WHITEPAPER · ENERGY SAVING SOLUTIONS

TRIM OPTIMIZATION

Performance & Energy + Dynamic Draught Measurement — Turning Raw Operational Data into Measurable Fuel and Power Savings.

Static trim tables from sea trials rarely reflect real operating reality. Hoppe Marine combines calibrated shaft power reference data with true dynamic draught and trim measurement to build a vessel-specific trim characteristic — and deliver trim advice the crew can trust. A case for small size container vessels.

75+
Years Marine Experience

7,500+
Ships Equipped

1,400+
Maihak Performance Systems

1,000+
Years Performance Data

HOPPE

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THE CHALLENGE

STATIC TRIM TABLES DON'T MATCH OPERATING REALITY.

Container vessels of 1,800–3,000 TEU operate across a wide spectrum of draught and trim conditions. Static trim tables from sea trials rarely reflect real operating reality — and small deviations from the optimum trim translate into significant power penalties.

STATIC DRAUGHT SIGNALS ARE NOT ENOUGH

Dynamic Draught and Floating Monitoring provides reliable draught measurements without hydrodynamic distortion while sailing — static sensors cannot.

TRIM MUST BE DYNAMIC, NOT ASSUMED

At sea, trim changes with speed, ballast operations and hydrodynamic effects. A static or distorted value can lead to false optimization advice.

DATA ERRORS CAN OUTWEIGH THE SAVINGS

Trim savings are a few percent of shaft power. Inaccurate signals can be larger than this effect — the model then "optimizes" toward a false minimum, undermining credibility and realized savings.

REAL-WORLD FINDING · 1,000+ YEARS OF PERFORMANCE DATA ACQUIRED BY HOPPE MARINE

A trim deviation of just **20 cm** from the optimum can increase speed-loss by **3 %** — equivalent to **~9.2 % more shaft power** and up to **2,100 t additional fuel per year** (worst case) on a comparable vessel.

<20 cm
Accuracy of dynamic trim operation

+3 %
Avg. speed-loss vs. optimum trim

+9.2 %
Power consumption vs. optimum

2,100 t
Extra fuel / year — worst case, reference vessel

THE POWER-CUBE RELATIONSHIP BEHIND THE SAVINGS

$$\Delta Fuel = Shaft\ Power \times [\,(1 + \Delta v/v)^3 - 1\,] \times hours \times days \times SFOC$$

Example: 10,000 kW × ((1.03)³ − 1) × 24 h × 250 d × 180 g/kWh ≈ 1,000 t fuel / year — lost to a trim deviation that the crew cannot even see without dynamic measurement.

THE SOLUTION

TWO PILLARS OF SYSTEM TECHNOLOGY. ONE CLOSED OPTIMIZATION LOOP.

Trim optimization only works when dynamic draught & trim are measured precisely in real time **and** correlated with reference shaft power and environmental factors following ISO 19030 criteria. Hoppe Marine delivers both — fully integrated.

MEASURE · CORRELATE · OPTIMIZE

PILLAR 1

PERFORMANCE & ENERGY

MAIHAK® Shaft Power Meter · Performance Monitoring · Energy Measurement

- Continuous, calibrated reference shaft power
- Navigation, weather and consumption data acquisition (MIoT)
- Foundation for ISO 19030 compliant performance baseline
- 1,400+ Maihak Performance Systems already in service

PILLAR 2

DYNAMIC DRAUGHT MEASUREMENT

Real-time draught & trim — even while sailing in rough seas

- Hydrostatic pressure sensors fore / mid / aft
- Dynamic floating condition determined with 2 IMUs
- True floating condition — not nominal draught from the loading computer
- Core components approved by major classification societies · made in Germany

WHY THIS COMBINATION WINS

1

OPTIMIZATION STARTS WITH MEASUREMENT

Trim advice is only as good as the underlying draught, trim, speed and power signals. Exact dynamic trim measurement is the critical prerequisite.

2

HOPPE PROVIDES THE FULL CHAIN

Performance data acquisition, dynamic draught/floating measurement, validation, ship-to-shore connectivity and API access — combined in one architecture.

3

SAVINGS BECOME PROVABLE

After several months of normal operation or targeted trim trials, a vessel-specific trim map quantifies power demand differences by draught and trim.

ONE SUPPLIER. ONE SIGNAL CHAIN. ONE RESPONSIBILITY.

From sensor to trim advice, every element is engineered, delivered and supported by Hoppe Marine.

HOW IT WORKS

FROM SENSOR TO TRIM ADVICE — ONBOARD AND VIA FLEET CONNECT.

High-quality data is acquired onboard, quality-checked, transmitted to shore and processed into a vessel-specific trim characteristic. The crew receives clear, regular trim advice — no interpretation effort required.

ACQUIRE 1

Shaft power, draught, speed and weather acc. ISO 19030 — MIoT data acquisition unit onboard.

TRANSMIT 2

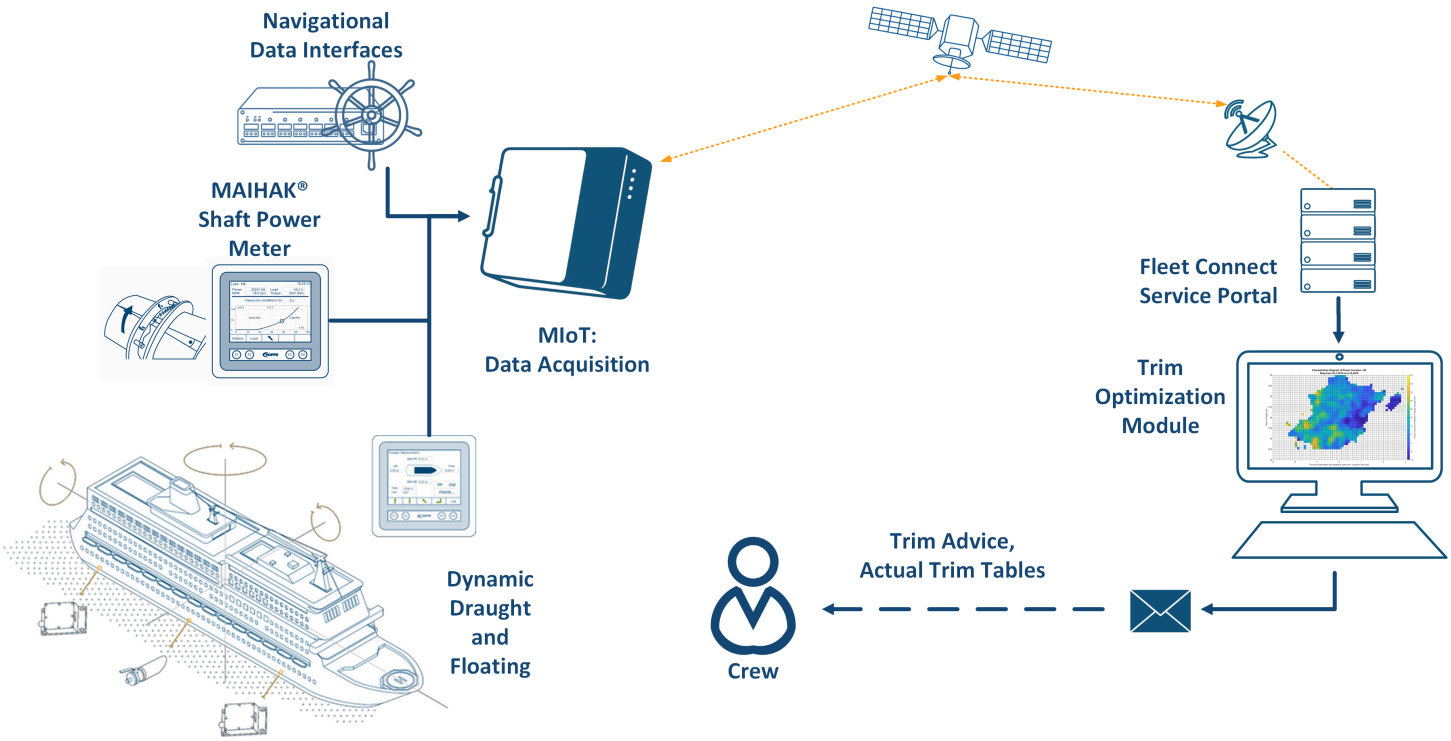
High-frequency data, continuously quality-checked, sent to shore via Fleet Connect.

COMPUTE 3

The Trim Optimization Module builds a vessel-specific trim characteristic diagram.

ADVISE 4

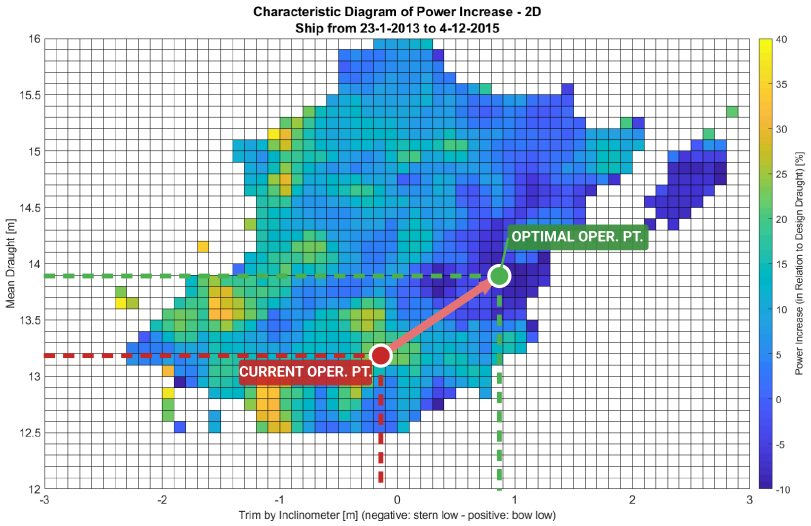
Crew receives regular trim advice, alerts and signal-health reports via the Trim Table Advisor.



DATA QUALITY FIRST Every data point is continuously quality-checked and validated against ISO 19030 criteria before it enters the optimization model — so the trim advice is built on signals the crew and the office can trust.

THE OUTPUT & THE INSIGHT

A VESSEL-SPECIFIC TRIM CHARACTERISTIC — AND WHY EVERY DECIMETER COUNTS.



WHAT YOU ACTUALLY GET

A heat-map of power increase (vs. design draught) across the full operating envelope of trim and mean draught — built from your vessel's own real-world data, not from a sea-trial assumption.

- **X-axis** — Trim by inclinometer [m] · negative = stern low
- **Y-axis** — Mean draught [m]
- **Color** — Power increase vs. design draught [%]
- **Cells** — Each cell = real operating hours, statistically validated

THE INSIGHT: 30 % LESS POWER — EVEN AT HIGHER DISPLACEMENT

CURRENT OPERATING POINT

Slightly stern-low · ~13.2 m draught
→ +25 % power vs. design

OPTIMAL OPERATING POINT

Bow-heavy trim · ~13.9 m draught
→ −5 % power vs. design

ACHIEVABLE DELTA

≈ 30 %

shaft power deviation at this operational draught

THE BUSINESS CASE

WHAT TRIM OPTIMIZATION IS WORTH — FOR A 2,500 TEU CONTAINER FEEDER.

Conservative model based on Performance & Energy field data and the power-cube relationship. Actual results depend on route mix, hull condition and loading patterns.

Vessel size · 2,500 TEU (typical) | Shaft power · ≈ 18,000 kW MCR | Sea days / year · 180–260 (scenario) | Avg fuel consumption · 18–25 t/day (scenario)
SFOC · 180 g/kWh | Fuel price (LSFO) · ≈ €600/t (≈ 650 USD/t) | FX · 1 USD ≈ 0.92 EUR | CO_2 factor · 3.114 t CO_2 / t fuel | Savings rate · 2.0–5.0 % (scenario)

≈ 162 t
fuel saved / year
per vessel (base case)

≈ 505 t
CO_2 avoided / year
supports CII rating

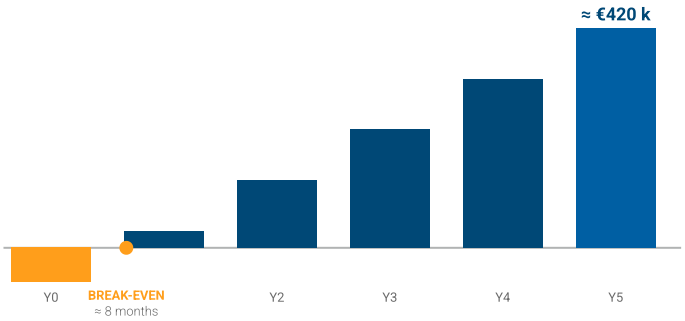
≈ €97 k
fuel cost saved / year
at ≈ €600/t LSFO

< 12 mo
typical payback
for full retrofit

SENSITIVITY — THREE OPERATING PROFILES

Scenario	Sea days / yr	Avg. fuel t/day	Savings rate	Fuel saved t/yr	Value @ ≈ €600/t
Conservative / mixed service	180	18	2.0 %	64.8	≈ €38,900
Base case	220	21	3.5 %	161.7	**≈ €97,000**
High utilization / near full-speed profile	260	25	5.0 %	325.0	≈ €195,000

5-YEAR CUMULATIVE NET VALUE — BASE CASE



Retrofit investment ≈ €50–80k (Y0, €65k shown) · base case savings ≈ €97k/yr · constant fuel price

MORE THAN TRIM — SAME DATA

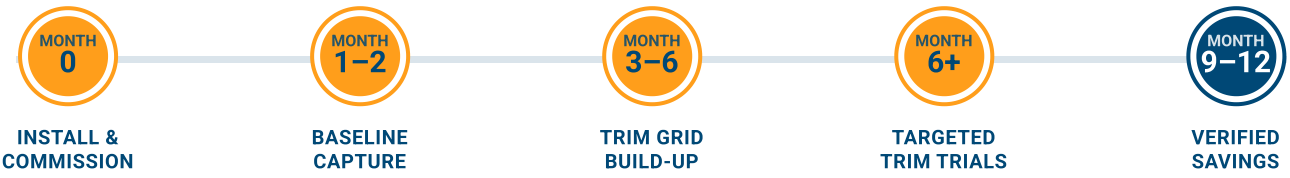
- ISO 19030 compliant hull & propeller performance trending — early detection of fouling and degradation
- Trim characteristics are continuously re-learned — advice stays valid as hull condition changes
- Validation of CFD- and sea-trial-based trim tables from yards against real operating data
- CII monitoring, reporting and charter-party performance evidence

All figures are illustrative commercial scenarios, not guaranteed savings. Actual results depend on route mix, hull condition and loading patterns. The 25 t/day reference applies to the high-utilization scenario; lower annual average consumption is assumed for mixed service profiles.

ROADMAP

FROM INSTALLATION TO VERIFIED SAVINGS — TYPICAL TIMELINE FOR A PILOT.

A standard rollout delivers the first vessel-specific trim grid within 3–6 months — processed online and provided directly to the vessel.



M 0 · INSTALL & COMMISSION

Start of data acquisition: MAIHAK shaft power meter and dynamic draught sensors installed. Integration with Fleet Connect.

M 1–2 · BASELINE CAPTURE

Grey-box model: sea trial curves combined with collected reference data across normal voyages as initial setup. Vessel performance baseline established.

M 3–6 · TRIM GRID BUILD-UP

Self-learning algorithm fills the trim characteristic diagram from real operating points, considering ISO 19030 criteria.

M 6+ · TARGETED TRIM TRIALS (OPTIONAL)

Dedicated trim trials accelerate coverage of under-sampled areas of the operating envelope.

M 9–12 · VERIFIED SAVINGS

Quantified power and fuel savings, regular trim advice to the crew, CII improvement reporting.

FIRST TRIM GRID — **Within 3–6 Months of Installation** — Processed online · provided directly to the vessel

READY TO FIND YOUR OPTIMUM TRIM?

Start with a pilot installation for trim grid creation — one reference vessel, full Hoppe Marine service support.

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Hoppe Marine GmbH, Hamburg · Hoppe Hellas

NEXT STEPS

PILOT INSTALLATION FOR TRIM GRID CREATION.

1 DISCOVERY WORKSHOP

1 hour, online — presentation of data collection and system boundaries.

2 TAILORED SCOPE & QUOTE

Per-vessel (retrofit) plan covering Performance & Energy + Dynamic Draught Measurement.

3 PILOT INSTALLATION

One reference vessel, full Hoppe Marine service support, Fleet Connect data connectivity.

4 VERIFIED SAVINGS REPORT

Quantified power, fuel and CII impact after the first 6–12 months.

REQUEST YOUR PILOT ASSESSMENT

75+ years marine experience · 7,500+ ships equipped · 1,400+ Maihak Performance Systems · 1,000+ years performance data

All performance and savings figures in this whitepaper are based on Hoppe Marine field data and illustrative commercial scenarios. Actual results depend on vessel type, route mix, hull condition and operating profile. Hoppe Marine provides a vessel-specific assessment before any commitment.