

EcoBoatTwin – Digital Twin Platform for Work-
Vessel Energy Optimization & Decarbonization

Sébastien BERTHEBAUD/ VECTURA SYSTEM
CEO - Founder
sebastien.berthebaud@vectura-system.com

Physical Twin description

- The physical twin consists of **work vessels** (such as trawlers, service vessels, push boats, and barges).
- These vessels are equipped with **various systems including propulsion (diesel, parallel hybrid, electric), hull geometries, variable-pitch or fixed-pitch propellers, hydraulic systems, fishing gear, and onboard consumers**.
- They operate in varying maritim, servicing environments, performing missions like fishing, towing, or transport, and generate heterogeneous data covering propulsion, sea state, emissions, hydraulic loads, and operational usage patterns.

Digital Twin usages

- **Simulate and Optimize vessel** configurations and decarbonization pathways.
- **Calibrate high-fidelity vessel energy models** using real sensor data (e.g., from the HYBA dataset).
- **Evaluate alternative designs**, such as hybridization, new motorization, and propeller optimization.
- **Model port infrastructure needs** (electric, H2) to enable fleet-level strategic planning.
- **Predict the Return on Investment (ROI)** of scenarios based on real operational cycles.
- **Compare vessel configurations** and decarbonization pathways for different stakeholders (naval architects, armateurs, public authorities).

Digital Twin Description

- EcoBoatTwin is a **Software as a Service (SaaS) decision-making platform** used by naval architects, shipyards, vessel owners (armateurs), and public authorities to simulate, optimize, and compare vessel configurations and decarbonization pathways.
- The platform integrates **high-fidelity vessel energy models** (hull, propeller, engine, hybrid systems) calibrated from real measurements , Digital Twins of fishing gear , scenario-based simulations , and economic/CO₂ models (TCO, ROI).
- **Interaction with Physical Twin:** The digital twin interacts with the physical twin by ingesting real sensor data for model calibration , evaluating alternative designs and retrofits (e.g., hybridization, propeller optimization) , and simulating port infrastructure needs for fleet-level strategic planning

Engineering Digital Twin challenges

- **Automating Mission Scenarios (Scenario Generation)**
- **Multi-physics Model Integration** (Hull, Propeller, Engine, Hybrid, Hydraulics coupling)
- Integrating Heterogeneous Data (Data standardization and calibration from \$80+\$ sensor channels)
- **Energy Management System** (Algorithms for coordinating the hybrid system and reducing computation time)
- **3D Hull Reconstruction** (Approximating "unknown hulls" via 3D scan/video)
- **External Component Integration** (Linking component databases and future fuel APIs)
- **Economic & Port Modeling** (TCO, ROI, port infrastructure, and subsidies models)
- **Multilayer UX/UI Design** (Tailoring the interface for basic, advanced, and professional users)

