Vessel Performance Management

How can IT and practices enable performance improvements for vessel operations ?

SHIP IT – Conference

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Agenda

- Project Aim, Deliverables, Setup & Timeline
- Current state of Vessel Performance Management
- Our approach to Vessel Performance Management
- Progress so far
- Q&A

Project Aim, Deliverables, Setup & Timeline

Project Motivation: Shipping anno 2015

Fuel efficiency is important – game changer

- Fuel price increased from 140 $/ton to 600+ $/ton in short time
  (And now it is down again, below 250$/ton in Rotterdam…)
- Cargo rates are fluctuating, and in some segments down, general oversupply of vessels
- Energy efficient new tonnage is being added to the market
- Total fuel costs over a ships lifetime is (much) higher than the ship cost for new buildings

Requirements from society, environmental framework puts pressure on the industry:

- Reduce CO2 emissions
- Reduce SOx, NOx emissions
- Ballast water treatment

Cost effective operations -> competitive advantage

VPM Project Setup, Funding & Timeline

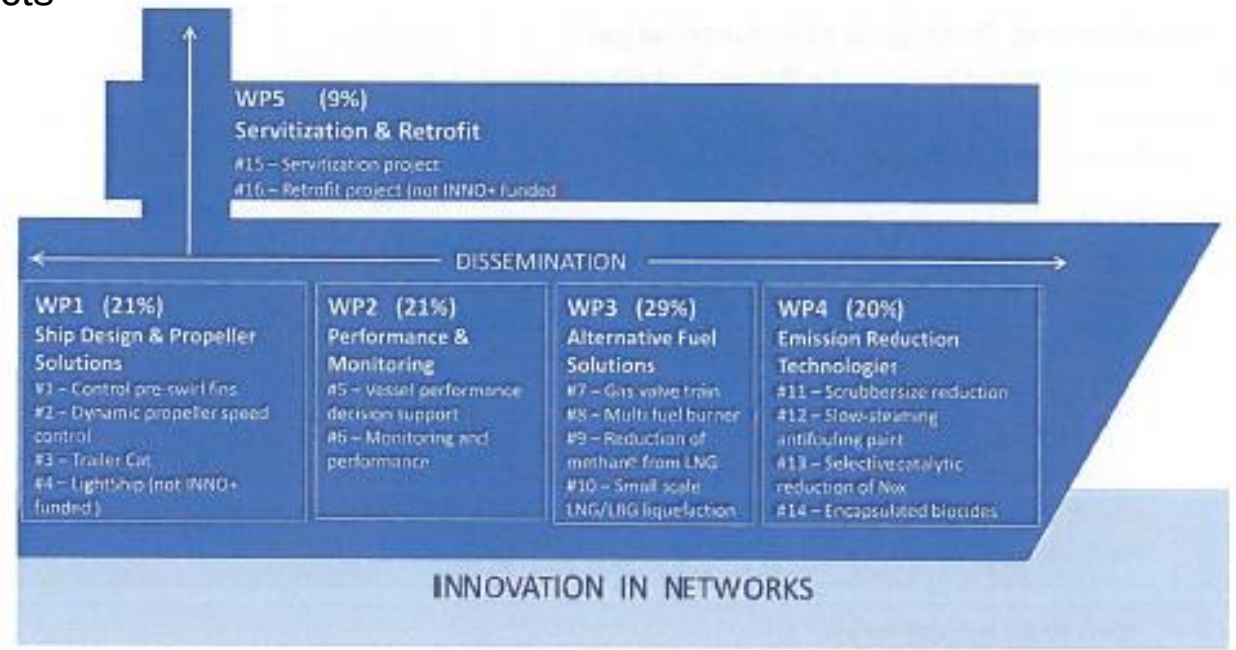
- Project consortium
  - Torm, shipping company
  - Lauritzen Kosan & Bulk, shipping company
  - FORCE Technology, GTS institute
  - Aalborg University, University partner
  - Vessel Performance Solutions Aps
- Duration: 2015-2018
- Budget: 2 mill. EUR
- Project is part of Blue InnoShip

Blue Innoship

- Denmark's largest maritime innovation project 2015-2019
- Aim is to create growth and employment in the Blue Denmark through development of green and energy-efficient solutions.
- Project consortium: 40 partners covering suppliers, shipowners, consultants, universities and schools, GTS institutions, authorities and classification societies
- Budget of 15 mill. EUR funded by project partners, Innovation Fund Denmark, the Danish Maritime Fund and Orient's Fund
- 5 Work Packages - 14 projects

WP2 focus is on Vessel Performance Monitoring & Management

Project A: Vessel Performance Decision Support



Project Aim & Deliverables

To deliver a

"Vessel Performance Management Platform & Practices

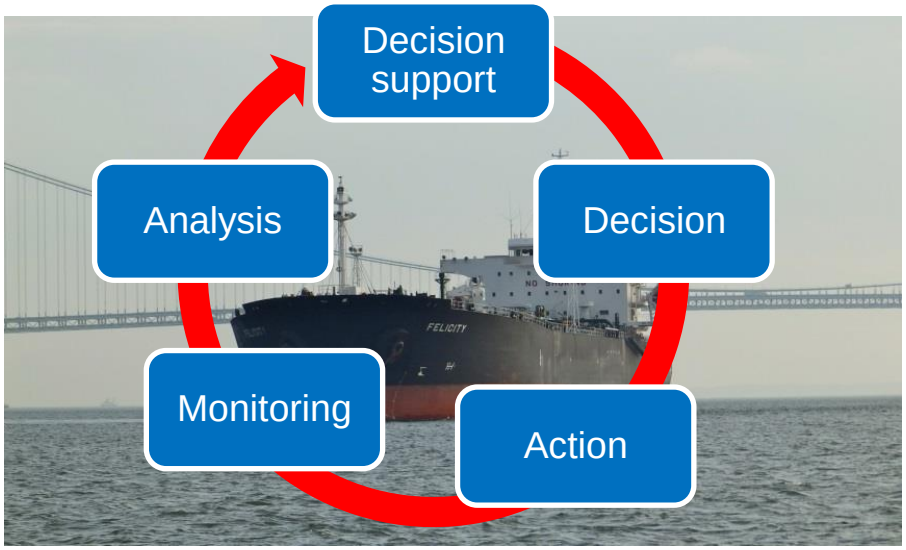
with the following characteristics:

- Modularity where the various modules will have transparent interfaces.
- An open standard that defines the interfaces between strategic modules (an Application Programming Interface (API)) for easy and transparent set-up of the interfaces between modules.
- A Vessel Performance Analysis engine (VPAe) that will convert operational data into decision support
- A simple platform for running performance reports or jobs
- Presentation layer for display of decision support
- A conning display for real-time display of performance indicators
- Robust Key Performance & Process Performance Indicators grounded in evaluations of data quality
- Target driven vessel performance improvement processes implemented in shipping companies

Current State of Vessel Performance Management

Vessel Performance Management

- An area evolving industrially but also unexploited as a research area
- Vessel Performance Management is a process enabling monitoring and analysis of vessel performance and ongoing decisions / actions targeting and achieving improvements across a range of objectives:
  - Costs
  - Energy Efficiency
  - Environmental performance (MRV,Sox,Nox)
  - Operations
  - Reliability
  - Safety
  - Tradeability



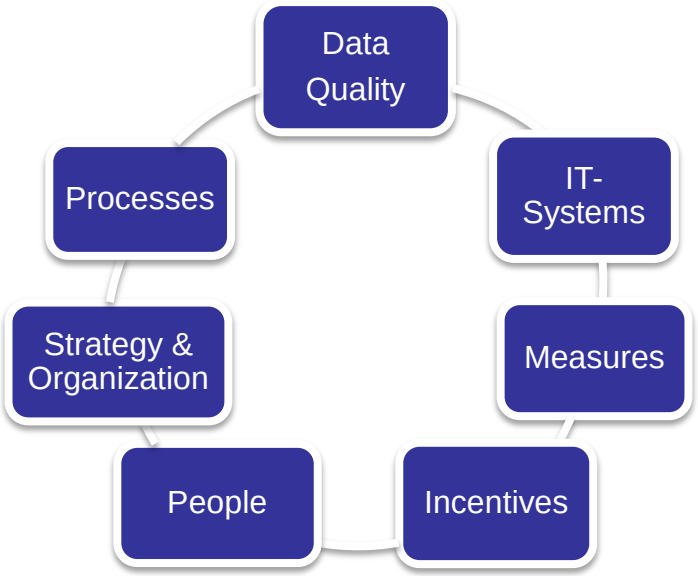
Vessel Performance Systems

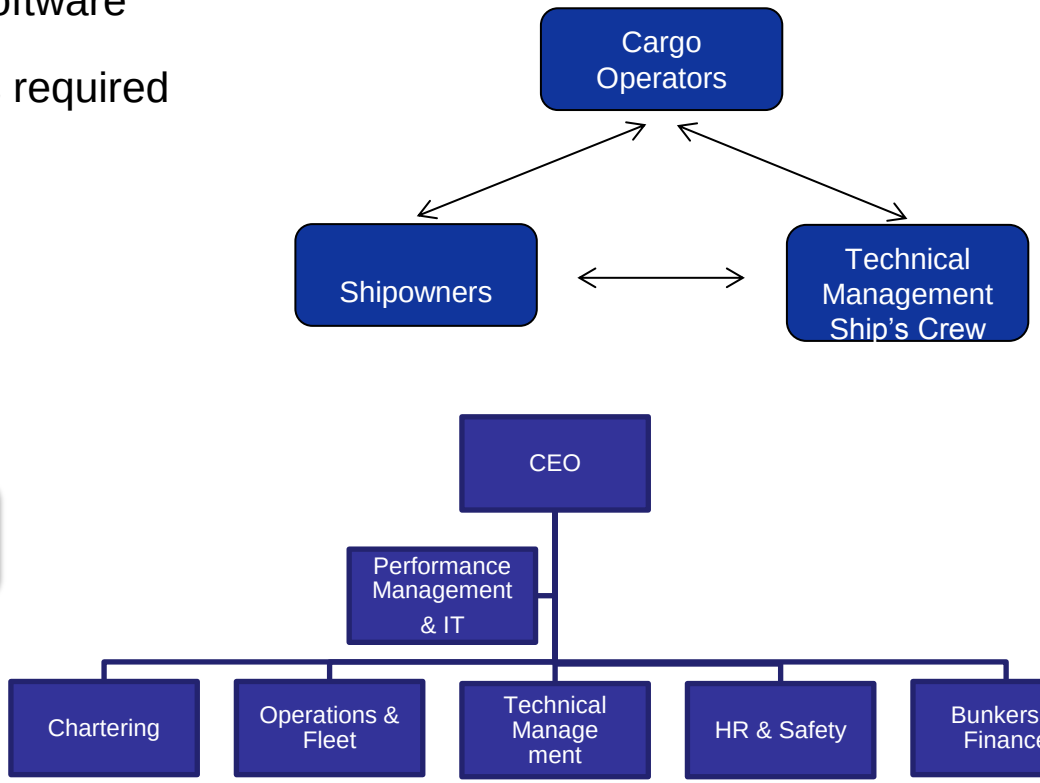
There are several applications in the market, but technologies are still under development – what are their strengths and weaknesses and how can shipping companies gain value from these today ?

The project will do benchmarking of systems (in use) to investigate this

Vessel Performance Management

- VPM is about more than IT and software
- An integrated approach to VPM is required





- Shipping companies differ in business models, asset structures and fleet compositions
- Multiple stakeholders onshore and onboard must be commited to succeed
- Organizational capabilities to be developed together with IT, Metrics implementation

The project approach

The project approach to VPM

- Exploits Industry expertise and familiarity with VPM System implementations (e.g. from Maersk group)
- Vessel Performance Analysis Engine to be “intelligent” and produce valid and reliable reports / conclusions
- Ability to handle noon reports as well as Autolog data (less focus on data collection)
- Emphasis on data quality and filtering of data as part of developing performance indicators and views
- State-of-art Presentation layer and performance analysis views to be developed
- Flexible, modular approach and integration in focus enabled by push for national / global VPM and information exchange standards
- Stepwise tailored implementation of VPM practices and skills to ensure an attractive cost-benefit case for each company project
- Parallel development of skills and capabilities of decision makers and performance improvement culture

PERFORMANCE MANAGEMENT – ITERATIVE IMPROVEMENTS

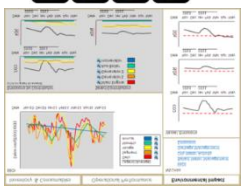
Data Collection
Monitoring

Analysis

Calculations
Normalization
Trending
Alarms
KPIs

Decision
Support

Dashboards
Reports
Interfaces
Diagnostics



Decision

Action

Ship Crew
- Main Engine efficiency
- Base load/elec. Cons.
- Aux. efficiency
- Voyage efficiency

Ship Management
- Main Engine efficiency
- Base load
- Aux. efficiency
- Voyage efficiency
- Hull and propeller
- Fuel tables

Ship Operations
- Fuel tables
- Voyage earnings
- ETA communication
- CP monitoring
- Deployment opt.

Asset Management
- Benchmarking

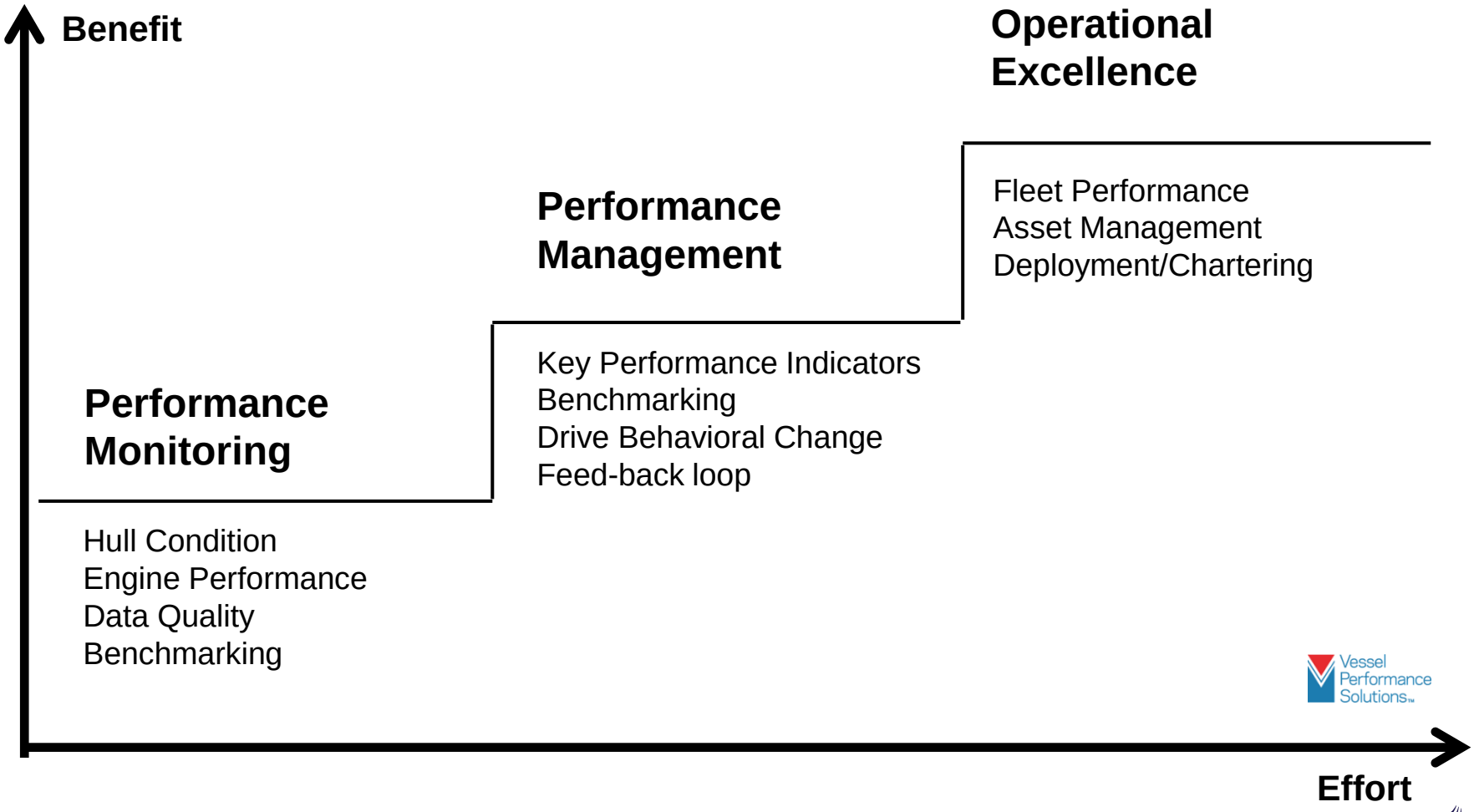
Transparency

Knowledge Sharing

Vessel Performance Solutions

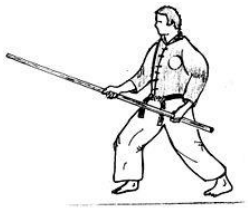
AALBORG UNIVERSITY
DENMARK

Performance management stages



Kaizen Practices and People

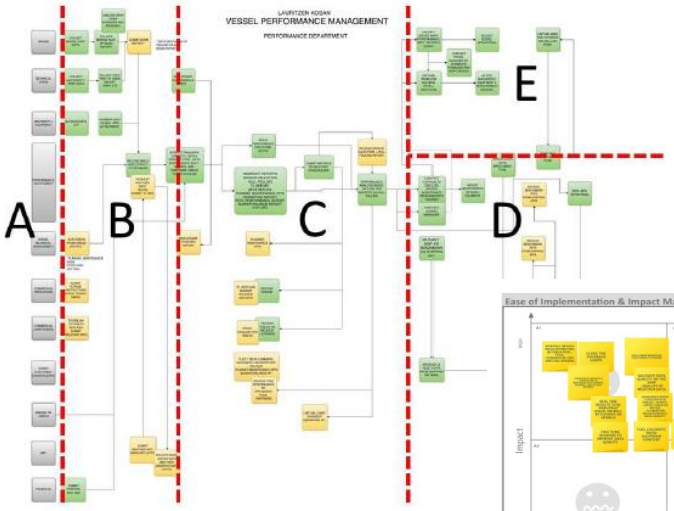
- Kaizen = Target driven performance improvement practices requires:
  - Relevant Performance Measures of good quality
  - Kaizen Boards / Visual display of actual performance for relevant stakeholders (real-time)
  - Robust performance monitoring, analysis and reporting tools is a + for deep dive into root causes
  - Clear targets for vessel operations should be aligned with functional and company strategy
  - Staff and managers onboard / onshore to be trained in PDCA methods and use of the Kata Approach
  - Motivated and engaged workforce and a coaching oriented leadership culture
  - Incentives in place to driven the desired behavior



Progress so far

Project Progress so far….

- Current State of Processes, Systems, Reports and Metrics mapped



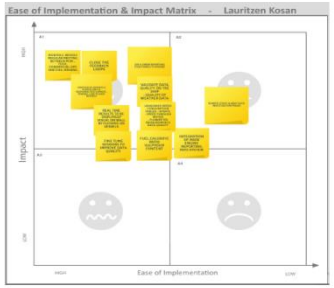


Figure 26: Ease of implementation and impact matrix. (See Appendix 10. for full size)

KPI Reports Report title	Topic	Frequency	Responsible	Users		
Sensor validation report	Monitor measurement devices and data quality	Daily	Performance	Performance	Ad Hoc	Instruct or vessel actions to improve sensor data validity
TC report	Monitoring of vessel performance compared to contractual obligations	Biweekly	Performance	Commercial OPS	Ad Hoc	Contact captains to investigate reasons
Spot voyage report	Monitoring of vessel performance compared to contractual obligations	At voyage completion	Performance	Commercial OPS, Performance	Ad Hoc	Contact captains to investigate reasons, Identify options for improving vessel performance and voyage profitability
Debriefing report (vessel / captain)	Monitor top 2 performance	When top2 disembark	Performance	Marine HR	Ad Hoc	Staff appraisals, salarry an bonus schemes
Hull fouling report	Identify needs for hull and / or propeller cleaning	Weekly	Performance	Performance	Ad Hoc	Initiate hull cleaning
Bunker Balance report	Identify / measure bunker fuel discrepancies based on different bunkers data sources	Ad hoc	Performance	Bunkers, Commercial OPS	Ad Hoc	Identify poor bunker suppliers and fraud
Planned Maintenance KPI report	Identify planned maintenance and performance for vessels	Weekly	Performance	Vessel Technical Management	Ad Hoc	Follow up on vessel maintenance
Main Engine Performance	Monitor main engine and performance trending	Biweekly	Performance	Vessel Technical Management	Ad Hoc	Adjust and calibrate main engine operations
Pool performance report	Benchmark vessel performance of pool vessels	Monthly	Performance	President LK, Pool partners, Head of Chartering, Head of Fleet	Ad Hoc	Financial rewards / punishments depending on pool performance, Follow up on LK vessel performance
EEOI (MRV) report	Environmental reporting	Yearly	Performance	LK and External stakeholders	Ad Hoc	
Vessel speed - Fuel-Consumption tables update	Update tables to reflect latest performance data	Ad Hoc	Performance	Commercial charterers, Commercial OPS	Ad Hoc	Adjust seetings in IMOS
LK vessel performance benchmarking report	Compare LK vessels with Shipping KPIs data	Quaterly	Performance	Head of Fleet	Ad Hoc	Input to strategic / tactical decision making
Live displaying of performance data on vessel basis						

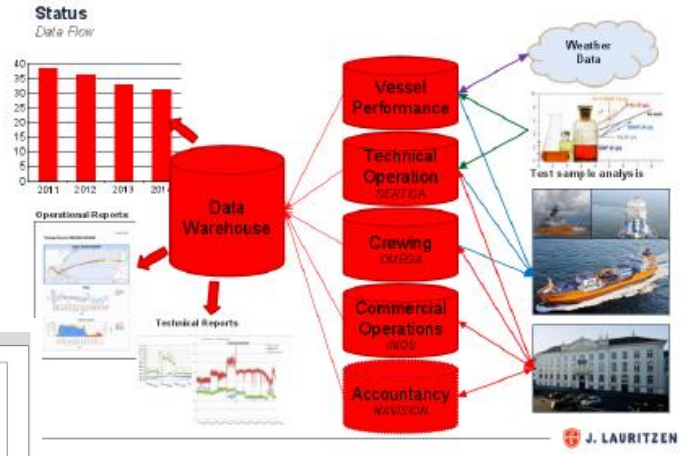
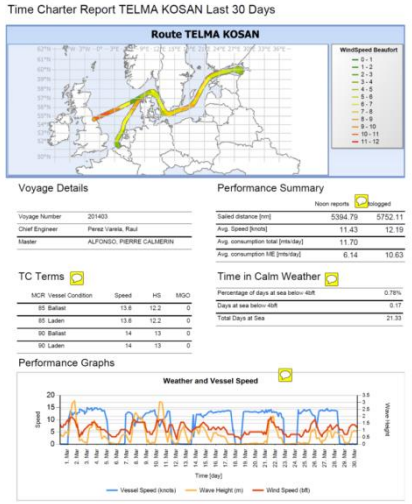
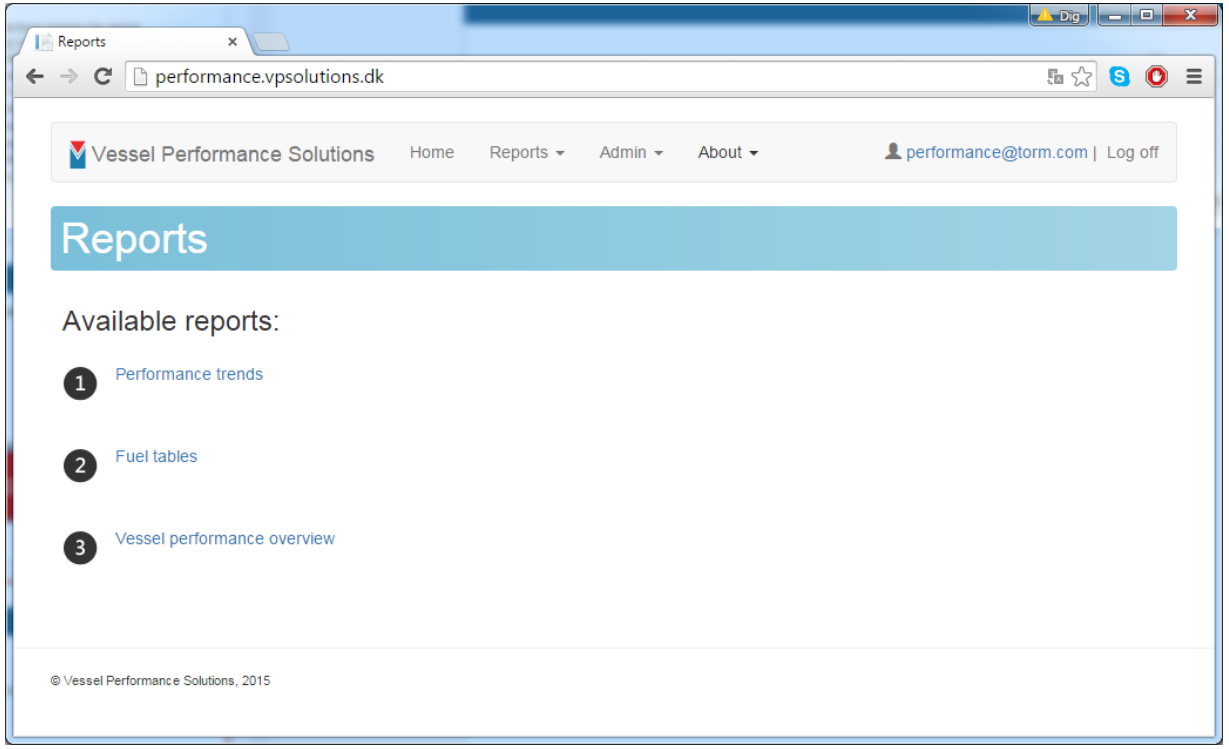


Figure 25: Data flow (PP, Lauritzen status and strategy, 2015, slide 5)



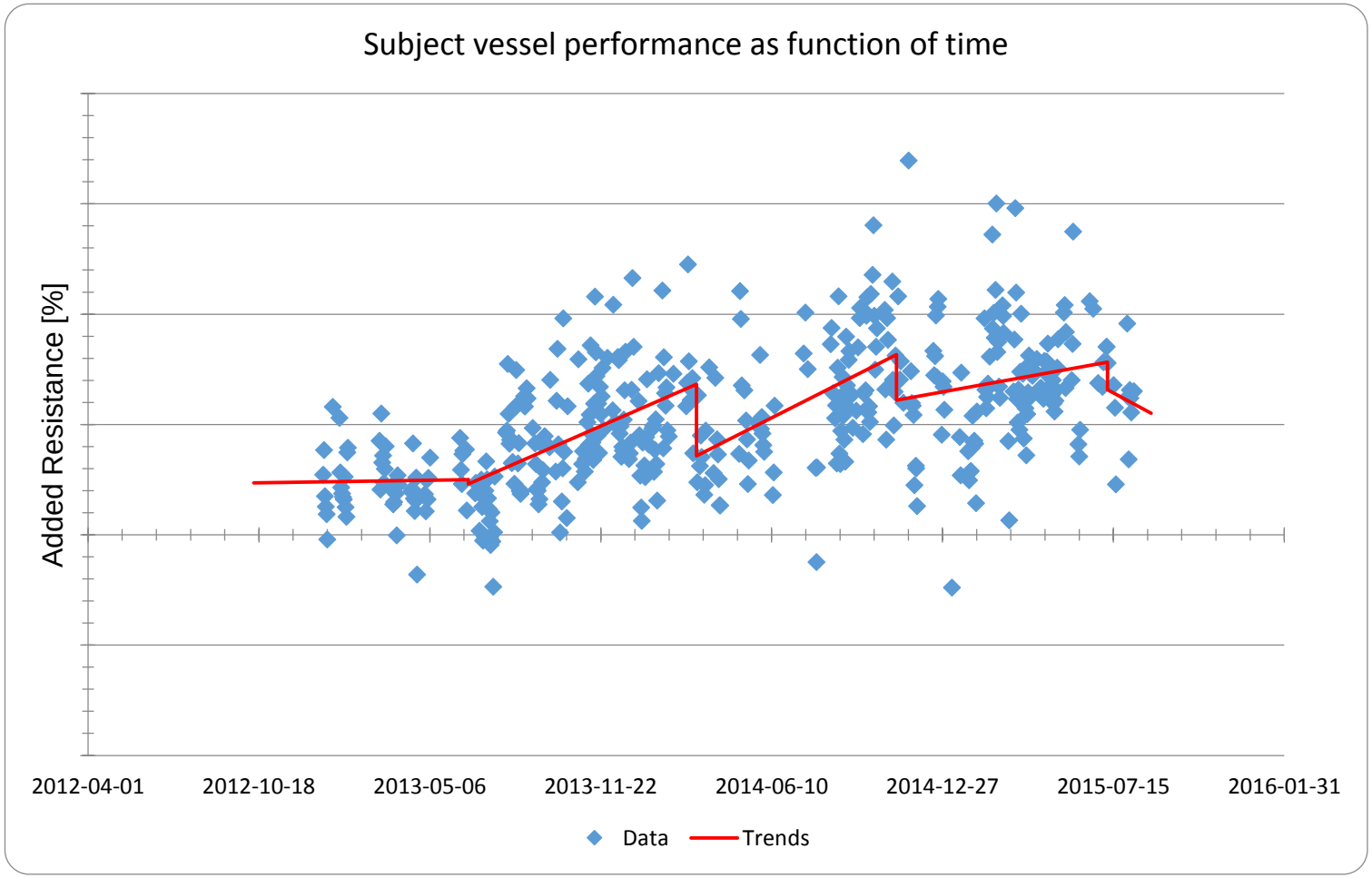
VPMP Progress so far….

- A working WWW platform
- Vessel Models for in total ~140 vessels,
  i.e. 140 vessels “in production”.
- A total of four reports working, output in Excel



VPMP Progress so far….

- Performance trending for selected measures



Effect after three hull-cleanings. Vessel performance and fuel consumption is determined from trend lines.

VPMP Progress so far….

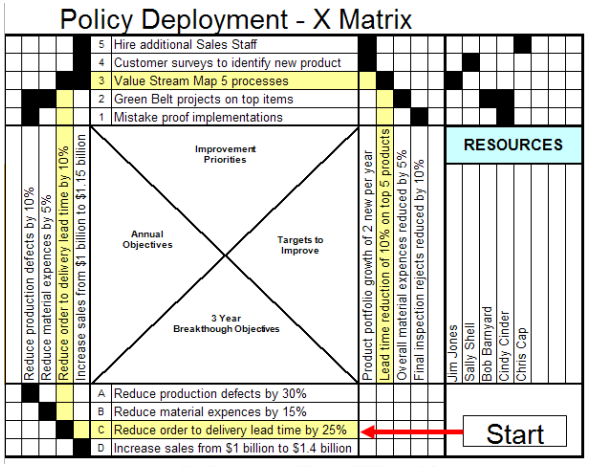
- Metrics and performance views – Energy efficiency KPIs / PPIs – likely to be in focus

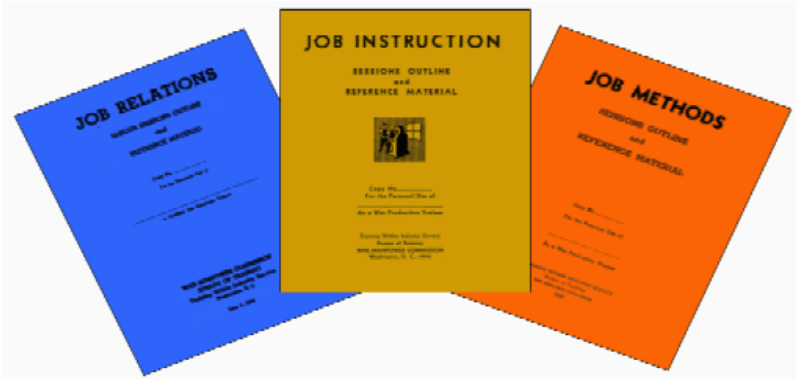
- Data Quality (e.g. no. of dataset outliers / flaws filtered away)
- Added Resistance / Hull and propeller efficiency (Added resistance in % across time)
- Main engine SFOC (g / KWH)
- Base Load (Aux engine, boilers, generators etc.) (KWH)
- Cargo handling consumption (KWH)
- Slip (actual vs planned distance in %)
- Voyage Efficiency
- EEOI (Fuel Consumption & CO_2 emissions per cargo load mile)

Data quality, filtering and normalization methods used together with control charting to remove noise / randomness from performance measures

Kaizen Progress so far….

- 3 Day Workshop planned for autumn to get inspired by best practices for performance management from other industries
- Topics will be:
  - Hoshin Kanri
  - Improvement & Coaching Kata
  - TWI (standard work)
- Instructors are experts with business background from industry and transportation companies
- Based on seminar, efforts in shipping companies will be prioriitized





Next steps

Next steps

- Project will progress according to overall plan on most fronts
- A combination of short term and long term benefits for shipping companies will continue to be in focus
- Standardization work will continue, and broader reach out to shipping companies and other vendors is planned (e.g. through Danish Ship Owners Association, BIMCO etc.)
- VPS and Force will offer software and advisory services to other clients in parallel
- Tracking and documentation of implementation results to be done (realized improvements to be measured on KPI / PPIs)
- Action Research approach, in 1-2 years scientific publications and dissemination activities will follow
- Reach out to international partners has begun

Q&A

Links / References

- http://blueinnoship.dk/
- http://www.vpsolutions.dk/
- http://forcetechnology.com/da/maritim-sektor
- http://www.shipping-logistics.aau.dk/
- http://www.torm.com/
- http://www.j-l.com/

APPENDIX