
Postgraduate Certificate in Marine Navigation and Nautical Technology

Marine Engineering and Systems Integration for Navigation.

Active Roll Stabilizer

Concept: A hydraulic or electric system that reduces vessel roll by generating counteracting forces.

Related terms: anti-rolling, gyroscopic stabilizer

Explanation: Sensors detect roll motion; actuators produce forces to oppose it, improving comfort and safety.

Example: A cruise ship using fin stabilizers that pivot in response to roll.

Application: Passenger vessels, offshore supply ships.

Challenges: Power consumption, maintenance of moving parts, effectiveness in heavy seas.

Acoustic Doppler Current Profiler (ADCP)

Concept: Instrument that measures water current velocity using the Doppler shift of sound waves.

Related terms: sonar, current meter

Explanation: Emits acoustic pulses; receives echoes from particles; calculates velocity profile.

Example: ADCP mounted on a hull to provide real-time current data for navigation.

Application: Route planning, fuel optimization, collision avoidance.

Challenges: Signal attenuation in turbid water, interference from hull noise.

Advanced Ship Control System (ASCS)

Concept: Integrated platform that automates steering, propulsion, and ancillary functions.

Related terms: autopilot, integrated bridge system

Explanation: Uses sensor fusion and algorithms to execute optimal control actions.

Example: A container ship employing ASCS for dynamic positioning during port entry.

Application: Reducing crew workload, enhancing precision.

Challenges: Cybersecurity, system redundancy, operator trust.

AIS (Automatic Identification System)

Concept: Maritime communication system that transmits vessel identity and position.

Related terms: VTS, AIS-IN, AIS-OUT

Explanation: Uses VHF radio to broadcast data; receivers display on electronic chart.

Example: A tanker broadcasting AIS to inform nearby traffic of its course.

Application: Collision avoidance, traffic monitoring.

Challenges: Data overload in congested areas, spoofing risks.

Alarms Management System (AMS)

Concept: Centralized system that prioritizes and displays alarm conditions.

Related terms: HMIs, fault detection

Explanation: Filters nuisance alarms, escalates critical events, and logs occurrences.

Example: Engine room AMS that highlights high oil temperature while suppressing minor alarms.

Application: Enhancing situational awareness, reducing alarm fatigue.

Challenges: Configuring thresholds, integration with legacy equipment.

Anti-Collision Radar (ACR)

Concept: Radar mode that predicts collision risk based on target trajectories.

Related terms: TCI, CPA

Explanation: Calculates closest point of approach and time to CPA; alerts operator.

Example: ACR on a ferry showing a red alert for an approaching vessel.

Application: Near-miss mitigation, decision support.

Challenges: False alarms due to clutter, reliance on accurate target data.

Artificial Horizon (Attitude Indicator)

Concept: Instrument displaying vessel pitch and roll relative to the horizon.

Related terms: gyrocompass, inertial navigation

Explanation: Uses gyroscopic sensors to maintain a stable reference.

Example: Electronic display showing a 2° roll on a research vessel.

Application: Navigation in poor visibility, dynamic positioning.

Challenges: Calibration drift, sensor failure.

Ballast Water Management System (BWMS)

Concept: System that treats ballast water to prevent invasive species transfer.

Related terms: IMO D-2, filtration

Explanation: Employs filtration, UV, or chemical treatment before discharge.

Example: A bulk carrier using a UV BWMS to meet compliance.

Application: Environmental protection, regulatory compliance.

Challenges: Energy demand, system fouling, monitoring accuracy.

Bridge Navigational Watch Alarm System (BNWAS)

Concept: Safety system that ensures bridge watch officer remains alert.

Related terms: watchkeeping, alarm escalation

Explanation: Periodic prompts; if no response, alarms trigger and crew must acknowledge.

Example: BNWAS on a cruise ship that escalates to the captain after three missed prompts.

Application: Reducing human error, enhancing vigilance.

Challenges: False alarms, crew acceptance.

Bridge Integrated Navigation System (BINS)

Concept: Consolidated suite that merges radar, ECDIS, AIS, and other sensors.

Related terms: IBS, bridge management system

Explanation: Provides a unified display and data management interface.

Example: BINS showing radar overlay on electronic chart for a ferry.

Application: Streamlined situational awareness, reduced equipment footprint.

Challenges: Interoperability, vendor lock-in, training.

Bridge Management System (BMS)

Concept: Software that coordinates bridge equipment and procedures.

Related terms: BINS, bridge alarm system

Explanation: Manages data flow, alarm handling, and decision support tools.

Example: BMS generating a route deviation alert during a storm.

Application: Enhancing decision quality, complying with SOLAS.

Challenges: System complexity, integration with legacy gear.

Bridge Navigational Watch Alarm System (BNWAS) – Level 3

Concept: Highest alert tier where alarm escalates to senior officers.

Related terms: BNWAS Level 1, Level 2

Explanation: If no acknowledgment, alarm propagates to chief mate and captain.

Example: Level 3 activation on a cargo vessel after bridge officer fails to respond.

Application: Critical safety net for watchkeeping.

Challenges: Balancing alert sensitivity, avoiding desensitization.

Carbon Dioxide Fire Suppression

Concept: Fixed system that extinguishes fires using CO₂.

Related terms: FM-200, inert gas

Explanation: Discharges CO₂ to lower oxygen concentration, suffocating fire.

Example: Engine room CO₂ system activated after a fuel leak ignition.

Application: Protecting high-value machinery spaces.

Challenges: Safe occupancy limits, discharge verification.

Celestial Navigation (Star Fix)

Concept: Determining position using observations of celestial bodies.

Related terms: sextant, almanac

Explanation: Measures angles between horizon and stars; computes latitude/longitude.

Example: A sailboat taking a noon sight for latitude.

Application: Redundancy when GPS unavailable.

Challenges: Requires clear sky, skilled operator, time-consuming.

Chart Display and Information System (CDIS)

Concept: Electronic chart system complying with IEC 61174.

Related terms: ECDIS, ENC

Explanation: Displays raster or vector charts with real-time vessel position.

Example: CDIS on a fishing vessel showing depth contours.

Application: Safe navigation, route planning.

Challenges: Data currency, display overload, regulatory acceptance.

Closed-Loop Control

Concept: Feedback system that continuously corrects a variable to a setpoint.

Related terms: P-control, PID

Explanation: Sensors measure output; controller adjusts actuator to minimize error.

Example: Thruster speed control maintaining heading.

Application: Dynamic positioning, engine speed regulation.

Challenges: Tuning parameters, sensor latency.

Collision Avoidance System (CAS)

Concept: Integrated suite that analyses traffic and suggests evasive actions.

Related terms: ACR, AIS, TCAS

Explanation: Combines radar, AIS, and algorithms to predict encounter outcomes.

Example: CAS on a ferry recommending a starboard turn.

Application: Reducing near-miss incidents.

Challenges: Human-machine interaction, false positives.

Compass Calibration

Concept: Process of correcting magnetic compass deviation.

Related terms: deviation table, swing-by

Explanation: Determines error at various headings; creates correction table.

Example: Swing-by performed in a dockyard for a research vessel.

Application: Ensuring accurate heading information.

Challenges: Magnetic interference, periodic re-calibration.

Computational Fluid Dynamics (CFD)

Concept: Numerical simulation of fluid flow around hulls and propellers.

Related terms: hydrostatics, resistance

Explanation: Solves Navier-Stokes equations to predict performance.

Example: CFD analysis of bulbous bow effectiveness.

Application: Design optimisation, fuel efficiency studies.

Challenges: High computational cost, validation with sea trials.

Condition Monitoring System (CMS)

Concept: Sensors and software that assess equipment health.

Related terms: vibration analysis, prognostics

Explanation: Tracks parameters like temperature, vibration; triggers alerts on anomalies.

Example: CMS detecting bearing wear on a main engine.

Application: Predictive maintenance, downtime reduction.

Challenges: Data interpretation, sensor placement.

Control Moment Gyroscope (CMG)

Concept: Rotating mass device that generates torque for attitude control.

Related terms: reaction wheel, gyroscopic stabilizer

Explanation: By changing spin axis, produces controlled torque.

Example: CMG used on a research vessel for fine heading adjustments.

Application: Precise maneuvering, dynamic positioning.

Challenges: Mechanical complexity, power demand.

COP (Coefficient of Performance)

Concept: Ratio of useful output to energy input for HVAC or refrigeration.

Related terms: energy efficiency, heat pump

Explanation: Higher COP indicates more efficient system.

Example: Shipboard HVAC achieving COP of 3.5.

Application: Reducing fuel consumption, environmental compliance.

Challenges: Maintaining performance under varying loads.

Course Over Ground (COG)

Concept: Actual path of vessel over the earth's surface.

Related terms: heading, track

Explanation: Derived from GPS; differs from heading due to currents or wind.

Example: COG of 045° while heading 040° due to set.

Application: Navigation planning, performance analysis.

Challenges: Real-time accuracy, integration with chart systems.

Cross-Track Error (XTE)

Concept: Lateral deviation of vessel from intended track.

Related terms: track line, waypoint

Explanation: Measured perpendicular distance; used for corrective steering.

Example: XTE of 0.3 NM during a coastal passage.

Application: Autopilot tuning, route adherence.

Challenges: Sensor noise, dynamic environmental influences.

Dead Reckoning (DR)

Concept: Position estimation based on last known fix, speed, and heading.

Related terms: DR plot, estimate

Explanation: Integrates course and speed over time; accumulates error.

Example: DR used when GPS signal lost in a fjord.

Application: Backup navigation method.

Challenges: Cumulative error, reliance on accurate speed measurement.

Dynamic Positioning (DP) System

Concept: Computer-controlled system that maintains vessel position using thrusters.

Related terms: DP1, DP2, DP3

Explanation: Uses GPS, gyro, wind sensors to compute thrust commands.

Example: DP2 offshore support vessel holding position for drilling operation.

Application: Offshore construction, subsea work.

Challenges: Power redundancy, sensor failure, environmental loads.

DP Class 1 (DP1)

Concept: Basic DP system with single redundancy.

Related terms: DP2, DP3

Explanation: Suitable for low-risk operations where one failure is tolerable.

Example: DP1 anchor-handling tug in calm waters.

Application: Light offshore support.

Challenges: Limited fault tolerance.

DP Class 2 (DP2)

Concept: DP system with duplicated critical components.

Related terms: DP1, DP3

Explanation: Provides higher reliability for moderate risk tasks.

Example: DP2 vessel performing ROV deployment.

Application: Medium-risk offshore work.

Challenges: Increased cost, maintenance complexity.

DP Class 3 (DP3)

Concept: Highest DP class with full redundancy and fire-proof compartments.

Related terms: DP2, DP1

Explanation: Designed for high-risk, mission-critical operations.

Example: DP3 vessel supporting deepwater drilling.

Application: High-value offshore projects.

Challenges: Significant capital investment, stringent certification.

Electronic Chart Display and Information System (ECDIS)

Concept: Digital navigation chart system mandated by SOLAS.

Related terms: CDIS, ENC

Explanation: Integrates position, sensor data, and chart layers for route monitoring.

Example: ECDIS on a container ship showing real-time ETA.

Application: Reducing paper chart reliance, enhancing safety.

Challenges: Data integrity, regulatory compliance, crew training.

Engine Room Automation (ERA)

Concept: Integrated control of propulsion and auxiliary machinery.

Related terms: ERT, DCS

Explanation: Uses PLCs, HMIs to monitor and control engine parameters.

Example: ERA adjusting fuel injection for optimal efficiency.

Application: Reducing crew workload, improving performance.

Challenges: Cybersecurity, system integration.

Environmental Monitoring System (EMS)

Concept: Network of sensors that track emissions and discharges.

Related terms: SO_x, NO_x, ballast water

Explanation: Measures exhaust gases, oil content, and other pollutants.

Example: EMS reporting CO₂ emissions for compliance.

Application: Regulatory reporting, environmental stewardship.

Challenges: Sensor calibration, data management.

FADEC (Full Authority Digital Engine Control)

Concept: Computer system that manages all engine functions.

Related terms: engine control unit, throttle

Explanation: Controls fuel flow, ignition timing, and variable geometry.

Example: FADEC optimizing turbine speed during cruise.

Application: Enhancing efficiency, reducing emissions.

Challenges: Software reliability, diagnostic access.

Fathometer (Echo Sounder)

Concept: Device that measures water depth by timing sound pulse return.

Related terms: sonar, depth sounder

Explanation: Emits acoustic pulse; calculates depth from travel time.

Example: Fathometer indicating 30 m depth near a reef.

Application: Safe navigation in shallow waters.

Challenges: Sound speed variability, bottom composition effects.

Fiber Optic Gyro (FOG)

Concept: Inertial sensor that measures rotation using the Sagnac effect.

Related terms: gyrocompass, INS

Explanation: Light travels in coil; rotation causes phase shift.

Example: FOG providing heading data for DP control.

Application: High-accuracy navigation, dynamic positioning.

Challenges: Temperature sensitivity, cost.

Fire Detection System (FDS)

Concept: Network of sensors that identify fire or smoke.

Related terms: heat detector, alarm panel

Explanation: Uses infrared, ionization, or optical sensors to trigger alarms.

Example: FDS detecting a fire in the galley.

Application: Rapid response, crew safety.

Challenges: False alarms, sensor fouling.

Fuel Oil Transfer System (FOTS)

Concept: Pumps and pipelines that move fuel between tanks.

Related terms: fuel management, ballast system

Explanation: Controlled by automated valves and flow meters.

Example: FOTS balancing fuel to maintain trim.

Application: Optimizing stability, fuel efficiency.

Challenges: Leakage risk, corrosion.

Galvanic Corrosion Protection

Concept: Use of sacrificial anodes to prevent metal corrosion.

Related terms: cathodic protection, zinc anodes

Explanation: Anodes corrode preferentially, protecting hull structures.

Example: Zinc anodes installed on a steel hull.

Application: Extending hull life, compliance with standards.

Challenges: Anode consumption monitoring, environmental regulations.

GNSS (Global Navigation Satellite System)

Concept: Satellite constellation providing positioning, navigation, and timing data.

Related terms: GPS, GLONASS, Galileo

Explanation: Receivers calculate position from multiple satellite signals.

Example: GNSS receiver delivering sub-meter accuracy.

Application: Primary positioning source for navigation.

Challenges: Signal blockage, spoofing, ionospheric delay.

Gyrocompass

Concept: Non-magnetic compass that finds true north using Earth's rotation.

Related terms: FOS, heading sensor

Explanation: Spinning gyroscope aligns with Earth's rotation axis.

Example: Gyrocompass indicating 0° true north on a research vessel.

Application: Reliable heading reference, especially near magnetic anomalies.

Challenges: Power requirement, warm-up time.

Hydraulic Power Pack (HPP)

Concept: Centralized system that supplies hydraulic pressure to ship systems.

Related terms: Pump, accumulator

Explanation: Uses electric motor-driven pumps and reservoirs.

Example: HPP providing pressure for steering gear and deck machinery.

Application: Consolidated power distribution, redundancy.

Challenges: Leak detection, maintenance of seals.

Integrated Bridge System (IBS)

Concept: Unified platform that merges navigation, communication, and control functions.

Related terms: BMS, BINS

Explanation: Provides single-screen operation for bridge crew.

Example: IBS displaying radar, AIS, and engine data together.

Application: Reducing clutter, improving decision speed.

Challenges: Vendor compatibility, system upgrades.

Inertial Navigation System (INS)

Concept: Self-contained system that calculates position using accelerometers and gyros.

Related terms: gyrocompass, dead reckoning

Explanation: Integrates motion data to estimate location without external signals.

Example: INS used during GPS outage in Arctic ice.

Application: Submarine navigation, backup for surface ships.

Challenges: Drift over time, sensor bias.

International Maritime Organization (IMO)

Concept: United Nations agency responsible for maritime safety and environmental standards.

Related terms: SOLAS, MARPOL

Explanation: Develops conventions and guidelines adopted by member states.

Example: IMO regulations requiring ECDIS on new vessels.

Application: Global regulatory framework.

Challenges: Enforcement consistency, evolving technology.

Junction Box (Marine Electrical)

Concept: Enclosure that houses electrical connections and protects them from environment.

Related terms: cable tray, conduit

Explanation: Provides organized, accessible terminations.

Example: Junction box consolidating sensor wiring in engine room.

Application: Simplifying maintenance, ensuring safety.

Challenges: Corrosion resistance, space constraints.

Kinetic Energy Recovery System (KERS)

Concept: System that captures and re-uses energy from ship motion.

Related terms: energy storage, regenerative braking

Explanation: Uses flywheels or batteries to store energy during deceleration.

Example: KERS on a ferry reducing fuel consumption during docking.

Application: Improving overall efficiency.

Challenges: Added weight, system integration.

Laser Rangefinder

Concept: Device that measures distance using laser pulse time-of-flight.

Related terms: LIDAR, optical sensor

Explanation: Emits laser, measures return time to calculate range.

Example: Laser rangefinder assisting in close-quarter docking.

Application: Precise maneuvering, collision avoidance.

Challenges: Atmospheric interference, surface reflectivity.

Linear Variable Differential Transformer (LVDT)

Concept: Sensor that converts linear displacement into electrical signal.

Related terms: position sensor, transducer

Explanation: Core moves within coils, altering voltage output.

Example: LVDT measuring thruster azimuth angle.

Application: Accurate actuator positioning.

Challenges: Calibration drift, temperature effects.

Load Line (Plimsoll Mark)

Concept: Mark on hull indicating maximum safe loading depth.

Related terms: freeboard, draft

Explanation: Determined by vessel type, water density, and season.

Example: Load line showing permissible draft of 12m in tropical waters.

Application: Preventing overload, ensuring stability.

Challenges: Monitoring changes due to cargo shift, ballast adjustments.

Marine Automation System (MAS)

Concept: Network that integrates sensors, actuators, and control logic across the vessel.

Related terms: DCS, SCADA

Explanation: Enables remote monitoring and automated control of ship functions.

Example: MAS adjusting ventilation based on temperature sensors.

Application: Reducing crew workload, improving safety.

Challenges: System interoperability, cybersecurity.

Marine Cybersecurity Framework

Concept: Set of policies and technologies to protect shipboard networks.

Related terms: firewall, intrusion detection

Explanation: Implements risk assessment, access control, and incident response.
Example: Implementing a segmented network for navigation and cargo systems.
Application: Safeguarding critical navigation data.
Challenges: Legacy equipment, crew awareness.

Marine Diesel Engine (MDE)

Concept: Internal combustion engine using diesel fuel for propulsion.
Related terms: slow-speed engine, medium-speed engine
Explanation: Operates on compression ignition, delivering high torque.
Example: 10,000 kW slow-speed MDE powering a bulk carrier.
Application: Primary propulsion for commercial vessels.
Challenges: Emissions compliance, fuel quality variability.

Marine Electrical Power System (MEPS)

Concept: Integrated generation, distribution, and consumption of electrical power onboard.
Related terms: generator set, switchboard
Explanation: Includes generators, transformers, and distribution buses.
Example: MEPS supplying power to propulsion, hotel, and navigation loads.
Application: Ensuring reliable electricity supply.
Challenges: Load balancing, fault isolation.

Marine Pollution Prevention (MARPOL)

Concept: International convention addressing pollution from ships.
Related terms: oil discharge, sewage treatment
Explanation: Sets limits on emissions of oil, chemicals, garbage, and air pollutants.
Example: MARPOL Annex I regulating oil spill reporting.
Application: Protecting marine environment.
Challenges: Monitoring compliance, retrofitting older vessels.

Marine Radar

Concept: Radio-frequency system that detects objects by reflecting radio waves.
Related terms: X-band, S-band
Explanation: Scans sea surface, displays targets on screen with range and bearing.
Example: Radar detecting a small fishing boat at 2 NM.
Application: Collision avoidance, situational awareness.
Challenges: Clutter, rain attenuation, target identification.

Marine Safety Management System (SMS)

Concept: Structured framework for safe operation and emergency preparedness.
Related terms: ISM Code, safety culture
Explanation: Defines policies, procedures, and audits.

Example: SMS requiring regular fire drill drills.

Application: Reducing accidents, meeting regulatory standards.

Challenges: Continuous improvement, crew engagement.

Marine Surveillance System (MSS)

Concept: Integrated suite of sensors monitoring vessel surroundings.

Related terms: surveillance radar, AIS, CCTV

Explanation: Combines data for comprehensive situational picture.

Example: MSS alerting bridge crew to a small craft in blind spot.

Application: Enhancing detection of non-cooperative traffic.

Challenges: Data fusion, false alarm mitigation.

Marine Telemetry

Concept: Remote transmission of vessel data to shore facilities.

Related terms: SCADA, satellite link

Explanation: Sends performance, position, and condition data for monitoring.

Example: Telemetry delivering engine parameters to fleet manager.

Application: Fleet management, predictive maintenance.

Challenges: Bandwidth limits, latency.

Marine Weather Routing

Concept: Optimizing voyage plans based on forecasted weather and ocean conditions.

Related terms: route optimization, GRIB

Explanation: Uses models to minimize fuel consumption and avoid hazards.

Example: Routing software suggesting a southerly course to avoid a storm.

Application: Cost savings, safety enhancement.

Challenges: Model accuracy, real-time updates.

Marine Vessel Traffic Service (VTS)

Concept: Shore-based service that monitors and guides ship movements.

Related terms: AIS, radar, traffic separation scheme

Explanation: Provides traffic information, navigational advice, and collision avoidance.

Example: VTS directing a tanker into a congested harbor.

Application: Enhancing port safety and efficiency.

Challenges: Communication overload, coordination with multiple vessels.

Mechanical Propulsion System

Concept: Traditional shaft-driven propulsion using a propeller.

Related terms: shaft line, reduction gear

Explanation: Engine power transmitted via shaft to rotate propeller.

Example: Conventional diesel engine driving a fixed-pitch propeller.

Application: Main propulsion for most commercial ships.

Challenges: Vibration, cavitation, limited maneuverability.

Metallic Hull Coating

Concept: Protective paint system applied to steel hulls.

Related terms: anti-fouling, cathodic protection

Explanation: Provides corrosion resistance and fouling prevention.

Example: Two-part epoxy coating on a container ship.

Application: Extending hull life, maintaining performance.

Challenges: Environmental regulations, coating adhesion.

Mid-Ship Engine Room

Concept: Engine space located amidships rather than aft.

Related terms: aft engine room, weight distribution

Explanation: Balances vessel trim and reduces vibration transmission.

Example: Mid-ship diesel engine arrangement on a cruise liner.

Application: Improving stability, optimizing interior layout.

Challenges: Complex ducting, accessibility for maintenance.

Modular Power Plant (MPP)

Concept: Scalable, containerized generation units that can be added or removed.

Related terms: diesel generator, hybrid system

Explanation: Enables flexible power capacity based on operational needs.

Example: MPP added to a research vessel for increased hotel load.

Application: Energy efficiency, rapid deployment.

Challenges: Integration with existing distribution, space allocation.

Navigation Bridge

Concept: Central command area where ship navigation is conducted.

Related terms: wheelhouse, bridge wings

Explanation: Houses consoles for radar, ECDIS, helm, and communication.

Example: Bridge of a cargo vessel equipped with integrated displays.

Application: Primary location for piloting and decision making.

Challenges: Ergonomic layout, information overload.

Navtex (Navigational Telex)

Concept: International system broadcasting maritime safety information.

Related terms: VHF, NBD

Explanation: Transmits weather forecasts, navigational warnings, and distress messages.

Example: Navtex receiver alerting crew to a newly posted buoy.

Application: Providing up-to-date safety information.

Challenges: Limited bandwidth, language barriers.

Near-Real-Time Data Link (NRTDL)

Concept: Communication link delivering data with minimal latency.

Related terms: satellite, VHF Data Exchange

Explanation: Supports time-critical navigation updates.

Example: NRTDL sending updated tidal information to a vessel.

Application: Enhancing situational awareness.

Challenges: Signal reliability, bandwidth management.

Non-Linear Control Algorithms

Concept: Advanced control methods that handle complex system dynamics.

Related terms: model predictive control, fuzzy logic

Explanation: Use mathematical models to predict and adjust system behavior.

Example: Non-linear controller optimizing thruster output during DP operations.

Application: Improving precision in dynamic environments.

Challenges: Computational load, model accuracy.

Oil Spill Response System (OSRS)

Concept: Equipment and procedures for containing and cleaning oil spills.

Related terms: containment booms, skimmers

Explanation: Deploys barriers, collects oil, and processes recovered material.

Example: OSRS activated after a fuel leak in a harbor.

Application: Environmental protection, regulatory compliance.

Challenges: Rapid deployment, effectiveness in rough seas.

On-Board Diagnostics (OBD)

Concept: System that monitors and reports engine and system health.

Related terms: fault codes, telemetry

Explanation: Provides real-time data on performance and malfunctions.

Example: OBD alerting crew to high exhaust temperature.

Application: Preventive maintenance, troubleshooting.

Challenges: Standardization across equipment, data interpretation.

Operating Room Temperature (ORT) Control

Concept: Climate control system maintaining temperature in specialized compartments.

Related terms: HVAC, environmental control

Explanation: Uses sensors and actuators to regulate temperature.

Example: ORT system keeping a medical bay at 22 °C.

Application: Crew comfort, equipment performance.

Challenges: Energy consumption, integration with main HVAC.

Optimized Hull Form

Concept: Hull shape designed to minimize resistance and improve fuel efficiency.

Related terms: bulbous bow, hull coating

Explanation: Uses CFD and model testing to refine geometry.

Example: New hull design reducing fuel consumption by 5 %.

Application: Cost savings, emission reduction.

Challenges: Balancing cargo capacity, structural integrity.

Overboard Monitoring System (OMS)

Concept: Sensors that detect accidental release of cargo or equipment overboard.

Related terms: spill detection, alarm system

Explanation: Uses radar, cameras, and acoustic sensors.

Example: OMS triggering alarm when a container falls into the sea.

Application: Prompt response, regulatory reporting.

Challenges: False alarms, sensor coverage.

Power Management System (PMS)

Concept: Controls generation, distribution, and consumption of electrical power.

Related terms: load shedding, automatic transfer

Explanation: Balances load demand with generation capacity.

Example: PMS shedding non-essential loads during generator failure.

Application: Maintaining critical systems, preventing blackouts.

Challenges: Accurate load forecasting, rapid response.

Propeller Pitch Control

Concept: Adjusting blade angle to vary thrust and efficiency.

Related terms: controllable pitch propeller, variable pitch

Explanation: Hydraulic or electric mechanism changes blade geometry.

Example: Pitch control optimizing performance during speed changes.

Application: Fuel savings, maneuverability.

Challenges: Mechanical wear, control synchronization.

Propulsion Control System (PCS)

Concept: Integrated system managing engine, gear, and propeller operation.

Related terms: FADEC, DP control

Explanation: Coordinates speed, direction, and thrust commands.

Example: PCS reducing RPM for efficient cruising.

Application: Streamlined operation, emission control.

Challenges: Integration with navigation data, fault tolerance.

Propulsion Power Take-Off (PPT)

Concept: Mechanical arrangement extracting power from the main engine for auxiliary uses.

Related terms: shaft line, generator drive

Explanation: Drives a secondary shaft to power a generator.

Example: PPT supplying electricity for hotel loads.

Application: Efficient use of engine output.

Challenges: Alignment, vibration transmission.

Radar Reflectivity

Concept: Measure of how strongly an object reflects radar signals.

Related terms: RCS, target detection

Explanation: Determines visibility on radar display.

Example: Small wooden boat having low radar reflectivity.

Application: Understanding detection limits.

Challenges: Variability with material, shape, and sea state.

Redundancy Management

Concept: Design approach ensuring duplicate systems for critical functions.

Related terms: fail-safe, fault tolerance

Explanation: Provides alternate paths if primary system fails.

Example: Dual GPS receivers for navigation redundancy.

Application: Enhancing reliability.

Challenges: Increased cost, complexity.

Regenerative Braking System (RBS)

Concept: Captures kinetic energy during deceleration and stores it.

Related terms: KERS, energy storage

Explanation: Converts mechanical energy into electrical energy.

Example: RBS on a hybrid ferry reducing fuel use during docking.

Application: Improving overall efficiency.

Challenges: Integration with propulsion control.

Remote Monitoring Interface (RMI)

Concept: User-friendly display for overseeing ship systems from a distance.

Related terms: SCADA, HMI

Explanation: Shows status, alarms, and trends.

Example: RMI on shore allowing fleet manager to view vessel performance.

Application: Centralized oversight, rapid response.

Challenges: Secure data transmission, bandwidth.

Resistive Load Monitoring

Concept: Measuring electrical load by detecting voltage drop across a resistor.

Related terms: current transformer, power meter
Explanation: Provides real-time consumption data.
Example: Monitoring hotel load to optimize generator usage.
Application: Energy management.
Challenges: Accuracy under varying load conditions.

Rudder Angle Sensor

Concept: Device that measures the position of the rudder relative to the hull.
Related terms: steering feedback, actuator
Explanation: Uses potentiometer or encoder to output angle.
Example: Sensor feeding data to autopilot for precise heading control.
Application: Accurate steering, DP operation.
Challenges: Mechanical wear, calibration drift.

Safety Management Certificate (SMC)

Concept: Document proving compliance with the International Safety Management (ISM) Code.
Related terms: ISM Code, audit
Explanation: Issued after verification of safety procedures.
Example: SMC displayed on a vessel's bridge for inspection.
Application: Demonstrating regulatory adherence.
Challenges: Ongoing compliance, documentation.

Sea State Estimation

Concept: Predicting wave height, period, and direction for navigation.
Related terms: wave spectrum, forecast
Explanation: Uses models and sensors to assess sea conditions.
Example: Estimating a sea state of 3 m significant wave height for route planning.
Application: Enhancing safety, optimizing speed.
Challenges: Model uncertainty, rapid changes.

Signal Processing Unit (SPU)

Concept: Hardware that filters and interprets sensor data.
Related terms: DSP, filter
Explanation: Removes noise, extracts relevant features.
Example: SPU cleaning radar returns to improve target detection.
Application: Improving sensor reliability.
Challenges: Processing latency, algorithm selection.

Ship Energy Management System (SEMS)

Concept: Integrated platform that monitors and optimizes energy usage.
Related terms: EMS, PMS

Explanation: Analyzes consumption patterns, recommends actions.
Example: SEMS suggesting reduced ventilation during low-load periods.
Application: Reducing fuel costs, meeting emission targets.
Challenges: Data integration, crew acceptance.

Ship Handling Simulator

Concept: Virtual environment for training navigation and maneuvering skills.
Related terms: bridge simulator, VR
Explanation: Replicates vessel dynamics, environmental conditions.
Example: Simulator training for emergency docking.
Application: Crew competency development.
Challenges: Realism, cost of high-fidelity systems.

Ship-to-Ship (STS) Transfer System

Concept: Equipment and procedures for transferring cargo between vessels at sea.
Related terms: offloading hose, manifold
Explanation: Uses pumps, hoses, and safety protocols.
Example: LPG carrier performing STS transfer with a tanker.
Application: Flexible cargo logistics.
Challenges: Weather dependency, spill risk.

Shipboard Integrated Automation (SIA)

Concept: Cohesive network linking navigation, propulsion, and auxiliary systems.
Related terms: MAS, DCS
Explanation: Enables coordinated control and monitoring.
Example: SIA adjusting ballast pumps based on trim sensors.
Application: Operational efficiency.
Challenges: System complexity, cybersecurity.

Shipboard Power Distribution Bus

Concept: Electrical conduit that routes power to various ship systems.
Related terms: switchboard, breakers
Explanation: Provides organized, protected pathways for electricity.
Example: Main bus supplying power to propulsion and hotel loads.
Application: Centralized power management.
Challenges: Load balancing, fault isolation.

Shipborne Weather Radar

Concept: Radar dedicated to detecting weather phenomena like rain and storms.
Related terms: meteorological radar, dual-polarization
Explanation: Scans atmospheric volume, displays intensity.

Example: Radar showing a convective cell ahead of a vessel.

Application: Avoiding severe weather, route planning.

Challenges: Interpretation skill, hardware maintenance.

Shipyard Acceptance Tests (SAT)

Concept: Series of inspections and trials performed before vessel delivery.

Related terms: sea trial, commissioning

Explanation: Verifies compliance with specifications.

Example: SAT confirming proper operation of DP system.

Application: Ensuring readiness for service.

Challenges: Scheduling, resolving deficiencies.

Side Scan Sonar

Concept: Acoustic imaging system that maps seabed features.

Related terms: multibeam, sub-bottom profiler

Explanation: Emits fan-shaped pulses; records return intensity.

Example: Side scan detecting a submerged wreck