



RANGE Master AI – Six Layers of Simple, Trustworthy Intelligence for Marine Range

Provisional patent is now lodged. We can now share for DAME judging panel.

We developed an AI model for Range Master predicting the range to go on electric boats. We started training a broad, 50-feature model on the water and quickly learned the real time and cost in training AI models. An estimated 1,500 hours would be needed across several styles of boats. This was impractical for new boats and way out of budget.

We drew on our early experience of machine learning and mathematical modelling with our Scotty AI product. There are three unsolved variables in the empirical formula for “drag” on a boat. If we could solve for these using machine learning on each unique boat, then a “model fit” would give an accurate estimate.

This is what we have done and is the core concept to our provisional patent as there is no prior art. The user of the electric boat is asked to perform 3 deceleration exercises each at increasing boat speed with the highest when the boat is planing. After acknowledgement on the setup page of each exercise, Range Master determines the coefficients for the polynomial formula for drag and calculates the wasted “reactive power” in driving the boat at various speeds. Range-to-Go still requires further calculation of a power value to use to determine time remaining from the battery bank. We do that using a mathematically calculated mean for the current trip which is constantly updating.

However, changes in sea conditions, boat loading and bottom fouling will change the initial drag calculation. We call on AI with much fewer variables to provide updated coefficients. Using a shadow model and a canary process of selective testing, Range master AI promotes the best fit based on delta change of estimated Range-to-Go. AI then predicts and displays on the super bright screen, the Range to Go at different RPM levels to guide the user who wants to spend all day with the tender without recharging.

This profound learning is simple in operation giving reliability without complexity. It also aligns with the next step in tender operation: autonomous workhorse for the boat owner.

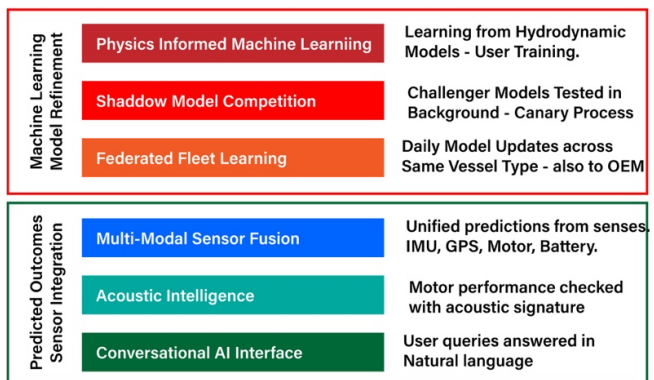
Then we layer other AI features like:

- **Sound signature of the motor,**
- **Anchor drift,**
- **Unauthorized boat entry,**
- **Restricted speed and range** linked to the wrist fob ID (sorry kids),
- **Conversational queries** using text on location, range to go.

Delivering what every user really wants to know ***without an App***:

Where is it? How long has it been there?
Does the tender have enough range for the guests to get back to the boat?

Two Mutually Exclusive Groups of Three Layers in RANGE Master AI for Electric Boats



The result is a new era in marine electronics combining electrical values, mathematical modelling and harnessing the multi-modal sensor fusion built into Range Master AI.



How it works:

Conventional electric propulsion readouts—State-of-Charge (%) and average “Time-to-Go”—don’t answer the only question skippers truly care about: How far can I go, right now, and how long will it take to recharge? As electrification accelerates, that blind spot fuels range anxiety and slows adoption of clean technology.

RANGE Master AI replaces static gauges with a system that continuously learns your vessel, adapts to conditions, and explains decisions in natural language. It’s the difference between a battery meter and a digital first mate.

The insight was to separate immediate assurance from future foresight—two groups of AI that don’t fight each other:

- Assurance (Estimating): Physics-informed machine learning and mathematical models create confidence in the current range estimate and support compliance for autonomous control.
- Foresight (Prediction): Multimodal “senses” forecast how range will shift with speed, loading, and sea state, and let the skipper interrogate the system in plain language.

This split is profound in effect yet simple in operation—reliability without complexity.

The Six Layers

1) Physics-Informed First-Use Modelling (30 minutes to confidence)

Out of the box, hydrodynamic laws and a three-pass learning routine produce the tender-specific drag and negative reactive power curve. A gradient-boosted regressor then tunes coefficients as data arrives, so range estimates start sensible—no “impossible” claims from an untrained boat. RANGE Master predicts range-to-go deltas (not just totals), showing how range changes with speed, load, and sea conditions—presented right above RPM on a super bright screen for immediate decisions.

2) Shadow Model & Canary Promotion (safe, cautious improvement)

On current and subsequent outings, live data refines the first-use model without risking stability. A shadow model runs alongside production while 3–5 challengers compete in real time. Canary testing promotes only the best performer, so updates are cautious and auditable. Anonymous summaries can be shared with the OEM fleet to lift all vessels without exposing private data.

3) Federated Fleet Learning (tiny payloads, big gains)

Each vessel contributes intelligence to the cloud without uploading massive binaries. Our patent-pending approach ships only a handful of parameters into the canary process, dramatically reducing data traffic. Every unit includes a modem and 5-year eSIM, enabling



lightweight two-way communication and daily improvements—privacy-preserved, bandwidth-thrifty, reliability first.

4) Multimodal Sensing & LSTM Reasoning (predictive range with context)

Long Short-Term Memory (LSTM) cells keep the right memories and forget noise. A real-time stream of 3-axis accelerometer, GPS SOG, motor power, and RPM yields sea state, hull dynamics, and early signs of developing issues. The model recommends RPM adjustments that increase range when conservation matters. Trials confirm the well-known “hockey-stick” truth: 4× speed requires ~16× power. RANGE Master translates that physics into simple guidance: “drop to N RPM for +X nm.”

5) Acoustic Intelligence (maintenance you can hear—with a mic)

A discreet microphone learns the motor's acoustic signature. The system flags bearing wear, incipient cavitation, and RPM sweet spots long before a human ear would. Maintenance becomes proactive, not reactive—protecting both efficiency and uptime.

6) Conversational Interface (plain-language answers, not dashboards)

Interact by SMS or onboard text:

- User: “How far can I go today?”
RANGE Master: “At 85% and today's headwinds, estimated range is 47.3 nm; headwinds reduce by 3.2 nm.”
- User: “What's that noise at mid-range RPM?”
RANGE Master: “Slight cavitation at ~2750 RPM; pattern suggests minor prop damage; ~7% efficiency impact.”

This isn't scripted chatbot gloss. It's the output of multiple cooperating neural models—explained, not obscured.

The conversation that really matters

- User: “Why is my range lower today?”
- RANGE Master: “Drag is 12% higher than last week. Motor acoustics normal. Accelerometer patterns indicate moderate biofouling. Clean within 10 days to maintain efficiency.”

Clarity, causality, and a timetable—so the skipper can act with confidence.



What this approach avoids

- Unwanted complexity with opaque outcomes
- \$500k+ sunk into brute-force AI training
- Terabyte-scale data demands
- Risky one-shot model updates without guardrails

What this approach builds on

- Five years refining auto-tuning machine learning (Scotty AI—patented)
- Hard-earned sensor reliability across radar, IMU, and MEMS platforms
- A design ethos: powerful ideas, simply executed

Why RANGE Master AI is DAME-worthy

The marine industry deserves more than voltage readouts and percentages. RANGE Master AI's six-layer stack understands the vessel, learns from real use, and communicates like a competent crewmate. It gives skippers a trustworthy picture of range today—and a plain-spoken forecast of how their choices will change it. The concept is sophisticated under the hood yet uncomplicated to operate, which is precisely why it's reliable.

Safiery Pty Ltd

RANGE Master AI — Entered for DAME Awards 2025

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