MARITIME

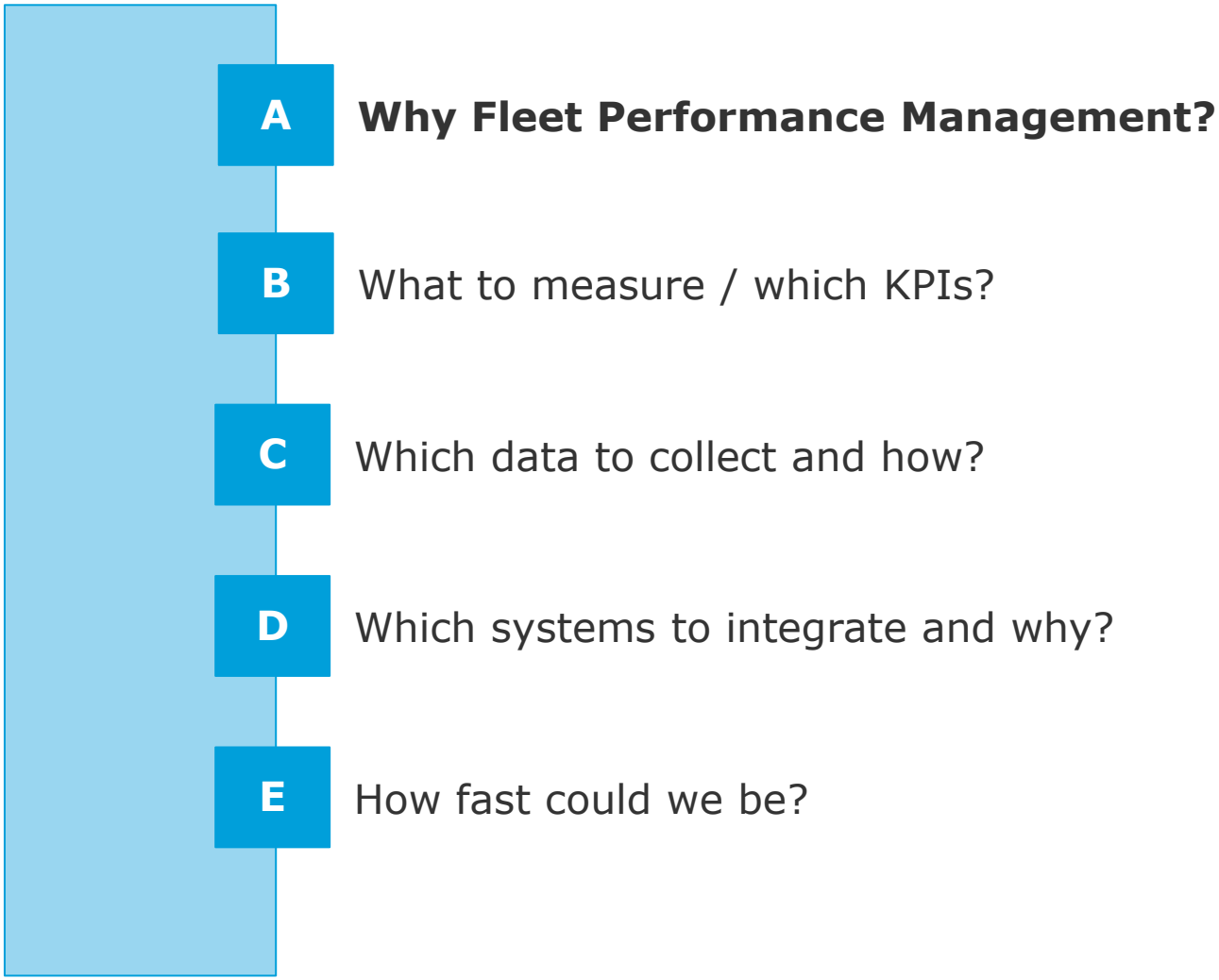
Fleet Performance Management & Reporting

Naples Shipping Week – Green Shipping Summit

Till F. Braun, DNV GL

June, 30th 2016

Agenda


A
Why Fleet Performance Management?
B
What to measure / which KPIs?
C
Which data to collect and how?
D
Which systems to integrate and why?
E
How fast could we be?

Many hardware based measures have been exploited, what is next now

Improving the vessel:

☑ New vessels

☑ Propulsion plant

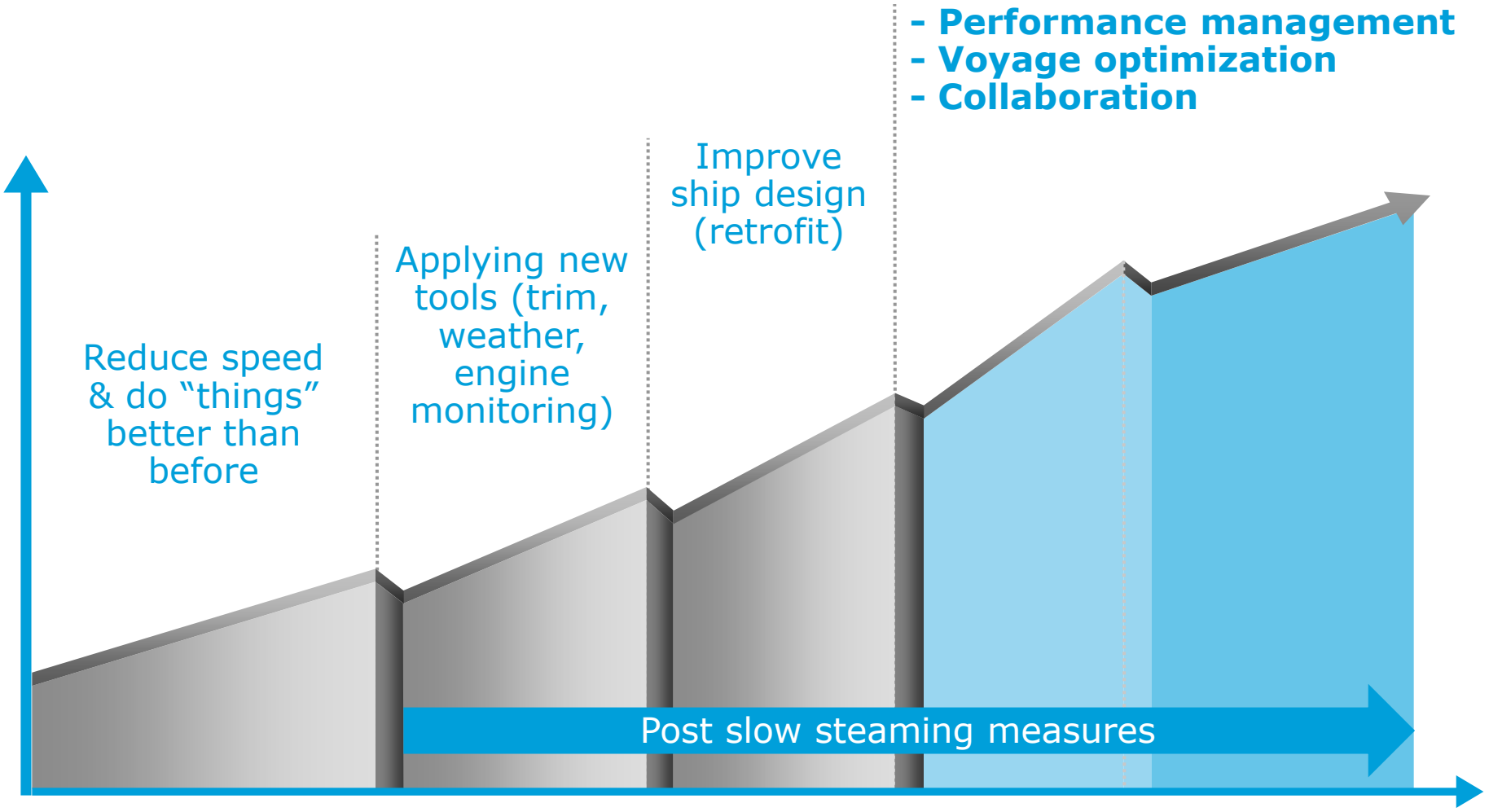
☑ Retrofitting

☑ Coating

How to improve the operation of the vessel?

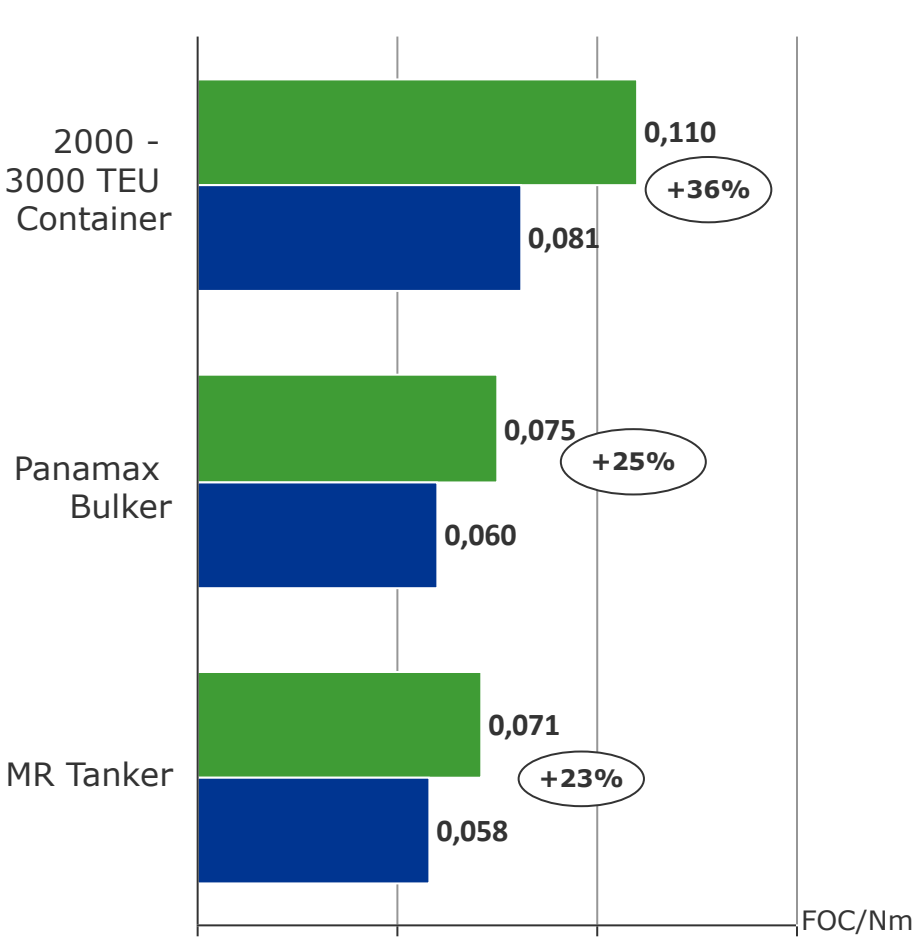
FLEET PERFORMANCE MANAGEMENT

Industry leaders are focusing now on the 4th wave of energy efficiency improvement



Performance Management: A lot to be gained
- substantial consumption differences, independent of ship types and size -

Fuel oil consumption/Nm during sea passage



- Industry leaders claim to have achieved 25% performance improvements post slow steaming, largely driven by performance management
- Performance management teams are being established by operators and managers
- Performance variances between vessels and fleets underscore the improvement potential

Source: DNV GL AIS Benchmarking workbench, world fleet averages full year 2013

The benefits of a good performance management system are threefold

Transparency

- Prove to your customers, financing bodies and other stakeholders that operations is in control
- Build visible line of defence against fuel claims
- Allows fact based collaboration between departments and with industry partners (suppliers, customers)

Compliance

- Makes you compliance with existing (ESI, CSI, CCWG) and upcoming environmental reporting (EU / IMO MRV)
- Improves TMSA scores in chapters 1A, 10A and E by providing KPI monitoring and external benchmarking

Cost position

- Saves fuel (or costs for fuel claims) and lubes costs and avoids engine breakdowns
- Saves investments in wrong fuel saving technologies
- Reduces reporting effort for crew and manual data management efforts ashore
- Changes behaviour of shore and vessel teams towards more efficient operations (sometimes against “seafarers tradition”)

EU environmental regulation will require continuous "Monitoring, Reporting and Verification" of emissions based on fuel consumption

Reporting needs:

For each ship and for each voyage to, within and from EU ports

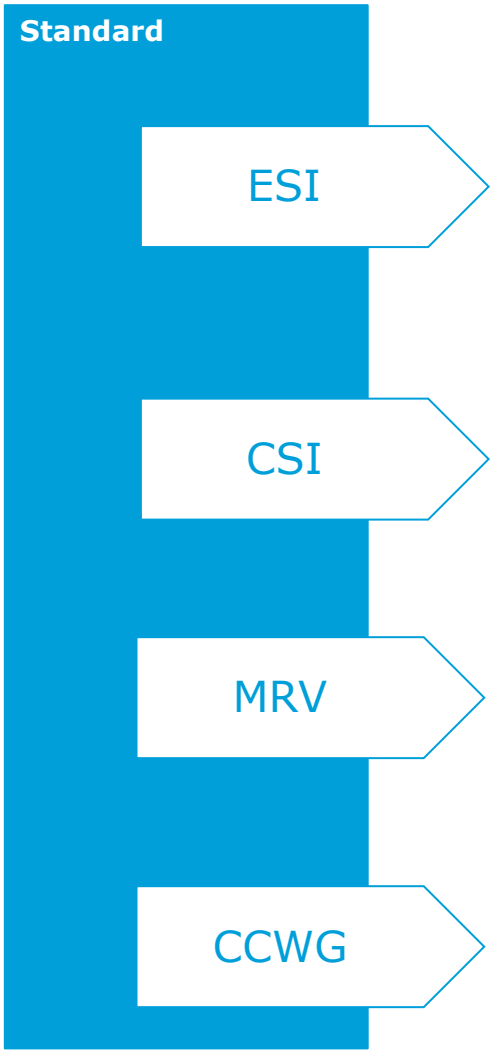
1. port of departure / arrival
2. amount and emission factor for each type of fuel consumed in total […]
3. CO_2 emitted
4. distance travelled
5. time spent at sea
6. cargo carried
7. transport work

Timeline:

Dec. 16:	Verification guidelines available
Aug. 17:	Monitoring plans to be handed in to verifyer
Jan. 18:	Start voyage reporting
Jan. 19:	Submit first voyage data sets (ie log abstracts) to verifyer

IMO has agreed in principle on a similar approach for all voyages starting 1 year later. (with DWT as "cargo carried" proxy), there will be two parallel regulations in force!

Environmental reporting should be delivered out of same performance management system to avoid double work



Explanation

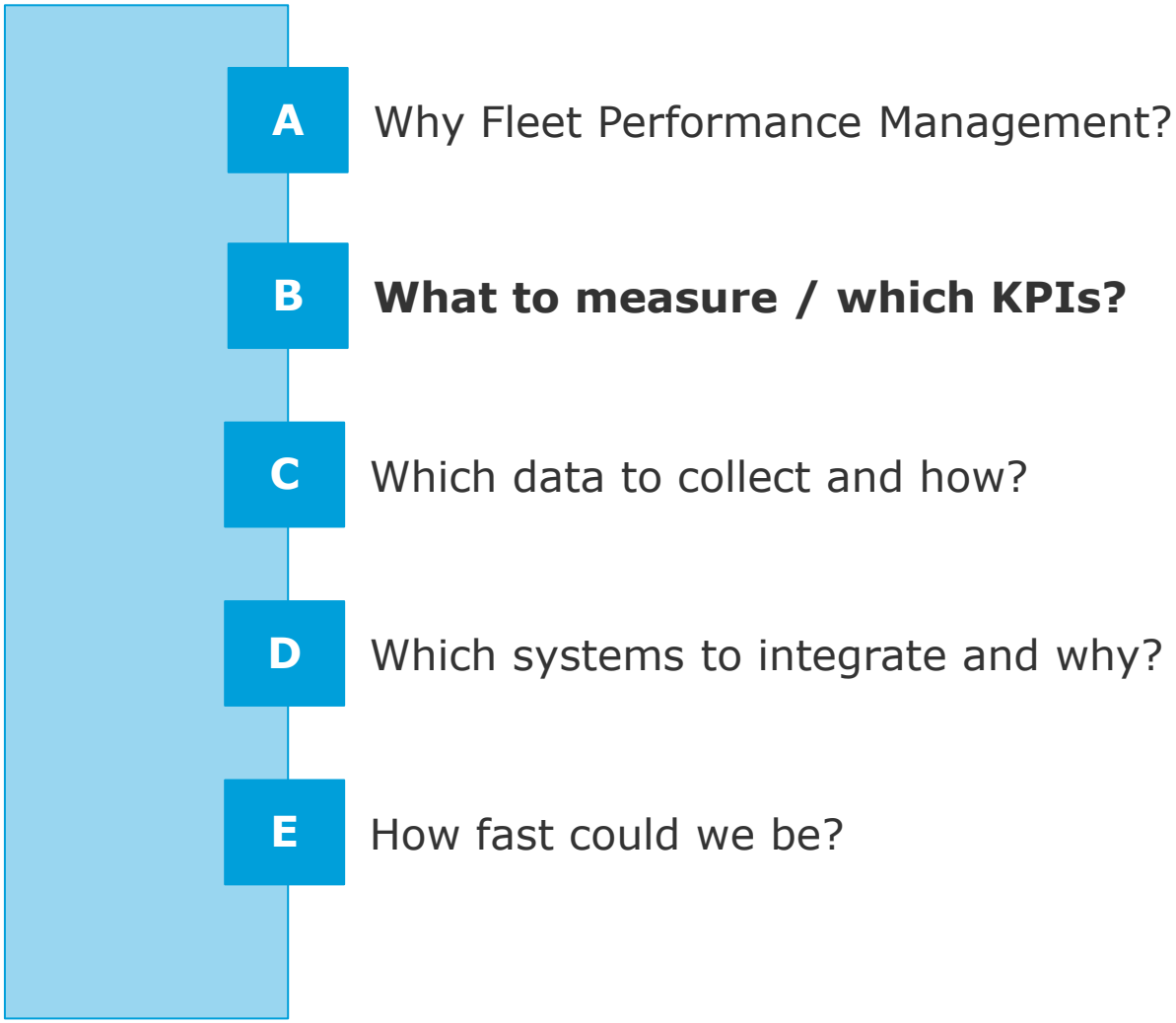
- CO2, NOx and SOx emissions and awards documentation and management of the energy efficiency. PM is included indirectly because of its strong link to SOx
- Some leading ports have started to provide discounts on harbour dues to the cleanest ships calling at their port

- CO2, Nox, SOx and Particulate Matter (PM), Water and waste control (ballast water, bilge water etc.), Chemicals (antifouling, lubricants etc.)
- rating to ships and shipping companies based on their environmental performance

- Emitted CO2 amount on the way to or from EU ports and in EU waters, time spend on the way to or from EU ports and in EU waters, Amount of cargo carried and cargo transport work in the relevant times, Sailed distances on the way to or from EU ports and in EU waters, EEOI in the relevant times, Departure and Arrival ports in, on the way to or from the EU

- Most comprehensive reporting scheme in place for container liner operators, incl. EEOI, NOX, SOX, certificates, garbage etc.

Agenda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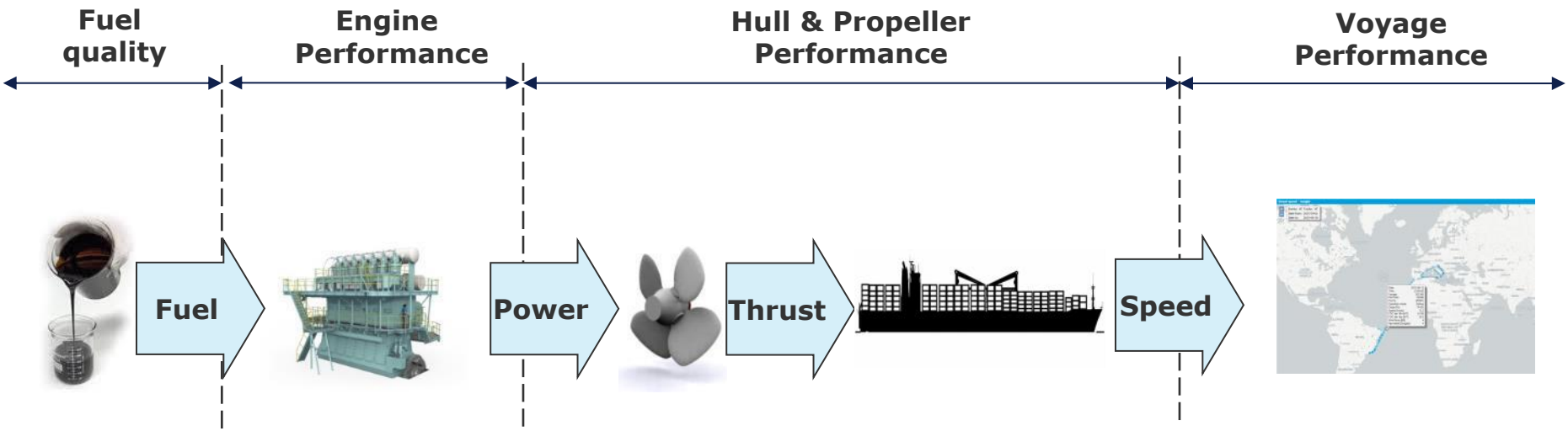
A performance break down of a vessel: ECO Insight modules



Fleet performance management should explain WHY a vessel performs worse than others – a comprehensive view is needed

Major performance categories

Voyage performance

Hull & Propeller performance

Engine & systems performance

Fuel performance

Environmental performance

Example KPIs

- Operational modes
- Consumption
- Speed profile
- Weather condition
- Energy Efficiency Operational Indicator (EEOI)

- Hull & propeller performance drop due to fouling
- Normalized speed power relationships
- Slip
- Trim

- Consumption, SFOC, RPM, loads, pressures, running hours, production rates, temperatures at
  - Main and Auxiliary Engines
  - Boiler
  - Cooling water system
  - Pressurized air system
  - Lube oil system

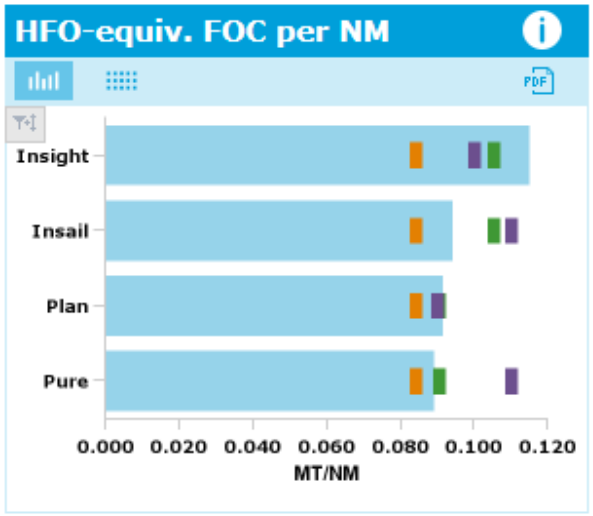
- Bunker statistics & performance by vessel
- Fuel quality per port / supplier
- Fuel quality benchmarks

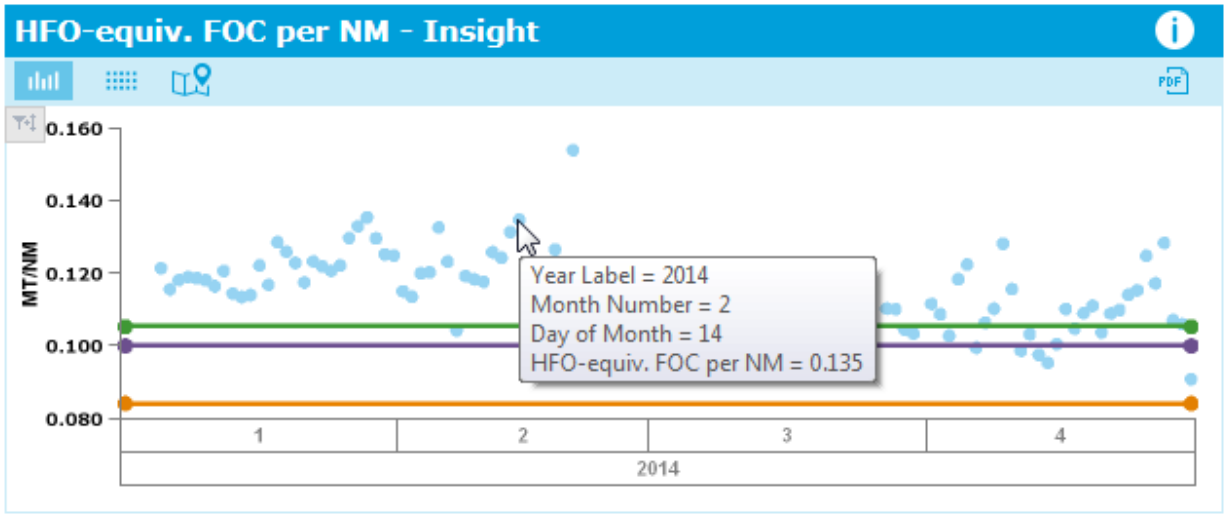
- Emissions
- Disposal
- Ballast

Many decisions can be taken given a comprehensive set of KPIs

	Example KPIs	Example Analysis & Decisions
	▪ EEOI ▪ Consumption ▪ Speed ▪ Operational modes ▪ Weather condition ▪ Trim adherence	• Improvement of EEOI, do measures pay off • Spread among same vessels, distance to benchmark • Slower speed, less speed variability • Maximize sailing time, minimize waiting (speed) • Reason for performance difference, routing
	▪ Performance drop ▪ Slip ▪ Baseline performance	• Hull & propeller cleaning • Consumption at different speeds, drafts etc • Trim advise followed, trim logic in place
	▪ Consumption ▪ Engine Loads ▪ SFOC ▪ Turbocharger RPM ▪ Combustion pressures ▪ Scavenge air pressure ▪ Exhaust Gas temperature	• Spread among same vessels, distance to benchmark • Auxiliary engine usage • Distance to engine baseline, engine maintenance • TC maintenance • Cyclinder condition • TC maintenance • TC / engine maintenance
	▪ Bunker statistics ▪ Sounding corrections at ports ▪ Fuel quality per port / supplier	• Select bunker supplier / port • Increase sampling usage • Bunker purchase & claim management
	▪ Emissions ▪ Disposal ▪ Ballast	• Reduce emissions • Reporting (CCWG, ESI, EU-MRV)

Benchmarking intra-fleet, against baselines and with industry is the unique capability of ECO Insight





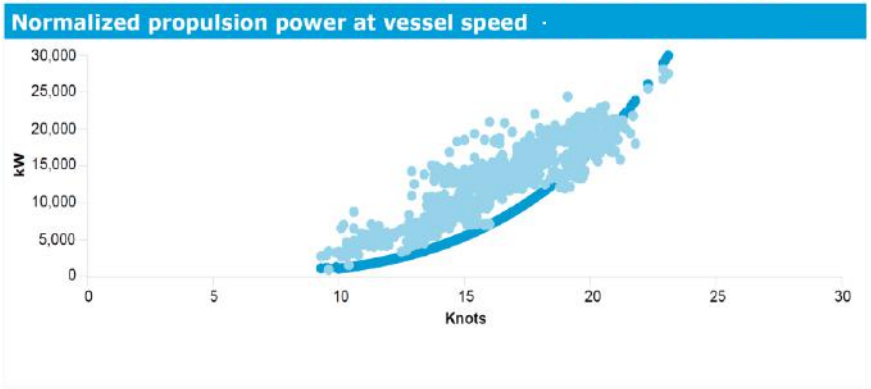
Legend: **World fleet average (same vessel type and size)** **Own Vessel Group average** **Own Target (e.g. Charter party)**

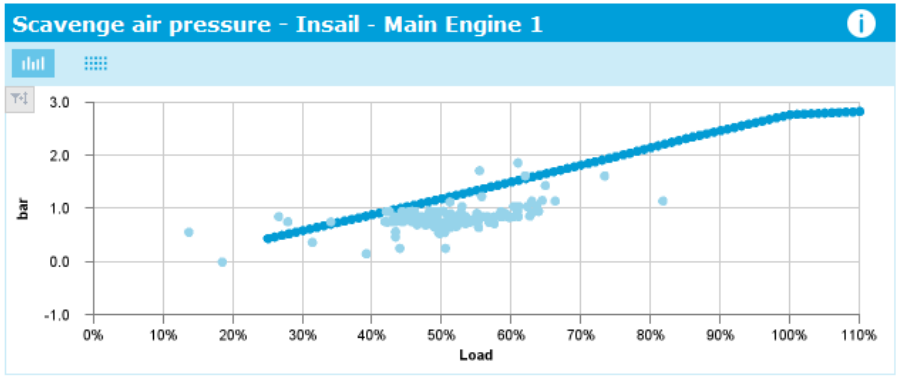
Compare against:

- Own vessels (of similar size), vessel group average
- Vessel specific baselines (sea trial, shop test, CFD)
- Industry benchmarks (speed, consumption, op. profile, fuel quality - world fleet, same vessel type and size)
- Own targets or limits (e.g. SEEMP, charter party)

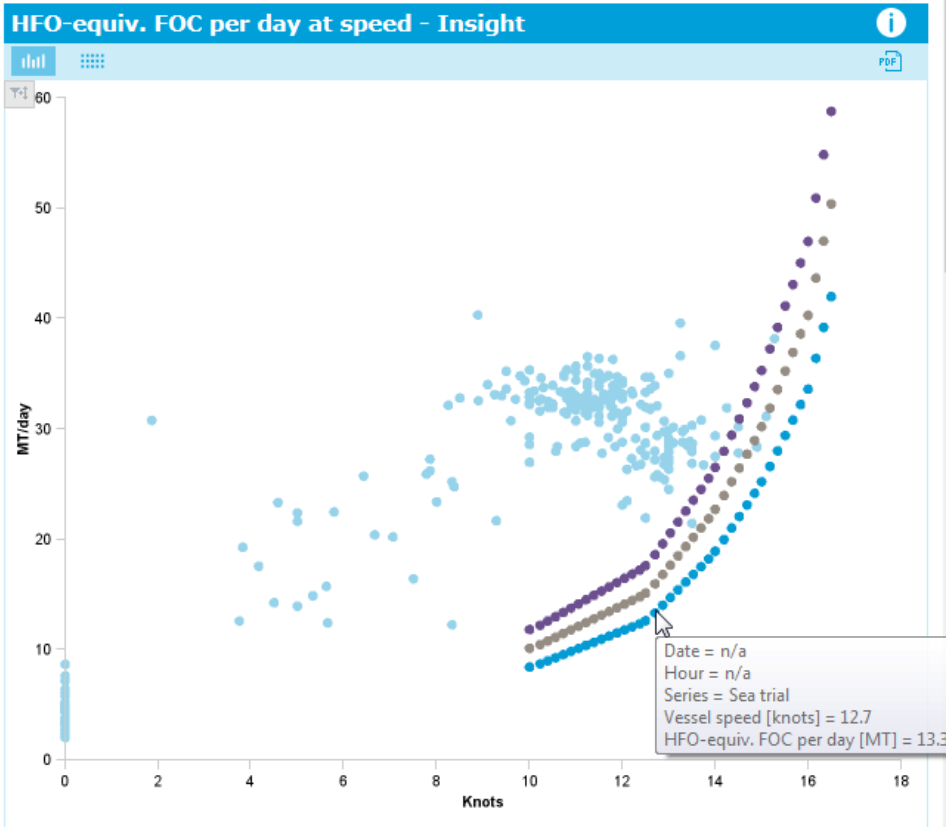
Good baselines guide analytics throughout a fleet performance assessment

CFD baselines used for normalization





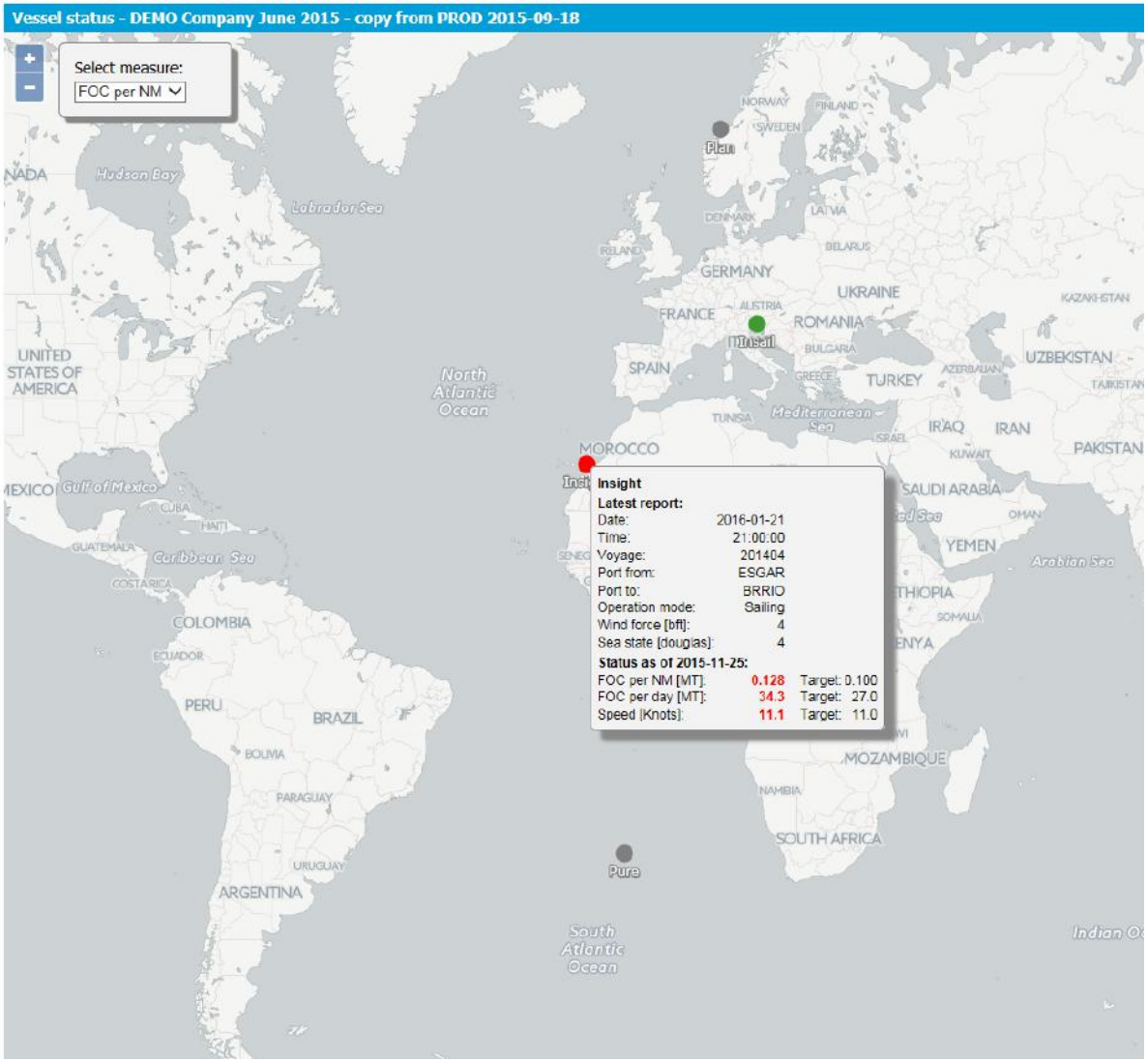
User defined baselines for speed-consump.



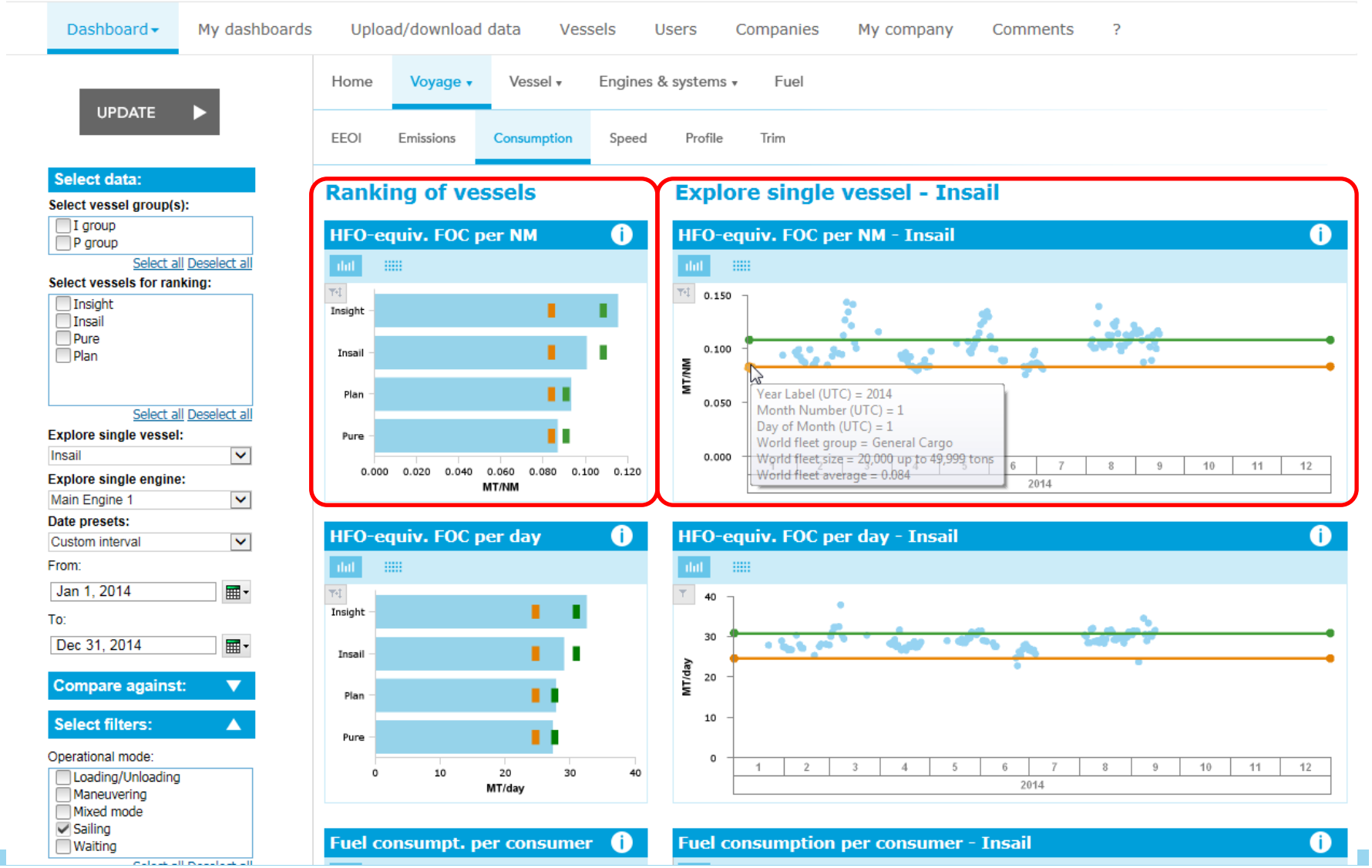
Shop test baselines used for Engine & Systems

Fleet status map

- One view:
- Where is the vessel!
- Out of target! (traffic light scheme)



Dashboards always compare vessel group and dive deep into a single vessel in the same view



The outside-in view with external data help you to make the right decisions

AIS benchmarks

- **Speed:** compare your speed mgmt. with market segment
- **Operational profile:** see optimization potential in port stay times or in waiting times
- **FOC:** See fuel efficiency improvement potential against market segment

Satellite weather

- **Weather:** Compare with reported weather and identify overstating of bad weather

Fuel samples

- **Fuel quality:** Identify performance gaps due to actual fuel quality
- **Fuel benchmarks**: Find ports / suppliers with good fuel quality track record

Performance management decisions happen on three time horizons – periodical reviews give the largest decision space

Close to real time

- Speed
- Direction
- (Position)

Periodical reviews

- EEOI
- FOC
- Speed + Speed Mgmt.
- Operating profile
- Trim adherence
- Hull / prop. Cleaning
- Engine maintenance

Vendor / Vessel selection

- Vessel type, size, age
- Management style

Fact based collaboration is key in all horizons!!

Most advanced hull degradation on the market reduces uncertainties on hull fouling

- Hull fouling adds resistance to the hull and is typically the "residual" effect on performance (after everything else is explained)
- World fleet is sailing with up to 30% added resistance on average due to hull fouling, which translates to apx. 20% surplus fuel consumption
- Fouling depends on many factors, an advanced computation is needed to assess when a next cleaning makes sense

Vessels measured power corrected by wind, sea state, swell and viscous effects

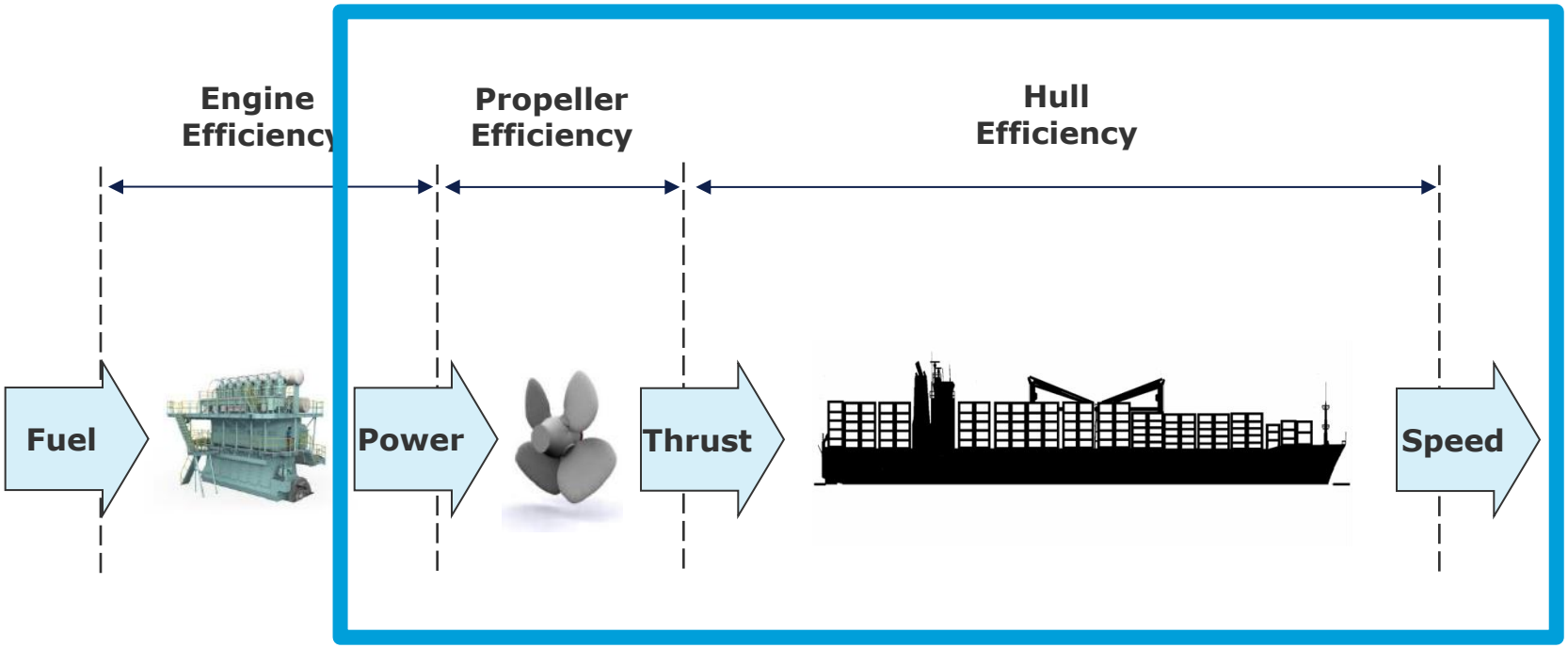
Power Rating (in %)[1]

Vessel required power at relevant operating conditions acc. to vessel CFD model

Norma-lization to the same speed, draft, trim

1 new ship 100%, performance drop due to hull fouling to a value <100% showing add. resistance

For hull degradation you need to know relationship between speed and power over time



- How does my coating protect my hull (between docking)?
- How effective is my coating?
- When should I do the next cleaning?
- How effective was my cleaning?

Innovation for hull degradation: DNV GL has successfully introduced low frequency snapshot reporting into the market

Snapshot data:

- Data at a certain point in time including its ambient conditions
- e.g. Speed through water, delivered power (torque & rpm), weather

High frequency data
(15 s from autologging system)

Standard method (ISO part 2)

Further filtering of data (bft 4, > 2C water temp, etc.)

Low frequency data
(1-3 x /day from manual system)

Normalisation of data (no data loss)

Event data:

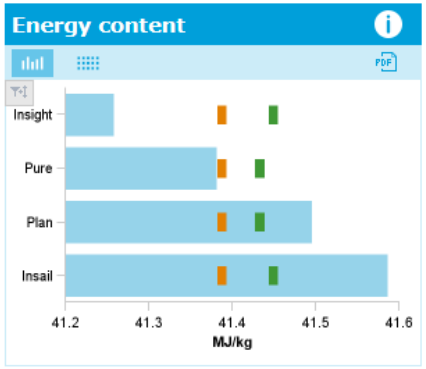
data over a period of time (e.g. noon-to-noon, or since last event)

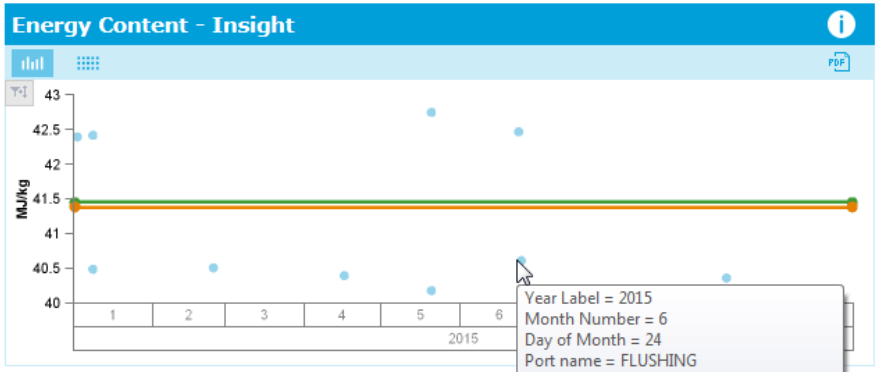
Low frequency data
(per event, e.g. noon, departure, arrival, BOSP, EOSP)

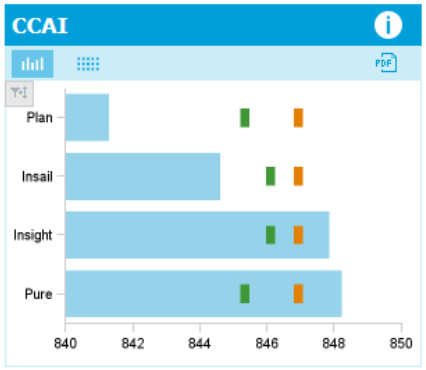
Alternative method (ISO part 3)

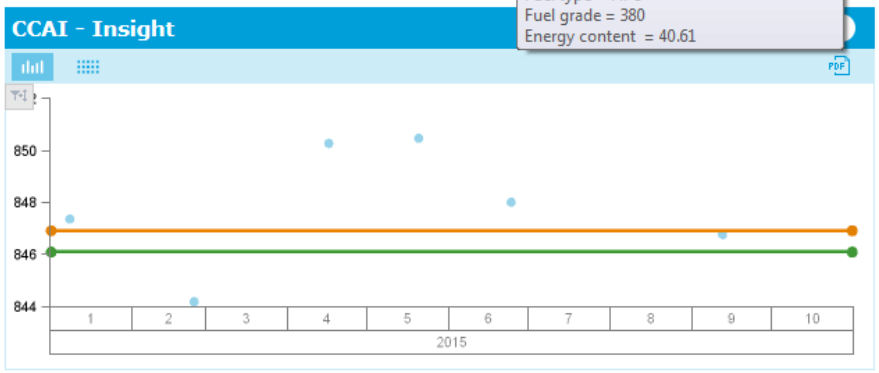
Not recommended as averaging over a period of time (weather the last 3 hours, average power last day) leads to additional errors

The new fuel module will allow you to identify performance difference due to fuel quality and find the best ports / suppliers







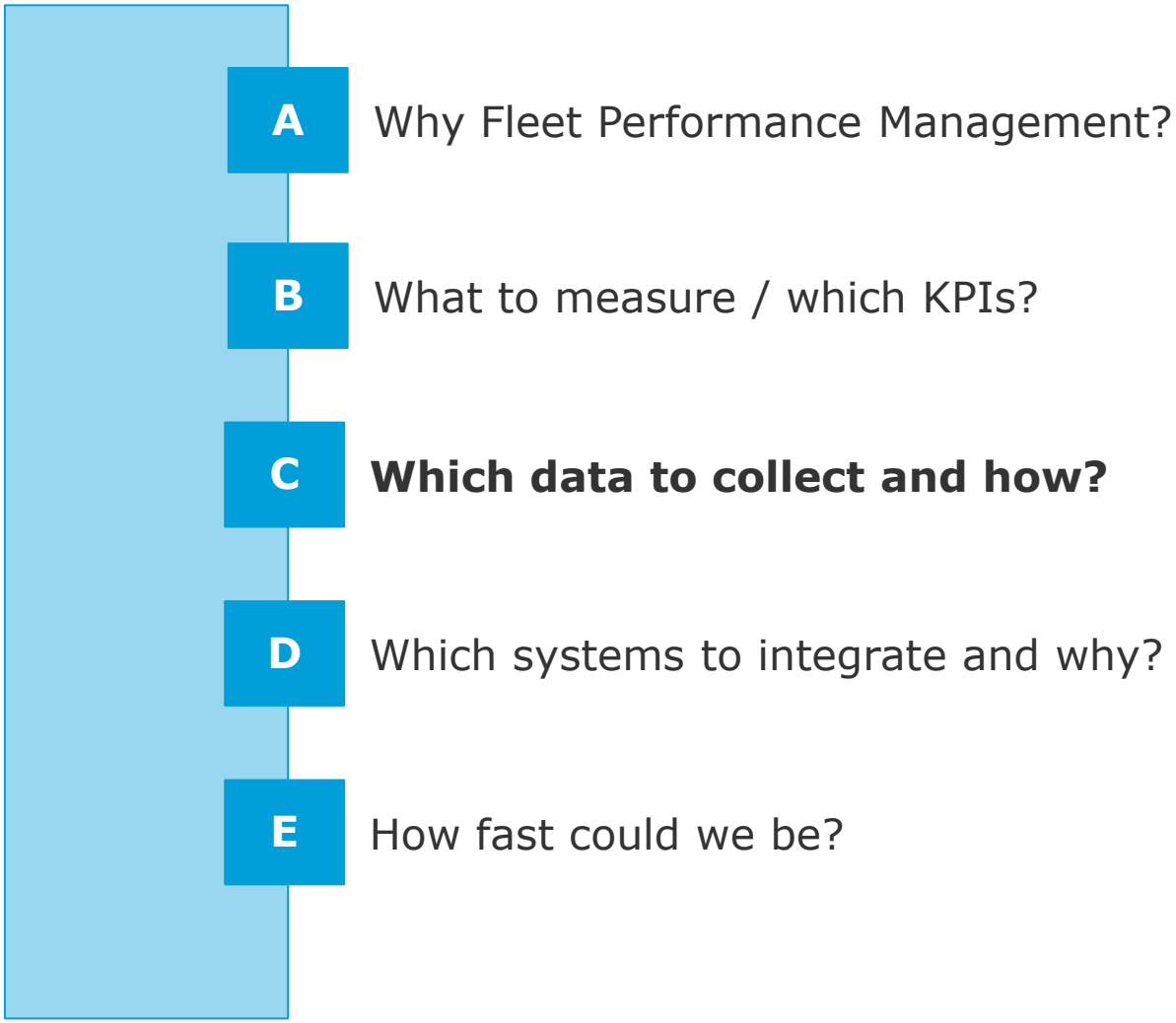


- Analyse own bunkered fuel types and quantities
- Comparing fuel quality across ports and suppliers available in the market
- Identify performance gaps due to bad fuel quality compared to the market

- Enabled by access to largest marine fuel sampling database

In cooperation with VPS

Agenda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For fleet performance management you need to collect two types of data

Event data:

data over a period of time (e.g. noon-to-noon, or since last event)

Needed for voyage and fuel performance

Avg. speed
Distance
FOC
…

- Hooks up to existing ship-to-shore processes in a shipping company
- Arrival, Departure, Noon, BOSP reports
- Manual input is required, but quality can be improved significantly if plausibility checked

+

Snapshot data:

Data at a certain point in time including its ambient conditions

Needed for hull and engine performance

Load
RPM
Pressure
Power
…

- Data exists but often only onboard (e.g. engine logbook)
- Measured once to several times a day

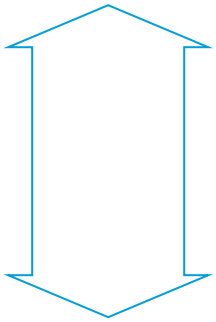
There is no need to change existing data collection processes.

What is better: Manual or automatically captured

Manual entry:

Manually entered on board

- Known to crew, no installation effort, data quality issues
- Key voyage parameters like BOSP, arrival, bunkering, departure, cargo, EOSP are always manual data



Golden mean:

- **Manual entry, but plausibility checked against ship and company specifics**
- **Event data and (low frequency) snapshot data covering 90% of relevant performance KPI**

Automatic collection:

Directly measured from systems

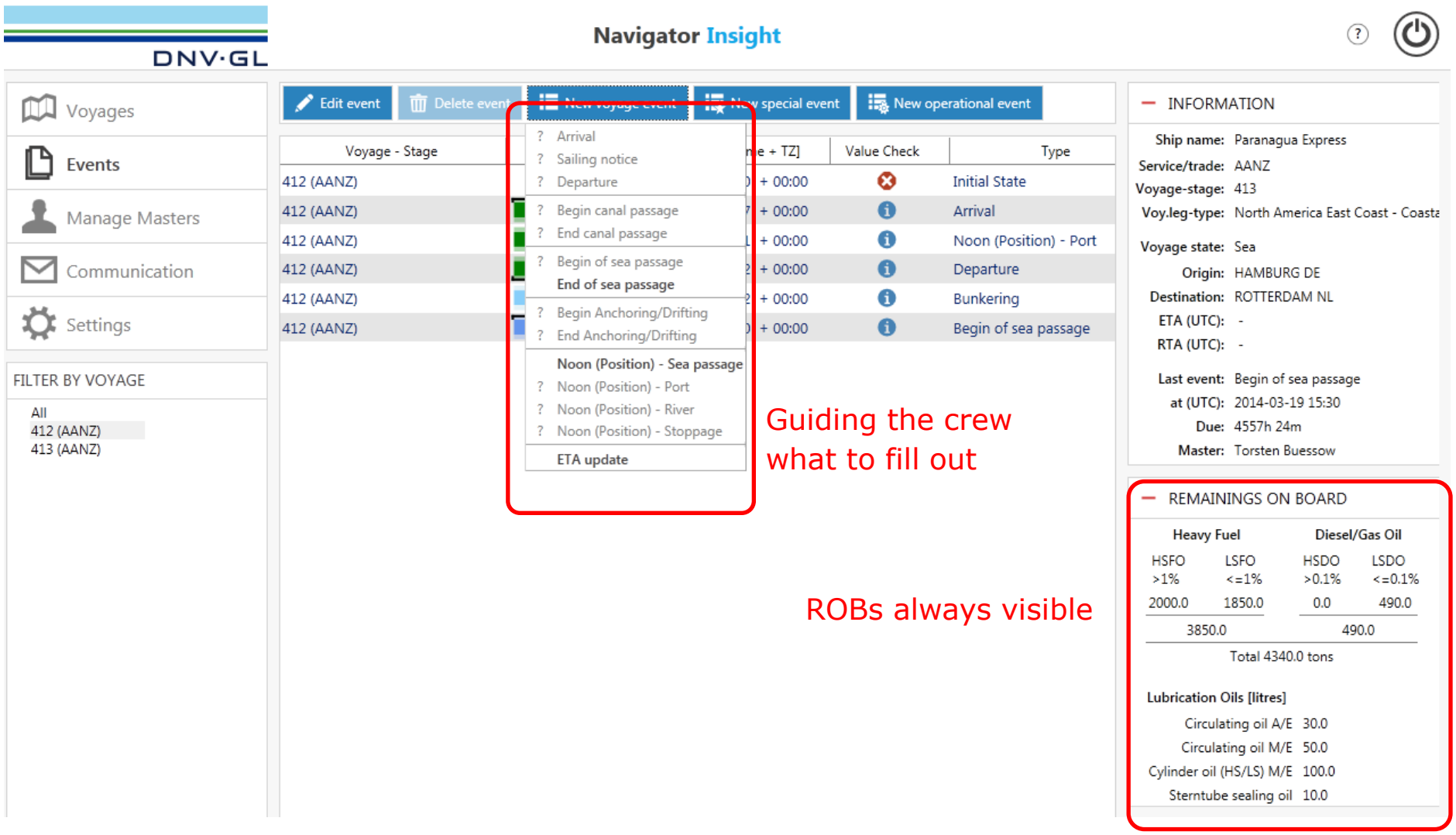
- Only relevant for snapshot data
- Data are high frequent, which is relevant for a few additional KPIs (like autorudder movement or engine overload)
- Need to go to every vessel, suited for "high investment vessels"

Navigator Insight onboard - data entry in easy-to-use software

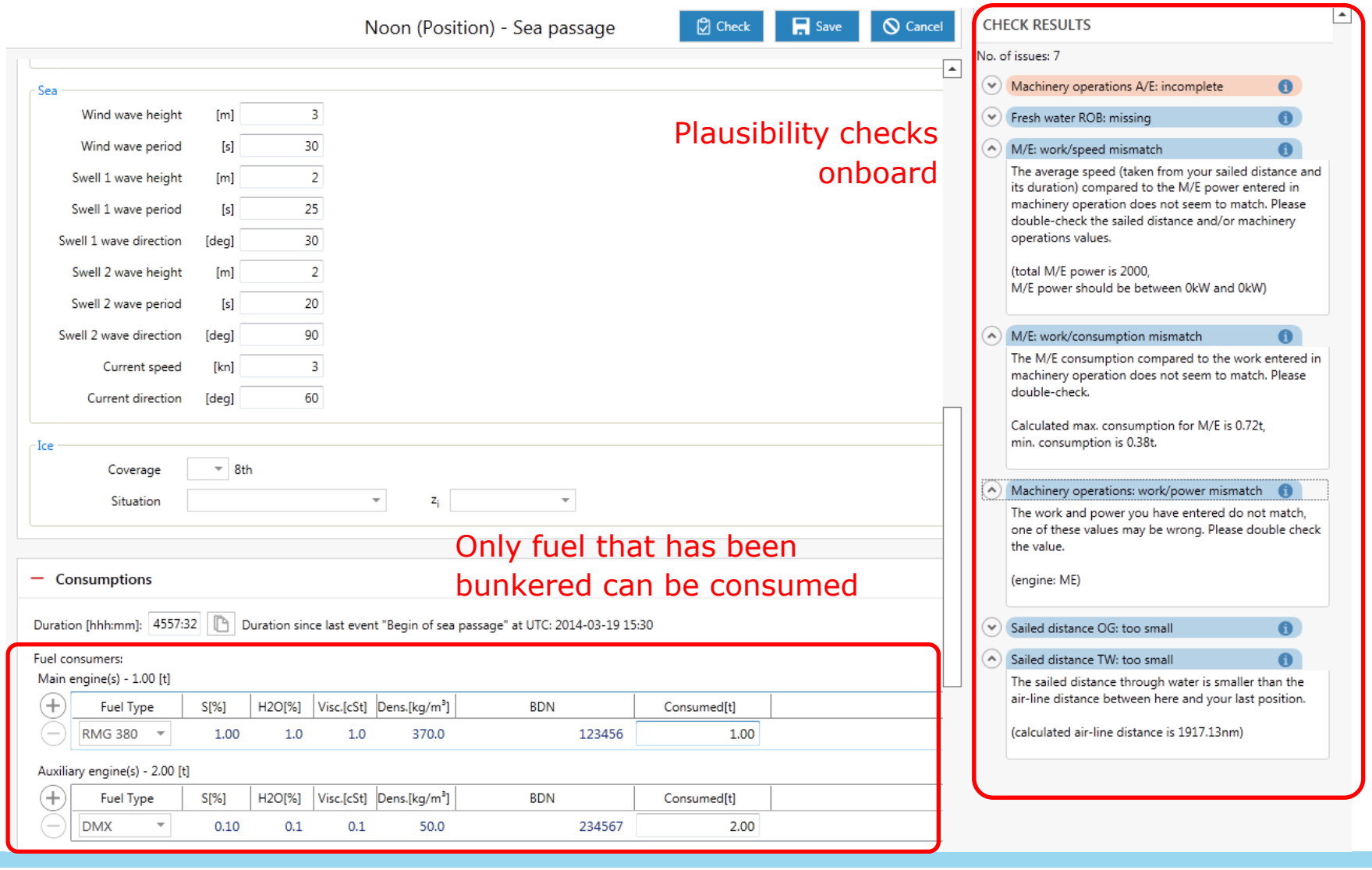
- Voyage based structuring
- Easy to use, smart default values reduce entry errors
- Data entered only once – automatically re-used
- Plausibility and completeness checks (as all reports are linked) against prior entries and ship specifics
- Sophisticated bookkeeping for fuel and lubes
- Not ship specific - easy to install on hundreds of vessel at the same time, initialized from Navigator Insight onshore

ECO Insight

Examples: Helping the crew to report in a simple manner…



Examples: ...and ensuring proper data quality onboard

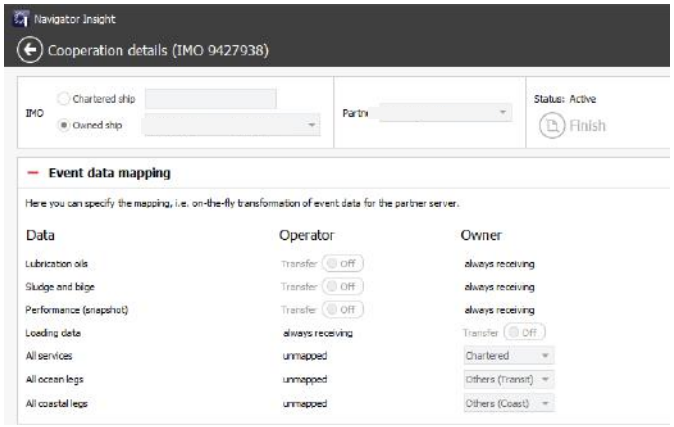


Trial results: manual collected data are not worse than autologged once, just less frequent

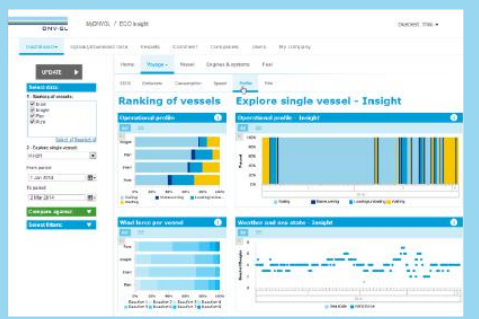
KPI	Filter	Navigator Insight	Autologger	Navigator Insight	Autologger
		Bulker		Container	
FOC/nm	all modes	0.173	0.174	0.146	0.150
	sailing only	0.157	0.162	0.138	0.142
FOC/day	all modes	17.4	17.2	47.8	46.0
	sailing only	36.7	39.7	49.3	50.4
Speed	all modes	4.2	4.1	13,6	12.8
	sailing only	9.7	10.2	14,9	14.8
Weather	sailing only	max 6.bft	max 6.bft	max 7.bft	max 7.bft
Operational Profile		41% sailing	36% sailing	Judged by speed	Judged by speed
ME load distribution		levelled out	very detailed	levelled out	very detailed

Unique way of avoiding double reporting for the crew if operator and owner are both using ECO Insight / Navigator Insight

Operator System

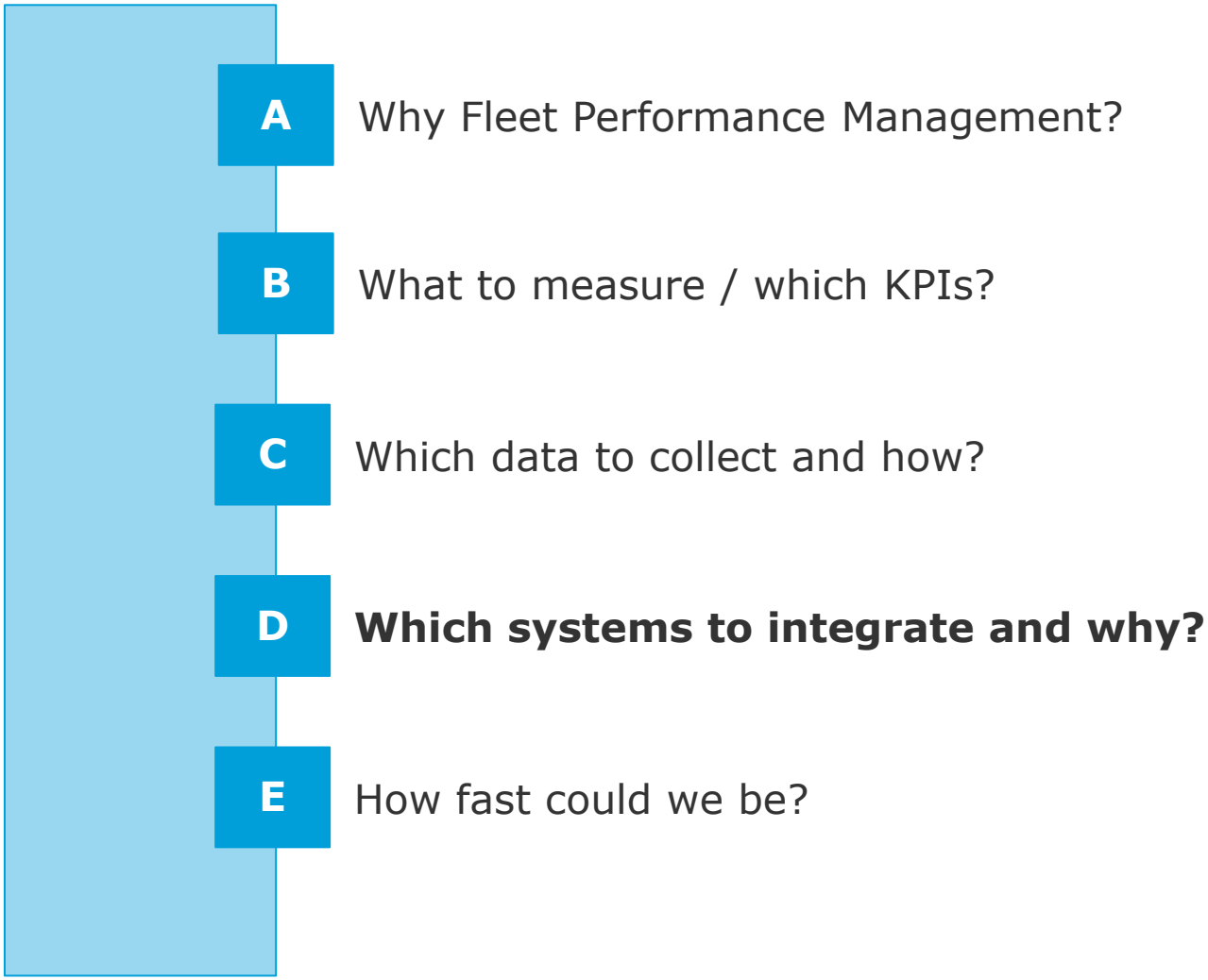


Cooperation agreement



Owner system

Agenda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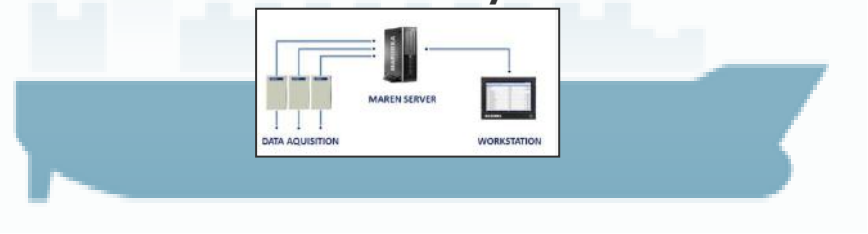
The solution is flexible to cover different vessel types in your fleet

"Low investment" candidate vessels (e.g. chartered in ones, 3rd party managed ones)

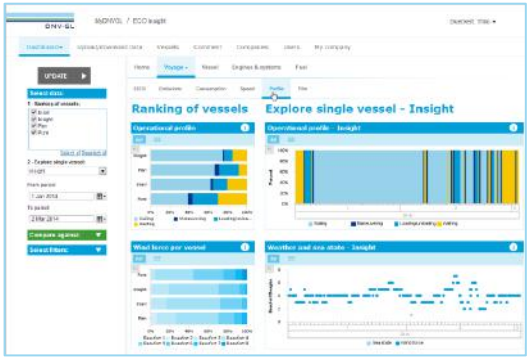
- Low-cost, quick data acquisition using **Navigator Insight software** e.g. on bridge, in engine room and ship office

"High investment" candidate vessels (own ones with sensors)

- **Navigator Insight** for event reporting + automatic data acquisition based on sensors and hard wiring with **automatic data collection system**



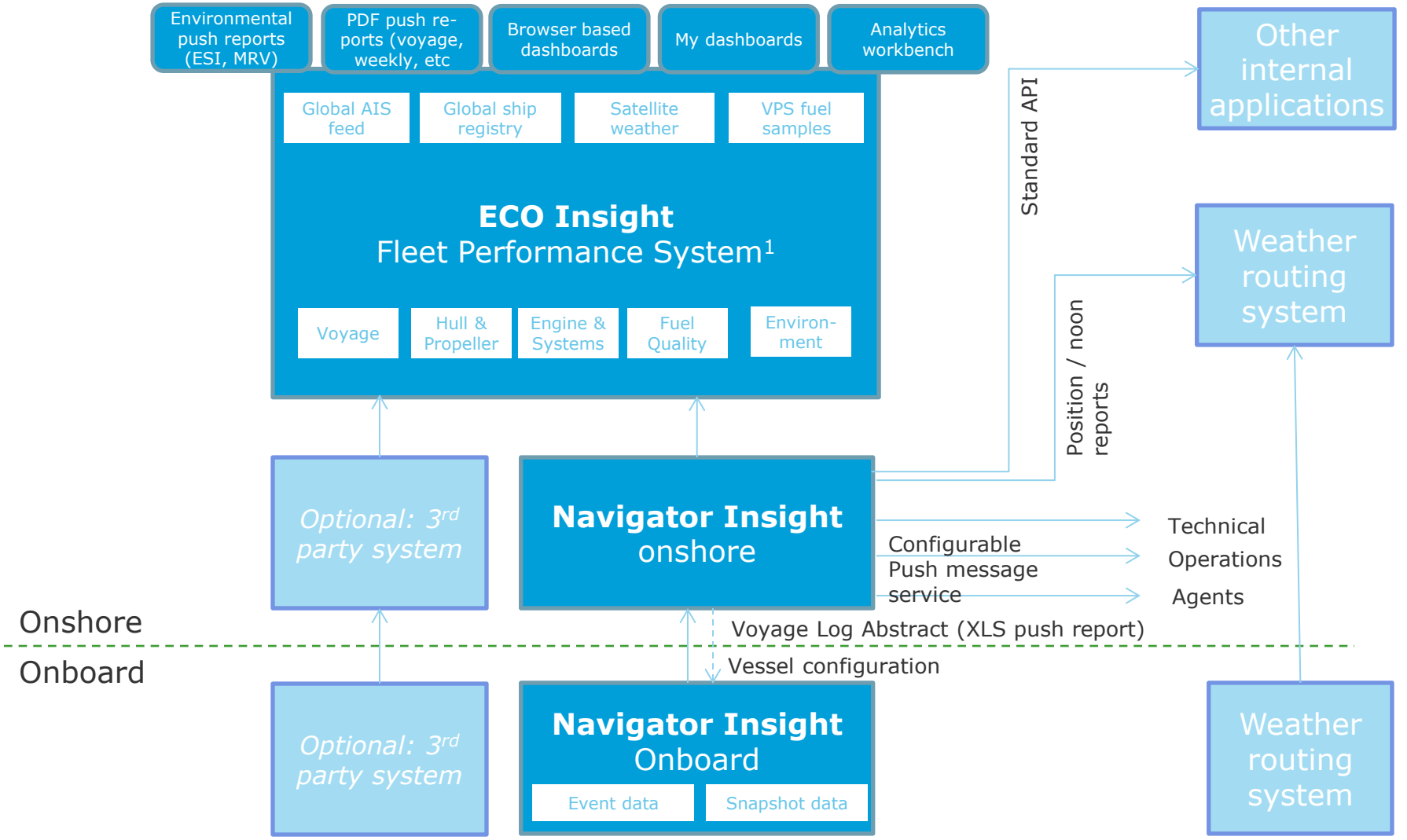
Integrated onshore access



- **One performance view of whole fleet independent of data collection method**
- High level of quality and transparency incl. automated reporting
- Less burden on crew by not introducing any additional processes (rather replacing)
- No onboard training needs

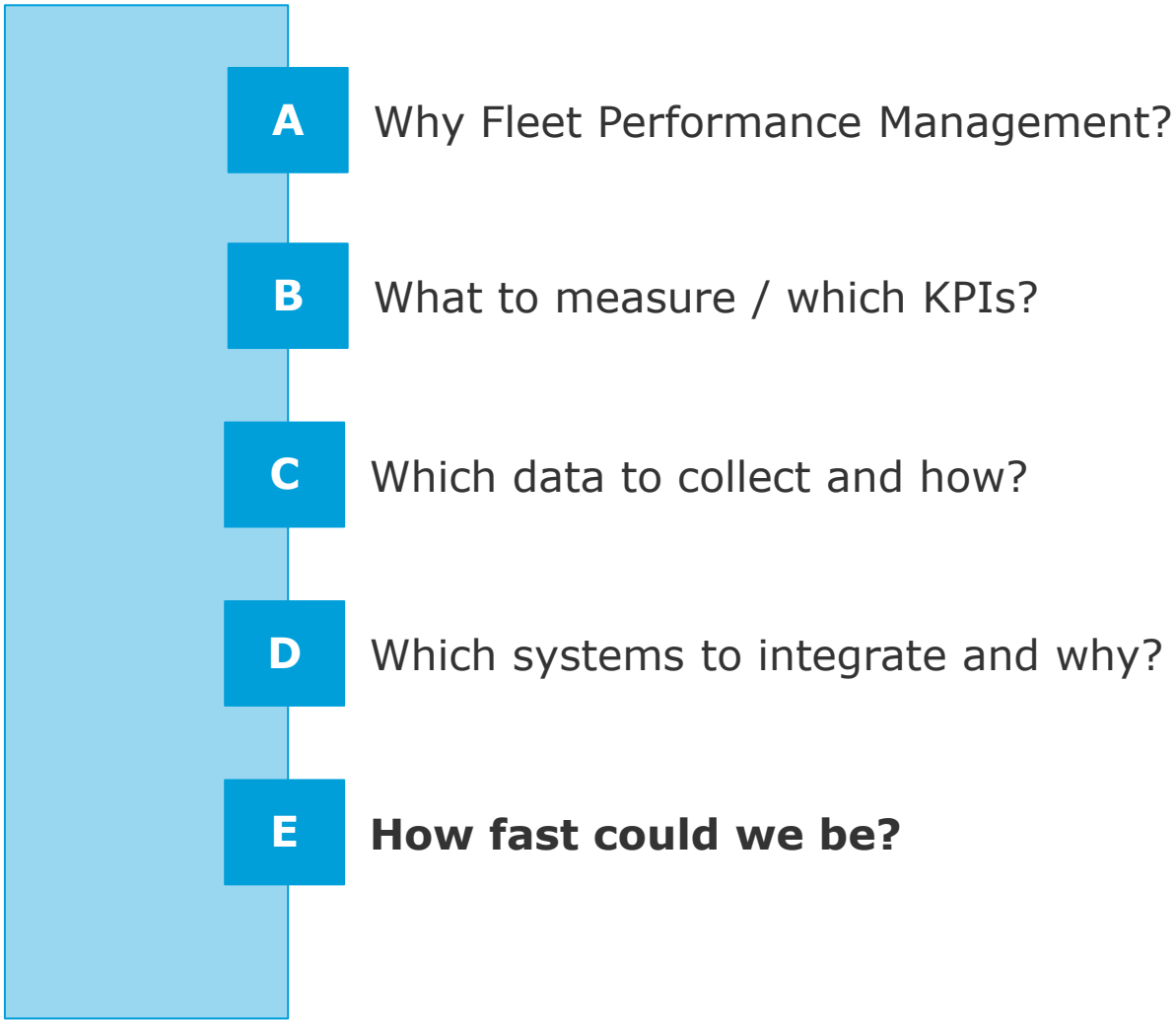
ECO Insight

The solution is flexible to cover different vessel types in your fleet



1 next module: Operations (port performance, schedule integrity etc.)

Agenda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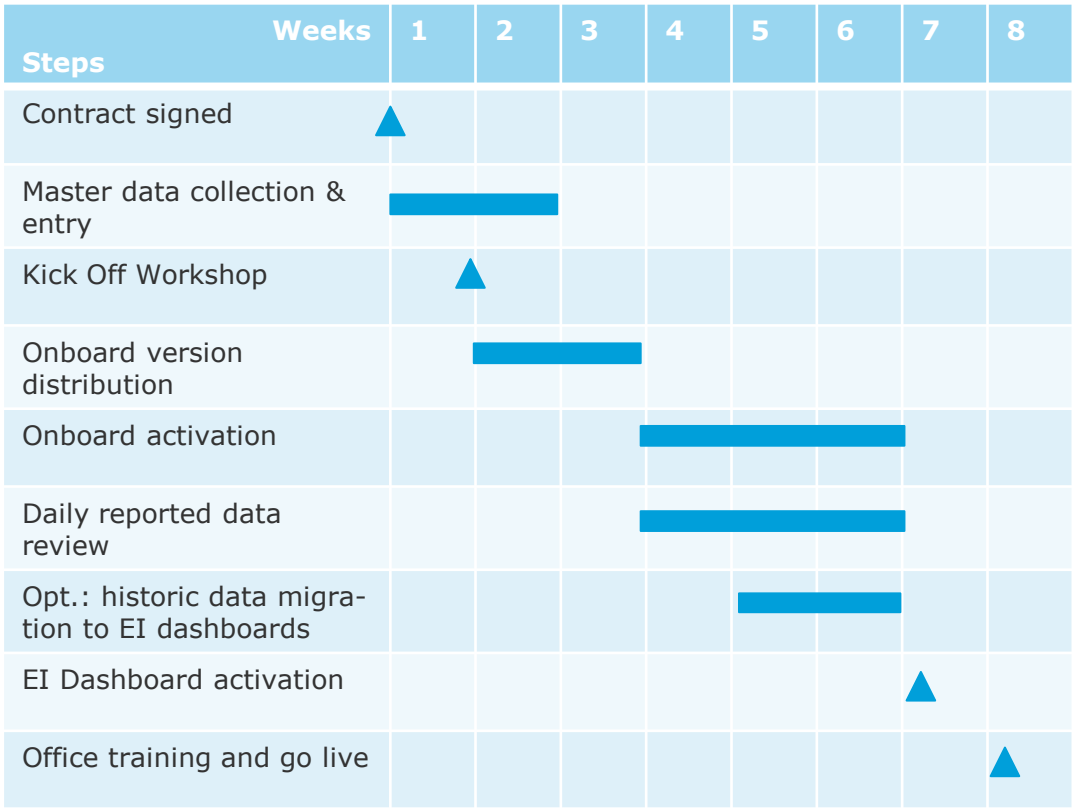
Taking the DNV GL Performance Management offering is the fastest track for a leading solution



Project logic

- Kick off workshop will give system overview and who does what until when in the coming weeks
- Master data are entered into server from DNVGL
- In parallel the board version can be send to the vessels
- If both done, the board versions can be activated
- Dashboards will only be activated after data collection works
- Historic data migration as optional step
- Office training of key users will mark official go live

NI: data collection system Navigator Insight, EI: fleet performance portal ECO Insight

DNV GL provides the fastest way to an industry leading performance management

Speed

- Predefined, industry best practice dashboards
- Hosted web based portal with a user friendly layout
- Easy to roll out onboard solution

Low CAPEX

- Use the existing processes in your shipping company
- No additional IT or hardware investment onboard
- Flexible subscription based pricing

Benchmarking

- Own vessels, vessel groups, fleet
- AIS data from the world fleet
- Weather and Fuel quality benchmarks

Advanced Analytics

- Highly precise ship model with CFD computations
- Enabling viable hull fouling prediction and good normalization of measured data

Advanced Emission Mgmt.

- Comprehensive collection of environmental relevant data onboard (emissions, disposals, ballast water, sludge, etc)
- Data feed to NGOs and regulators possible (e.g. CCWG, ESI, CSI, EU-MRV)

More then 200 shipping companies and 2.500 vessels trust in our performance solutions

Selected references ECO Solutions

Ahrenkiel Shipmanagement
Anglo Eastern
APL
BW Gas ASA
Claus-Peter Offen
Columbia Shipmanagement (Deutschland)
COSCO Container Lines Co., Ltd.
Costamare
CSCL China Shipping Container Lines Ltd.
DSME Korea
Geden Lines
Godby Shipping AB
Hamburg Sued
Hansa Shipping
Hapag-Lloyd AG
Harren & Partner
Höegh Fleet Services AS
Hyundai Heavy Industries (HHI)
Hyundai Merchant Marine (HMM)
Jüngerhans Maritime Services
Masterbulk Pte. Ltd.
Meyer Werft Papenburg (Yard)
MSC Shipmanagement Ltd.
Norddeutsche Reederei H. Schuldt
NSB Niederelbe Schiffahrtsgesellschaft
NSC Schiffahrtsgesellschaft
Ocean Shipmanagement GmbH
Oshima Shipbuilding
Peter Döhle
Reederei "Nord" Klaus E. Oldendorf GmbH
Reederei F. Laeisz G.m.b.H.
SAL Heavy Lift GmbH
Samos Steamship Co.
Seaspan Ship Management Ltd.
Thenamaris Ships Management Inc.
Torm A/S
United Arab Shipping Company (S.A.G.)
ZIM Integrated Shipping Services Ltd.

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