# ONE OCEAN AI DEVELOPMENTS

**Test platform: Class40 2026 – IMOCA 2027 – 2030**
**Objective: Autopilot development, video monitoring of sail trim smart services for IMOCA**


# EXECUTIVE SUMMARY

**One Ocean AI Apps**

**Innovation:** Edge AI · Autopilot · Video Surveillance · Smart Services
Test phase: Class40 2026 → Scaling IMOCA 2027–2030

Goal: Development of a **commercial marine autopilot and navigation software stack** first for racing and as a **lite version** for leisure sailors (giving them a safe and easy to use navigation system)

Test bed: Class40 2026 — validated quickly and cost-effectively

Focus: **Autopilot performance** through sensor fusion + video-based trim feedback + smart services

Secondary: Video surveillance (sails & deck), HMIs & IPCs for navigation and crew interface

# ARCHITECTURE BASICS - PROJECT

- Industrial-grade Edge & PLC Ecosystem (PLCnext)
- MLnext for auto-learning of the autopilot (update)
- Smart Ethernet Box (PoE) for camera topology
- Security & Remote Access (mGuard / TC Router)
- Smart Services: Cloud-based design, diagnostics and performance optimisation
- HMIs &IPCs: Robust marine-grade control and visualisation systems

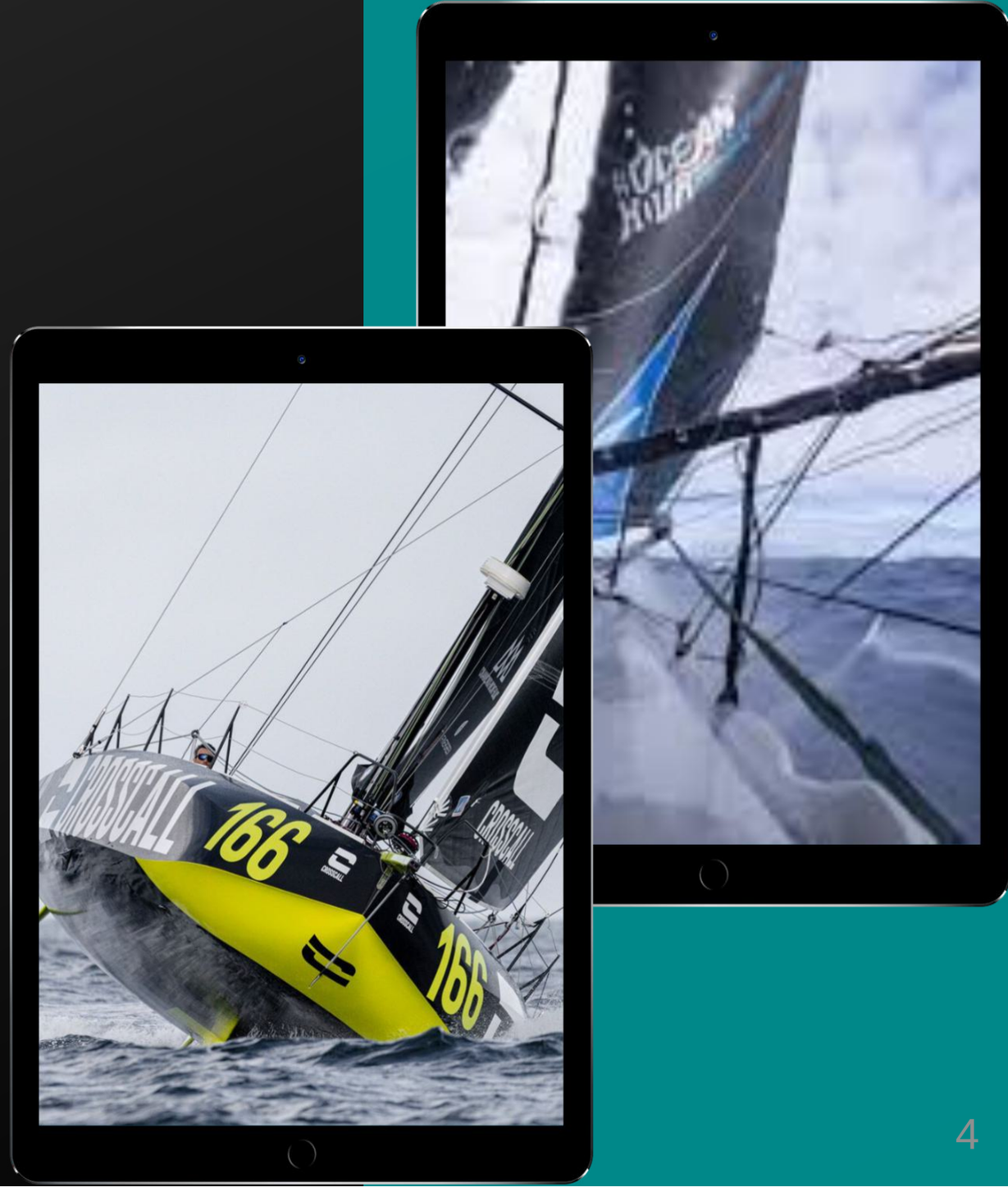
# PROJECT OVERVIEW & ROADMAP

Q1 2026: Hardware setup Class40 — cameras, PoE network, edge hardware

Q2 2026: Smart Services integration (performance monitoring, predictive insights)

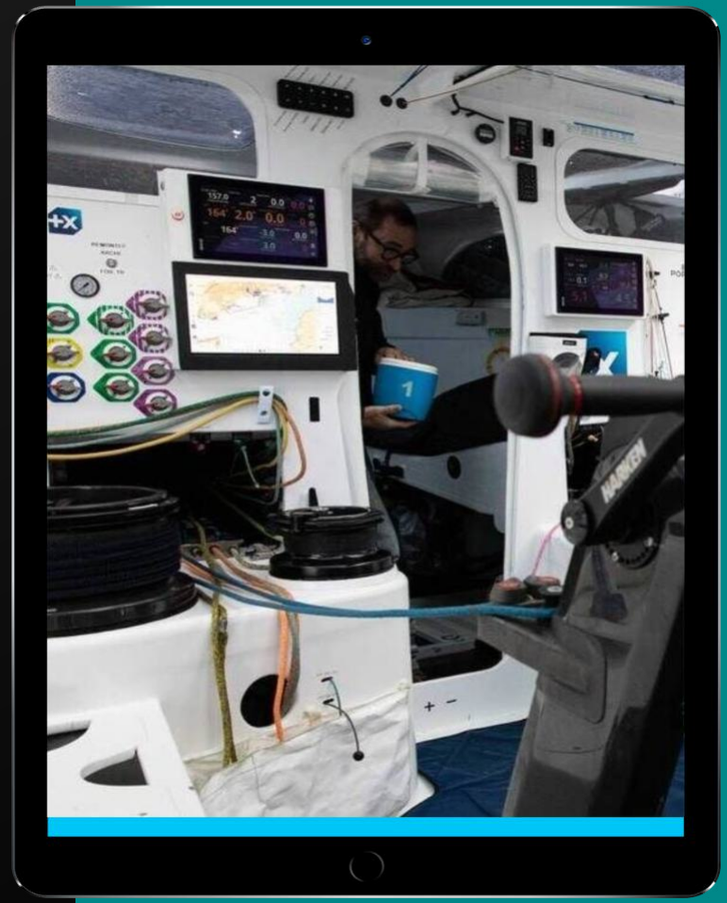
Q3 2026: Autopilot integration (Pilot + PLCnext + Smart Services)

Q1 2027: Sea trials → Scaling IMOCA 2027/2028



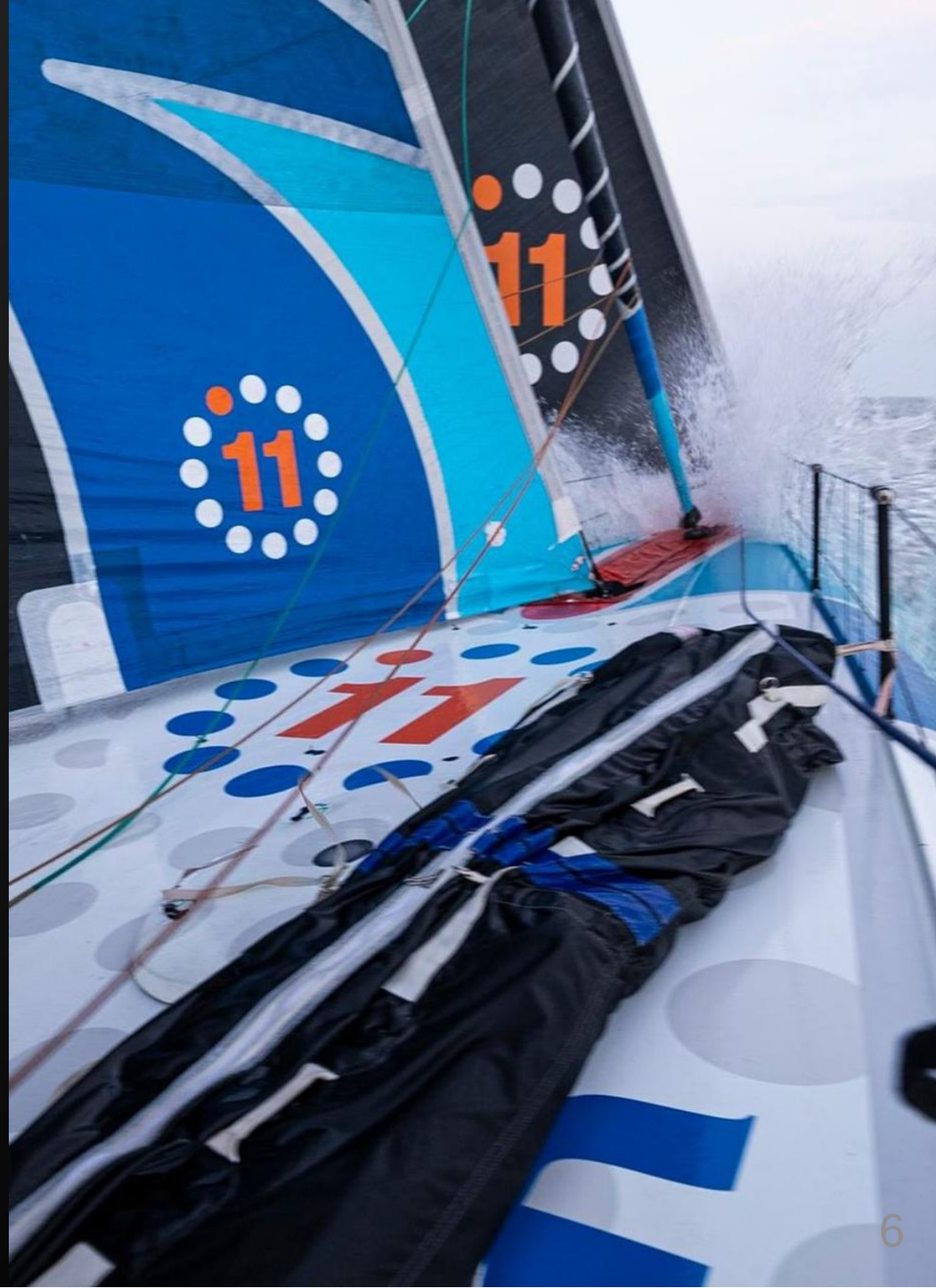
# USE CASES (HIGH-IMPACT)

- **Autopilot Performance Plus:** Integration of camera data, sensors and smart services → more precise control optimised for foiling performance
- **Real-time Trim Advisory:** Camera detects sail shape → ML provides trim recommendation → Autopilot/HMI displays optimisations
- **Navigation & Crew Interface:** HMIs & IPCs provide clear visualisation of performance data, system status, alarms
- **Design and performance optimisation:** Use of smart services for continuous improvement of data models and control algorithms



# SYSTEMARCHITECTURE (OVERVIEW)

- Cameras (ONVIF/RTSP) → PoE Smart Ethernet Box → Edge Compute (PLCnext + IPC) → ML models (MLnext / Custom) → Output (OPC UA / JSON) → Autopilot → Actuators/HMI
- Smart services: Cloud-based data analysis, feedback of optimisation parameters in edge algorithms
- Security: mGuard router, VPN & VLAN architecture

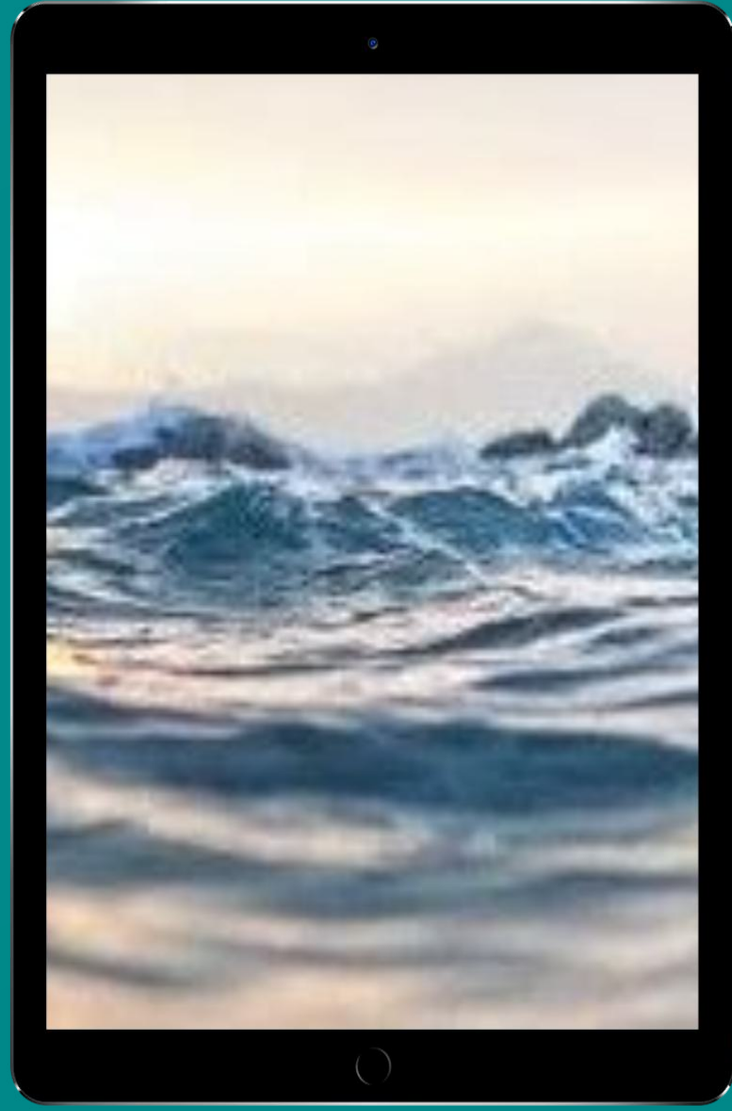


# AI ROUTING UPDATE FOR NAVIGATION SOFTWARE

An edge-led, cloud-supported AI layer that combines real-time weather conditions, historical data and live boat telemetry.

**Core functions**

- **Auto-Model Pick** — uses real sensor data/weather data (barometer) to identify which weather model (GFS/ECMWF/AROME/ICON/MeteoFrance, etc.) is currently the most accurate and uses it for routing
- **Real Performance Calibration** — calculates live polar % from the last 45 minutes (adaptive sliding window) and dynamically adjusts routing inputs.
- **Competitor Routing** (Tactical View) — automatically routes 3–5 pre-selected opponents, provides delta time, best VMG trends and tactical options.
- **Explainable Decisions —** ‘Why this model?’, ‘Why 95% polar?’ — understandable explanation & confidence scores.
- **Fail-Safe Mode —** in case of data loss, the AI switches to conservative routing with warnings.
- **Plug & Play for Adrena & Co. —** NMEA2000/0183 + Adrena plugin + virtual GPS/NMEA feed, API-first.



# AI ROUTING UPDATE FOR NAVIGATION SOFTWARE

**Inputs (Data Sources)**

- Live: Wind (masthead/anemometer), GPS (SOG/COG), barometer.
- External: Automatically downloaded weather model grids (GFS, ECMWF, AROME, ICON, MeteoFrance) — synchronised regularly (3 times a day as soon as a new model is available).
- Historical: Boat polar, TTF data.
- Race info: Waypoints, laylines, list of opponents (IMO/MMSI).

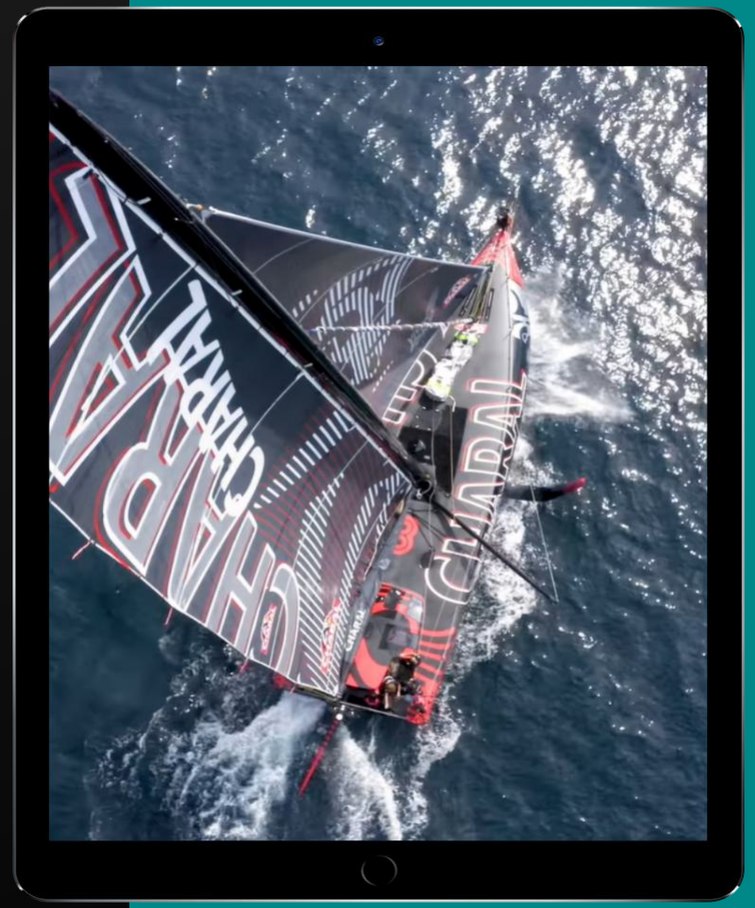
**Architecture**

**A — Edge-First Plugin (Low Latency, Offshore-ready)**

- Components: Onboard Edge Box (Raspberry/NUC), Adrena Plugin, Local Model Selector, lightweight ML, weather model cache.
- Advantages: works offline, extremely low latency, ideal for racing.
- Disadvantages: limited computing power for complex ML.

**B — Hybrid Edge + Cloud (Balanced)**

- Components: Edge Box for telemetry + preliminary decisions, cloud for heavy ensemble processing & model training, bi-directional sync (satellite/4G when available).
- Advantages: best of both worlds, MLOps, continuous updates.
- Disadvantages: requires intermittent connection.



# AI ROUTING UPDATE FOR NAVIGATION SOFTWARE

**Model selection strategy (Auto Model Pick)**

**1) Error-Matching Ensemble (recommended)**

- Calculate the local error in real time: compare measured wind direction/speed and pressure with model forecast at ship location (interpolated).
- For each model: RMS error over last X hours → lowest error → select.
- Additionally: Weighted ensemble (error-inverse weighting) for more robust routing inputs.

**2) ML Classifier (supervised)**

- Train a Random Forest / Gradient Boosting: Inputs = local obs vs model-bias features (time of day, frontal passage flag, proximity to coast), Output = most probable 'best model'.
- Advantage: learns regional biases (coast vs open ocean).

# AI ROUTING UPDATE FOR NAVIGATION SOFTWARE

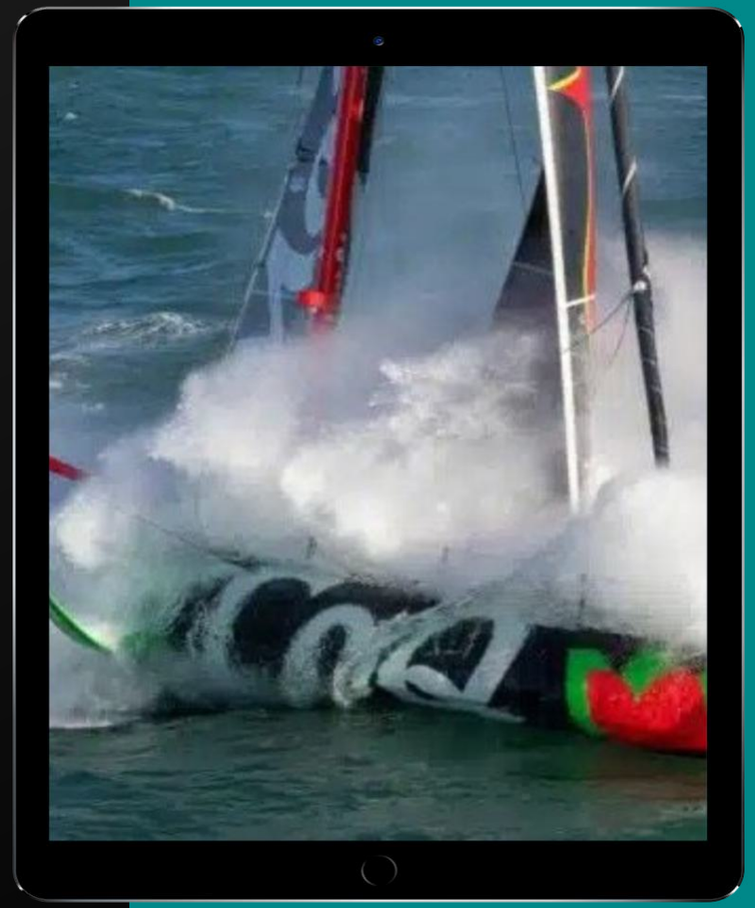
**Real Polar % calculation (45-minute window) — 3 approaches**

**A — Sliding Window Regression (simple & robust)**
- Last 45 minutes in segments (e.g. 5 minutes). Regress SOG to theoretical polar (at given TWA/TWS) → calculate median % performance.
- Smoothing via exponential moving average → prevents jumps.

**B — Kalman Filter / State Estimation (dynamic)**
- Models boat state (trim, current, sail config) and estimates performance state as a latent system.

**C — ML Regression (if a lot of data is available)**
- Trained model (XGB/NN) uses sensor features + sea state proxies → gives performance% + confidence. Good for long-term learning.

**Competitor Routing (Windbag 2.0) — Features**
- Automatic selection of 3–5 competitors (MMSI/name).
- Receptions: their AIS positions/TWS estimates (if shared) or inferred wind from relative motion. Connection to online race tracker.
- Routings: Performs ‘routing’ of competitors in parallel with selected weather models and calibrated polars.
- Outputs: relative VMG chart, time to finish, tactical suggestions: ‘Leeward turn in 0.8 NM gives 2.3 minute lead over competitor B’ etc...



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