment around during operations.
- **Radar-based, real-time monitoring**, measures the conditions experienced **at the vessel's location**, not few KM away.
- **Longer operational life**, less affected by environmental factors. Wave radars are dry-mounted and don't get lost at sea.

The Alternative..

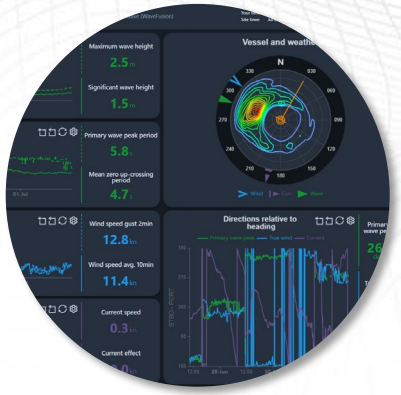
Offshore Vessels

WaveSystem sensors

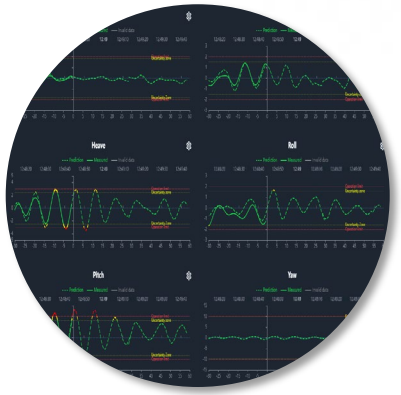
Wavex®

RangeFinder

WaveSystem application



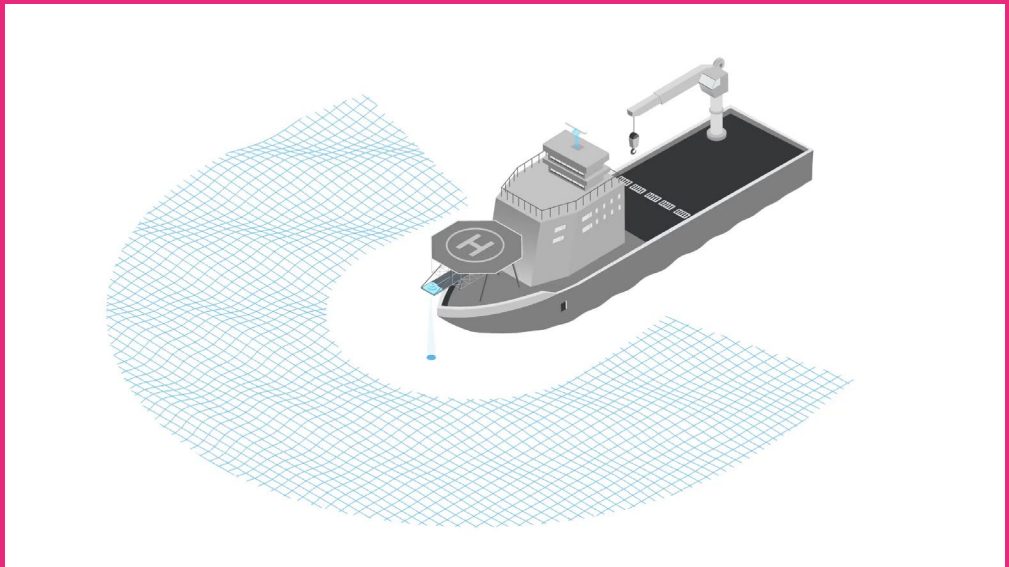
PredictifAI technology enables:



Wave Prediction

Vessel Motion Prediction

Measurement principle



Essential for:

- Weather-critical marine operations
- Lifting & jacking operations
- Wind turbine installation and overhaul
- Structural integrity verification
- Cable & pipelay campaigns
- Diving support operations
- ROV launch & recovery

WaveSystem

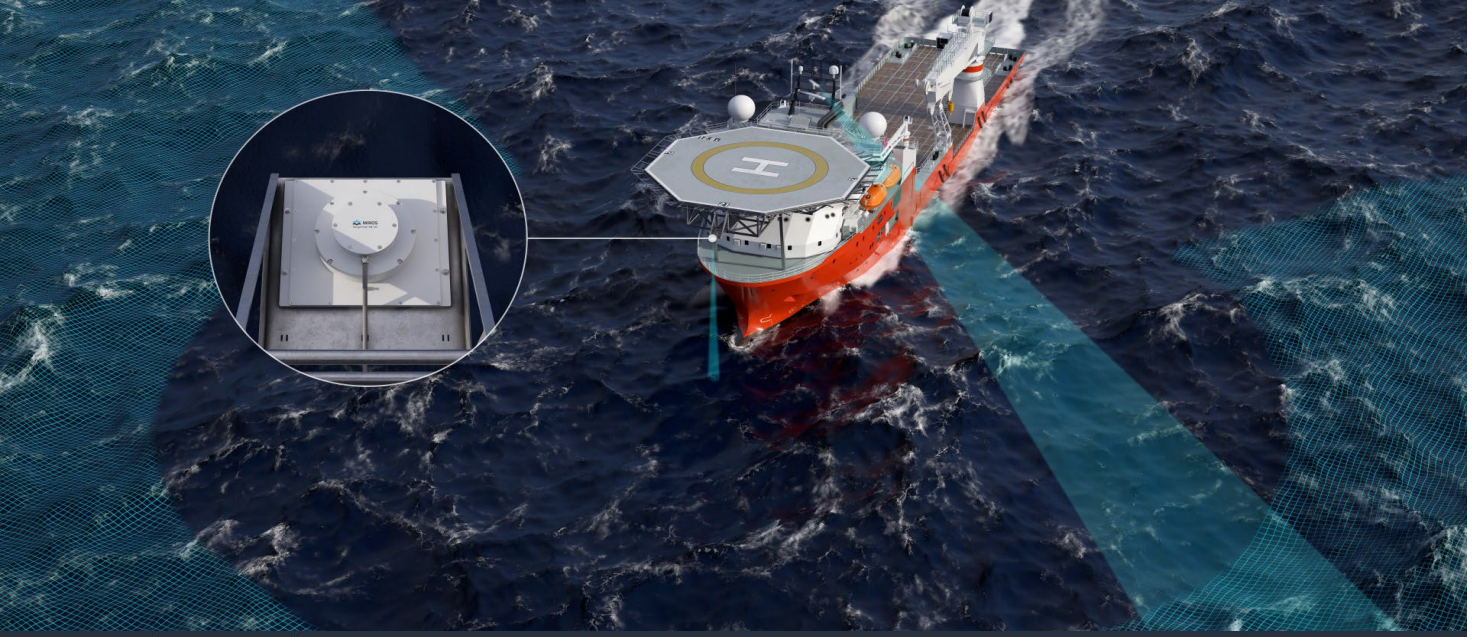
WaveSystem is comprised of

Miros Wavex: Virtual sensor designed for wave and current measurements using data from standard marine X-band radars.

- Measures waves, surface currents and speed through water from digitized sea clutter images provided by a marine X-band radar when operated in short pulse mode.
- Wave height accuracy ± 0.2 m
- Current & STW accuracy ± 0.05 m/s

RangeFinder: DNV alpha-factor approved, high-frequency vertical microwave radar providing sea level and draught measurements.

- Measures waves with high accuracy by combining air gap and motion measurements
- Measurement distance up to 95 m
- Measurement error <1 cm (individual measurements), <1mm (averaged)



Live situational awareness

- Measuring the environmental forces affecting the vessel in real-time.
  - Wave Height, Period
  - Wave Direction
  - Current Speed and Direction
  - Wind Speed and Direction
- Cloud Based System allow automatic sharing of data to forecasters

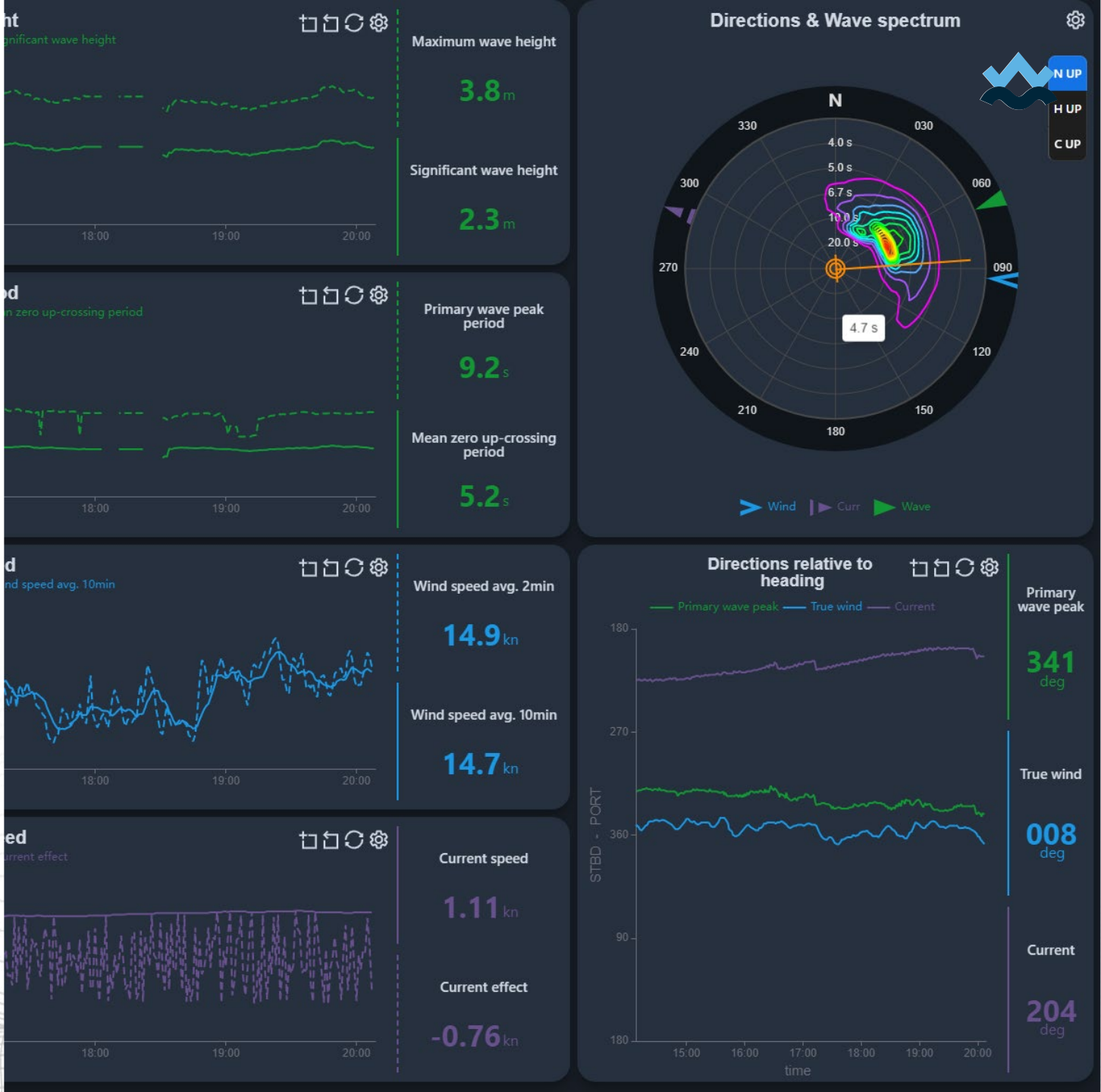
User Case 1

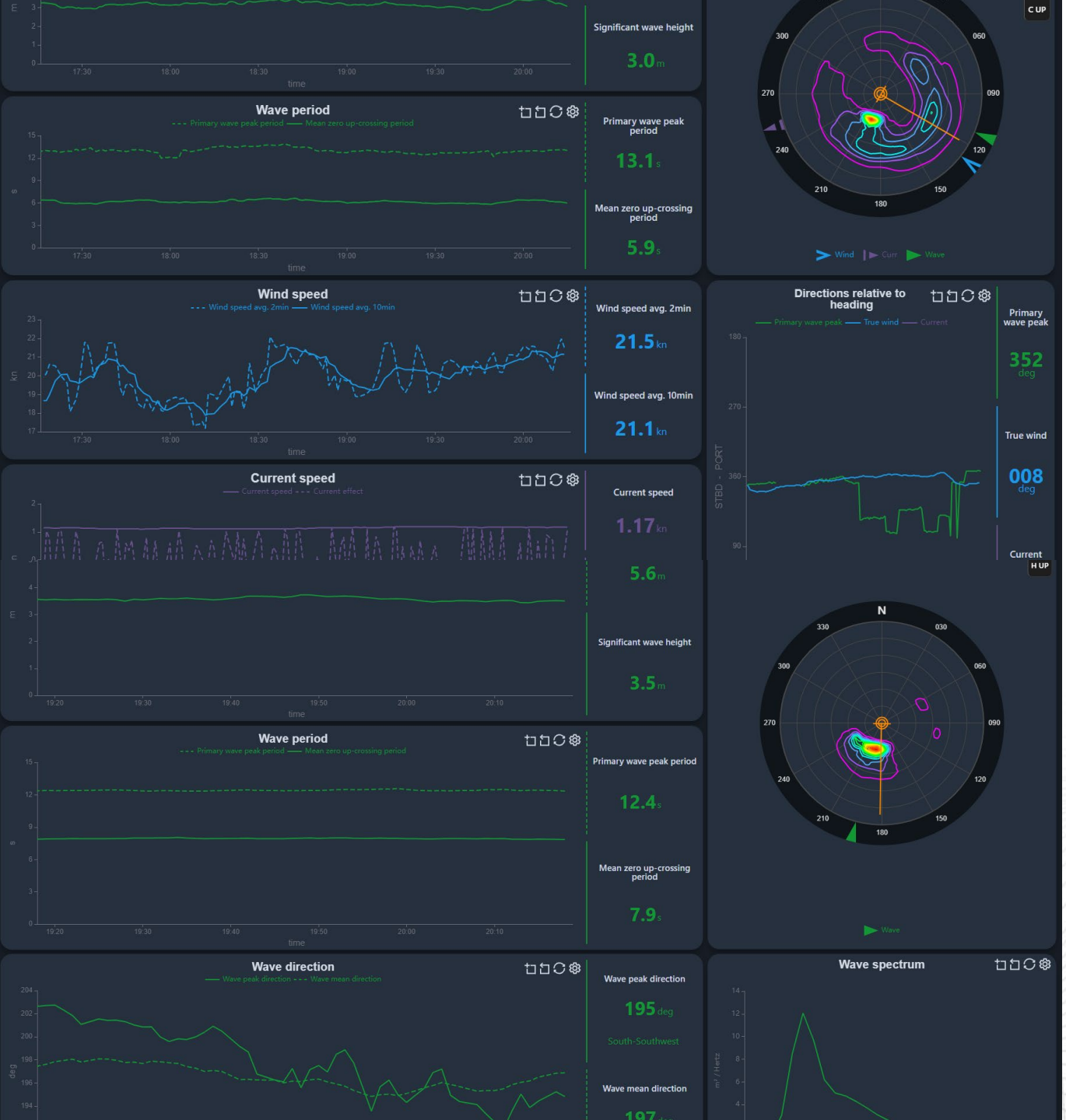
Heading Optimization

Crews can use measured Directional Spectrum to determine optimal heading.

Advantages:

- Updates every minute
- Detects both unimodal and bi-modal seas





User Case 2

Adapt operations to changing Sea States

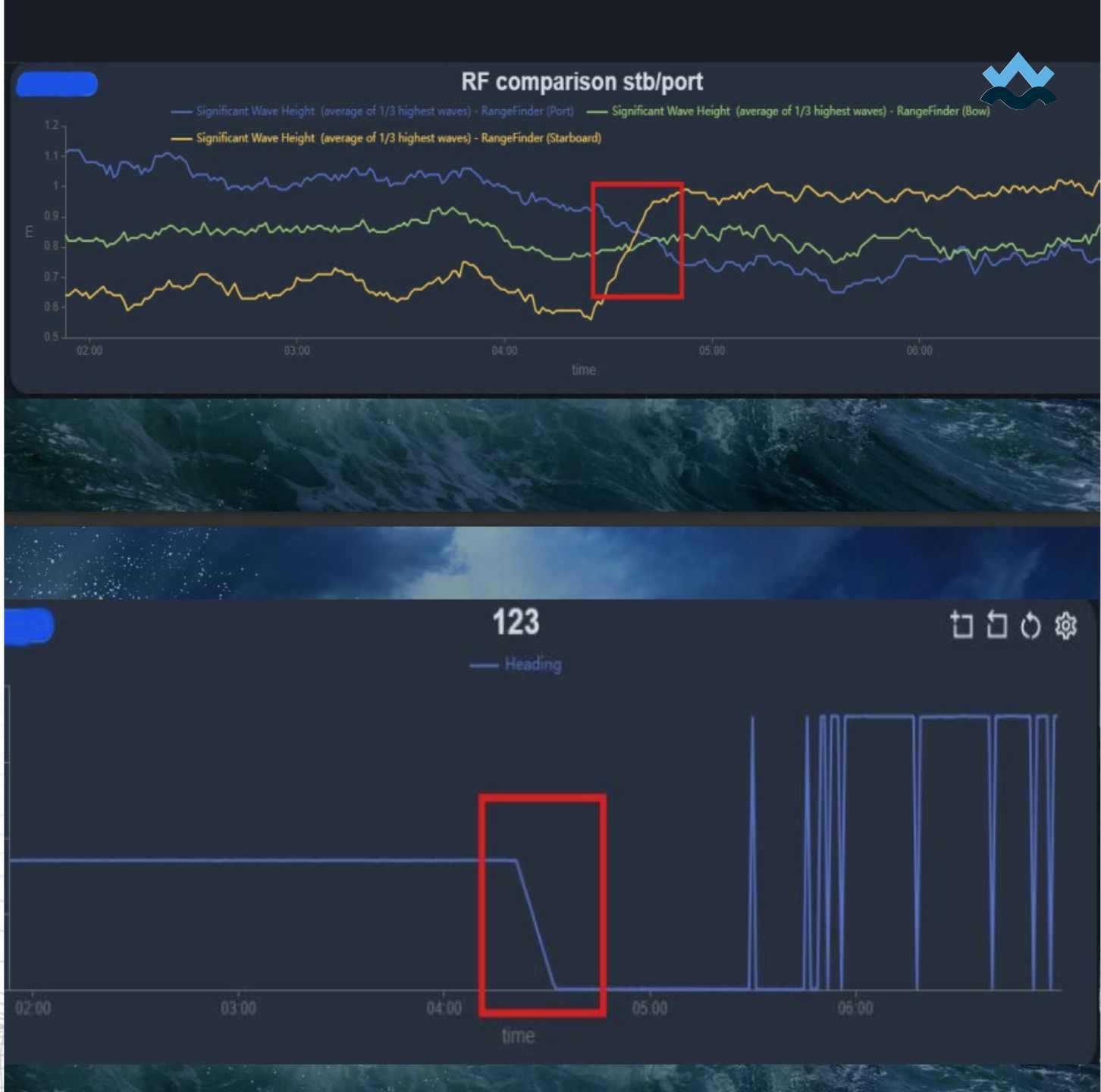
Real-time measurement of multi modal sea states allow practical interventions to minimize vessel motions in response to changing conditions.

User Case 3

Measuring Shielding Effects

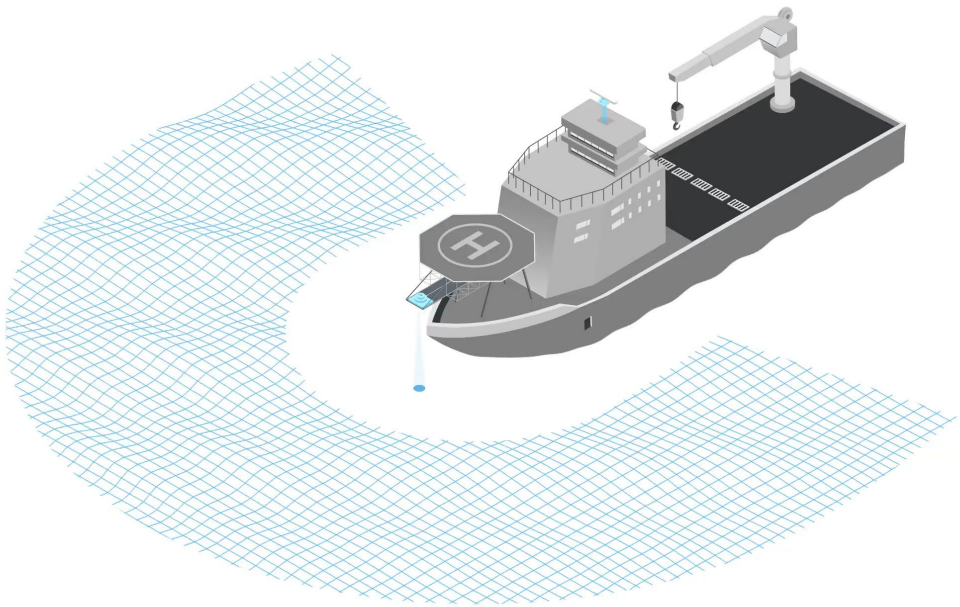
Using multiple RangeFinder wave sensors on Bow, Starboard and Port sides.

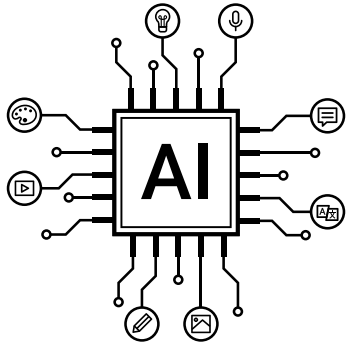
Customers can measure the effects of vessel shielding and to allow calculated decisions for short term operations.



PredictifAI

Pairing radar technology with Artificial Intelligence and **measuring** the near future.





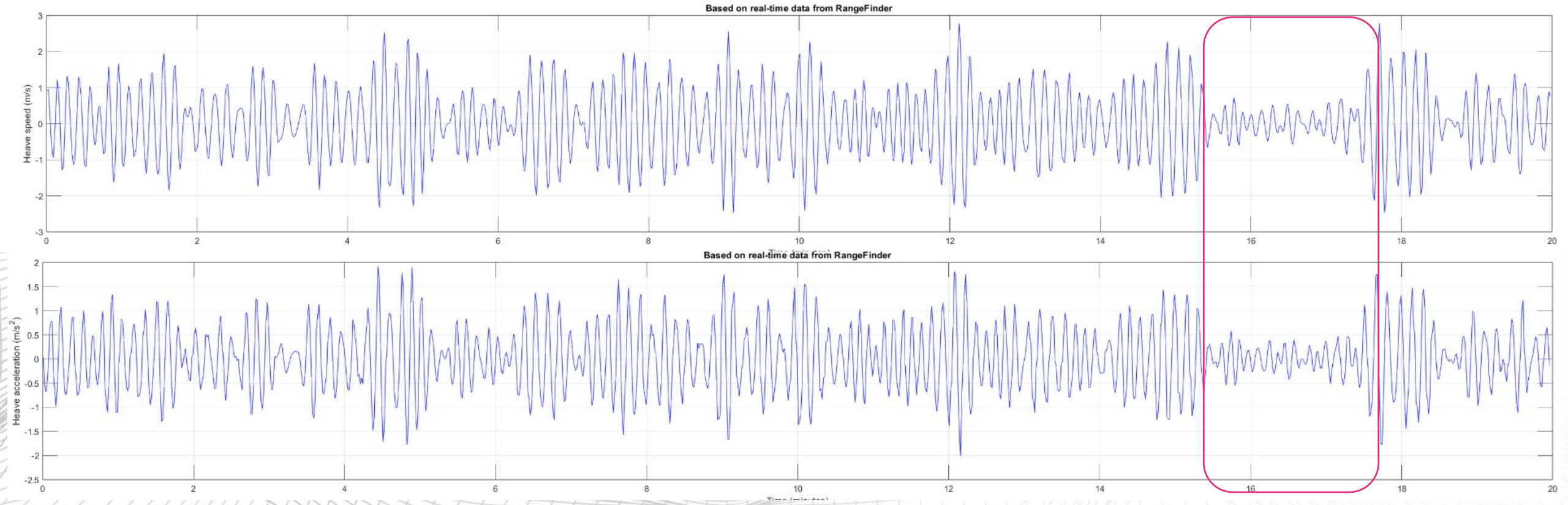
Deterministic wave prediction

Vessel Motion Prediction

- Real-life data from the North Sea
- PredictifAI currently installed on OSV with WaveSystem onboard
- Display: Data for vessel motion prediction

Enabling Data Driven Safe Operations

Case: 20 minute time series gathered using PredictifAI



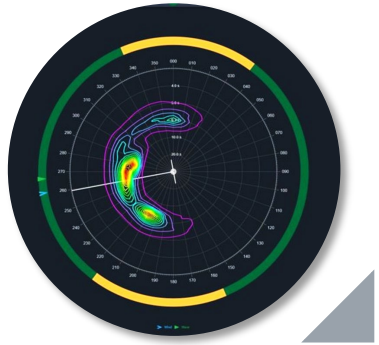
5 Levels of Operational Excellence

Old fashioned OPs

- Forecasts, RAOs
- Marine Warranty Surveyors
- Crew observations

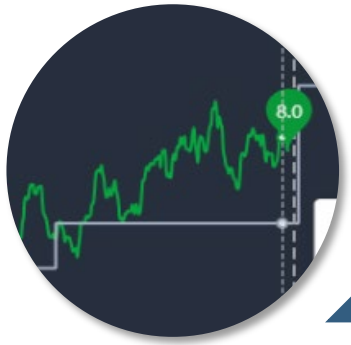
Expanding Operability

- Use Real-Time Monitoring
- Real-time vs Forecasts
- Update/ Calibrate Forecasts



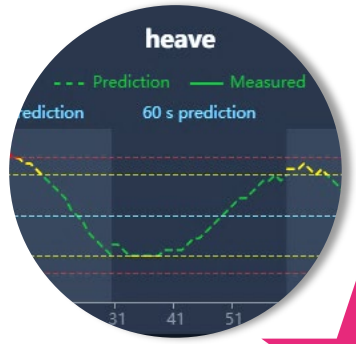
Data Enhanced Operations

- Vessel Heading optimisation
- Shielding Effect
- Consequence Analysis- Entail



Real-time RAO

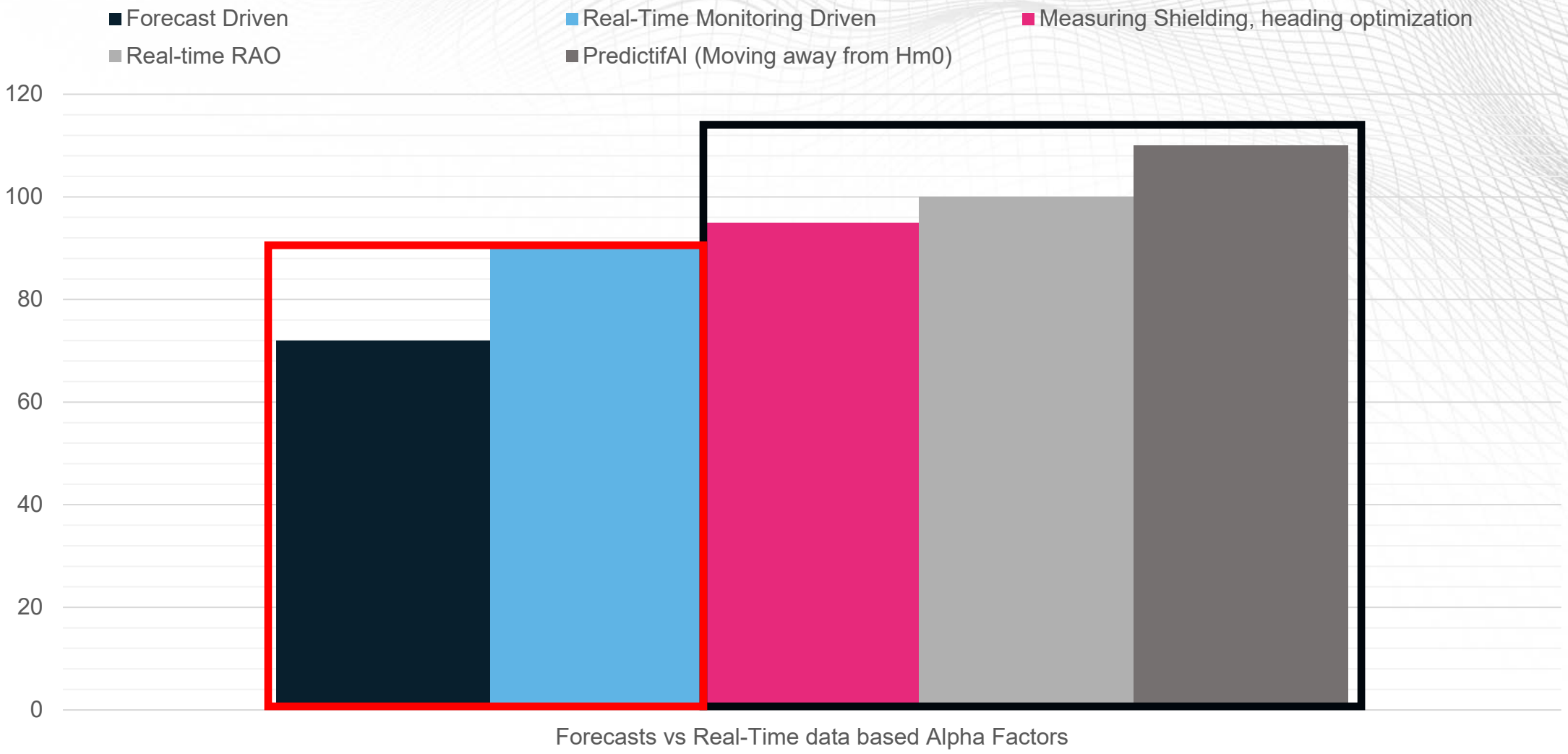
- Verifying and improving RAOs
- Measuring capabilities in different Wave heights and Periods
- Narrowing the triangle of Lost opportunities



Moving Beyond Hm0

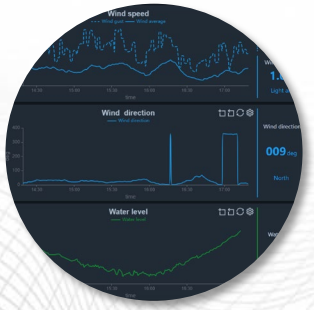
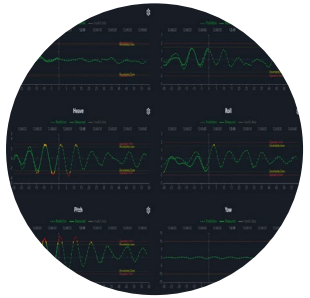
- Set limitations on measured and predicted Motions using PredictifAI

Data Driven Elimination of Conservatism



Unlocking the Value of Accurate Data

Providing Sea State Data to Meet All Stakeholder's Needs

PAST	PRESENT	FUTURE
Historic	**Real-time data**	**Predicted / Forecasted**
		 
Data Explorer	**Miros.app**	**PredictifAI** **Forecast**
Stakeholders	MetOcean/Data Analytics/Operations	Operations/Onshore	Operations	Operations/Onshore

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