

The Journey of Operational Ship Propulsion Performance Improvements

Erik van Ballegooijen - Director R&D



our technologies

sustainability

investors

people & culture

who we are

130 locations
15000 people
€ 3.2 billion revenue

our technologies

our technologies impact everyday life



VAF

INSTRUMENTS



- VAF was founded in 1938
- Located in Dordrecht (near Rotterdam), The Netherlands
- 85 year old

➤ ViscoSense® 3D

Viscosity & Density Measurement

To optimize combustion
and prevent engine damage



➤ T-Sense®

Torque Measurement

To provide engine
performance related to fuel
consumption



➤ AQ Rate Coriolis

Industrial Mass Flow Measurements

To measure high flow,
corrosive liquids for industrial
application



➤ PD Flowmeters

Highly Accurate Flow Measurement

To monitor fuel consumption
with temperature compensation



➤ ShaPoLi

EEXI Power Limitation

To limit the propulsion power
And comply with EEXI



➤ Data Collection Box SPU-3

High Frequent Data Collection

To collect sensor data for propulsion performance monitoring:

- Pulses
- NMEA
- Modbus
- Analogue

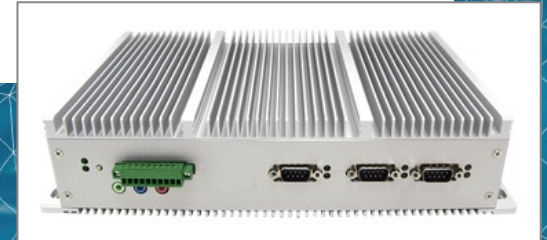


➤ Data Collection Box IPC

High Frequent Data Collection

To collect additional sensor data for performance monitoring

- Modbus TCP/IP
- NMEA



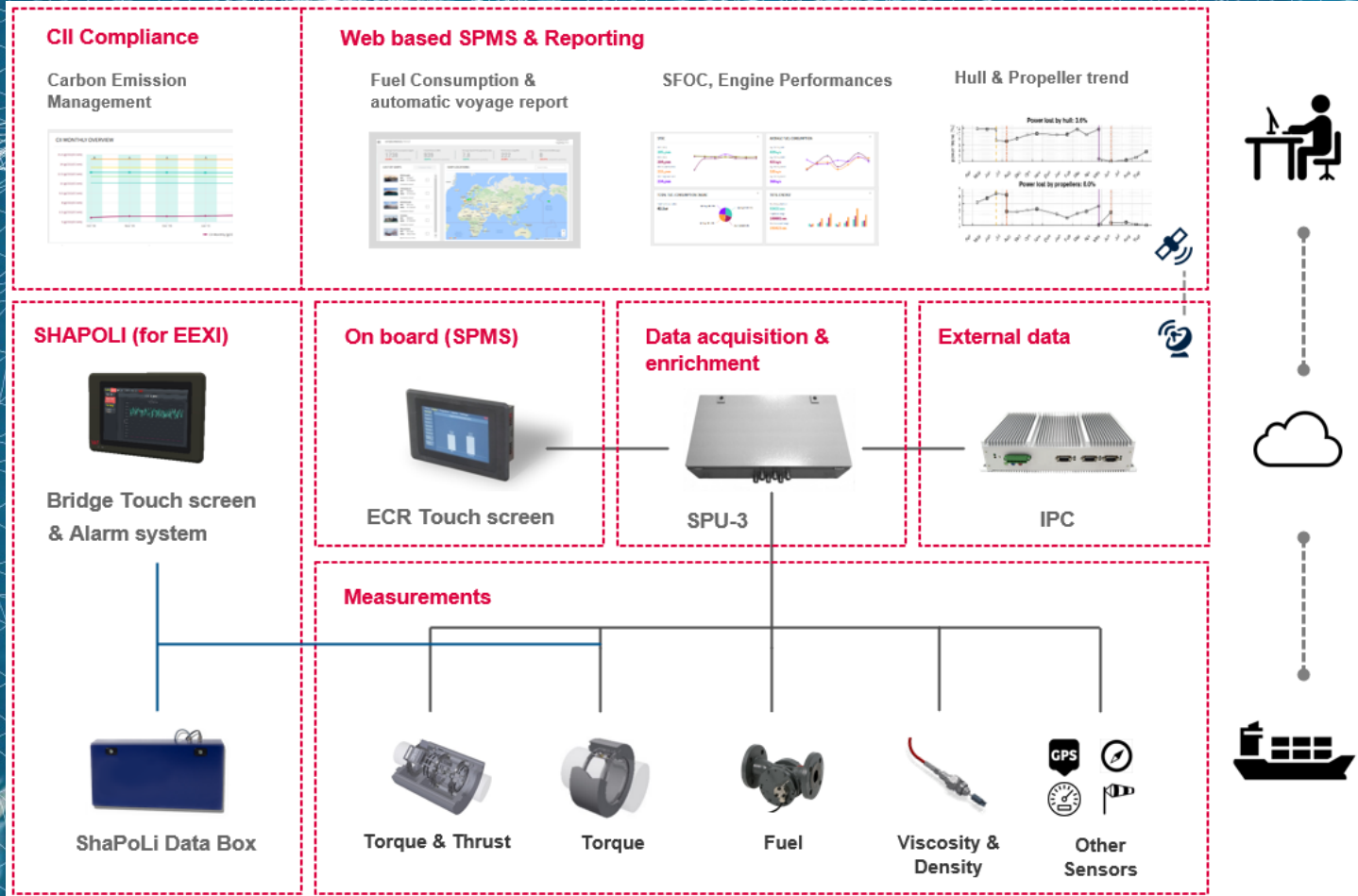


Web Based SPMS

To manage and improve
propulsion performance
& Carbon emission



High frequent Data Collection



The Journey of Operational Ship Propulsion Performance Improvements via Digitalisation

Your need to have a clear view on your application of the offered technologies.

And be aware that:

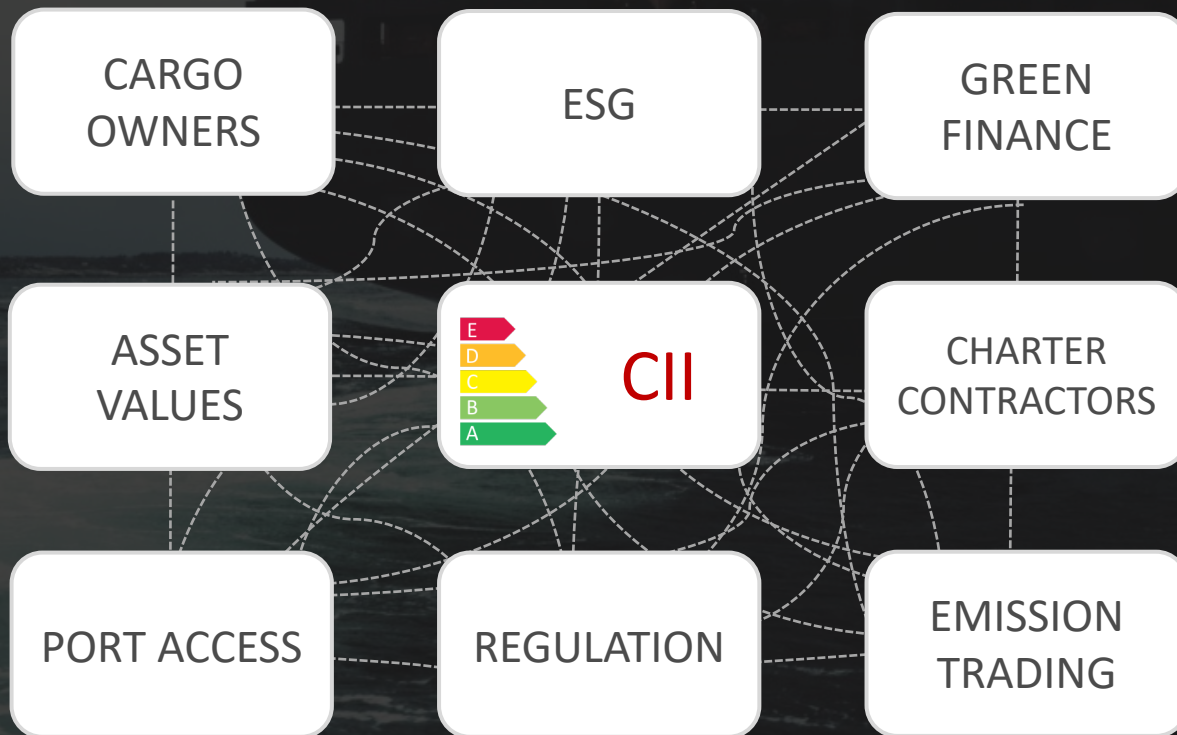
- *Purpose*
- *Goal to achieve*
- *Not always easy*
- *Persistent*
- *Experience*
- *Time*
- *Support*
- *Step by step to the highest level*

But the reward is HIGH !



INSTRUMENTS

Measure Data – Analyze - Report - Act





Ship Propulsion Performance Improvements via Digitalisation

How to measure ship propulsion performance ?

The Basics

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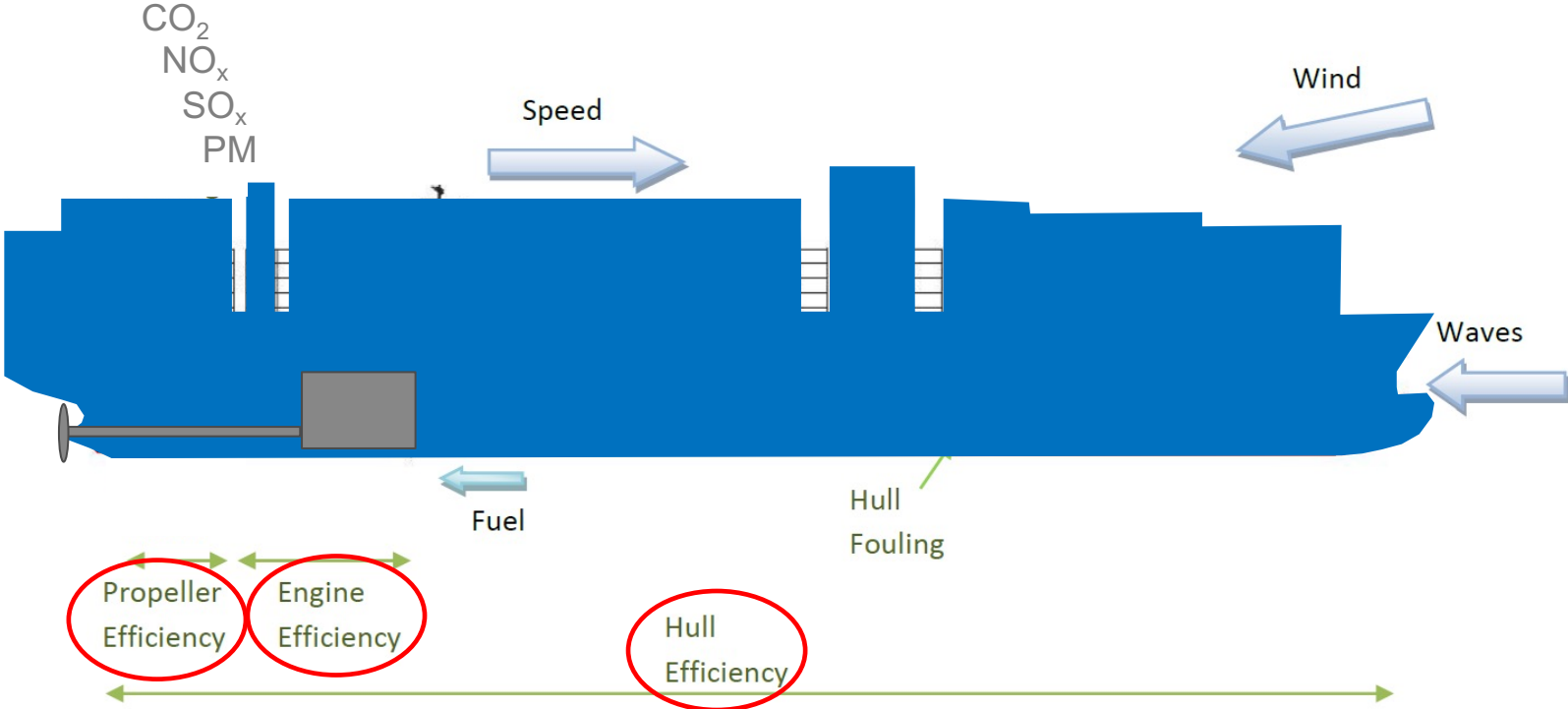
INSTRUMENTS



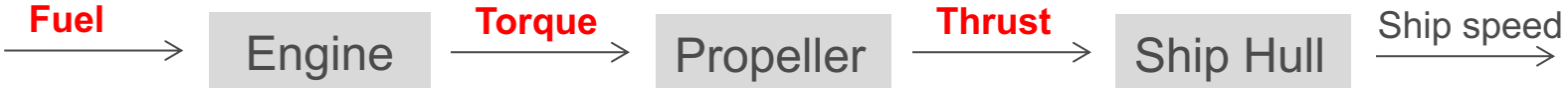
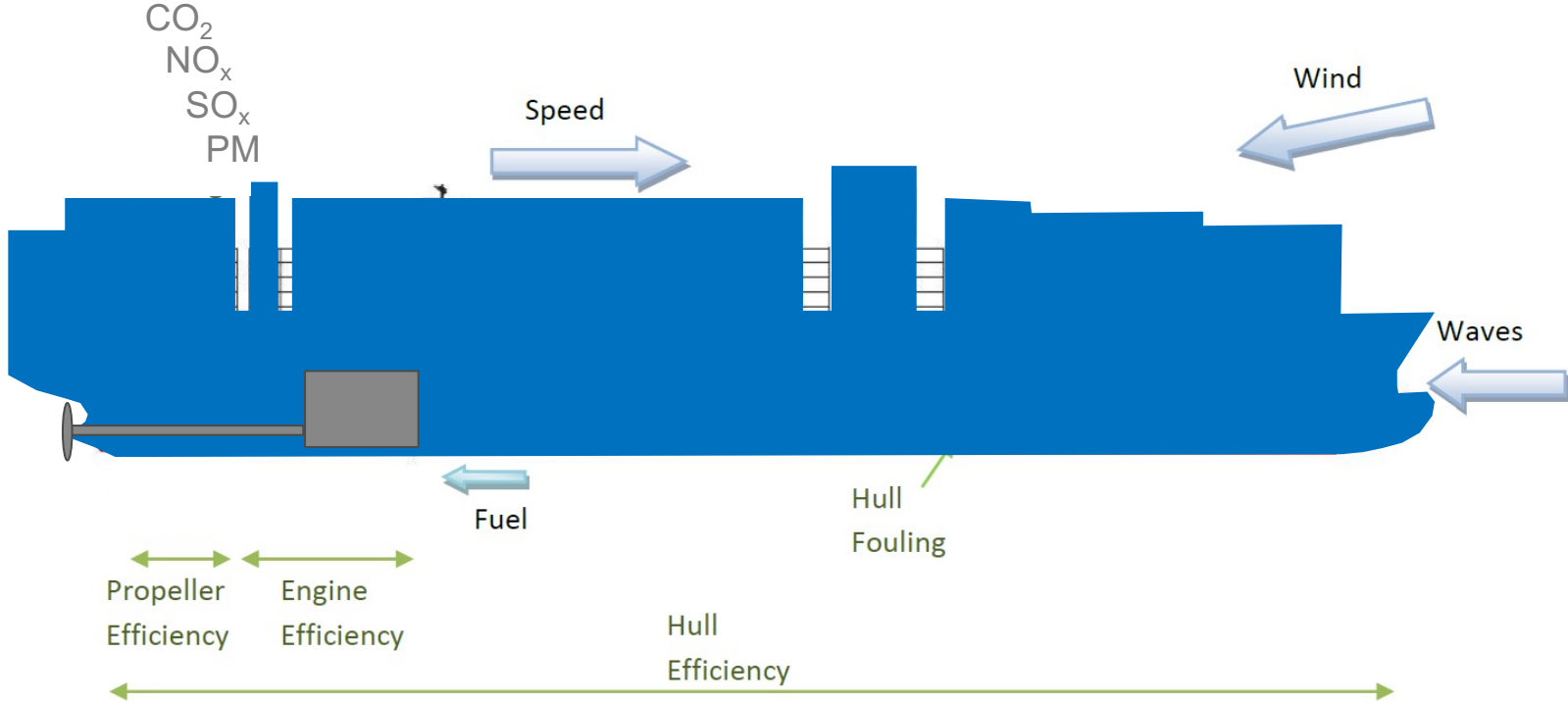
The Basics

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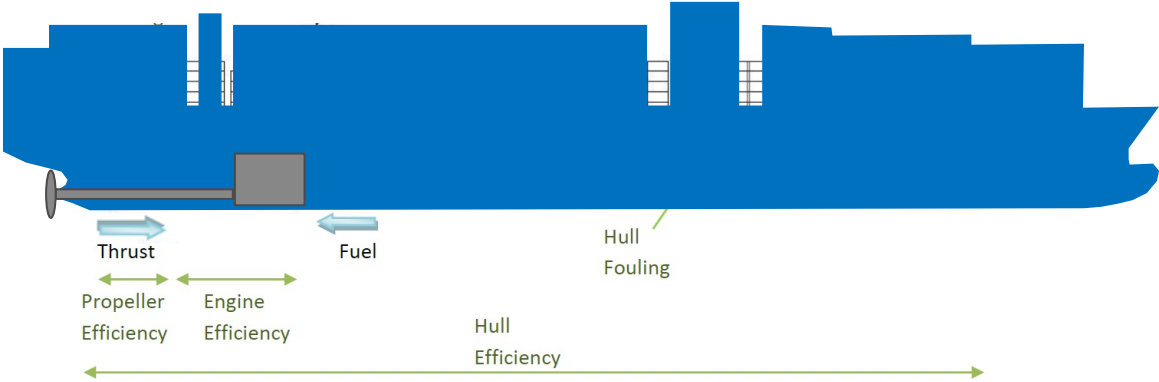
INSTRUMENTS



The Basics



LEVEL 1. Bunker Delivery



LEVEL

4.

3.

2.

1.

BDN



Engine + Propeller + Ship Hull

Ship speed →

LEVEL 1. Bunker Delivery

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INSTRUMENTS



Use own Bunker flow meter to verify BDN

Bunker flow meter advantages:

- Verification of BDN
- Forces accuracy at bunker supplier

Propulsion Performance based on Bunker Delivery:

- Verification of overall fuel used between bunkers
- Changes in Fuel Consumption can not be assigned to either the:
 - Engine, Propeller, Hull, or other external factors like:
 - Draught,
 - Wind,
 - Waves,
 - Trim



BDN



Engine + Propeller + Ship Hull

Ship speed



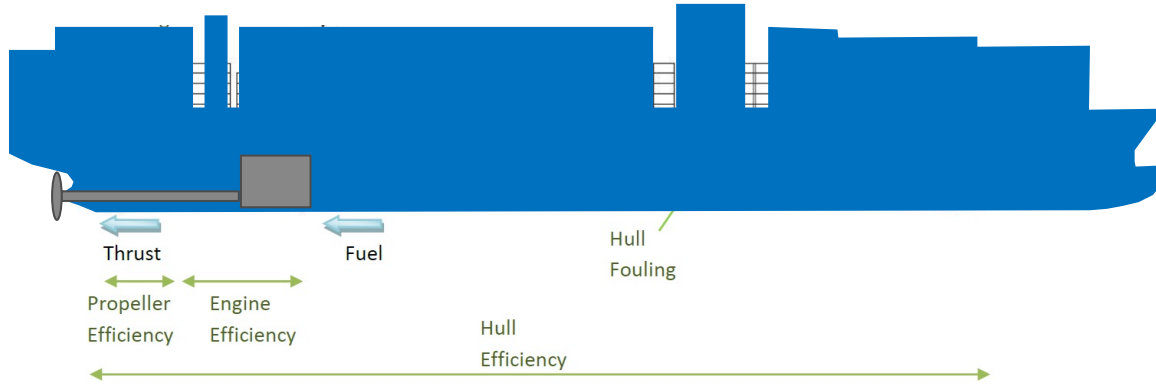
Conclusion:

- *Propulsion performance analysis on Bunker Delivery data is the 1st level.*
- *Easy to perform but only global general insights on ship performance.*

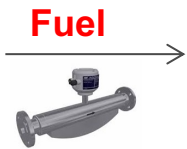
LEVEL 2. On Board Fuel Flowmeter

VAF

INSTRUMENTS



LEVEL
4.
3.
2.
1.



Engine + Propeller + Ship Hull

Ship speed →

BD-Note →

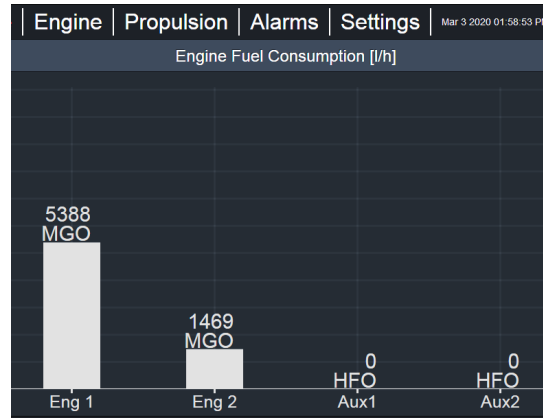
Engine + Propeller + Ship Hull

Ship speed →

LEVEL 2. On Board Fuel Flowmeter

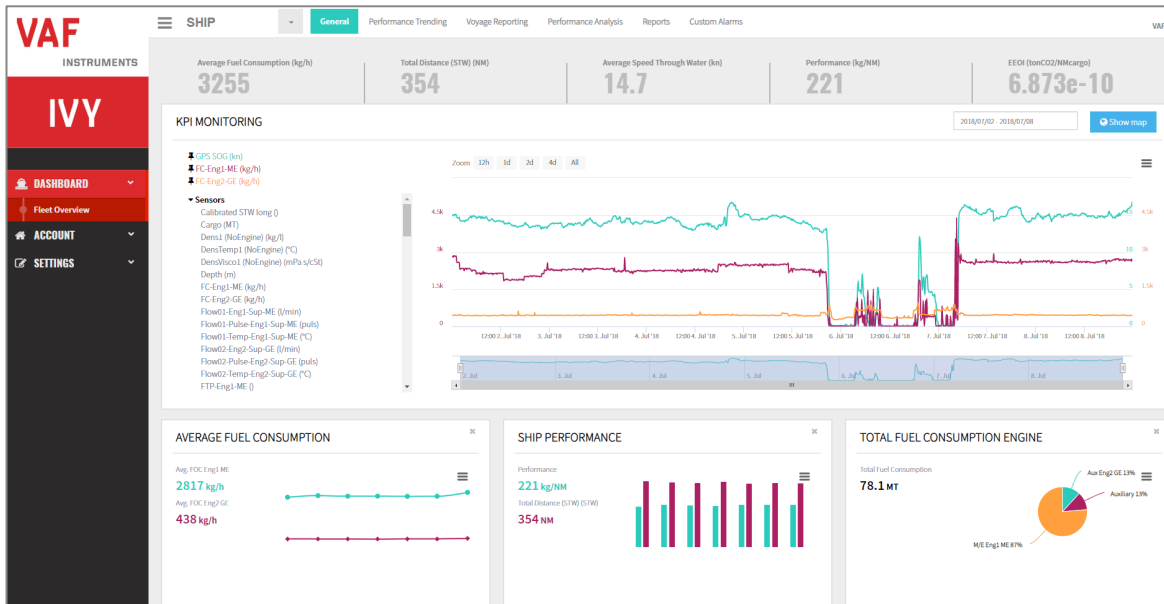
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INSTRUMENTS



On Board Measuring fuel consumption per consumer:

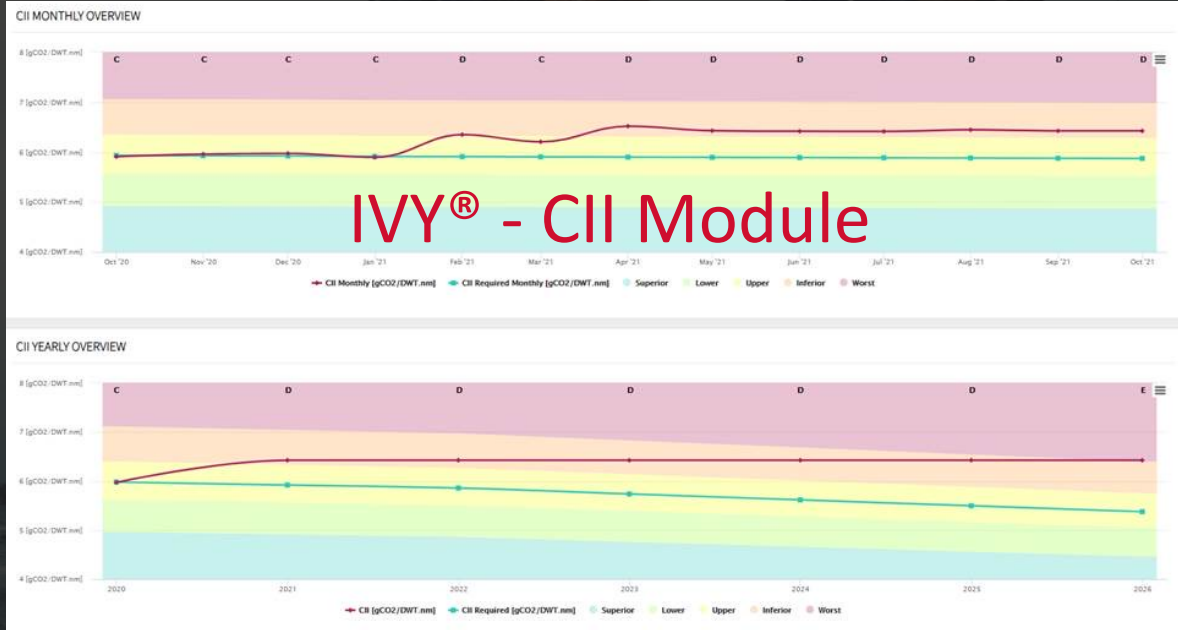
- Main Engine
- Auxiliary Engine(s)
- Boiler
- Data visualisation



Office Analysis via IVY[®]:

- High Freq. data collection
- In depth fuel analysis KPI's
- MRV + IMO DCS + CII
- Data in Cloud
- Integration customer BI-tool

INSTRUMENTS



	2023 (-5%)	2024 (-7%)	2025 (-9%)	2026 (-11%)
A:	8.11 / -37.47 [%]	8.11 / -37.47 [%]	8.11 / -37.47 [%]	8.11 / -37.47 [%]
D:	6.43 / 6.36 [%]	6.43 / 6.36 [%]	6.43 / 6.36 [%]	E: 6.43 / 6.36 [%]
A:	15.79 / -33.31 [%]	15.79 / -33.31 [%]	15.79 / -33.31 [%]	A: 15.79 / -33.31 [%]
C:	6.01 / -0.54 [%]	6.01 / -0.54 [%]	D: 6.01 / -0.54 [%]	D: 6.01 / -0.54 [%]

LEVEL 2. On Board Fuel Flowmeter



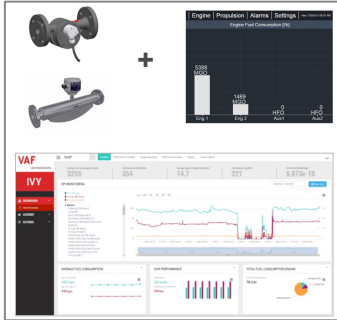
LEVEL 2. On Board Fuel Flowmeter

VAF

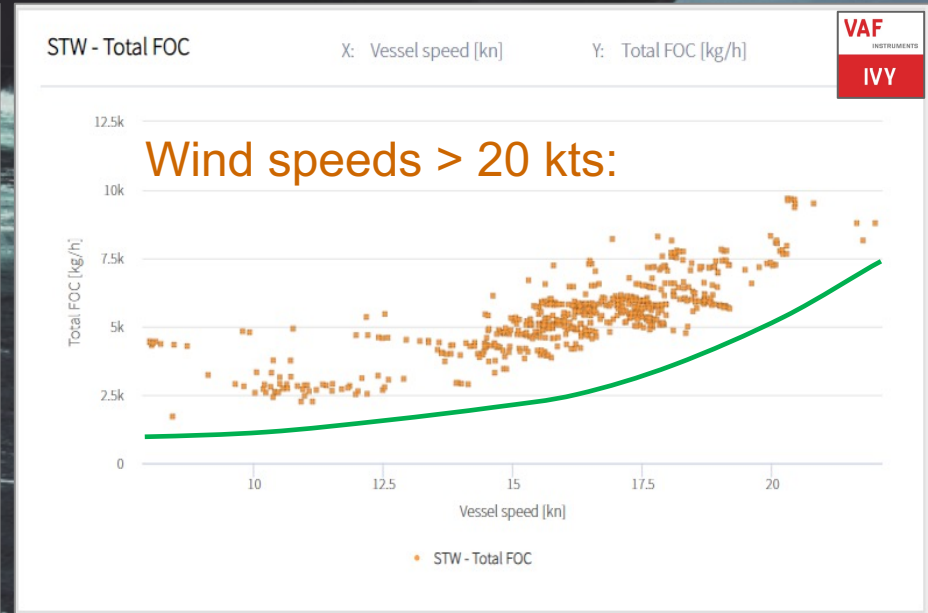
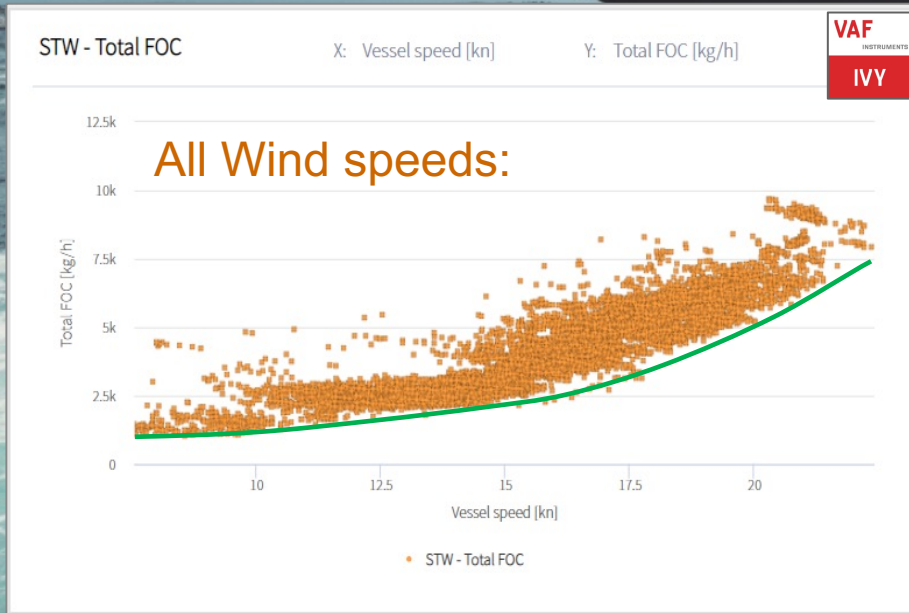
INSTRUMENTS

Benefits Fuel Flowmeter package:

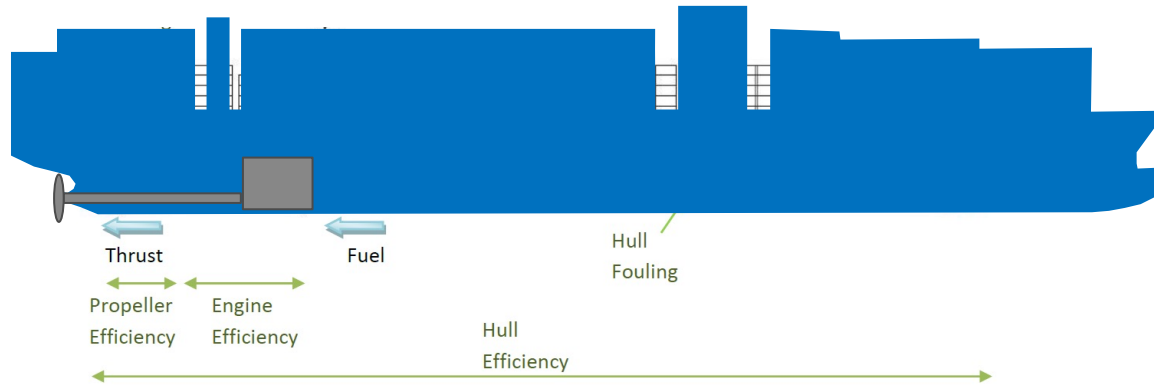
- Automatic High Frequent Data Collection
- Performance Department decisions via IVY cloud dashboards and KPI's
- Crew awareness via on board PEM4 performance dashboard
- CII optimisations based on measured Speed – Fuel curves
- Effects of wind, draft, etc. on fuel consumption



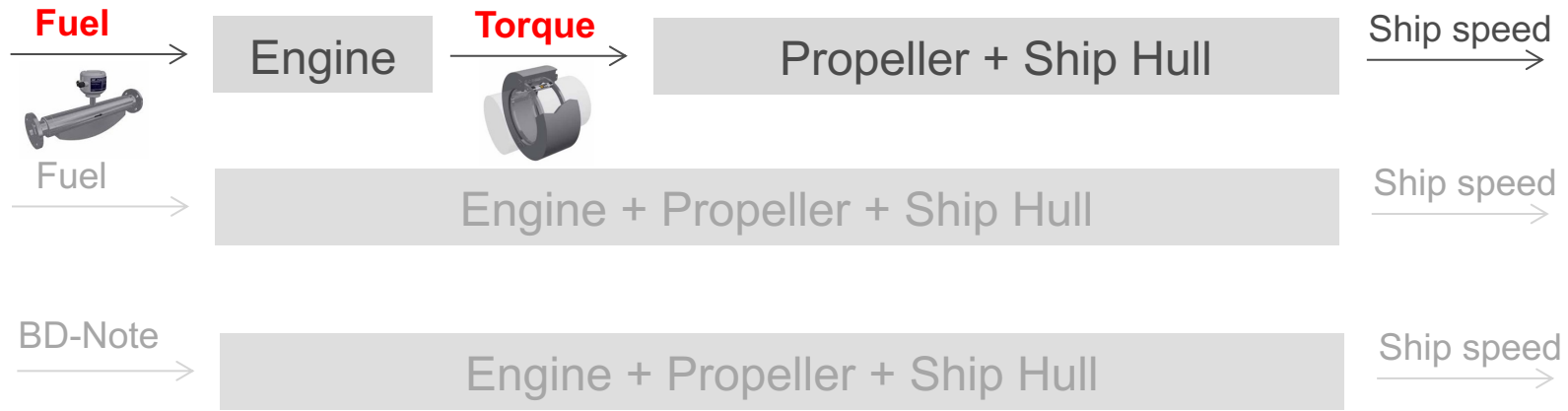
Effects of wind on fuel consumption (FOC) at ship speed, example of Large Container vessel:



LEVEL 3. Fuel Flowmeter + Torque meter



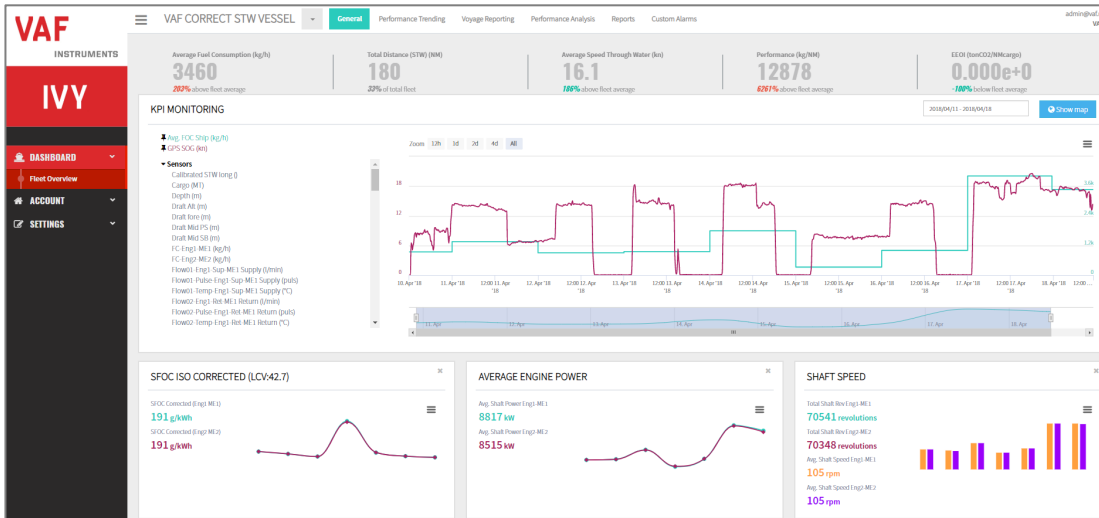
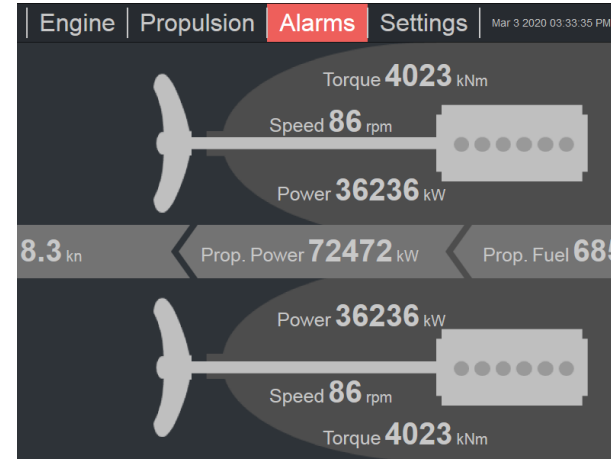
LEVEL 4. 3. 2. 1.



LEVEL 3. Fuel Flowmeter + Torque meter

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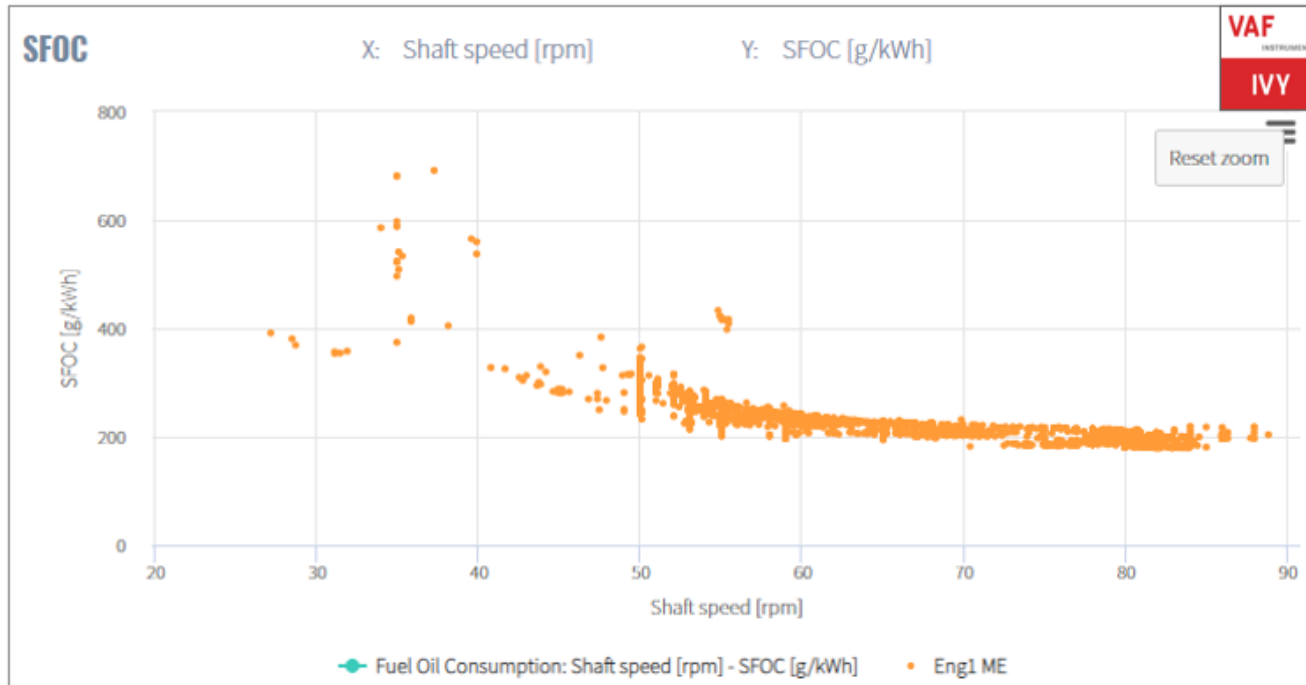
INSTRUMENTS



Additional insights with T-Sense[®] Torque Meter:

- Engine SFOC Measurements
- Speed – Power Curves
- Engine Load Curves
- Propeller Load Curves

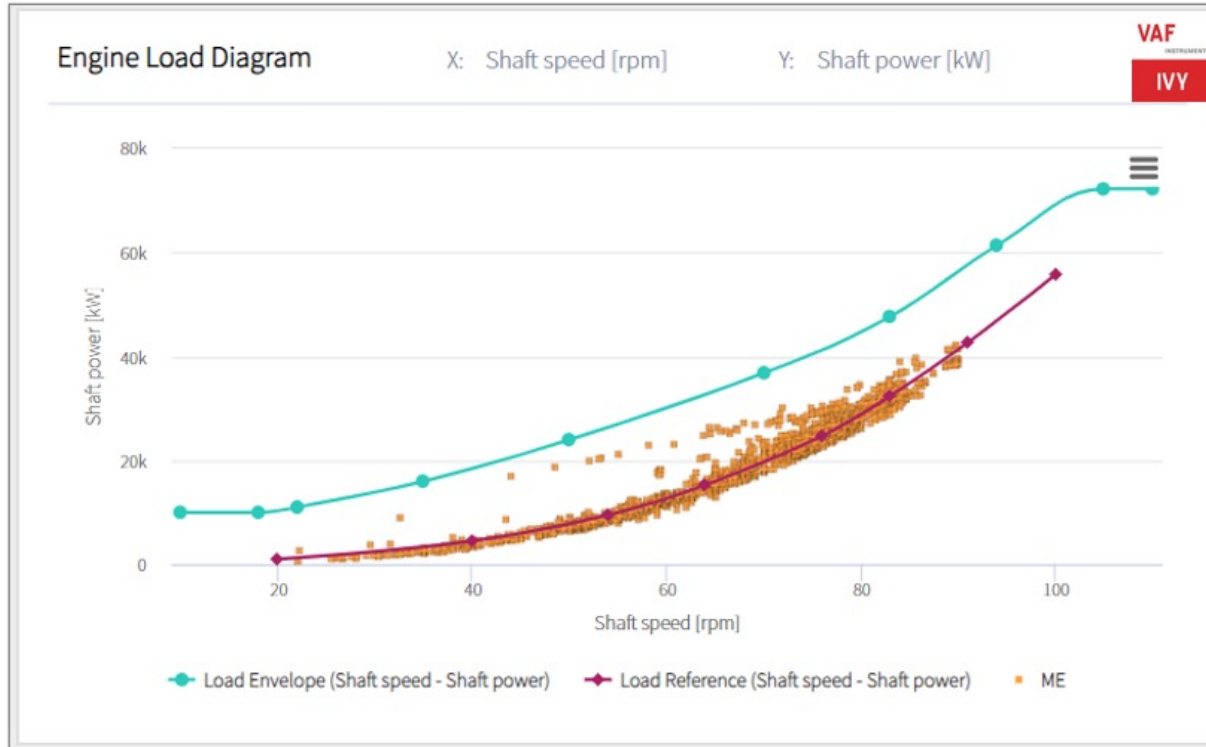
Measured Engine SFOC Large Container Vessel



Engine SFOC curves by adding T-Sense[®] Torque meter:

- Compare actual Engine SFOC towards Factory Test Bed Curves
- Find optimal SFOC RPM of Engine
- Monitor Engine degradation over time / engine maintenance

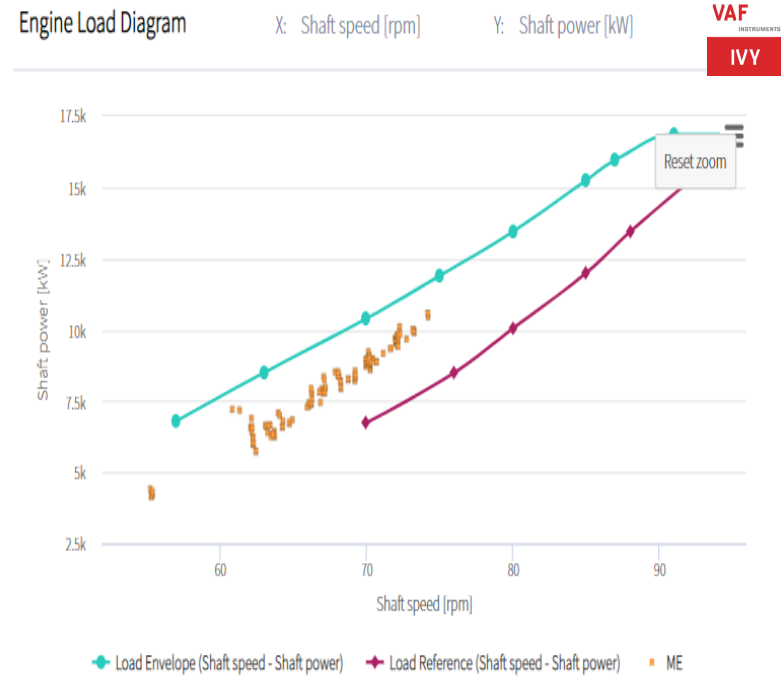
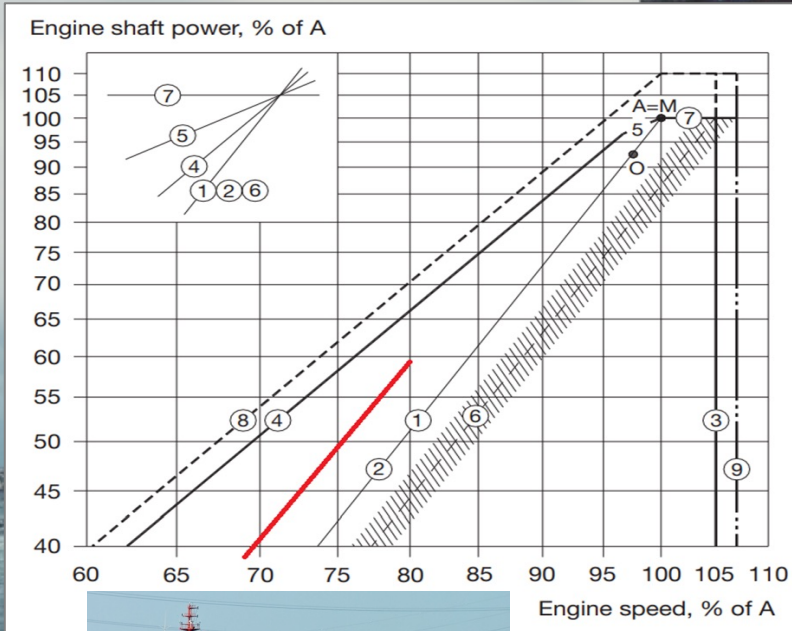
Propeller Load Reference Curve Large Container Vessel



Propeller Load Curve by adding T-Sense[©] Torque meter:

- Compare actual propeller power absorption towards new condition
- Check propeller power absorption towards engine load limit curve
- Find possible heavy running propeller

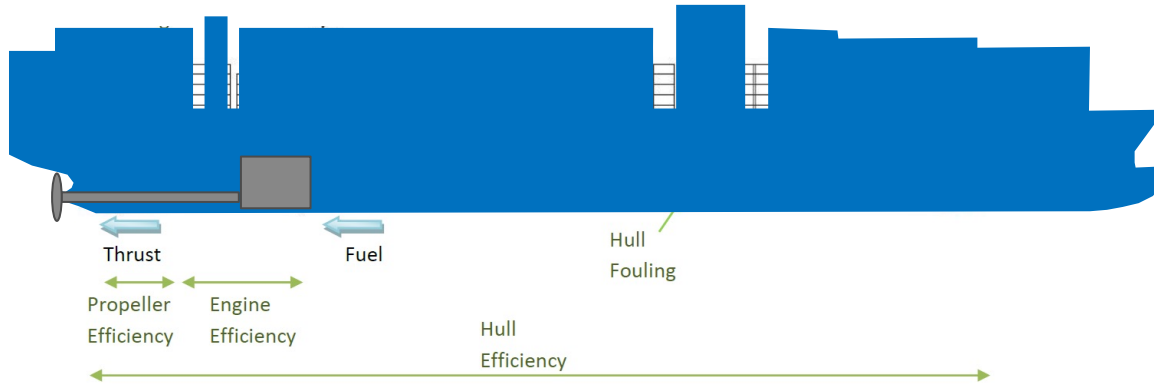
LEVEL 3. Fuel Flowmeter + Torque meter



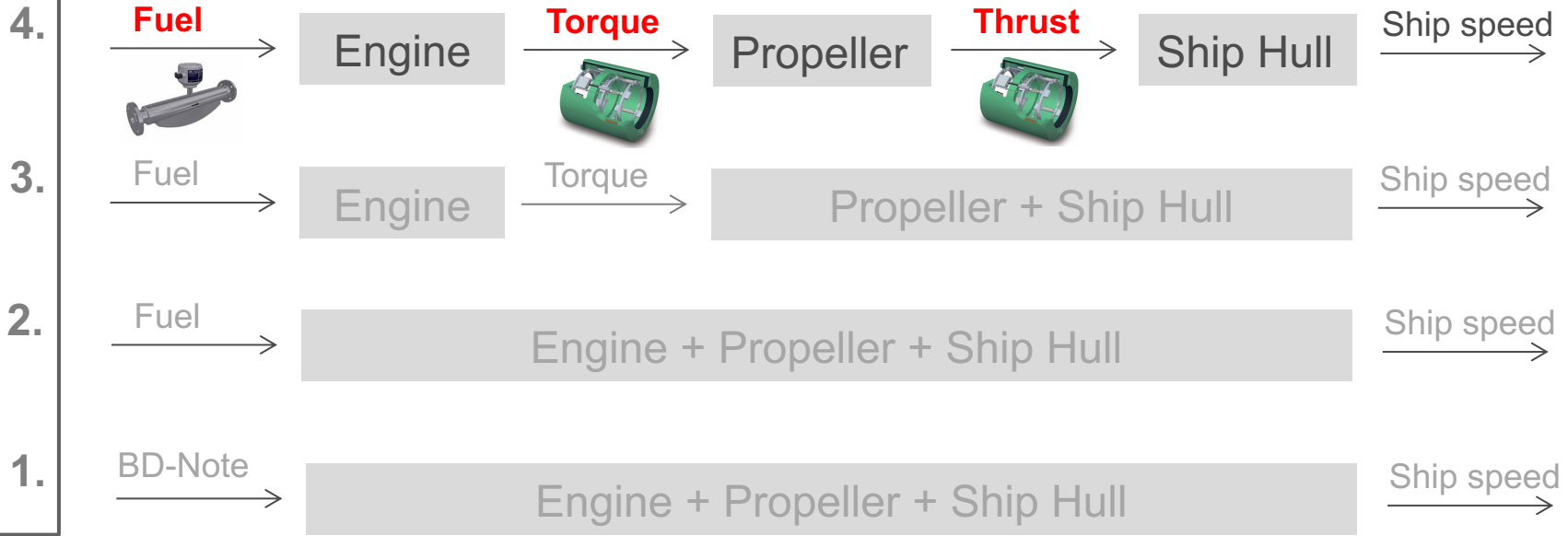
Benefit of finding Heavy Running Propeller by adding T-Sense[®] Torque meter:

- Prevent Engine running on it's load limit
- No full Engine RPM / Power possible
- Prevent Engine wear, high temperatures and additional fuel oil consumption

LEVEL 4. Fuel Flowmeter + Torque & Thrust meter



LEVEL



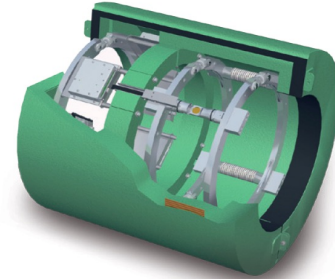
LEVEL 4. Fuel Flowmeter + Torque & Thrust meter

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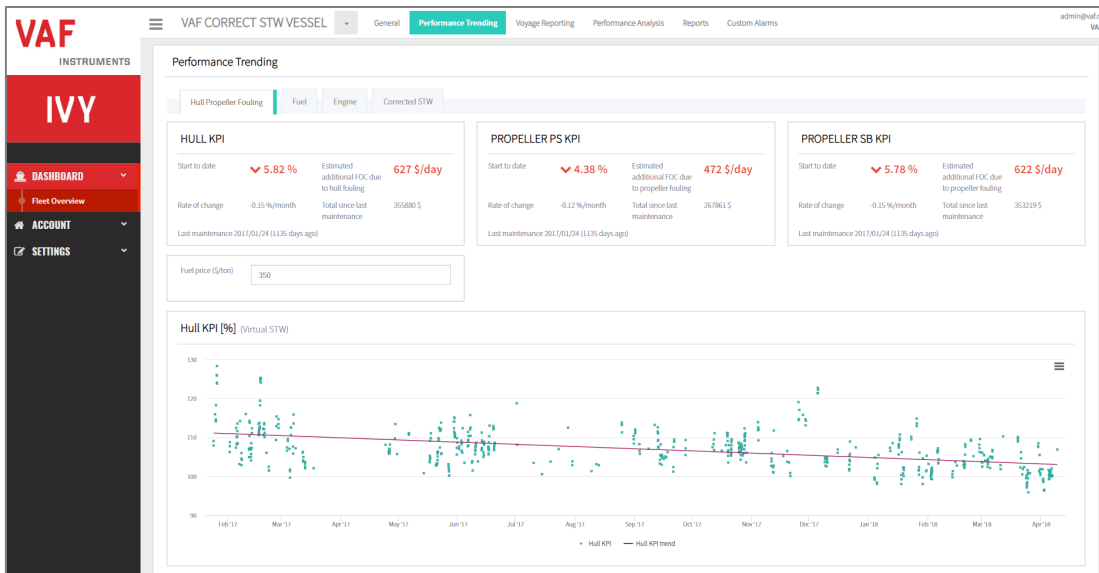
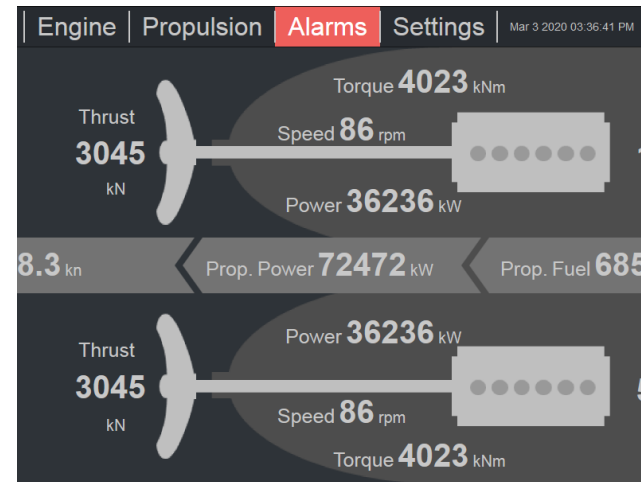


+



TT-Sense®

+



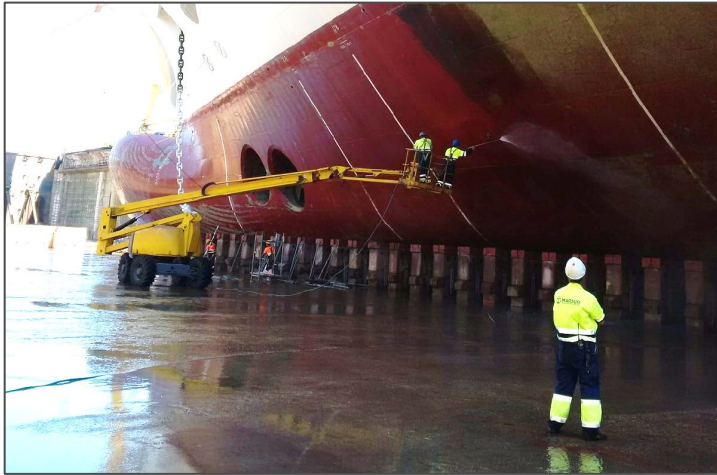
Additional insights Propeller Thrust measurements:

- Propeller Fouling / Cleaning
- Hull Fouling / Cleaning
- Effects of new Hull Coating
- Propeller Efficiency
- Propeller retrofit
- Bulbous Bow retrofit

LEVEL 4. Fuel Flowmeter + Torque & Thrust meter

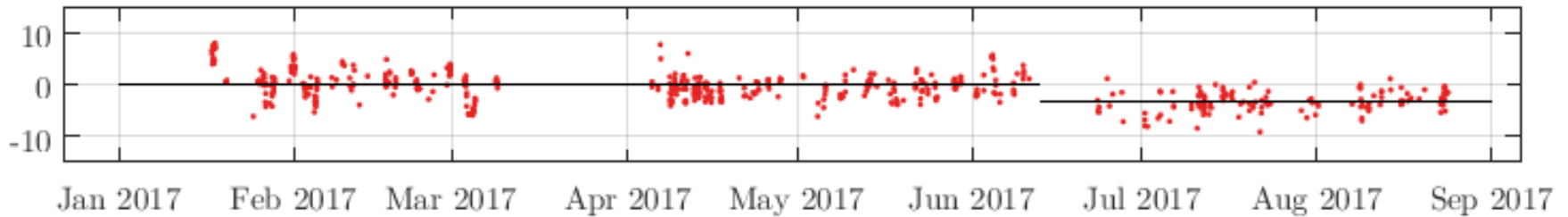
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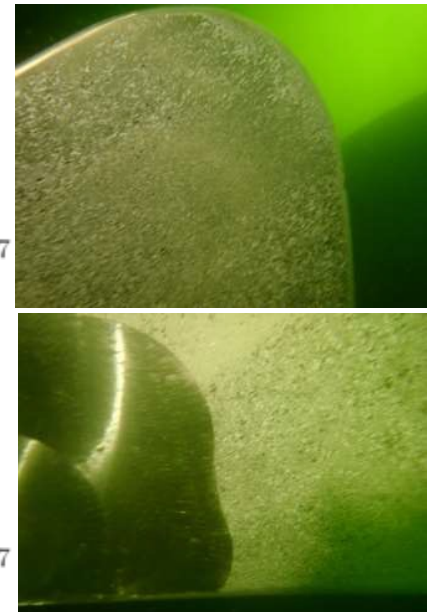
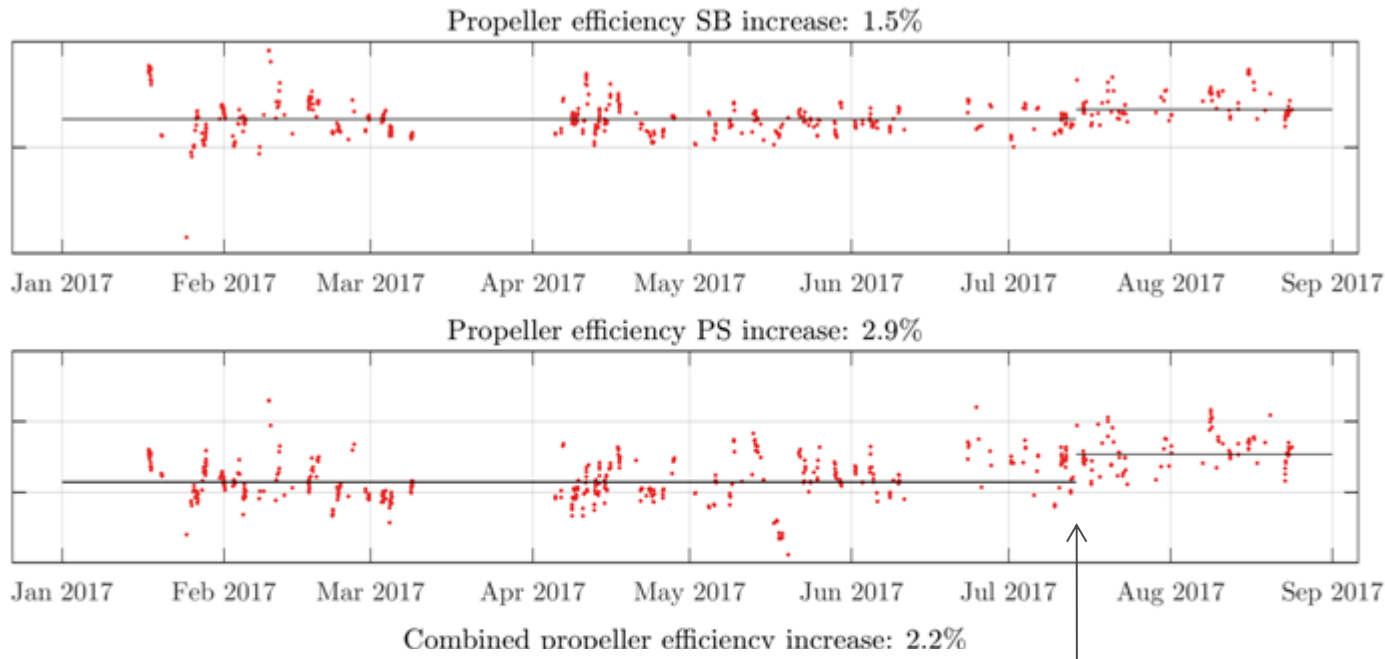
Hull cleaning,
+3.4% resistance reduction

Hull resistance reduction due to hull cleaning: 3.4%



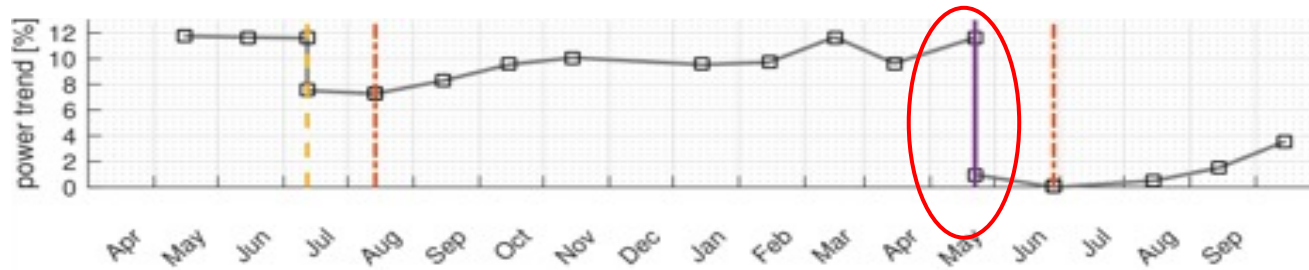
Hull cleaning in drydock

Propeller Polishing Cruise Vessel: + 2.2% in Propeller Efficiency



Propeller polishing

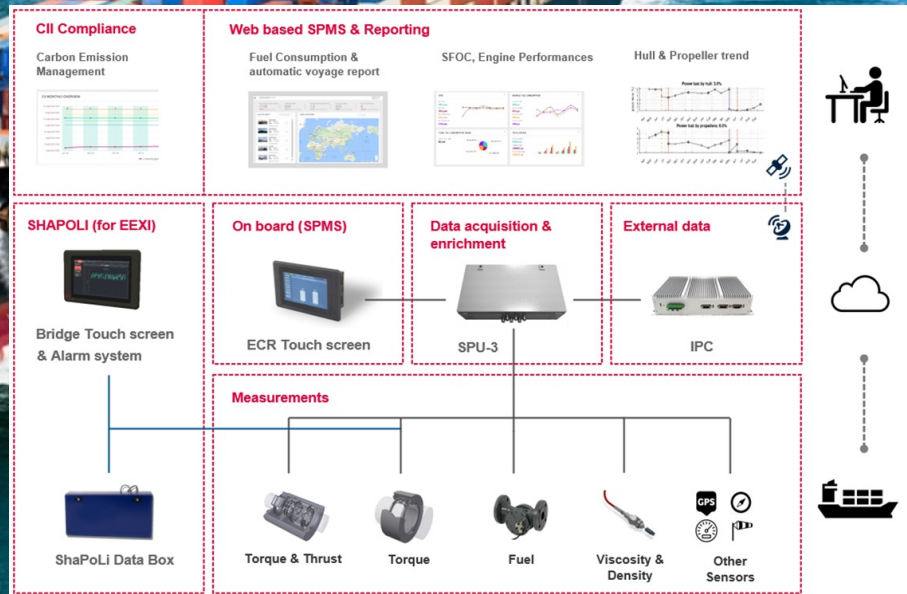
LEVEL 4. Fuel Flowmeter + Torque & Thrust meter



New Hull Coating: 10% reduction in Fuel

Digitalisation in Ship Propulsion Performance Improvements is getting essential

- High Frequent Data Collection
- Accurate sensors
- Domain knowledge
- Goal, Problem, Purpose
- Act operational on the insights
- *VAF Instruments is here to support you !*



VAF

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THANK YOU !

Please visit our booth
Hall D D06-48



MAS Fluid Control

EQUIPMENT CONTROL SYSTEMS SHIP EFFICIENCY

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