

How to establish a culture of energy efficiency by utilizing the potential of fleet data

Vessel Automation and 2030-2050
Green Technology / Decarbonisation
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Vessel Fouling



- Marine fouling is the accumulation of micro and macro organisms on immersed surfaces
- Marine fouling generates surface roughness and drag resistance
- The accumulation of fouling over time leads to a significant drop in performance and an increase in the vessel's fuel consumption and environmental footprint

Great Loss

- Vessels are power-hungry
- Large vessels can consume more than 100 MT daily
- Vessel consumptions are continuously increasing through time

Hempel (2015) cited figures from DNV GL and quantified the losses as:

 **30.000.000.000 USD**

Energy Efficiency & Performance - an omnipresent topic



Shipping stakeholders have identified benefits many years ago:

- ✓ Reduced daily costs
- ✓ Operational optimization
- ✓ Data driven decision making
- ✓ Future-proof operations
- ✓ Part of Decarbonization

Decarbonization - Regulations



EU & UK MRV

Monitoring Reporting & Verification of the carbon dioxide emissions from maritime

IMO DCS

Mandatory fuel oil data collection system for international shipping

Sulfur Cap 2020

Limit in the Sulphur content in the fuels oil used on board on ships

China MSA

Chinese Maritime Safety Administration requires an energy consumption report of the last voyage for all vessels entering territorial waters

EEXI

Technical measure looking to the design of the ship in comparable ways as the EEDI for newbuildings

CII – Game Changer

Introduction of the requirement to reduce the Operational Carbon Intensity through the Carbon Intensity Indicator (CII).

Data is the key



Take care of your data so as they take care of you.
Else: Garbage in
- Garbage out

Robust procedure for filtering and validation should be established

High frequency data are essential to produce fast and reliable results



Fleet Performance

Classic approach:

The most prominent is the ISO 19030 which is agreed & standardized method to measure fleet performance.

- Delivers valuable, clear & transparent results.
- Robust procedure which can yield insights for almost every situation.
- Used and trusted for many years.

Modern approach :

Big data and AI have been exponentially used recently and are developing towards the holy grail of vessel performance.

- They include advanced analytics which can consolidate much more variables and parameters
- Upon deployment, they provide extreme automation and value (including time-saving)
- Can be easily utilized for route optimization

Creating Machine learning models to predict vessel performance



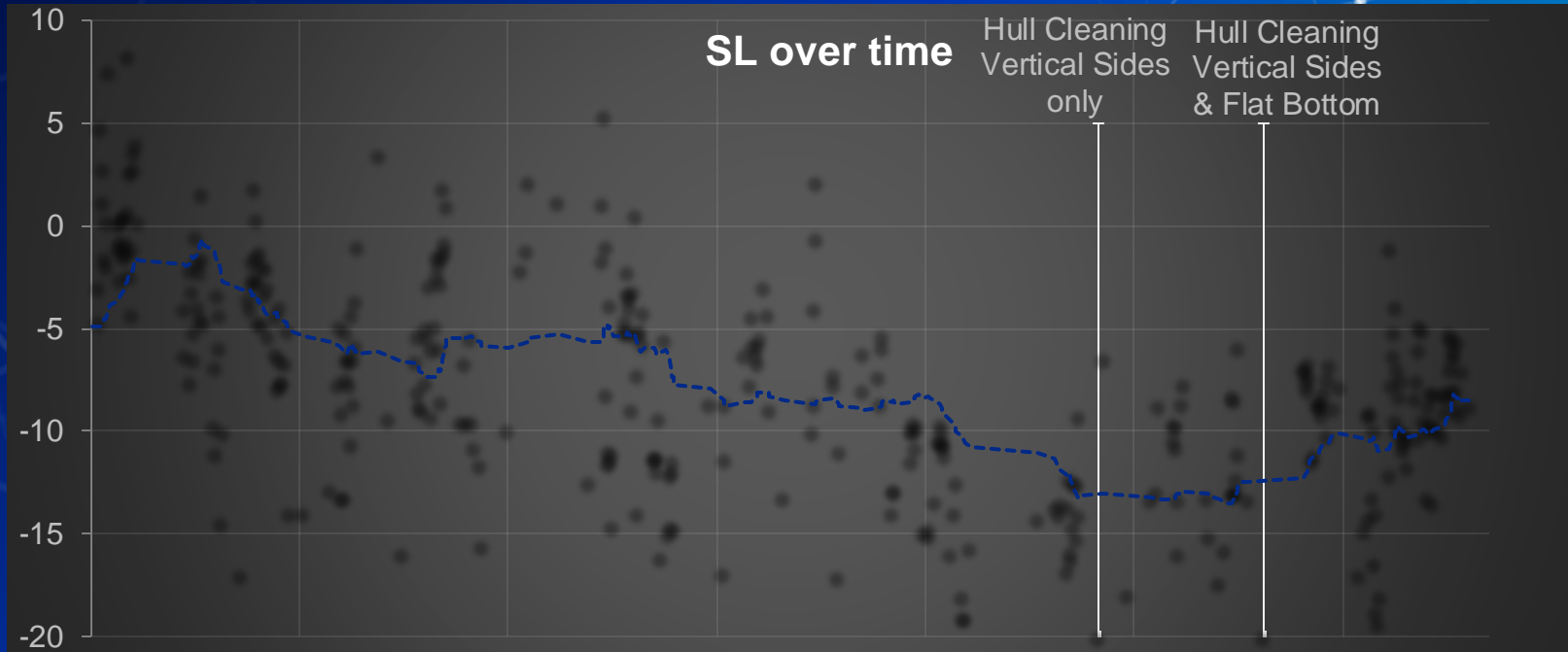
- ❖ State of the art machine learning algorithms (ANN, XGBoost etc.) have a great potential for such applications
 - ❖ Don't just throw data into algorithms
 - ❖ Human experience is absolutely essential

Using Machine Learning Models – Forecasting

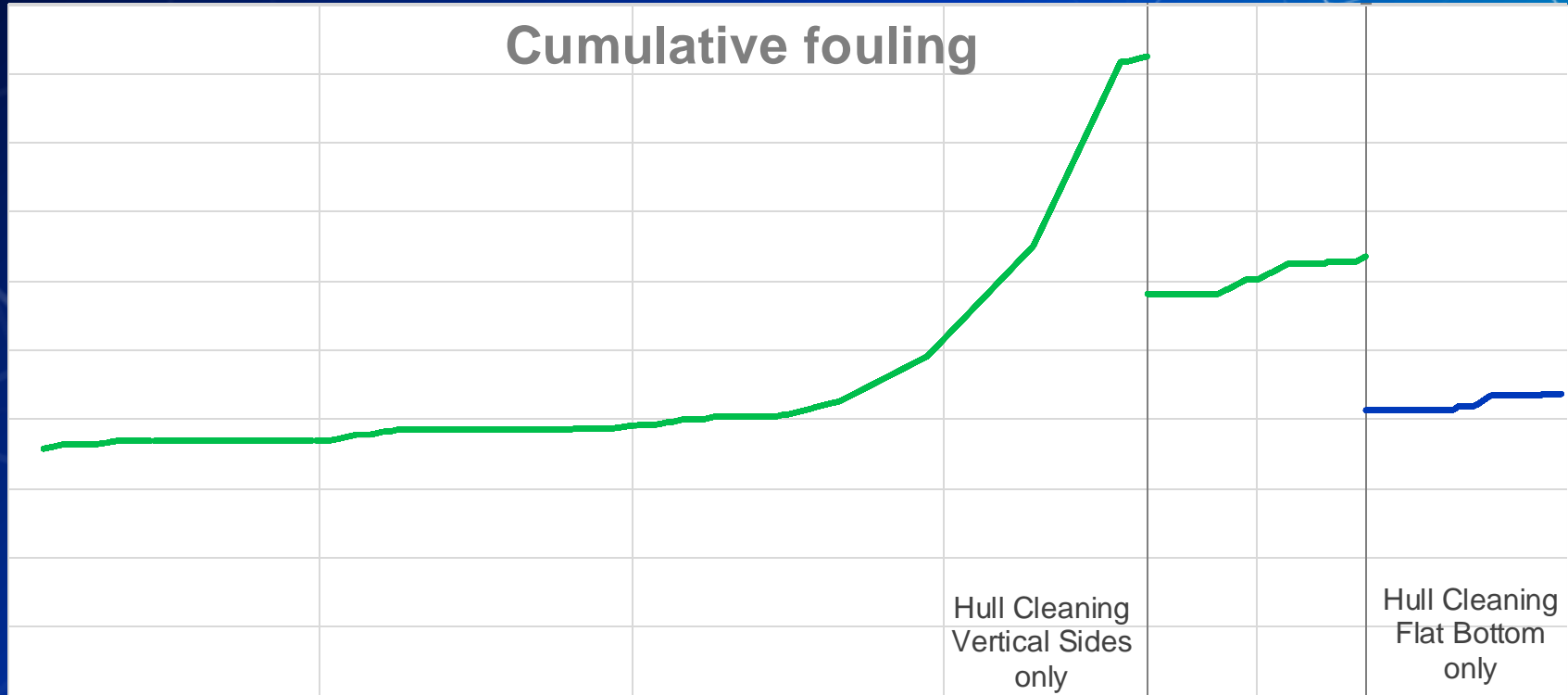


1. Real condition targets must be set for the testing of machine learning models
2. Machine learning models that defy the underlying laws of physics are not usable
3. Voyage prediction provides the big picture and incentive

Real condition example (1/2)



Real condition example (2/2)



Best Practices for optimum hull & propeller performance

- Elaborate as much as possible to the paint specification and calculate the best possible predictions for speed, water temperature and voyage ratio & patterns
- Follow the specifications of the antifouling paint as much as possible
- Slow steaming increases fouling rate (minimum levels of speed and activity should be maintained as per the paint specification)
- Try to avoid idle periods close to shore in hot and shallow waters. If not possible, inspect the vessel regularly and take action based on findings
- Frequent and short high speed sailing trips should be avoided as they provide little value compared to the required expenditures

Breaking existing barriers

Changing the existing cultural mindset can be a very arduous task...

Transparency is the key...

"Traditional" ship-owners are difficult to convince...

Complex models must be secularized and explained in plain words...

Establishing an internal culture of energy efficiency in shipping



Benefits must be made clear throughout a lasting time interval.

Build trust to the models and procedures through experiments, comparisons etc.

Always keep a strong financial incentive among stakeholders.

Getting the crew's support



Don't		Do		
1	Add unnecessary workload	✗	✓	Remove workload as much as possible
2	Give tasks without explanation	✗	✓	Work with them together explaining every new task
3	Suppose they know everything	✗	✓	Provide seminars and training

Examples of crew support



Route optimization:

Using models to continuously optimize a vessel's route with the latest weather updates can cause extra workload in order to maximize energy efficiency

Auxiliary Engines:

Introducing a threshold on which the vessel should start a second diesel generator is a very subjective issue for every chief engineer and can have impact on fuel consumed.

Takeaways - Conclusions

- Data is key and must be used in an intelligent and skillful way.
- Modern approaches such as Artificial intelligence (AI) and big data are a new powerful weapon into the arsenal of performance engineers and companies
- Continuous validation and human expertise is absolutely essential for the future of new technologies and the creation of robust procedures
 - Cooperation between different departments into shipping companies is a prerequisite
- Until the total deployment of fully autonomous vessels, without crew support most actions are in vain
- Real life examples of correctly engineered actions is the proof that data, energy efficiency and fleet performance are no-brainer towards decarbonization

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