

Application Bulletin

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# PROPULSION PERFORMANCE MANAGEMENT

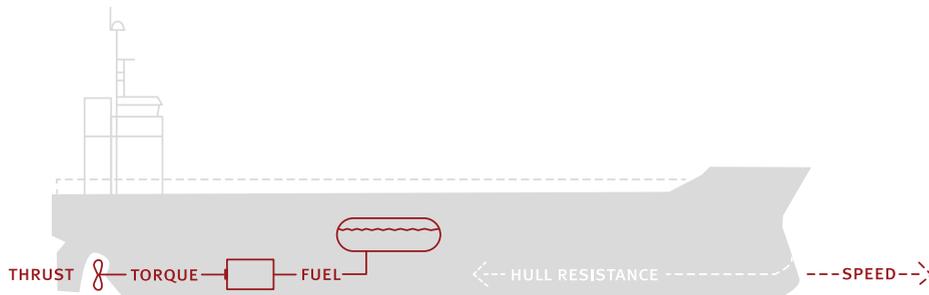


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# Propulsion Performance Management

Managing a fleet comes with numerous responsibilities and challenges. When it comes to fleet management, optimising fleets' performance is key. But Fleet Performance Management is not only driven by cost-effective goals and decisions. Environmental impact, competition and pending rules and regulations are also taken into account. To be one step ahead in Propulsion Performance Management, IVY®, VAF Instruments' software solution for Propulsion Performance Management provides you the fleet at your fingertips.



*Energy conversions & efficiencies  
Only by measuring propeller thrust you are able to separate the propeller efficiency from the hull resistance*

## Fleet performance

IVY®, Propulsion Performance Management system provides a relevant overview of the performance of the fleet as a whole. It enables monitoring and comparing the performance of the entire fleet of ships, as well as on individual ship level. IVY® automatically

collects all data, performs powerful analyses and visualises dedicated Key Performance Indicators (KPIs) and provides insight with full graphical display of sensor data. In addition, performance of sister ships can easily be compared in the fleet overview.

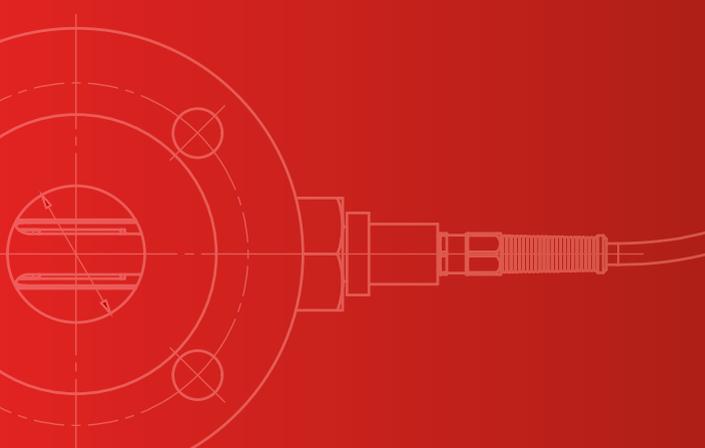
## From sensor to KPI

Data collection of the relevant sensors on board of various ships of a fleet usually results in unmanageable large amounts of data, so called Big Data. Therefore, the most important and difficult step is to refine the vast amount of raw measurement data into relevant data points. This enriched data is critical for KPIs on which decisions for ship performance optimisation can be based.

Big Data enrichment is automatically performed by IVY® and is based on the use of complex mathematical algorithms, which have been developed by VAF Instruments over many years. These mathematical algorithms of IVY® provide clear Key Performance Indicators (KPIs) on which the performance of the various ships and the fleet can easily be tracked. Strong algorithms also form the internal engine of the virtual sensors that improve sensor signal quality such as speed through water.

With by IVY®'s powerful analysis, visualising raw sensor data and performing difficult time consuming data analysis is no longer necessary. IVY® enriches and then analyses data into KPIs which are presented to the ship and fleet performance decision maker through a clear visualisation dashboard. These KPIs enable optimization of operational costs, energy efficiency, fuel consumption, emissions and maintenance.

If, based on the displayed KPIs, there is a necessity for further analysis of the performance of the individual ship or fleet, IVY® also offers the possibility to zoom in on the individual sensor signals. This enables the user to perform more in depth analysis of a possible change in a trend.



## Calculated and visualised KPIs by IVY®

### WHEN COMBINED WITH VAF INSTRUMENTS' SENSORS

- Fuel consumption,
- Specific Fuel Oil Consumption,
- CO2 emissions,
- Shaft power,
- Propeller thrust,
- Energy produced per engine,
- Total thrust energy,
- Total auxiliary energy,
- Total PTO energy,
- Propeller slip,
- Propeller quotient,
- Propulsion quotient,
- Shaft speed and total revolutions per day,
- Power-speed diagram,
- SFOC diagram,
- Engine load diagram,
- Ship speed,
- Sea-current speed and direction,
- Wind speed and direction,
- Ship locations, track and heading,
- Total distance sailed,
- Average sea depth,
- Average draft.

#### *Fleet level: (daily values)*

- Average fuel consumption,
- Average speed,
- Total distance,
- Fleet performance,
- Fleet EEOI.

#### *KPIs related to various legislations*

- MRV,
- IMO DCS,
- SEEMP,
- EEOI,
- ISO19030 "Measurement of changes in hull and propeller performance"

The information is available on the easy accessible IVY® web application as well as in various reports.

## Automated voyage reports

To report all the details per ship and per voyage, made obligatory by legislation such as MRV and IMO DCS, seems to be a lot of extra paperwork and handling. There is an easier way though.

The automatic data collection and automated voyage reports by IVY® are the answer to push back the extra work and to be in compliance with the MRV & IMO DCS regulations. This IVY® solution for voyage reporting includes automatic berth &

anchorage detection, automatic fuel oil consumption monitoring and automated voyage & MRV reports. This unique solution is certified by verification bodies and claimed to be the most advanced solution for MRV and IMO DCS compliance.

With this certified solution, IVY® eliminates human error in voyage reporting, due to automatic data collection, automated voyage reporting and no manual input.



## Hull & propeller efficiency

IVY® provides important input to optimize ship propulsion performance. There are different levels of measuring ship propulsion performance. The first step is by measurement of the propeller power or torque. By measuring torque the total propulsive performance change over time can be determined. The use of VAF Instruments' T-Sense® torque measuring system facilitates efficiency improvement and overload protection avoiding maintenance and breakdown costs. Using T-Sense® has led to savings up to 10% on fuel costs. The system is based on a highly accurate optical sensor technology and can be mounted on shafts in power transmission systems. The T-Sense® can measure the combined effect of propeller and hull. But in order to separate the propeller performance and the ships' hull performance, the propeller thrust needs to be measured as well. The advantage of thrust measurement by

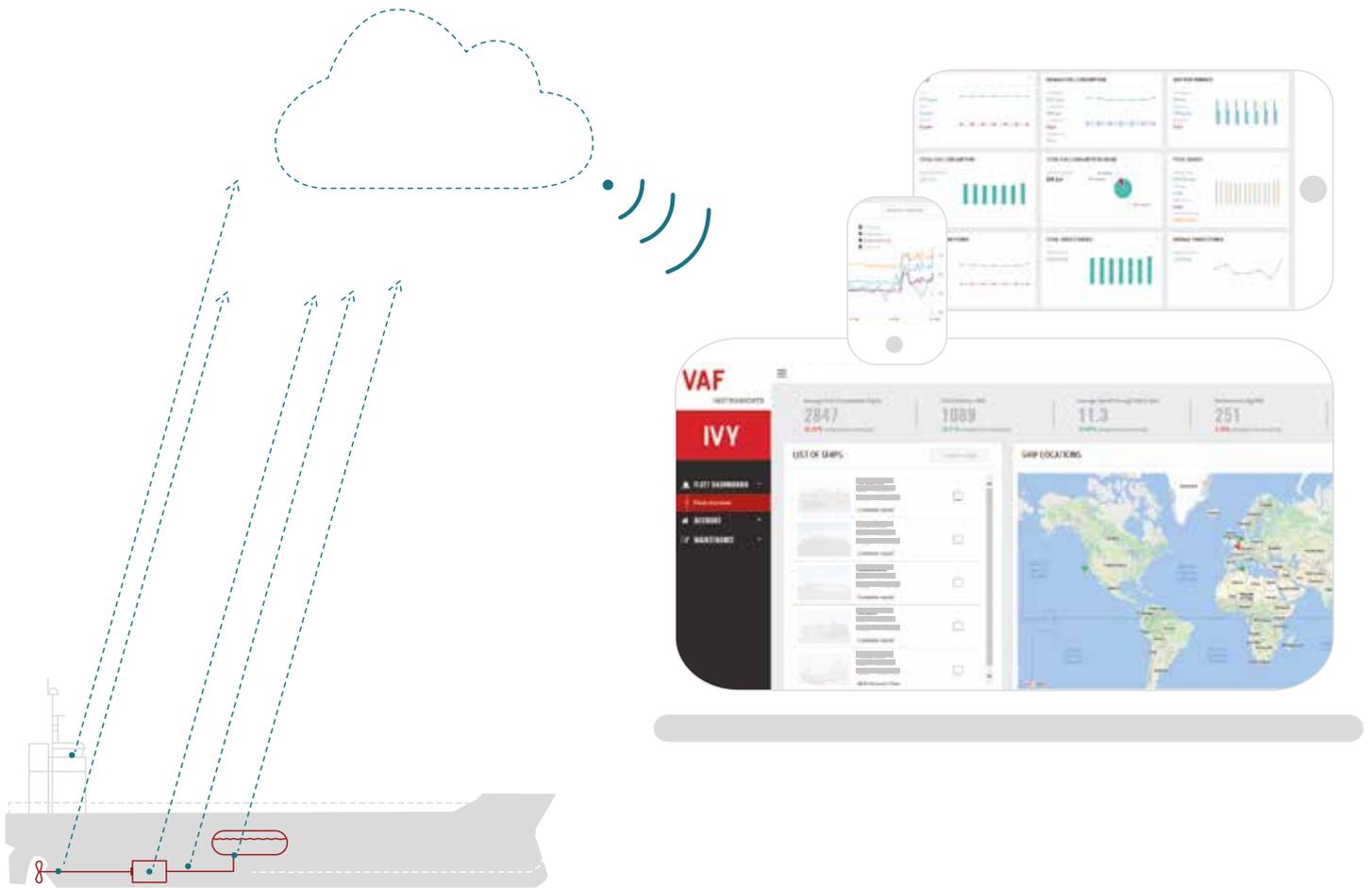
TT-Sense® is that the performance of the propeller and hull can be quantified separately. The propeller plays an important role in the decrease of the total propulsion performance of a ship. In general one third of propulsion performance decrease is caused by propeller, where two thirds is caused by hull. Based on factual data, proper decisions can be made for either a hull cleaning or just a propeller cleaning (or repair). Next to this, the effects of for instance a propeller modification or a new hull coating can be measured much more accurately. In the end this provides essential insight aiding investment decisions for propulsion energy saving measures and greenhouse gas reductions.

In addition to torque measurement, combining IVY® and VAF Instruments' TT-Sense® offers the unique possibility to separate propeller and hull resistance, therewith maximising the total savings potential on your maintenance and fuel bill up to 20%.

## Insight in operational performance

Besides insight into the propulsive performance of the ships in your fleet, IVY® can also reveal potential improvements in operational performance. Its powerful reporting capabilities allow you or your analysts to get a helicopter view over all operations to reveal possible savings, or problems. After spotting an anomaly, further detailed inspections on a minute by minute basis will tell you exactly what happened, when it happened, why it happened and how it can be improved.

Browse through key figures per day or per voyage, either in IVY® or in exported spreadsheets, to reveal what went wrong and what went right on your ships. By performing analyses on a per voyage basis it becomes easy to spot potential improvements in speed optimization and power management, and will allow you to evaluate the effectiveness of your voyage planning. IVY® gives you all the tools to monitor the activities of your ships and verify how effectively policies are being implemented within the fleet.



## Any time, any where

All relevant and available sensors are used for real time collection of ship performance data on board of each individual ship. Via the IVY® solution, the gathered sensor data is enriched. Via the ships' satellite connection, the data is sent to the IVY® cloud and is made accessible at the office on shore. The data is

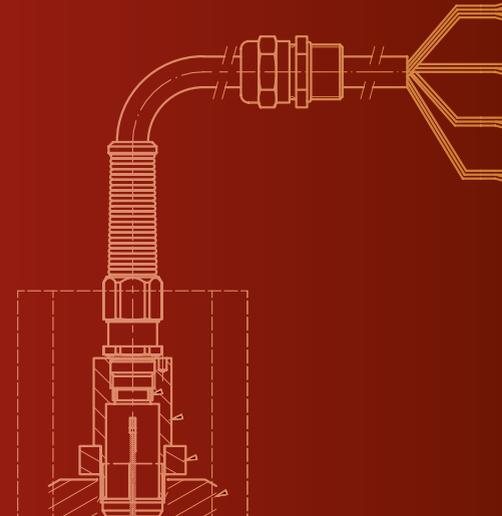
available on ship level as well as fleet level when data of multiple ships is combined. The ship and fleet data can be easily accessed, visualised and analysed via the IVY® Propulsion Performance Management web application. This application is available any time and on any device with a web browser.

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# The fleet at your fingertips



## The Internet of Ships

IVY® is the total solution for fleet and ship Propulsion Performance Management. From ship to shore, IVY® provides relevant ship and fleet performance data and KPIs, instead of just Big Data visualisation. All this information is displayed on an easily-accessible dashboard both onboard and on shore, either on an office desktop, mobile laptop, tablet or any other device. IVY® enriches big data for powerful analysis, fleet and ship performance visualisation and insight into the relevant data and KPI's via the IVY® dashboard. VAF Instruments' Propulsion Performance Management system IVY®, turns the Internet of Things into the Internet of Ships and brings Big Data back to the essence.

### VAF Instruments B.V.

VAF Instruments is the most preferred supplier of the top 100 shipyards and market leader in maritime measurement systems. Since 1938, VAF Instruments has gained a worldwide reputation as a specialist in developing and manufacturing measurement and control systems for the maritime and process industry. Our mission is to develop innovative and accurate measurement systems as well as integrated solutions to maximise efficiency, improve operational excellence and reduce the environmental impact of these operations. With agents around the globe, VAF Instruments has a worldwide network. Over 70 representatives are specialised in VAF Instruments' products and solutions. Please feel free to contact us or one of our representatives, any time, any place.

