
Certificate in Maritime Data Analytics

Maritime Data Visualization and Communication

AIS (Automatic Identification System)

Related terms: Vessel Tracking, SAR, VTS

A digital broadcast system that transmits a ship's identity, position, speed, and heading to nearby vessels and shore stations. Example: a cargo vessel in the Gulf of Mexico sends AIS data every 5 seconds. Practical applications include collision avoidance, traffic monitoring, and maritime domain awareness. Challenges involve signal loss in congested ports, spoofing attacks, and data overload in high-traffic corridors.

AR (Augmented Reality)

Related terms: VR, HMD, GIS

Technology that overlays digital information onto the real-world view of a maritime operator. Example: a bridge officer wearing a heads-up display sees real-time weather overlays on the horizon. Used for training, navigation assistance, and equipment maintenance. Challenges include hardware durability in harsh marine environments and ensuring data latency is below perceptual thresholds.

Bathymetric Chart

Related terms: S57, ENC, GIS

A map depicting underwater depth contours and seabed features. Example: a digital bathymetric chart of the North Sea shows depth variations from 20 m to 200 m. Supports route planning, dredging, and habitat mapping. Challenges are keeping the chart up-to-date, integrating multi-sensor data, and handling varying datum references.

Berth Allocation Dashboard

Related terms: Port Management, KPI, KPI Dashboard

Interactive visual tool that displays real-time berth occupancy, vessel ETA, and turnaround times. Example: a dashboard shows that Berth 3 is free for the next 2 hours while Berth 7 is delayed due to a mechanical fault. Enables port operators to optimize resource use and reduce vessel waiting time. Challenges include data integration from disparate terminal systems and ensuring user-friendly design for non-technical staff.

Carbon Emission Heatmap

Related terms: IMO 2020, ESG, GIS

Spatial visualization that represents CO₂ emissions intensity across shipping routes. Example: a heatmap highlights high emissions along the Asia-Europe corridor during winter months. Helps regulators assess compliance with emission reduction targets and guides operators in route optimization. Challenges involve obtaining accurate fuel consumption data and accounting for weather-induced variability.

Charted Depth Overlay

Related terms: Bathymetry, GIS, ENC

Layer that adds depth information to a base nautical chart within a GIS platform. Example: overlaying a 10-meter depth contour on a coastal chart to identify safe anchorage zones. Used for route planning and

risk assessment. Challenges include aligning different coordinate systems and managing large raster datasets.

Cluster Analysis

Related terms: K-means, DBSCAN, Anomaly Detection

Statistical technique that groups vessels with similar movement patterns or characteristics. Example: clustering AIS trajectories reveals a group of fishing vessels operating in a specific zone. Supports surveillance, fleet management, and market analysis. Challenges include selecting appropriate distance metrics and handling noisy AIS data.

Coast Guard Situation Room

Related terms: Command Center, C4ISR, NOC

Centralized facility where maritime authorities monitor live feeds, AIS data, and sensor alerts. Example: operators use multi-screen displays to track a search-and-rescue operation after a vessel capsizes. Provides coordinated decision-making. Challenges involve integrating legacy systems, ensuring data security, and preventing information overload.

COMBINE (Composite Oceanographic Model for Integrated Navigation and Exploration)

Related terms: Ocean Modeling, Forecast, Data Assimilation

A unified framework that merges satellite, buoy, and model data to provide high-resolution ocean state forecasts. Example: a ship's navigation system accesses COMBINE outputs to anticipate wave heights along a trans-Atlantic crossing. Enhances safety and fuel efficiency. Challenges include computational intensity and reconciling disparate data formats.

Compass Rose

Related terms: Navigation Symbol, Cardinal Directions, Chart Annotation

Graphic element on nautical charts indicating true and magnetic north. Example: a compass rose on a ENC shows a magnetic variation of +2° east. Aids mariners in interpreting bearings. Challenges are minimal but require accurate updating when magnetic declination changes.

Container Flow Map

Related terms: Supply Chain, Port Throughput, Sankey Diagram

Visual representation of container movements from origin ports to destination terminals. Example: a flow map depicts 1 million TEUs moving from Shanghai to Los Angeles annually. Assists logistics planners in identifying bottlenecks. Challenges include aggregating data from multiple carriers and visual clutter in high-volume routes.

Cross-Track Error (XTE) Chart

Related terms: GPS, Navigation Accuracy, Deviation

Graph that plots the lateral distance between a vessel's actual track and the intended route. Example: an XTE chart shows a vessel deviating 0.5 nm to starboard due to strong currents. Used for performance monitoring and autopilot tuning. Challenges involve distinguishing between intentional course changes and navigational errors.

Dashboard (Maritime)

Related terms: KPI, Data Visualization, Executive Summary

A single-screen interface that aggregates key performance indicators such as fuel consumption, ETA accuracy, and cargo turnover. Example: a fleet manager views a dashboard summarizing daily fuel usage across all vessels. Facilitates rapid decision-making. Challenges include selecting relevant metrics and avoiding information overload.

Data Fusion

Related terms: Sensor Integration, Kalman Filter, Multi-Source Data

Process of combining data from AIS, radar, satellite imagery, and environmental sensors to create a unified situational picture. Example: fusing AIS with SAR imagery improves detection of vessels in AIS-dark zones. Enhances accuracy of maritime surveillance. Challenges are handling differing temporal resolutions and resolving conflicting data.

Data Lake

Related terms: Big Data, Hadoop, Storage Architecture

Central repository that stores raw maritime data in its native format for later processing. Example: a port authority maintains a data lake containing historic AIS records, weather forecasts, and cargo manifests. Enables flexible analytics and machine-learning model training. Challenges involve governance, security, and ensuring data discoverability.

Data Mining

Related terms: Pattern Recognition, Predictive Analytics, Clustering

Exploratory analysis technique to uncover hidden patterns in large maritime datasets. Example: mining AIS data reveals seasonal spikes in illegal fishing activities near protected areas. Supports enforcement and policy development. Challenges include data quality, bias, and computational cost.

Dead Reckoning (DR) Plot

Related terms: Navigation, Position Fix, Inertial Navigation

Graphical representation of a vessel's estimated position based on last known fix, speed, and heading. Example: a DR plot shows a vessel's projected path during GPS outage. Useful for short-term navigation when satellite signals are unavailable. Challenges include cumulative error growth and reliance on accurate speed measurements.

Digital Twin

Related terms: Simulation, IoT, Predictive Maintenance

Virtual replica of a ship or port facility that mirrors real-time operational data. Example: a digital twin of a container terminal simulates crane operations to predict bottlenecks. Enables scenario testing and performance optimization. Challenges are high data bandwidth requirements and model fidelity.

Distress Signal Visualizer

Related terms: MMSI, EPIRB, SAR

Tool that maps received emergency signals (e.g., EPIRB) onto a nautical chart with contextual layers such as sea state and nearby assets. Example: a visualizer displays a distress call at 55°N, 12°E with a 10-km radius

circle. Aids rapid response coordination. Challenges include false alarms and limited coverage in remote regions.

Dockside Emissions Dashboard

Related terms: IMO 2020, Air Quality, Port Authority

Interactive display showing real-time emissions from vessels while at berth, often derived from fuel flow meters and stack sensors. Example: the dashboard indicates that a tanker exceeds the 0.5 g/kWh NO_x limit while docked. Supports compliance monitoring. Challenges involve sensor calibration and integrating data from diverse shipboard systems.

Dynamic Positioning (DP) Map

Related terms: DP System, Thrusters, GPS

Geospatial display of a vessel's DP status, including reference point, thruster vectors, and environmental forces. Example: a DP map shows a offshore supply vessel maintaining position within a 5-meter radius despite 15-knot winds. Critical for offshore operations. Challenges include visual clutter and real-time data latency.

E-Navigation

Related terms: IMO, GNSS, VTS

Framework that integrates electronic information, communication, and navigation services to enhance maritime safety. Example: an e-navigation portal provides electronic charts, AIS data, and weather forecasts to ships via a unified interface. Drives modernization of maritime services. Challenges include standardization across jurisdictions and cybersecurity.

Electronic Chart Display and Information System (ECDIS)

Related terms: ENC, AIS, MARPOL

Digital navigation system that uses electronic nautical charts to provide real-time positioning, route planning, and alerts. Example: a vessel's ECDIS warns of shallow water ahead based on the ENC depth layer. Replaces paper charts under many flag state regulations. Challenges involve user training, chart updates, and ensuring system redundancy.

Environmental Impact Map

Related terms: GIS, ESG, Pollution Hotspot

Spatial visualization that highlights areas of ecological sensitivity, such as coral reefs or marine protected areas, overlaid with shipping traffic density. Example: the map shows high vessel traffic intersecting a marine sanctuary, prompting routing adjustments. Supports sustainable shipping initiatives. Challenges include acquiring high-resolution ecological data and balancing economic considerations.

Euro-Nav (European Navigation Standards)

Related terms: IMO, ECDIS, IHO

Set of guidelines harmonizing navigation chart symbols, data formats, and display conventions across Europe. Example: Euro-Nav mandates the use of standardized buoy symbols in all ENCs. Facilitates cross-border maritime operations. Challenges are aligning legacy national charting practices with the new standards.

Fault Tree Analysis (FTA)

Related terms: Reliability Engineering, Root Cause, Risk Assessment

Diagrammatic method for identifying potential causes of system failures. Example: an FTA for a vessel's fuel monitoring system pinpoints sensor drift as a primary fault. Used to improve system robustness. Challenges include comprehensive identification of all failure modes and maintaining the analysis as systems evolve.

Ferry Route Heatmap

Related terms: Passenger Flow, GIS, Service Frequency

Visualization that depicts intensity of ferry services across a coastal region. Example: a heatmap shows peak usage between two islands during summer weekends. Helps operators allocate vessels efficiently.

Challenges include integrating ticketing data and representing seasonal variability.

Geofencing

Related terms: Virtual Boundary, AIS, Compliance

Digital perimeter that triggers alerts when a vessel enters or exits a predefined area. Example: a geofence around a marine reserve generates a notification when an unauthorized ship crosses the boundary.

Supports regulatory enforcement and environmental protection. Challenges involve GPS accuracy, especially in congested ports, and avoiding false positives.

Geospatial Information System (GIS)

Related terms: Spatial Analysis, Map Layer, Cartography

Software platform for storing, analyzing, and visualizing geographic data. Example: a GIS combines AIS tracks, bathymetry, and weather layers to produce a risk matrix for a shipping lane. Enables multi-dimensional maritime analysis. Challenges include data interoperability and the steep learning curve for non-GIS specialists.

Heatmap (Maritime)

Related terms: Density Plot, Kernel Estimation, Traffic Intensity

Color-coded map that shows concentration of vessel positions or events. Example: a heatmap reveals dense traffic near the Strait of Hormuz during daylight hours. Useful for identifying congestion zones and potential collision hotspots. Challenges include selecting appropriate kernel bandwidth and updating in near-real time.

Hybrid Navigation System

Related terms: GNSS, Inertial, AIS

Combination of satellite positioning, inertial sensors, and AIS data to provide continuous navigation coverage. Example: a hybrid system switches to inertial mode when GNSS signals are blocked in a fjord. Increases reliability for critical operations. Challenges involve seamless handover and sensor calibration.

Hull Performance Dashboard

Related terms: Fuel Consumption, Trim, Resistance

Interactive interface that displays real-time hull efficiency metrics such as speed-loss, draft variation, and propeller slip. Example: the dashboard highlights a 2% increase in resistance after cargo loading, prompting ballast adjustment. Supports fuel optimization. Challenges include accurate sensor integration and

presenting data without overwhelming the crew.

Hydrographic Survey Visualization

Related terms: Multibeam, Bathymetry, Point Cloud

3-D rendering of seabed data collected by sonar or LiDAR. Example: a visualization shows a detailed model of a harbor entrance, revealing submerged wrecks. Assists in dredging planning and navigational safety assessments. Challenges involve processing large point clouds and aligning multiple survey passes.

Incident Reporting Dashboard

Related terms: CAS, SAR, KPI

Tool that aggregates reported maritime incidents, categorizes them by severity, and displays trends over time. Example: the dashboard shows a rise in near-miss collisions during a particular quarter. Enables targeted safety interventions. Challenges include ensuring consistent reporting standards and preventing data entry fatigue.

Integrated Bridge System (IBS)

Related terms: ECDIS, Radar, Autopilot

Networked suite of navigation and control equipment that shares data across bridge consoles. Example: radar targets are automatically plotted on the ECDIS, and autopilot receives heading commands from the bridge. Improves situational awareness and reduces manual workload. Challenges involve system redundancy, cyber-security, and crew training.

IoT Sensor Network

Related terms: Edge Computing, MQTT, Telemetry

Distributed collection of smart sensors on vessels or port infrastructure that transmit real-time measurements (e.g., temperature, vibration). Example: an IoT network monitors hull stress on a container ship, sending alerts when thresholds are exceeded. Enables predictive maintenance. Challenges include bandwidth constraints, power management, and secure data transmission.

J-Curve (Fuel Consumption)

Related terms: Speed-Fuel Curve, Engine Performance, Optimization

Graphical representation showing fuel consumption decreasing with speed reduction up to an optimal point, then increasing again due to increased resistance. Example: the J-curve indicates the most economical speed for a bulk carrier at 12 knots. Guides speed-optimization strategies. Challenges are accounting for weather, cargo weight, and engine condition.

Kalman Filter

Related terms: State Estimation, Sensor Fusion, Navigation

Recursive algorithm that estimates the true state of a dynamic system by weighting multiple sensor inputs. Example: a Kalman filter fuses GPS, gyro, and AIS data to produce a smoother vessel track. Enhances accuracy of position and velocity estimates. Challenges include proper tuning of noise covariances and handling non-linear dynamics.

KPI (Key Performance Indicator)

Related terms: Dashboard, Metrics, Benchmarking

Quantifiable measure used to evaluate the success of an operation. Example: "On-time Arrival Percentage" is a KPI for a liner service. Provides focus for performance improvement. Challenges lie in selecting indicators that truly reflect operational goals and avoiding metric overload.

Laguerre Diagram

Related terms: Voronoi, Spatial Partitioning, Allocation

Weighted Voronoi diagram used to allocate service areas based on vessel capabilities. Example: a Laguerre diagram assigns rescue zones to coast-guard vessels based on speed and range. Facilitates efficient resource distribution. Challenges include dynamic updating as vessel positions change.

Layered Map Architecture

Related terms: Tile Server, GIS, WMS

Design principle that separates map content into independent layers (e.g., base map, traffic, weather). Example: a web portal allows users to toggle the AIS traffic layer on top of a satellite imagery base. Improves usability and performance. Challenges involve synchronizing layer updates and maintaining consistent projection.

Legislation Compliance Dashboard

Related terms: IMO, MARPOL, ESG Reporting

Visualization that tracks a vessel's adherence to regulatory requirements such as emission caps, ballast water treatment, and crew certifications. Example: the dashboard flags a ship that has not submitted its latest ballast water management plan. Supports audit readiness. Challenges include aggregating data from multiple compliance systems and ensuring data integrity.

Line-of-Sight (LOS) Analysis

Related terms: Radar Coverage, VTS, Obstruction

Assessment of visual or radar visibility between two points, considering terrain and obstacles. Example: LOS analysis shows that a coastal radar station cannot detect vessels behind a headland, prompting installation of an additional antenna. Helps design surveillance networks. Challenges involve complex terrain modeling and dynamic sea states.

Logistics Network Visualization

Related terms: Sankey Diagram, Supply Chain, Port Connectivity

Graphic representation of cargo flows between origin, intermediate, and destination nodes. Example: a Sankey diagram illustrates TEU movement from Asian ports through transshipment hubs to European destinations. Aids strategic planning. Challenges include data standardization across carriers and preventing visual overload.

Marine Traffic Density Map

Related terms: Heatmap, AIS, Congestion

Map that displays the number of vessel passages per unit area over a defined period. Example: a density map of the English Channel shows peak traffic during morning hours. Used for capacity planning and risk assessment. Challenges involve handling seasonal variations and ensuring timely updates.

Marine Weather Overlay

Related terms: GRIB, Forecast, GIS

Layer that adds meteorological information such as wind speed, wave height, and visibility to navigation charts. Example: a ship's navigation system overlays a 12-hour wind forecast onto its route. Improves decision-making for route optimization. Challenges include data latency, resolution mismatches, and integrating multiple forecast models.

Marine Spatial Planning (MSP) Map

Related terms: GIS, Zoning, Ecosystem Services

Tool that visualizes designated uses of marine space, such as fishing zones, renewable energy sites, and shipping lanes. Example: an MSP map shows a conflict between a proposed wind farm and an established fishing area. Supports stakeholder negotiations. Challenges include reconciling competing interests and updating the map as activities evolve.

Maritime Domain Awareness (MDA) Portal

Related terms: C4ISR, AIS, SAR

Web-based platform that aggregates data sources (AIS, radar, satellite imagery) to provide a comprehensive view of maritime activity. Example: a national MDA portal shows real-time vessel tracks, alerts for illegal fishing, and weather warnings. Enables coordinated response. Challenges involve data sharing agreements, cybersecurity, and maintaining data quality.

Maritime Incident Heatmap

Related terms: Safety, GIS, Risk Zones

Spatial depiction of historical incident locations, color-coded by frequency or severity. Example: a heatmap reveals a cluster of grounding events near a reef, prompting navigational chart updates. Supports proactive safety measures. Challenges include ensuring accurate geo-referencing of incident reports and avoiding bias from under-reporting.

Maritime Safety Information (MSI) Broadcast

Related terms: VHF, NAVTEX, NBDN

Transmission of safety-related messages (e.g., navigational warnings, weather alerts) to vessels via radio or satellite. Example: a NAVTEX broadcast informs mariners of a newly discovered shoal. Essential for situational awareness. Challenges include ensuring message receipt in congested radio environments and maintaining up-to-date content.

Medium-Resolution Satellite Imagery

Related terms: Sentinel-2, Landsat, SAR

Earth observation data with spatial resolution between 10 m and 30 m per pixel. Example: Sentinel-2 imagery captures vessel wakes in coastal waters, aiding in vessel detection where AIS is disabled. Complements higher-resolution SAR for maritime monitoring. Challenges are cloud cover for optical sensors and processing large image volumes.

Metadata Catalog

Related terms: Data Governance, ISO 19115, Data Discovery

Repository that stores descriptive information about maritime datasets (origin, time span, format). Example: a metadata catalog lists an AIS dataset with fields for MMSI, timestamp, and position. Facilitates data reuse and compliance. Challenges include maintaining consistency and encouraging contributors to provide rich metadata.

Minimum Safe Distance (MSD) Visualizer

Related terms: Collision Avoidance, CPA, RTA

Tool that displays the calculated minimum separation required between two vessels based on speed, size, and maneuverability. Example: the visualizer shows a 0.5-nm MSD between a tanker and a fishing boat, prompting course alteration. Supports adherence to COLREGs. Challenges involve real-time computation and integrating with existing bridge displays.

Mixed-Reality Bridge Simulator

Related terms: VR, AR, Training

Immersive environment that replicates bridge operations using both virtual and physical controls. Example: trainees practice emergency steering while seeing a holographic sea state projected onto the simulator. Enhances learning retention. Challenges are hardware durability, realistic motion cues, and synchronizing data streams.

Multibeam Sonar Mosaic

Related terms: Bathymetry, Point Cloud, GIS

Composite image created from overlapping multibeam swaths, providing seamless seabed coverage.

Example: a mosaic of a harbor entrance reveals subtle depth variations that inform dredging plans. Offers high-resolution terrain modeling. Challenges include data stitching, tide correction, and managing large file sizes.

Networked Vessel Tracking System

Related terms: AIS, Satellite, VTS

System that aggregates vessel positions from terrestrial AIS, satellite AIS, and radar into a unified interface. Example: a coastal authority monitors both near-shore and offshore traffic through a single dashboard. Improves coverage and reduces blind spots. Challenges are data latency, reconciling duplicate reports, and ensuring bandwidth for satellite links.

Noise Filtering (AIS)

Related terms: Outlier Removal, Data Cleaning, Signal Processing

Process of removing erroneous or spurious AIS messages caused by interference or equipment malfunction. Example: a filter discards position reports that jump 50nm within 30 seconds, which are physically impossible. Improves data reliability for analytics. Challenges include distinguishing genuine rapid movements (e.g., high-speed craft) from noise.

Oil Spill Trajectory Model

Related terms: Numerical Modeling, GIS, Forecast

Simulation that predicts the spread of oil on the sea surface based on currents, wind, and oil properties. Example: a model forecasts that a spill from a tanker will reach a coastline within 48 hours, prompting

evacuation measures. Critical for environmental response. Challenges involve uncertainty in weather forecasts and oil degradation rates.

On-Board Data Recorder (OBDR)

Related terms: Black Box, Voyage Data Recorder, NMEA

Device that continuously logs navigation and engine data for post-incident analysis. Example: an OBDR captures AIS, GPS, and engine RPM during a grounding event, aiding investigators. Supports safety investigations and regulatory compliance. Challenges include storage capacity, data encryption, and ensuring tamper-proof operation.

Operational Area Heatmap

Related terms: Logistics, Fleet Management, GIS

Visualization that shows the geographic distribution of a fleet's active zones over a specified period. Example: a heatmap reveals that a fishing fleet concentrates in the Atlantic during spring. Helps allocate support services and plan maintenance. Challenges include handling varying reporting intervals and normalizing activity levels.

Overlay Analysis

Related terms: Spatial Join, GIS, Buffer

Technique that combines multiple map layers to identify intersecting features. Example: overlaying a piracy risk layer with AIS traffic highlights high-risk passages. Enables targeted risk mitigation. Challenges include ensuring compatible coordinate systems and managing computational load for large datasets.

Port Call Timeline

Related terms: ETA, Turnaround Time, KPI

Chronological representation of events from a vessel's arrival to departure, including berthing, loading, and inspections. Example: a timeline shows a 12-hour turnaround for a bulk carrier, with a 2-hour delay caused by customs clearance. Facilitates performance tracking. Challenges involve synchronizing data from multiple terminal systems and handling exceptions.

Port Congestion Heatmap

Related terms: Vessel Density, Queue Theory, KPI

Map that visualizes areas where vessels experience queuing or delayed berthing. Example: a heatmap of the Port of Rotterdam highlights a congestion hotspot near berth 12 during peak season. Supports capacity planning and berth allocation. Challenges include real-time data collection and distinguishing between temporary and systemic congestion.

Port Performance Dashboard

Related terms: KPI, Throughput, Vessel Turnaround

Aggregated view of key metrics such as TEU throughput, crane productivity, and berth occupancy. Example: the dashboard shows a 5% increase in crane moves per hour after implementing a new scheduling algorithm. Enables strategic decision-making. Challenges involve data integration from disparate terminal operating systems and maintaining data freshness.

Predictive Maintenance Model

Related terms: Machine Learning, IoT, Failure Forecast

Algorithm that forecasts equipment failure based on sensor data trends. Example: a model predicts that a ship's main engine bearing will exceed its vibration threshold in 120 hours, prompting pre-emptive replacement. Reduces unplanned downtime. Challenges include obtaining sufficient labeled failure data and avoiding over-fitting.

Probabilistic Risk Assessment (PRA)

Related terms: Monte Carlo, Hazard Analysis, Safety

Quantitative method that estimates the likelihood and consequences of adverse maritime events. Example: a PRA calculates a 0.02 % probability of a catastrophic oil spill for a given route. Informs risk-based decision-making. Challenges are accurate input data and computational intensity for large scenario sets.

Proximity Alert System

Related terms: CPA, RTA, Collision Avoidance

Automated system that generates warnings when vessels approach within a defined distance. Example: the system triggers a visual and audible alarm when a nearby vessel breaches the 0.3-nm threshold. Enhances compliance with COLREGs. Challenges include false alarms due to AIS errors and integrating alerts into existing bridge displays.

Radar Range Rings

Related terms: Navigation Aid, Scale, Chart Overlay

Concentric circles displayed on a radar screen indicating distances from the radar antenna. Example: a 5-nm ring helps a pilot assess the vessel's proximity to a harbor entrance. Assists in situational awareness. Challenges are limited utility in high-latitude regions where radar range may be reduced by atmospheric conditions.

Real-Time Vessel Performance Dashboard

Related terms: KPI, Fuel Flow, Trim

Live interface showing metrics such as speed-through-water, fuel consumption per hour, and hull trim. Example: the dashboard alerts the chief engineer when fuel consumption exceeds the baseline by 10 %. Enables immediate corrective action. Challenges include ensuring data latency below 5 seconds and managing alarm fatigue.

Redundancy Mapping

Related terms: System Architecture, Fault Tolerance, Backup

Visualization of backup pathways for critical maritime communication and navigation systems. Example: a map shows that a vessel's primary VHF antenna is backed up by a satellite link and an auxiliary antenna. Supports resilience planning. Challenges involve keeping the map current as equipment is upgraded or replaced.

Regatta Course Planner

Related terms: Race Management, GIS, Waypoint

Tool that designs sailing race routes considering wind forecasts, currents, and safety zones. Example: the

planner generates a 12-hour course that maximizes downwind legs while avoiding restricted areas. Used by race committees. Challenges include integrating rapidly changing weather data and ensuring fairness among competitors.

Remote Sensing Classification

Related terms: Land-Sea Mask, Supervised Learning, SAR

Process of assigning land, water, and other feature labels to satellite imagery pixels. Example: a supervised classifier distinguishes oil slicks from sea surface in SAR images. Supports environmental monitoring. Challenges include limited ground truth data and varying sensor characteristics.

Risk Matrix

Related terms: Probability, Impact, Safety Assessment

Two-dimensional chart that plots likelihood against severity to prioritize hazards. Example: a risk matrix places "collision with a small craft" in the medium-risk quadrant, prompting mitigation measures. Provides a clear visual prioritization tool. Challenges involve subjectivity in assigning scores and ensuring consistent use across teams.

Route Optimization Engine

Related terms: Shortest Path, Fuel Efficiency, Weather Routing

Software component that calculates the most economical or safest path between ports, factoring in currents, winds, and fuel costs. Example: the engine suggests a slower but fuel-saving route around a cyclone. Widely used by shipping companies. Challenges include real-time data integration and balancing speed versus cost objectives.

Safety Management System (SMS) Dashboard

Related terms: ISO 45001, Incident Reporting, KPI

Central view of safety metrics such as near-miss frequency, training compliance, and audit findings. Example: the SMS dashboard shows a decreasing trend in crew injury reports after implementing a new safety protocol. Encourages continuous improvement. Challenges involve data consistency across vessels and avoiding under-reporting.

Satellite AIS (S-AIS)

Related terms: Space-Based AIS, Coverage, Data Latency

AIS messages captured by orbiting satellites, extending coverage beyond shore-based receivers. Example: S-AIS tracks a fishing vessel in the open Pacific where no terrestrial AIS stations exist. Enhances global maritime surveillance. Challenges include limited bandwidth leading to lower update rates and occasional message collisions.

Scenario-Based Training Simulator

Related terms: VR, Decision Support, Emergency Response

Interactive platform that recreates specific maritime incidents for crew training. Example: a simulator presents a fire on board a tanker, requiring crew to execute emergency shutdown procedures. Improves preparedness. Challenges are realistic scenario modeling and ensuring transfer of skills to real-world situations.

Seabed Habitat Mapping

Related terms: Multibeam, GIS, Conservation

Process of classifying seabed types (sand, rock, coral) using acoustic data and visualizing the results.

Example: a habitat map identifies a coral reef area that must be avoided by anchoring vessels. Supports marine protected area designation. Challenges include high survey costs and interpreting complex acoustic returns.

Ship-to-Shore (S2S) Data Exchange

Related terms: IoT, MQTT, Edge Computing

Bidirectional communication channel that transmits vessel sensor data to on-shore systems and receives operational commands. Example: a vessel streams engine temperature data to a shore-based analytics platform, which then sends a throttle adjustment command. Enables remote monitoring and control.

Challenges involve bandwidth limitations, latency, and cybersecurity.

Shipborne Weather Radar

Related terms: METAR, Radar Imaging, Forecast

On-board radar system that detects precipitation and wind patterns ahead of the vessel. Example: the radar shows a band of heavy rain moving across the ship's projected course, prompting a route alteration.

Improves situational awareness in adverse weather. Challenges include interpreting radar signatures and integrating with other meteorological data.

Shiplog Visualization

Related terms: Voyage Data Recorder, Narrative Analytics, Timeline

Graphical representation of textual log entries, often linked to timestamps and sensor data. Example: a shiplog visualization highlights periods of engine alarm correlated with GPS speed drops. Facilitates quick review of operational events. Challenges include natural language processing of free-form entries and aligning logs with sensor timestamps.

Signal-to-Noise Ratio (SNR) Map

Related terms: Radar Performance, Coverage, Interference

Spatial depiction of the quality of received signals across a coverage area. Example: an SNR map shows reduced radar performance near a coastal industrial zone due to electromagnetic interference. Guides antenna placement and frequency selection. Challenges involve dynamic environmental conditions and measurement accuracy.

Single-Cell Maritime Dashboard

Related terms: Micro-Visualization, KPI, Mobile

Compact visual element that displays one key metric (e.g., fuel consumption) in a concise format suitable for mobile devices. Example: a single-cell dashboard on a tablet shows real-time fuel flow for a vessel's engine room. Enables quick glance checks. Challenges are limited screen real estate and ensuring data relevance.

Smart Port IoT Hub

Related terms: Edge Gateway, Data Aggregation, 5G

Centralized node that collects and preprocesses sensor data from port infrastructure (e.g., gate sensors,

cranes). Example: the hub aggregates crane load data and streams it to a cloud analytics platform for efficiency monitoring. Drives automation in port operations. Challenges include interoperability with legacy equipment and network security.

Sonar Backscatter Classification

Related terms: Seabed Type, Acoustic Imaging, GIS

Technique that uses the intensity of returned sonar signals to infer seabed composition. Example: backscatter analysis differentiates between soft mud and hard rock in a harbor approach. Supports dredging decisions. Challenges involve calibration of sonar settings and interpreting mixed-substrate returns.

Spatial Autocorrelation (Moran's I)

Related terms: Geostatistics, Hotspot Analysis, GIS

Statistical measure that evaluates the degree to which similar values cluster spatially. Example: a high Moran's I for piracy incidents indicates that attacks are not randomly distributed but clustered. Guides targeted enforcement. Challenges include selecting appropriate spatial weights and handling edge effects.

Speed-Loss Chart

Related terms: Fuel Efficiency, Hull Performance, Drag

Graph that plots vessel speed against fuel consumption, highlighting the impact of added resistance (e.g., due to fouling). Example: the chart shows a 5 % speed loss after hull cleaning, improving fuel efficiency. Used for performance monitoring. Challenges involve isolating variables such as weather and cargo weight.

Stakeholder Engagement Map

Related terms: ESG, Community Impact, GIS

Visualization that identifies and locates stakeholders (e.g., fishing communities, NGOs) relative to maritime activities. Example: a map shows the proximity of a proposed offshore wind farm to local fisheries, informing consultation processes. Supports transparent decision-making. Challenges include gathering accurate stakeholder location data and representing diverse interests.

Standard Shipping Route (SSR) Visualizer

Related terms: Lane, AIS, Traffic Separation Scheme

Tool that overlays predefined shipping lanes onto live vessel traffic displays. Example: the visualizer highlights the North Atlantic SSR, helping vessels maintain compliance with traffic separation schemes. Enhances navigational safety. Challenges involve updating lane definitions as international regulations evolve.

Statistical Process Control (SPC) Chart

Related terms: Quality Control, Control Limits, Process Variation

Control chart used to monitor a maritime process (e.g., fuel loading) for stability over time. Example: an SPC chart shows fuel loading times staying within $\pm 5\%$ of the target, indicating a stable process. Enables early detection of deviations. Challenges include selecting appropriate sampling intervals and accounting for seasonal effects.

Storm Surge Forecast Map

Related terms: Coastal Flooding, NOAA, GIS

Map that projects the height and extent of storm-driven sea level rise for a given event. Example: a forecast predicts a 2-meter surge along a coastal port, prompting temporary berth closures. Critical for emergency planning. Challenges include model uncertainty and rapid update requirements.

Supply Chain Visibility Dashboard

Related terms: Logistics, KPI, End-to-End Tracking

Interface that shows the status of cargo movement from origin to destination, including vessel positions, port dwell times, and inventory levels. Example: the dashboard indicates a delay at a transshipment hub, allowing shippers to adjust downstream schedules. Improves customer service. Challenges involve integrating data from multiple carriers and standardizing status codes.

Surface Current