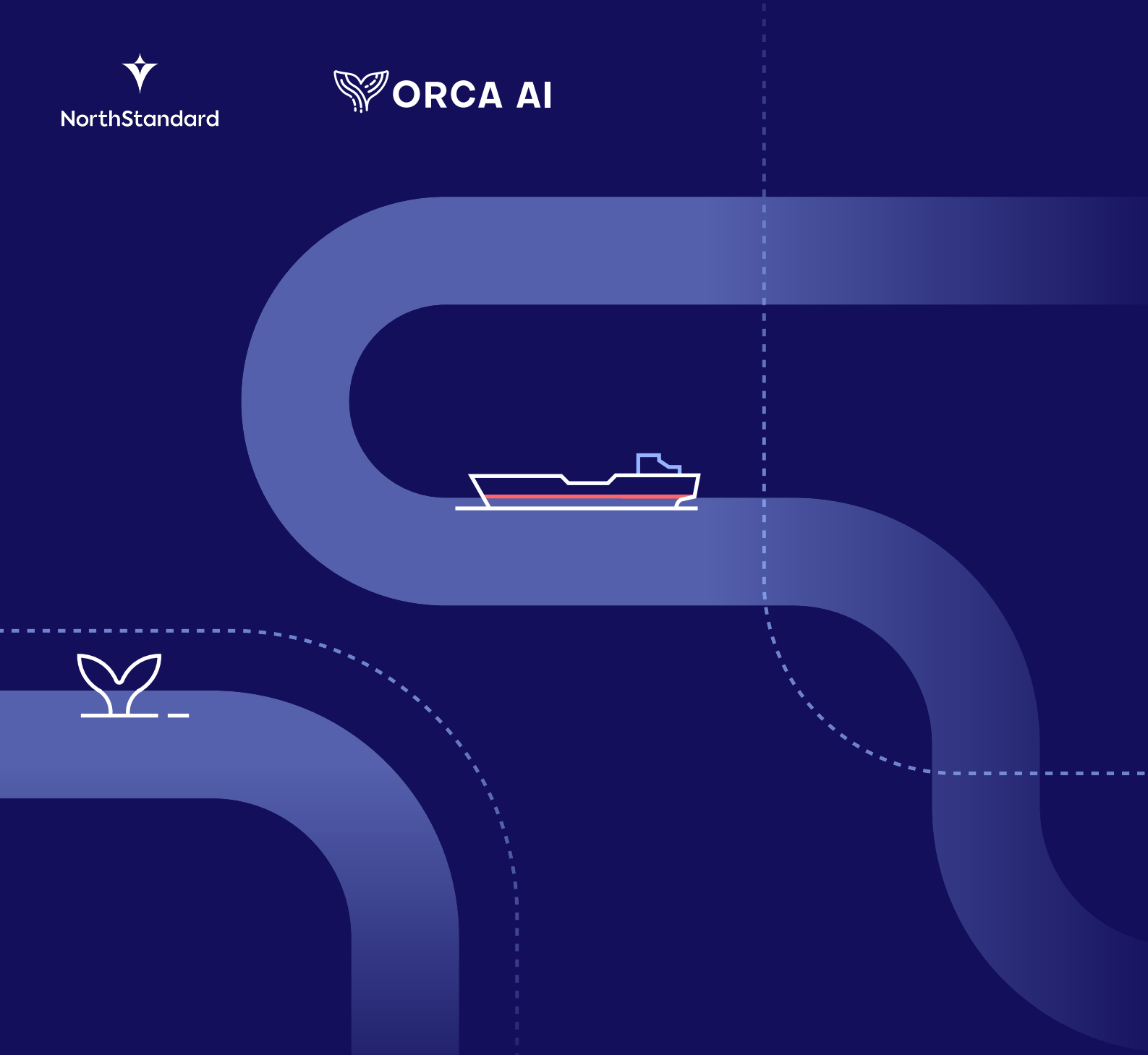
NorthStandard

ORCA AI



Orca AI and NorthStandard safety report

April 2026

Data is key to making our seas safer

Navigational risk is changing. For years, safety management has focused on rules, training, and investigating incidents after they happen. Today, shipping companies and insurers are increasingly looking toward continuous digital watchkeeping, AI-powered decision support, and hard data to better understand where risk is highest and how it can be reduced in practice.

The Orca AI and NorthStandard Navigational Safety Report analyzes anonymized data from 139 vessels, covering 139 ship-years and more than 10.8 million nautical miles of global trading through 2025.

The data reflects the day-to-day reality faced by bridge crews, fleet managers, safety managers, and loss prevention teams responsible for managing risk across busy fleets. The purpose of this report is to provide evidence of how carefully deployed AI-driven situational awareness can materially improve navigational safety in today's demanding operating environments shaped by increasing traffic density, higher asset values, unpredictable weather, and tighter margins for error.

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CEO and Co-founder
Orca AI

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Head of Loss Prevention
NorthStandard

A note on methodology

The Orca AI and NorthStandard Navigational Safety Report analyzes anonymized, aggregated data from 139 vessels equipped with the Orca AI SeaPod digital watchkeeper over each vessel's first 12 months of AI-assisted watchkeeping. The analyzed cohort consists of vessels engaged in global trading, spanning a mix of vessel types, sizes, ages, and operating conditions across major shipping corridors, including Northern Europe, the Mediterranean, East and Southeast Asia, and key intercontinental routes.

For every ship, an initial adaptation phase (the first three full months after installation) is compared with a stabilized phase (months 10–12), with each vessel aligned to its own "Month 1". We analyzed performance data collected between 2023 and 2025, with each vessel's timeline anchored to its installation date.

The analysis focuses on three indicators: high-severity close encounters per vessel per month; high-risk avoidance maneuvers in open waters; and minimum passing distance during open-water encounters. High-severity events are defined using objective criteria, including CPA/TCPA thresholds, COLREGs scenarios, traffic density, and counterpart vessel type, capturing situations where collision risk is elevated and escalation potential is high.

More about methodology on page 16

Orca AI's platform has an immediate and sustained impact on navigational safety

139
mixed-type vessels

139
ship-years

10.8M
nautical miles

After analyzing the first year of usage of the Orca AI platform across the fleet, the data shows a clear and sustained reduction in high-risk navigational encounters.

Using anonymized, aggregated data aligned by months since deployment, the analysis shows that vessels operating with the Orca AI platform experience a rapid early improvement followed by continued gains over time.

In the early post-installation period (Months 1–3), vessels averaged approximately 2.7 high-severity close encounters per vessel per month. This rate declined to approximately 2.1 events per vessel per month during Months 4–6.

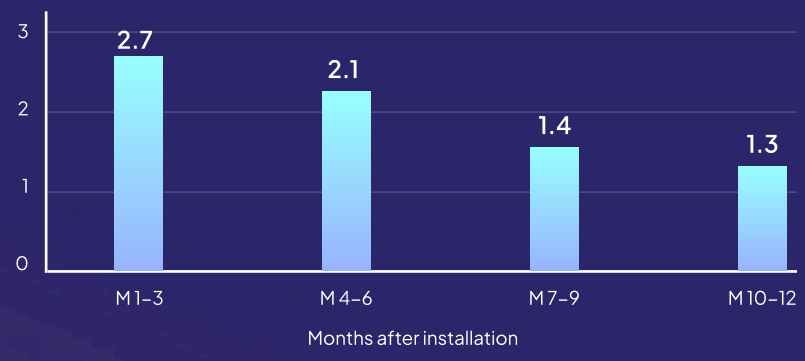
The reduction continued as platform tenure increased. By Months 7–9, the average rate fell further to approximately 1.4 events per vessel per month, and by Months 10–12, to approximately 1.3 events per vessel per month.

This represents a 52% reduction in high-severity close encounters compared to the early post-installation period.

Reduction in high-severity close encounters

↓ 22%
within **6 months**

↓ 52%
within **12 months**



SMS adherence improves in open waters

The analysis found a positive safety dynamic in open water areas, reflected in two key indicators - a reduction in high rate-of-turn (ROT) maneuvers and an increase in minimum passing distance. While open waters are often perceived as less demanding environments, they can in reality present elevated risks due to factors such as crew fatigue and reduced vigilance. This serves as a strong leading indicator of improved navigational discipline and adherence to Safety Management System (SMS) policies.

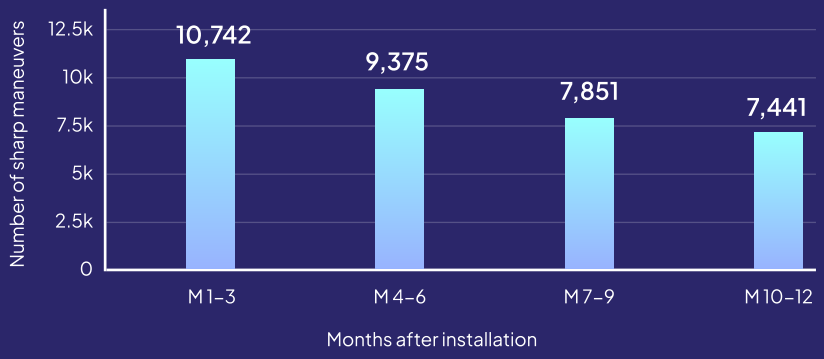
What high ROT reflects

High rate-of-turn (ROT) events in open waters indicate late or aggressive evasive maneuvers, where such reactions are less likely to be driven by external constraints and therefore reflect the crew's baseline navigational behavior.

Reduction in high rate-of-turn events in open waters

↓ 12.7% at approx. 6 months

↓ 31% at approx. 12 months

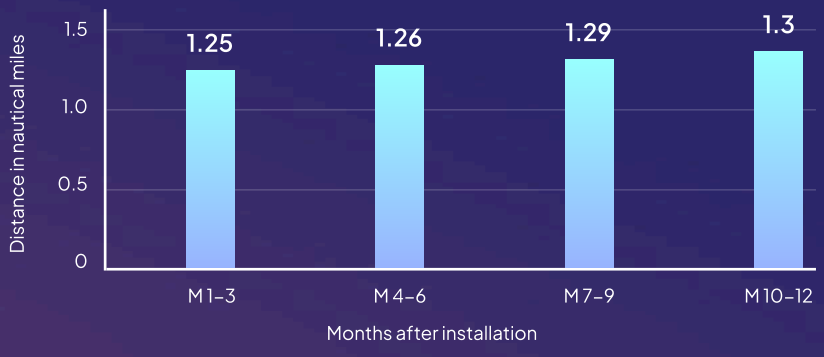


What passing distance indicates

Minimum passing distance in open waters indicates the proximity at closest point of approach (CPA), providing a clearer reflection of crew behavior and adherence to company passing-distance policies, free from the constraints of congested waterways

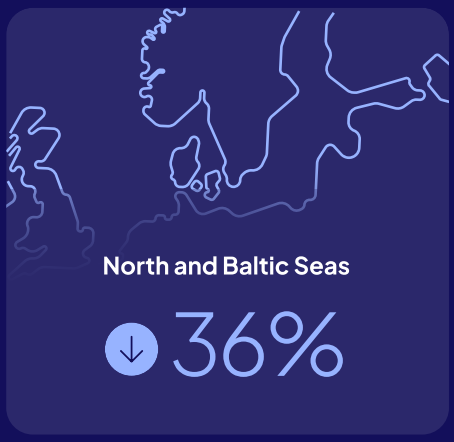
Increase in minimum passing distance in open waters

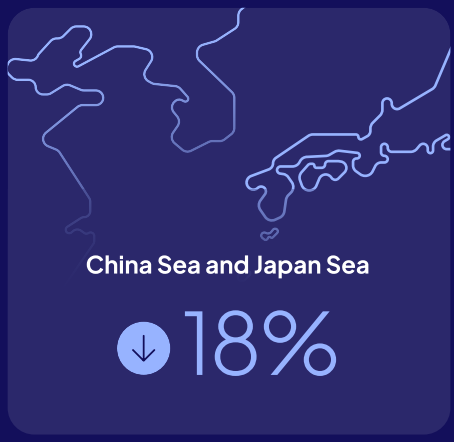
↑ 4% at approx. 12 months



Safety gains under congested operating conditions

Noticeable reductions in high-severity close encounter events are observed even in the most complex and congested shipping corridors.





Improved adherence to Safety Management System (SMS) practices in open waters translates into more consistent and proactive behavior in congested environments. As crews reinforce compliant habits in lower-complexity conditions, these behaviors carry into higher-density traffic, supporting more effective use of safety protocols and improved situational awareness.

This is reflected in reductions in close encounter events across congested regions such as the North and Baltic Seas and the China and Japan Seas.

Higher usage in congested areas

Increased adherence to SMS protocols in open waters is mirrored by higher usage of Orca AI among bridge teams in congested waterways.

This shift toward more proactive behavior is also reflected in platform usage. Engagement increases in areas of highest navigational complexity, where bridge teams manage dense traffic, multiple contacts, and limited decision time. In these conditions, AI decision support is actively relied upon to support safe and timely decision-making.

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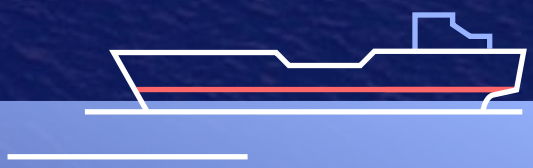
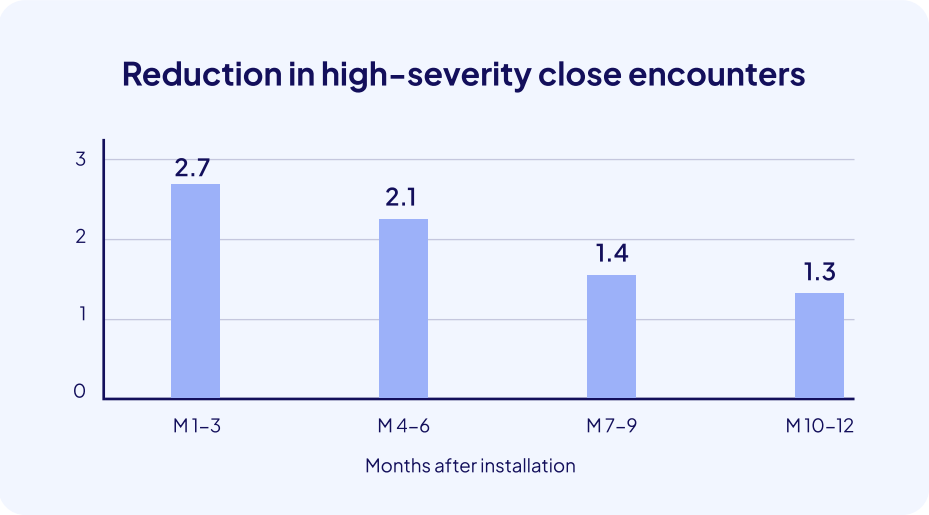
Orca AI's impact on navigational safety



Looking at the vessels' first year operating with AI-assisted watchkeeping, we observe clear and progressive reductions in high-risk navigation behaviors over time. Reductions are calculated using anonymized, aggregated vessel data and aligned by months since system deployment.

High-severity close encounters

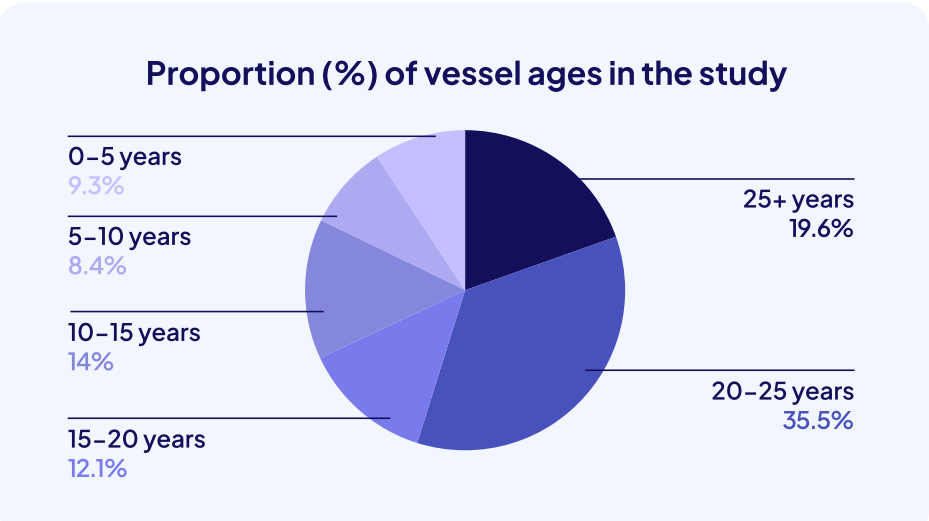
Vessels show a sustained reduction in high-severity close encounter events over time. High-severity encounters decrease by 22% within six months and by 52% within 12 months.



These benefits are consistent across all vessel ages

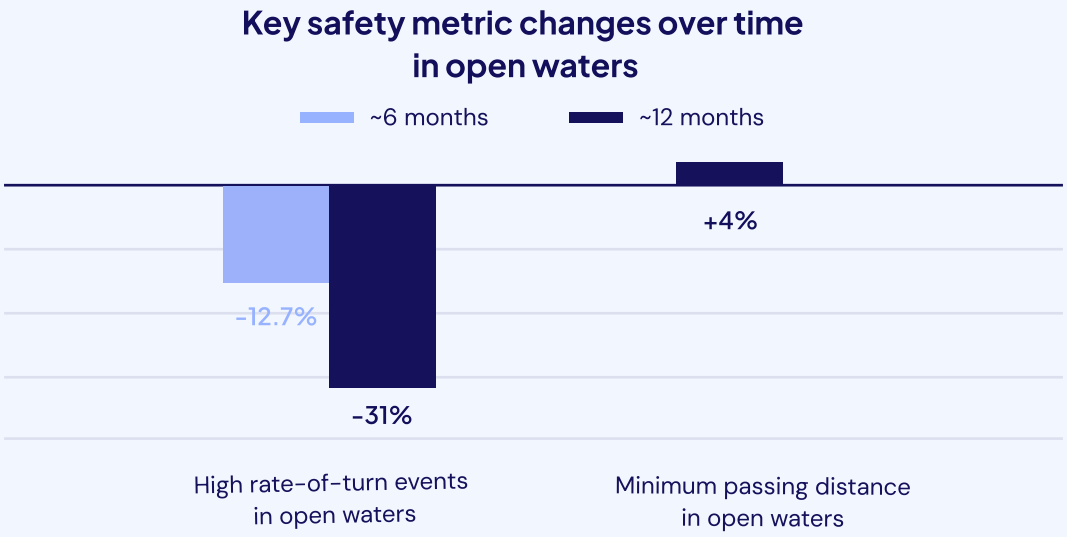
Reductions in high-severity close encounters were observed consistently across vessels of all ages, from newbuilds to ships over 35 years old.

Older vessels typically operate with legacy bridge equipment, which can influence navigational risk profiles across fleets. The reductions observed in this study were consistent across all vessel ages, indicating that the safety improvements measured in this study are not dependent on vessel age and can be achieved on older tonnage through AI-assisted watchkeeping.



Fleet-wide visibility into navigational behavior

Open water operations provide a clear view into whether routine navigational behavior across the fleet aligns with company expectations.



In open waters, high rates of abrupt course correction (rate-of-turn events) and minimum passing distances were initially not fully aligned with internal SMS expectations.

While these findings do not necessarily indicate immediate safety-critical events, they are more revealing in open water, where the absence of external constraints such as traffic separation schemes, shallow waters, fishing activity, or dense traffic makes them less reactive and more reflective of routine navigational decisions. This provides a clearer indication of adherence to passing-distance policies.

Through Orca AI's FleetView application for shore offices, this data is aggregated and benchmarked against company-defined SMS thresholds for passing distance and maneuvering behavior. Operators can then identify deviations, review events, and take corrective action through structured follow-up and targeted training based on real navigational scenarios.

As these actions are applied across fleets, both indicators improve over time:

- High rate-of-turn maneuvers declined, suggesting that encounters are being resolved with fewer late or aggressive course corrections.
- Minimum passing distance increased, indicating that vessels are maintaining greater separation during routine open water encounters.

Over time, this translates into measurable improvement in SMS compliance: last-minute deviations decrease and adherence to defined safety policy improves. By establishing discipline in unconstrained environments, fleets build the foundation for better decision-making in more complex conditions.

High engagement and meaningful safety improvement in congested corridors

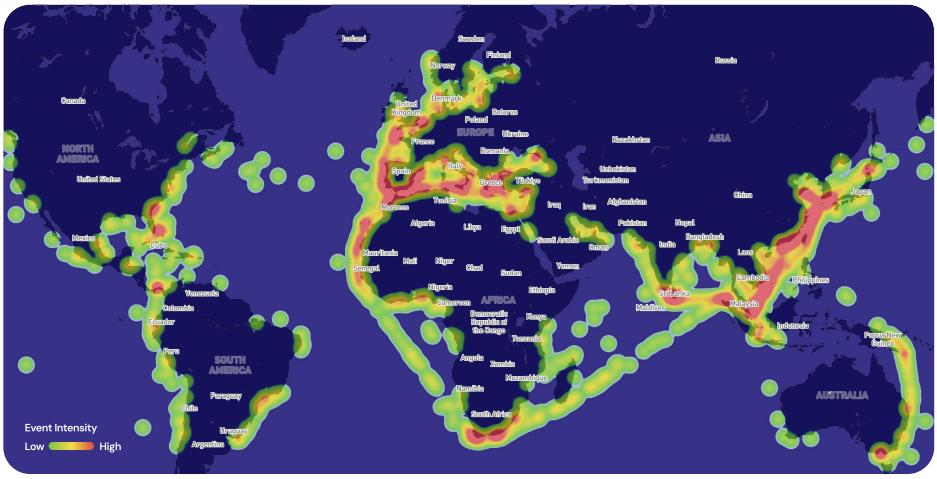
Improvements observed in open waters carry into congested environments, suggesting that stronger adherence to Safety Management System (SMS) practices also supports more consistent, proactive decision-making under higher workload and limited maneuvering space, resulting in measurable reductions even across the fleet's most heavily trafficked routes:

North and Baltic Seas

↓ 36%

China Sea and Japan Sea

↓ 18%



High-severity close encounter events cluster along major global shipping corridors, with the highest concentrations observed in Northern Europe, the Mediterranean, and East and Southeast Asia.

The user engagement map shows that interaction with Orca AI's digital watchkeeper, the SeaPod, is highest in these same corridors.

Increased adherence to SMS protocols is also reflected by user engagement data, which shows interaction with Orca AI's digital watchkeeper concentrated in the same high-density corridors, signaling that AI-assisted perception and risk prioritization are actively integrated into bridge decision-making, even when cognitive load is highest.

Taken together, the alignment between reduced high-severity encounters and increased system engagement suggests that AI-assisted watchkeeping is not only present but operationally relevant in high-complexity conditions, supporting earlier detection and more controlled responses to developing collision risk.

The technology driving these improvements

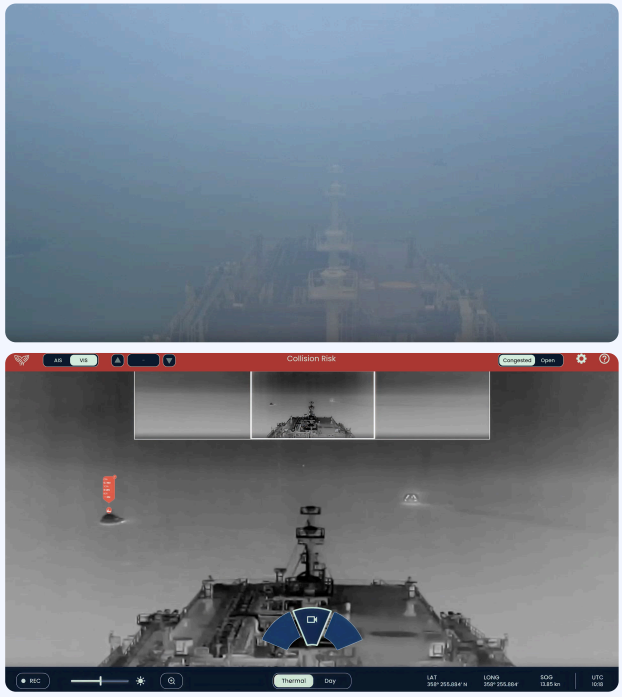
This study's results are underpinned by Orca AI's AI-powered operational platform, designed to enhance navigational safety and operational efficiency through data-driven decision-making. By leveraging AI and computer vision, the platform enables continuous situational awareness and early detection of navigational risk under real operating conditions.

A fully automated lookout on the bridge

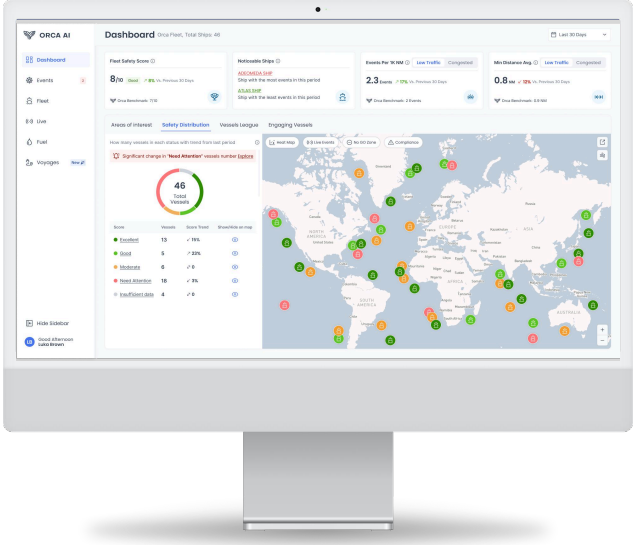
The SeaPod unit provides 24/7 continuous monitoring of vessel surroundings.

Using high-resolution day and thermal cameras with proprietary deep-learning algorithms, it delivers accurate, real-time perception across distances and visibility conditions.

Through automatic detection, alerts, and target prioritization, including non-AIS objects, SeaPod reduces bridge workload and helps prevent confusion and fatigue. This supports timely, safe, and effective decision-making, empowering crews to avoid costly mistakes during complex navigational situations.



Top image is a human-eye view from the bridge during fog, while the bottom image shows the view through Orca AI's thermal camera, revealing the collision risk.



Fleet-level visibility into navigational safety

FleetView provides fleet managers, owners, and masters with real-time visibility into navigational safety and operational performance across the fleet by connecting ships to shore.

This visibility enables proactive safety management by identifying trends and risk patterns, supporting Safety Management System (SMS) adherence under COLREGs situations, and reducing manual oversight. It supports more informed decisions, targeted interventions, and clearer engagement with insurers around risk reduction.

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Industry context

The safety improvements observed in this study must be viewed against a backdrop of rising operational and financial pressure across the maritime industry.

Congested waters and growing fleet

As of 2025, the world merchant fleet (≥100 GT) reached approximately 109,000 vessels, the highest level on record. Global capacity rose to ~2.4 billion DWT, reflecting sustained newbuild vessel deliveries and limited scrapping.

Operationally, fleet expansion results in denser traffic in major shipping corridors, more frequent vessel interactions, and increased navigational complexity, particularly near ports and in congested waters.

GNSS disruption and routing volatility

Geopolitical tensions, regional disruptions, and shifting trade patterns are concentrating traffic into fewer corridors.

At the same time, rising GNSS interference and signal unreliability introduce additional uncertainty, increasing reliance on visual awareness and real-time assessment.

AI-based situational awareness provides an independent reference layer, supporting anomaly detection and alerting in cases of GNSS disruption.

Aging fleet and technology gaps

A significant portion of the world fleet comprises older vessels 15 to 20 years-plus whose bridges may have legacy Radar, limited automation, and no AI-driven navigational tools. This can limit situational awareness compared to newer ships.

As already stated, the vessels in the study spanned a wide range of ages and bridge equipment levels. Despite this, the AI-assisted safety gains were uniform, proving that even legacy tonnage can be retrofitted with AI systems to dramatically improve safety outcomes.

Crew shortage and experience gap

Across 2024–2025, operators continued to report a persistent shortage of licensed officers. Smaller bridge teams, higher individual workload, and uneven experience levels collectively narrow the margin for error during navigation.

At the same time, newer officers are entering service in an environment characterized by higher traffic density and greater information complexity.

This experience gap increases the importance of decision-support systems that reinforce situational awareness and support consistent interpretation of developing risk.

Crew fatigue and human error

Crew fatigue and task overload reduce situational awareness and reaction time, particularly during long transit legs and night watches with lean staffing.

These conditions increase the likelihood of human error, which remains the dominant contributing factor in collision and near-miss events, often involving delayed recognition or misinterpretation of COLREGs situations.

AI-based situational awareness addresses this by providing continuous monitoring of the environment, highlighting relevant targets, and identifying collision risk earlier, enabling more timely and controlled decision-making.

Loss severity

The financial impact of navigational incidents continues to rise. Average newbuild container ship prices exceeded USD 90 million in 2024, increasing the capital at risk per vessel.

P&I data shows the average cost of a collision claim to the club exceeds USD 500,000, highlighting consistent financial exposure.

Rising asset values and claim exposure are increasing premium pressure, making the prevention of high-severity close encounters a growing priority.

Strategic recommendations for fleet safety managers

Embrace AI to enhance safety of navigation

The analysis shows that AI-assisted watchkeeping can reduce high-severity close encounters by more than half over a vessel's first year of operation. By continuously monitoring the vessel's surroundings and highlighting emerging collision risk in real time, Orca AI gives bridge teams more time and clarity to act. Earlier awareness enables smaller, controlled navigational adjustments and reduces reliance on late, aggressive maneuvers that carry the highest escalation risk.

Use real event playback to improve training

Reviewing real events allows crews to see how situations developed, what decisions were taken, and where earlier or different actions could have reduced risk. This grounds training in real operations, reinforces good practice, and directly links observed behavior to skill development on the bridge.

Use data to focus improvement where it matters most

Fleet-wide safety data makes risk visible before it turns into incidents. By tracking trends in close encounters, maneuvering behavior, and operating context, safety managers can identify where risk concentrates by route, vessel type, or operating environment. This allows targeted interventions that address real exposure, rather than relying on lagging indicators or isolated incidents.

Resolve disputes using computer vision-based evidence

Computer vision provides an objective, time-synced record of navigational events that can be replayed and reconstructed after an incident. Visual footage, combined with contextual data such as AIS and Radar, clarifies what occurred, reduces reliance on subjective accounts, and supports faster, more defensible dispute resolution.

Navigational safety is evolving from decision support to assisted autonomy

The next phase of maritime safety will be defined by earlier awareness, stronger human-machine collaboration, and more consistent risk control. Rather than reacting to incidents after they occur, fleets are increasingly focused on detecting and mitigating navigational risk before situations escalate.

AI-assisted watchkeeping sits at the center of this shift. By handling continuous monitoring and early risk detection, AI reduces cognitive load on bridge teams and creates more time for deliberate, controlled decision-making. This is not about replacing seamanship, rather augmenting it - allowing officers to focus on judgment, supervision, and accountability while technology manages vigilance-intensive tasks.

As connectivity improves, fleets will increasingly benefit from shared intelligence. Networked systems that surface insights on traffic conditions, environmental hazards, and navigational anomalies can extend situational awareness beyond the individual vessel, supporting earlier and more coordinated responses across operations.

Autonomous capabilities will continue to advance gradually, under human supervision and within evolving regulatory frameworks. In this environment, AI-enabled situational awareness provides a practical foundation: building trust, transparency, and operational discipline long before full autonomy becomes widespread.

As traffic density, operational complexity, and external pressures continue to rise, fleets that adopt proactive, AI-supported navigation will be better positioned to manage risk with consistency and confidence. Orca AI is built to support this transition, strengthening bridge teams today while laying the groundwork for safer, more resilient maritime operations tomorrow.

Analytical approach

This study evaluates how Orca AI's SeaPod influences the frequency and handling of high-severity close encounter events under real operating conditions.

Orca AI's trained models continuously detect, classify, and track surrounding vessels and objects, enabling earlier identification of collision risk. The analysis focuses on how this earlier awareness affects the occurrence and escalation of high-severity close encounter events during normal commercial operations.

Study design, dataset, and observation periods

The analysis was conducted using anonymized data from a global fleet comprising 139 vessels, representing 139 ship-years and over 10.8 million nautical miles across major trade routes.

Full-year operational data was analyzed for each vessel, aligned to post-installation timelines to isolate system tenure effects. Performance was evaluated across defined windows: early (months 1–3), intermediate (months 4–6 and 7–9), and mature (months 10–12), capturing early adaptation and steady-state operation.

Safety metrics

The primary metric is the rate of high-severity close encounters per vessel per month, defined using objective criteria: CPA, TCPA, applicable COLREG scenarios, local traffic density, and counterpart vessel behavior.

To contextualize these outcomes, two indicators were analyzed: high rate-of-turn (ROT) events, reflecting late or aggressive maneuvers, and minimum passing distance during high-severity encounters, indicating proximity at closest approach.

Operating environment segmentation

Events were segmented using Orca AI's dynamic congestion classification, defining low Traffic, congested, and hyper-congested states based on real-time nearby vessel counts. This reflects crew maneuvering optionality and the dynamic nature of maritime traffic driven by routing, port proximity, time of day, and operational disruptions.

Normalization and robustness

Incident data was normalized per vessel per month and aggregated across the fleet to reduce short-term variability. Trends were consistent across vessel ages and bridge configurations, indicating outcomes are not driven by vessel age or baseline equipment. Fleet-wide coverage, long operating duration, and large mileage exposure support operationally and statistically persuasive conclusions on directional safety outcomes.

About Orca AI

Orca AI brings pioneering AI technologies to the maritime industry to tackle some of the most demanding tasks of operations at sea. While serving in the navy, co-founders Yarden Gross (CEO) and Dor Raviv (CTO) experienced first-hand some of the most challenging aspects of ocean navigation. The two founded Orca AI in 2018, leveraging their business and technological expertise with far-reaching maritime industry knowledge.

Join us in safeguarding the world's oceans and maritime interests for generations to come.

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