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 CO_2.
Related terms: FM-200, inert gas
Explanation: Discharges CO_2 to lower oxygen concentration, suffocating fire.
Example: Engine room CO_2 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: SOx, NOx, ballast water
Explanation: Measures exhaust gases, oil content, and other pollutants.
Example: EMS reporting CO_2 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 12 m 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