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Fleet Performance Management on OSV's using Big Data

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> "What can be digitalized will be digitalized"
>
> Carly Fiorina

Content

1. Introduction
2. Design Optimization
3. Operational Optimization

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Various types of OSVs in the market to cater for the petroleum industry

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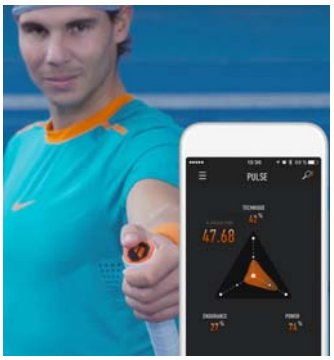
This is not a normal tennis rack – but an example of IoT (Internet of Things)



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What is Big Data and where does it come from?

"Moores law turning 50"

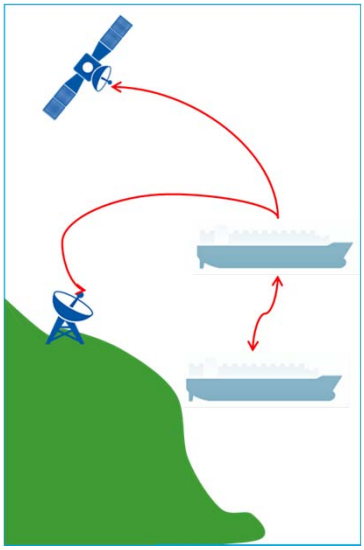
"The rediscovery of the log file"
(user behaviour in www)

"Internet of things"
(smart products, sensors)

"Connectivity"

- **Volume:** The size of datasets is growing fast and challenges archiving and analysing activities
- **Velocity:** Data is more frequently generated and needs to be analysed in real time
- **Variety:** Data can be of any type and can be structured or unstructured. This challenges data integration
- **Veracity:** The quality of data is uncertain. Being able to trust data is therefore an important aspect

Example: AIS data – the “log file” of a ship



- **Free & unencrypted VHF signal** transmitted by every vessel >300 GT containing, e.g.
  - Vessel MMSI/IMO & name
  - Vessel position
  - Speed
  - Draft
  - Vessel dimensions
- **Signal can be received by any organisation or person** operating **land based stations** (~30 nm shore coverage, seconds to few minutes updates) and **satellites** (global coverage, minutes to few hours updates), or vessels themselves
- Original use for safety and traffic control near shore
- Data is **offered by many commercial providers** in different qualities

Complete picture of the entire world fleet at almost any point in time

Example: Satellite weather is available across all oceans

NOAA NATIONAL CLIMATIC DATA CENTER

- Satellite weather records in 6 h intervals
- Covering all oceans with e.g. wind force information on 0.25° grid

Challenges: There are fully sensored up vessels today, what do we do with the data…….

- **1.3 PetaBytes data**
- Brand new drillship
- 10.000 sensors
- 5 months of data

And how do we harness this Big Data??

Design Optimisation

- **High fuel savings potential**, as many degrees of freedom are still available to optimize hull, engine and systems to intended operating conditions
- **Potential for immediate investment cost savings,** e.g. through reduced engine power

Operational Optimisation

- **High fuel savings potential,** especially if related to change in speed patterns or to hull resistance
- **Very short payback time,** as measures typically address operating practices that can be changed without cost or require minimum investment for measuring equipment only

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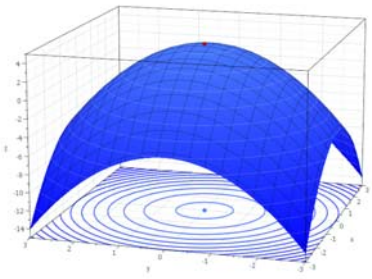
Definition >> Optimization <<

Optimization is the **process of finding** function **extrema** to solve problems“



To optimize a structural design, you would want a design that is both light and rigid.

Because these two objectives conflict, a trade-off exists. There will be one lightest design, one stiffest design, and an infinite number of designs that are some compromise of weight and stiffness.

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Optimization Hull

- Traditional lines development
  - Open drawer
  - Select similar ship
  - Adjust dimensions
  - Some selected CFD
  - Model testing
    - Bossing
    - Rudder configuration
    - Propeller position
  - Done!
- Variations looked at < 10

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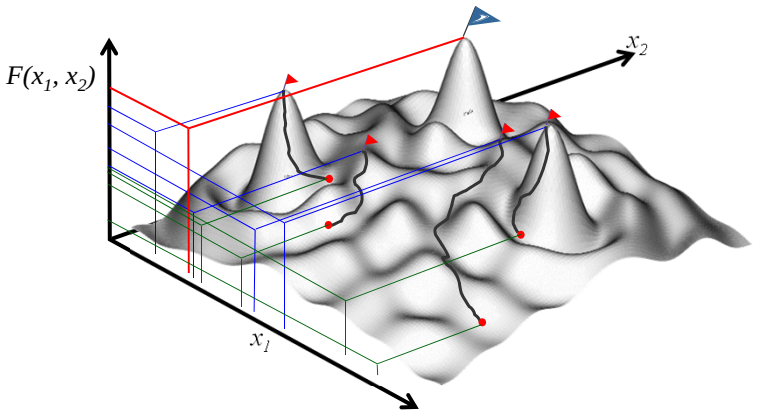
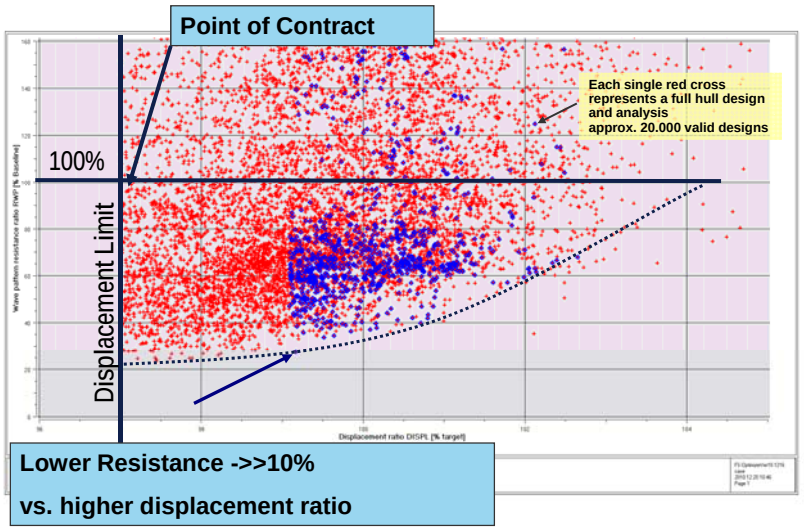
Optimization task



Hull Optimization - Exploration of design space



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Understanding the operational profile and optimizing the design

50 % fuel reduction possible – and proven

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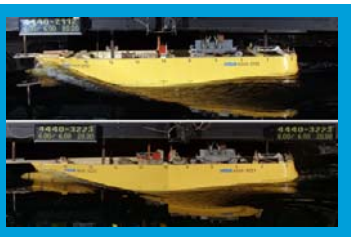
Benefit Case – ECO Lines: Offshore Tug

SITUATION AND CRITICAL ISSUE

Performance optimisation of offshore tug

The design of the shipyard did not perform to contract specifications even after a modified hull was investigated

DNV GL's team was contracted to improve the performance to attain contract conditions



DNV GL SOLUTION

- By means of a formal optimization of the forebody shape a **large number of design alternatives** have been developed and a promising candidate has been identified

VALUE DELIVERED

- The model test of DNV GL's design proposal confirmed a **saving of about 20%** propulsion power at the design speed
- At 100 sailing days more than 1,200 t fuel or **240,000 USD[1] can be saved annually**
- The contract condition of the shipyard could conveniently be met

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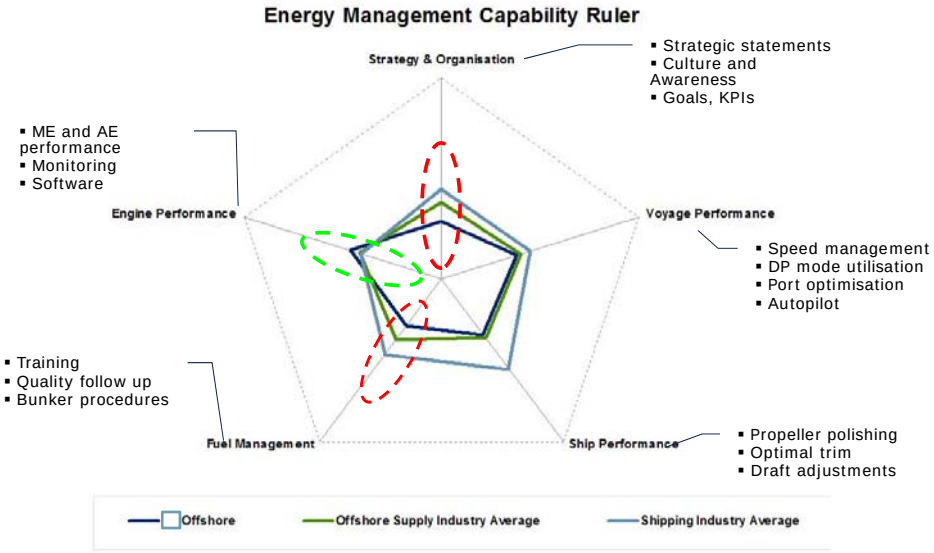
1: fuel price USD 200/T

Content

DNV-GL Operational Optimization project with 7 Owners

- 7 Shipping companies:
  BOA, Eidesvik, Farstad, Gulf offshore Norge, Havil, Siem and Solstad offshore
- Total 170 vessels
- 170 vessels emitting around 1.7 Mt of CO_2 per year
- Work together with DNV GL for reducing fuel consumption.
- Identified that contractual barriers and lack of economic incentives prevent good solution to be implemented
- In the 1st project, improvement potential of 16% reduction was identified

Strategy & Organisation and Fuel management are the main areas of improvement for Fleet Performance



But how do you set the benchmarks and good baselines…

Major performance categories

Voyage performance

Engine & systems performance

Hull & Propeller performance

Fuel quality performance

Environmental performance

Example KPIs

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

- 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

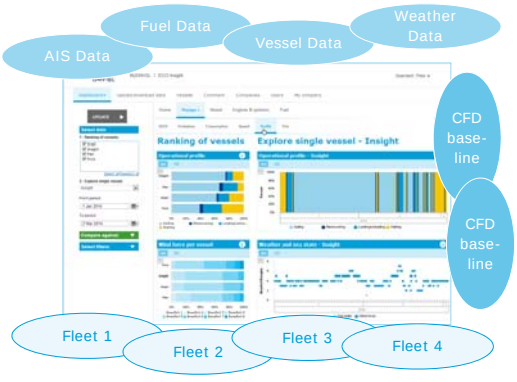
- Hull & propeller performance drop due to fouling
- Normalized speed power relationships
- Slip
- Trim

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

- Emissions
- Disposal
- Ballast

DNV GL solution: ECO Insight is more than just dashboards, it gives an outside in view on your fleet performance

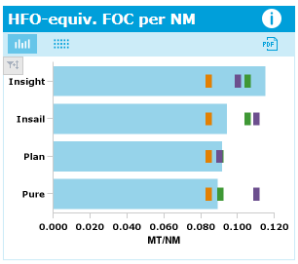
Public domain industry data

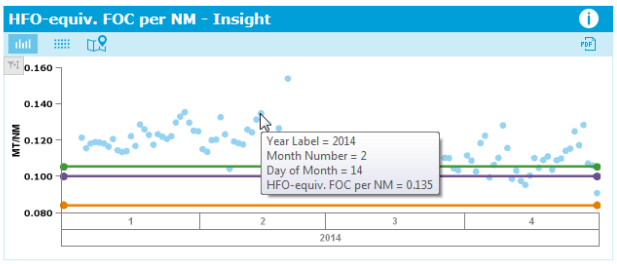


Operations data from customers' vessels

- **Comprehensive view on fleet performance (voyage, engine & system, hull & propeller, fuel)**
- **Enriched with additional industry data: weather, fuel-quality, satellite data, …**
- **Benchmarks against own fleet and market averages**
- **Advanced Analytics e.g. for hull degradation or normalizations using CFD models**
- **My dashboard function to customize user specific views and analysis trails**
- **Optional: Advice from DNVGL specialists**

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



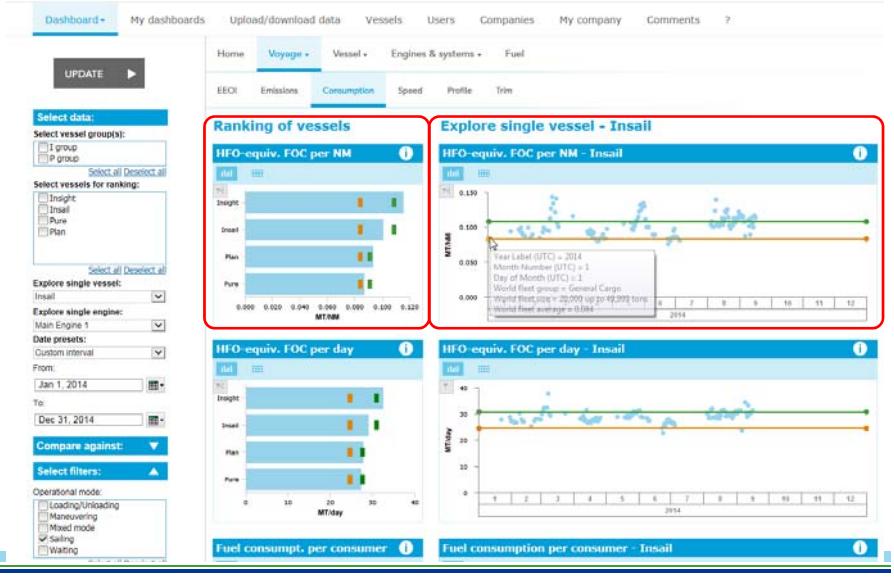


Legend: World fleet average (same vessel type and size) Own Vessel Group average Own Target (e.g. Charter party)

Compare against:

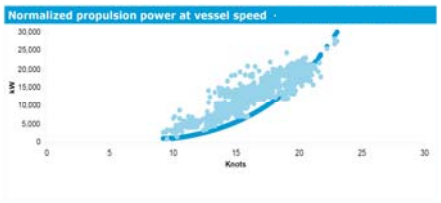
- Own vessels (of similar size), vessel group average
- Vessel specific baselines (sea trial, shop test, CFD)
- Industry benchmarks (speed, consumption, op. profile, fuel quality - world fleet, same vessel type and size)
- Own targets or limits (e.g. SEEMP, charter party)

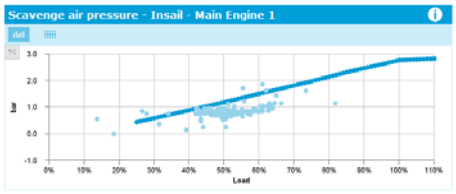
Dashboards always compare vessel group and dive deep into a single vessel in the same view



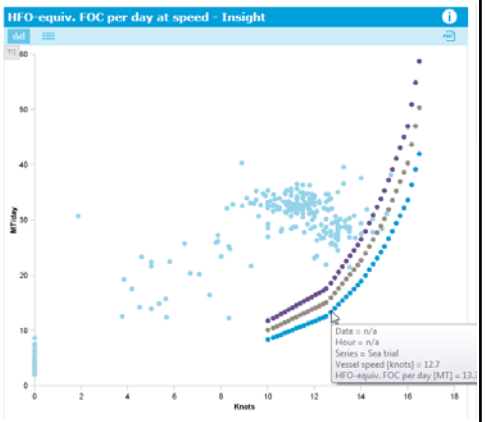
Good baselines guide analytics throughout a fleet performance assessment

CFD baselines used for normalization



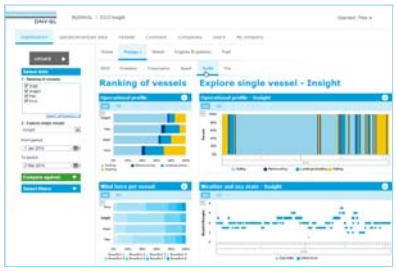


User defined baselines for speed-consump.



Shop test baselines used for Engine & Systems

There are multiple ways ECO Insight gets information back to you, not just via the web portal



- Push emails per event
- Log abstract per voyage
- Environmental reporting formats (e.g. CCWG, ESI, CSI, EU-MRV)
- Standard interactive dashboards (via browser)
- Personal interactive “My dashboards” (via browser)
- Predefined PDF reports pushed to email recipients, i.e., also crew
- Own analytics and reports (advanced workspace option)

Example: Track visualisation to support analytics

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)

> We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten.
>
> Bill Gates

Thank you for your kind attention

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