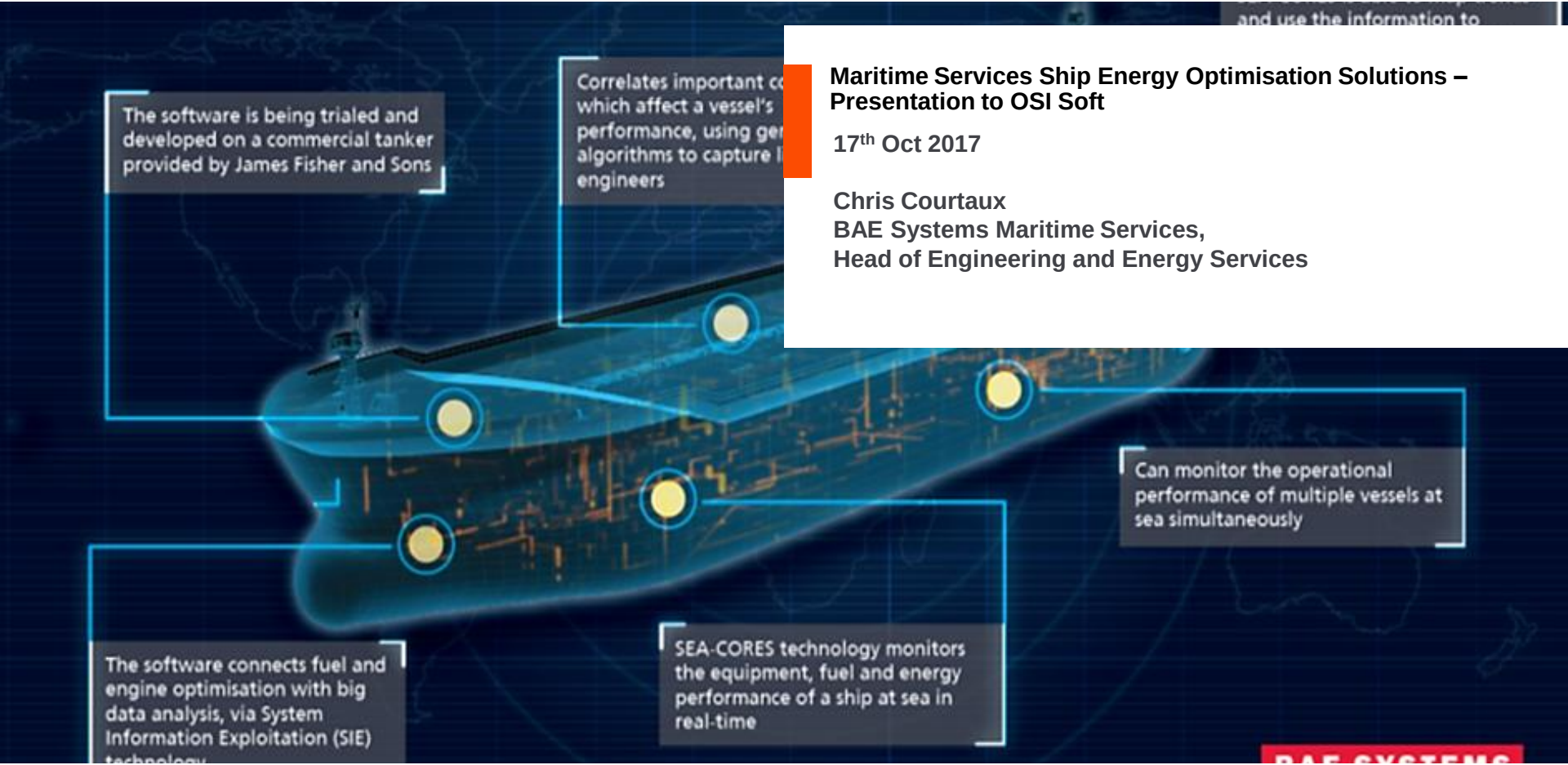
Maritime Services Ship Energy Optimisation Solutions

Presented by Chris Courtaux

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Maritime Services Ship Energy Optimisation Solutions – Presentation to OSI Soft

17th Oct 2017

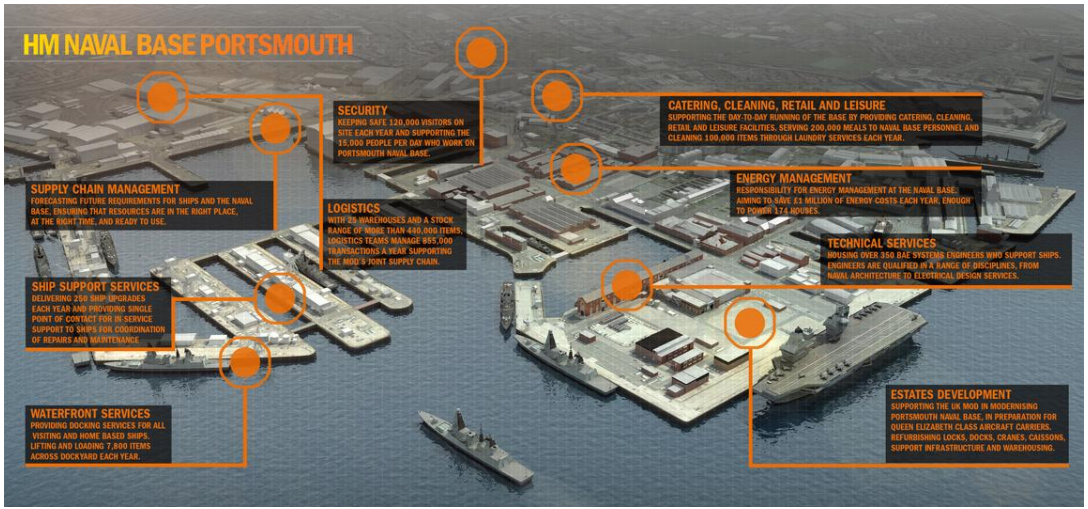
Chris Courtaux
BAE Systems Maritime Services,
Head of Engineering and Energy Services

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BAE Systems - Business Overview

BAE Systems is committed to driving up energy efficiency for our customer by developing a suite of cost-effective solutions capable of meeting demanding financial and environmental targets.

- 3 areas of focus:
  - Ships energy
  - Facilities energy
  - Facilities Energy off-grid
- Portsmouth naval base:
  - Managed by BAE Systems
  - £10m / annum energy bill



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Key Top Level Shipping Operator Requirements

- Increase range of ships, through improved information
- Support efficiency savings for fuel and maintenance
- Release future electrical capacity to support future equipment upgrades
- Increase reliability of all surface ships
- Improve measurement and management of energy-use on surface ships
- Comply with current and future emission legislation
- UK MoD has a target or reducing fuel usage by 18% by 2020/21

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Sharing Knowledge and Leveraging the Power of Sensor Data Increases Operating Efficiency..











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Today's Operator Dilemmas

- How much capability is lost by slowing down to save fuel?
- Will reducing maintenance costs be wiped out by increased fuel cost?
- How much money am I wasting on unnecessary fuel by not optimising trim?
- Am I compromising reliability by reducing engine speed and increasing vibration of key plant?
- How much capability will I lose through-life by 'slamming' into rough seas to maintain schedule? Does this shorten safe operating life?
- Will re-routing to calmer routes impact cost and operational capability?



Optimising ONE operating parameter can be detrimental to overall performance

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Solution requires a 'Big Data' Challenge

- Multi-dimensional data analysis of:
  - Weather and Sea Conditions
  - Navigation and Routing
  - Hull Condition – Drag, Stress and Strain,
  - Hull and Plant Vibration,
  - Torque
  - Fuel flow



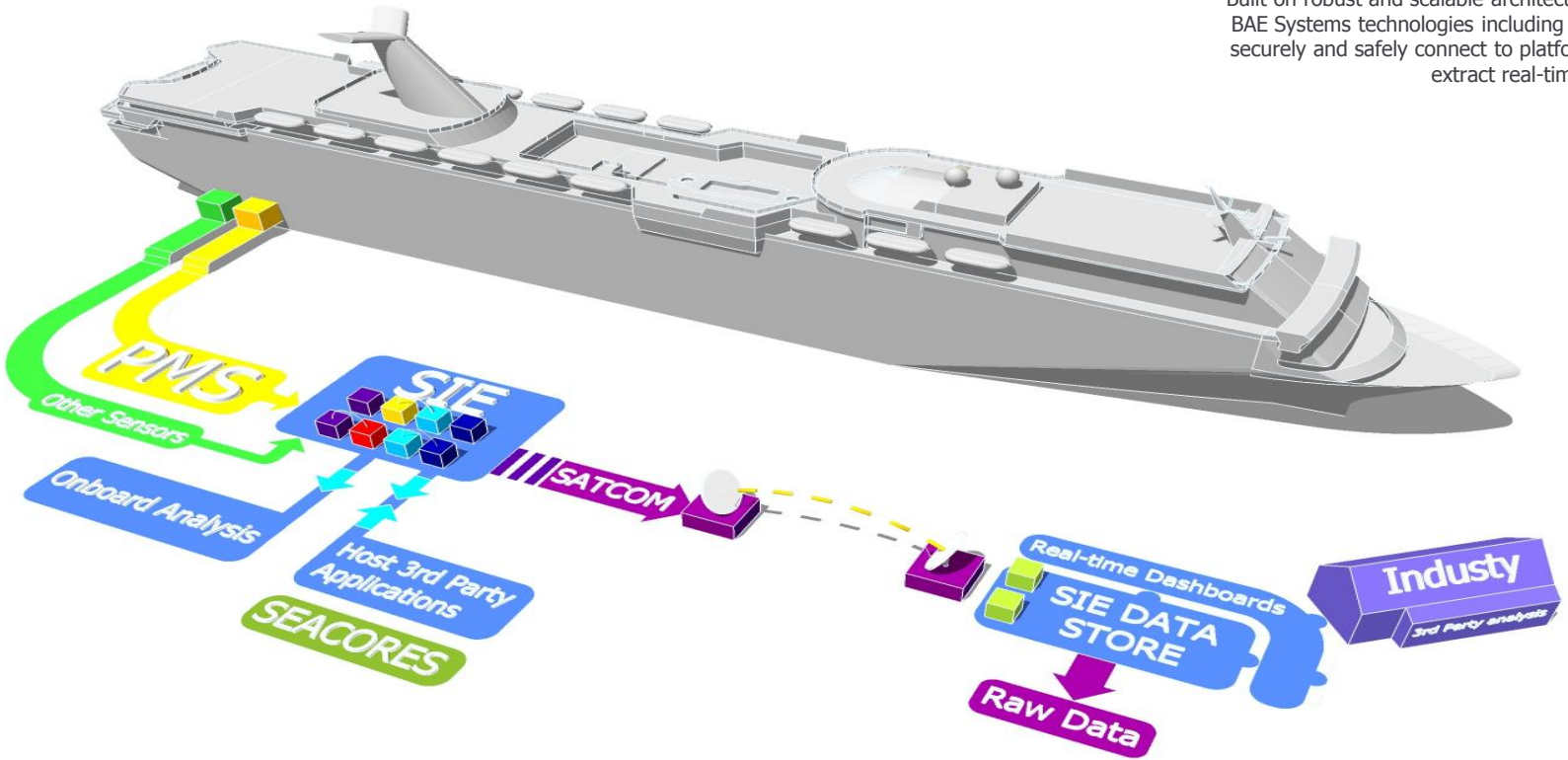
'..data is a raw material. How we collect it, how we handle and exploit it will determine our fighting edge, providing we have the connectivity and the right form of information architecture.'
Sir George Zambellas, DSEI 2015

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Integrated Version Only - Engineered and Accredited to a Secure Military standard

Receive > Secure > Process > Store > Communicate

Built on robust and scalable architectures, SIE uses BAE Systems technologies including data diodes to securely and safely connect to platform systems to extract real-time system data

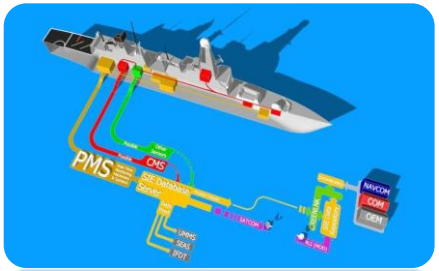


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SEA-CORES Options

- **Available as Standalone**
  - **Onboard Tool (Tablet/Laptop)**
  - **Near Realtime – data updates onboard**
  - **Monthly Ship Performance Reports**
- **Realtime in future, using a secure datalink**
- **Currently Standalone (monthly) data collection**
- **Ships Logs – Manual – digitisation**
- **Weather Feed (external service)**



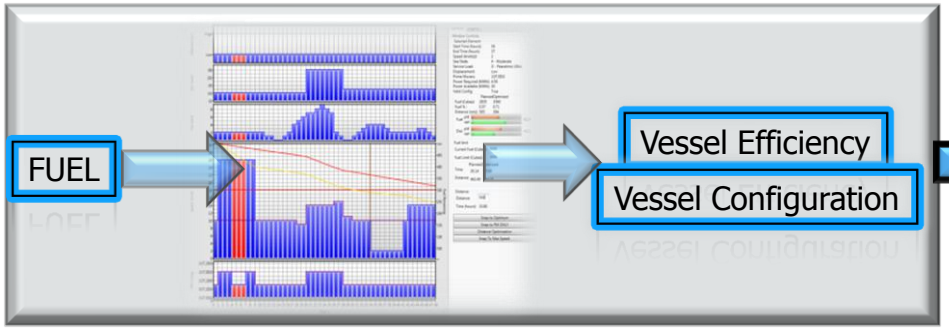
Why PI ?

- **Storage of high frequency data**
- **Multiple disparate data sources**
- **Processing requirement for high volume time aligned dependent data**
- **Scalable solution**
- **Personal Recommendation – James Fisher**
- **PI User Conference (Prague) - Success stories**

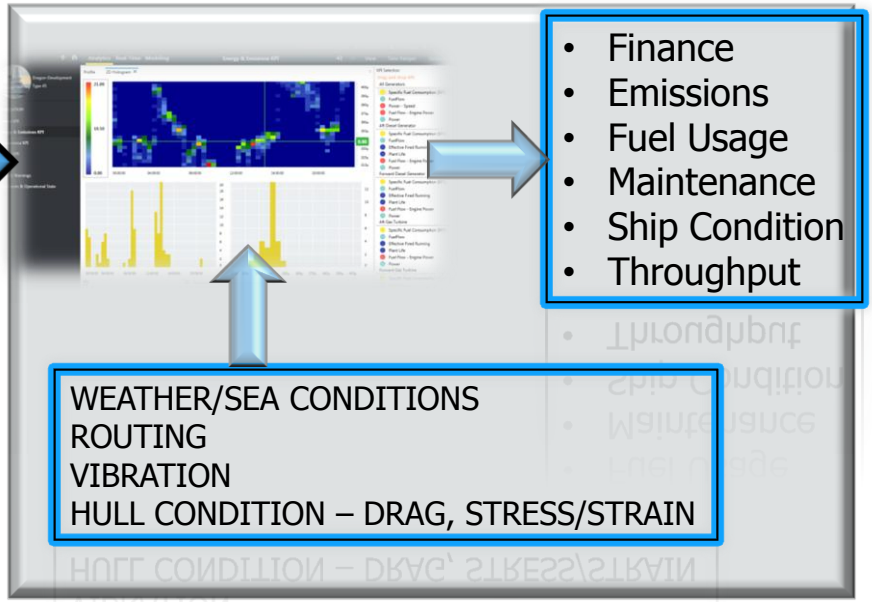
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SEA-CORES Concept

SEAS MODULE



SEACORES MODULE



- SEACORES predicts in Real Time:
  - Emissions
  - Fuel Usage
  - Maintenance and Ship Condition

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SEA-CORES
Architecture

SEA-CORES CLIENT (SHORE)	SEAS-CLIENT (SHORE)	SEA-CORES CLIENT (SHIP)	SEAS-CLIENT (SHIP)

SEA-CORES ANALYTICS

DATA ABSTRACTION LAYER (DAS)
OSISOFT PI SYSTEM



T45/QEC, etc. System Information Exploitation (SIE)



Type 26 Shared Computing Environment



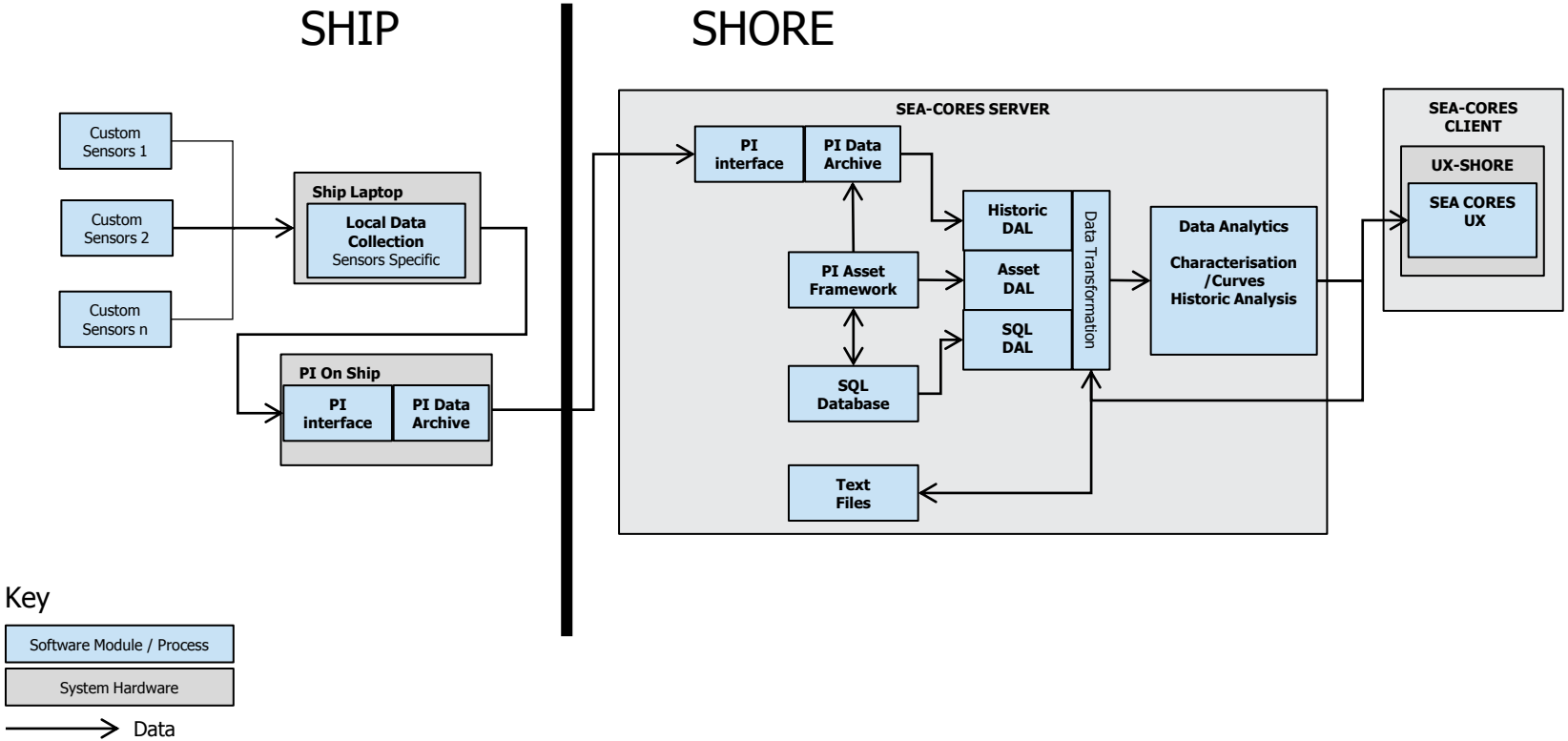
Commercial Vessels (E.g. Voyage Data Recorders)

PLATFORM AGNOSTIC – Eliminating Duplicated Data, Network & Transmission Costs

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SEACORES Technical Architecture Slide



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Partnering

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- Consortium Lead
- Design
- SEA-CORES GUI
- System Integration
- Trial Management
- Data Analytics

OSIsoft.

- Data Management
- Business Intelligence
- SEA-CORES Platform

University of Southampton

- Drive Motor Power
- Signature Analysis

TUGRO

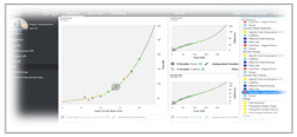
- Weather Routing
- Trim Management
- Remote Positioning

Fisher

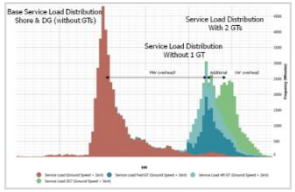
- Ship Sensors
- Trial vessel
- MIMIC vibration

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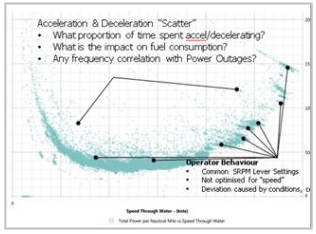
Typical SEA-CORES Output – "Unlocking" Value from Data ?



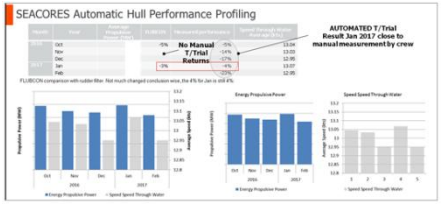
- Most economical Speed Profile (Hull performance)
- Fuel used per nm (for each sea state)

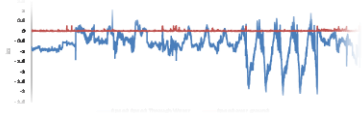


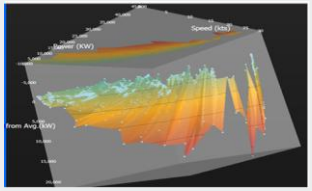
- Fuel used by each engine configuration
- Fuel Endurance calculations – including accelerations and de-accelerations

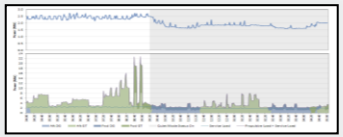


- Service Load Profiles – (power/fuel overhead)
- Hull Stress/strain profile
- Pitch/roll Performance
- Trim Fuel Performance









- Ship Speed profile histogram
- Hull/Propeller fouling trends
- Electrical demand profile
- Engine usage profiles
  - Change in fuel usage and efficiency
  - Operator configuration behaviour
  - Hull Power/Speed Profile – supports endurance calculations
- Fuel and Energy consumption (Pre and Post Equipment Improvement Changes)
- Alerts – abnormal fuel consumption
- Sensor Defects

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Examples - SEA-CORES on Two Deployed Ships

Commercial - James Fisher Petrochemical Tanker – Speciality



- Specialist data acquisition kit..
  - **Dynamic Fuel Flow meters**
  - **Vibration Monitoring (J/F Mimic)**
  - **Digital Torsion Meters**
  - **Power Meters**
  - **Voyage Data Recorder**
  - **Pitch/Roll Trim Monitoring System**
  - **Positioning System (6 degrees of freedom)**
  - **PI Data Collection System**

Royal Navy – Type 45 Destroyer



- Specialist sensor & data acquisition kit..
  - **Dynamic Fuel Flow meters**
  - **Digital Inclinometer (pitch/roll)**
  - **Stress/Strain Gauges**
  - **Platform Management System**
  - **Vibration Monitoring - sensors only**



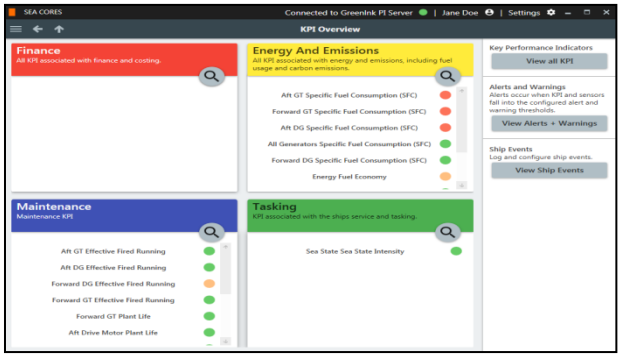




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Efficiency Gains – Financial benefits

- Payback typically within 12 months
- Fuel savings of >5% achieved on trials
- Fuel savings up to 20% achieved on some instances
- Greater savings possible with greater task / behavioural change
- Improved plant unitisation and reduced maintenance
- Example shipping company with fleet of 25 ships, spending £700m / year on fuel could save £35m (5%)





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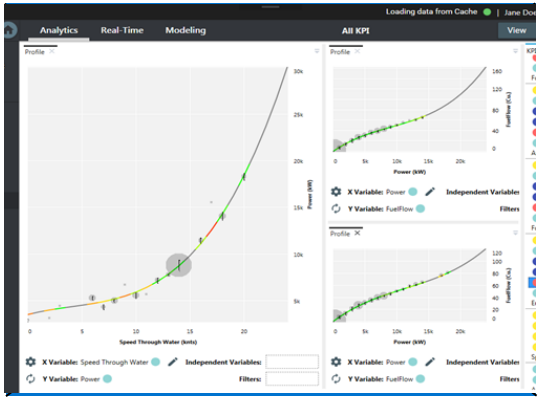
Ship Energy Optimisation Solutions (SEACORES)

COMPANY and GOAL

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1) Prove big data concept using sensor data
2) Creating a new business for shipping industry

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CHALLENGE

Increase energy efficiency of ships. Provide baseline before future upgrades

- Understand trade off between fuel economy / maintenance costs / ship vessel condition and capability

SOLUTION

Consortium combining domain experience. Integrating multiple data sources

- Machine learning
- In service trial vessels
- Weather routing / vibration analysis
- High fidelity time series data

RESULTS

>5% fuel savings achieved.

Impact of environment of fuel efficiency

- Increased availability
- Increased throughput
- Optimization of fuel
- Baseline of ship performance
- Representative dataset

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Questions

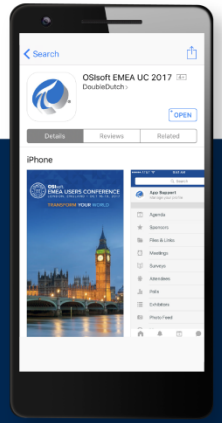
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감사합니다

Danke

谢谢

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado

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