



**Workflow Management**

Operator-defined workflows for timely and effective response to rising events!



e.g. An alarm is fired

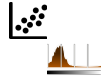
- what actions must take place
- who - from the crew - should be involved
- actions logging and system's feed forwarding

**Routines**

**Data Analytics / Algorithmic Analysis (operator-defined) of Fused Data**

**HINDSIGHT: 'reflect and learn from past data'**

- statistical processing of past observations (trend analysis, ...)
- detection of hidden correlations among seemingly un-related data



Deep Knowledge on various aspects of vessels' lifecycle



**INSIGHT: 'interpret data and respond efficiently to the present'**

- KPIs real-time monitoring (operational efficiency, safety performance,...)
- vessel's benchmarking against:
  - theoretical curves
  - specifications, tests and trials
  - sister and competitors vessels
- timely anomaly detection / alerting
  - abnormal behavior
  - deviation from predefined thresholds

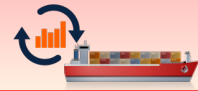


**Routines...**

- BCS, pMatrix, Power Mgmt, Steam Mgmt, DDA...
- Tanks Mgmt, Bunker Analysis, Bunker Surveys, Bunkering Monitoring...
- Performance, Propulsion, Emissions...

**Reflect on the past, respond to the present and prepare for the future!**

- technical efficiency
- economical efficiency
- environmental protection



**FORESIGHT: 'predict and get ready for the future'**

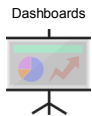
- what-if scenarios (forecasting based on current observations)
  - e.g. condition-based maintenance
- risk assesment (technical / economical / environmental / ...)



**DANAOS SHIPPING Co. EXPERTISE**  
 giving context to complex sets of information

**Data Visualization Layer**

**Situation-aware data representation in pictorial and/or graphical format**



**easily conceivable media**  
 specially designed - adopted to shipping industry

- Quickly grasp the big picture over large volumes of data
- make observations
  - uncover hidden patterns in the underlying data
  - gain knowledge



Strengthen Decision Making!

**Data Integration Layer**

Machine-accessible low-level data

**OPERATOR-DEFINED DATA COMBINATION**

Higher-level abstractions suitable for DECISION MAKING

**Change level of abstraction from data to meaningful info.**

e.g. **M/E Fuel Consumption**

- flow meter [LAROS]
- Tank In Use [TELEGRAMS]
- fuel density [LAB ANALYSIS]

**Conceptual Representation Layer**

**Transparent manipulation of data provided by heterogeneous sources**

Data Conceptual Representation

- hide semantic heterogeneity of multi-source data using ontologies



e.g. **Wind Speed**

- Vessel A: from TELEGRAM
- Vessel B: from LAROS computed from TrueWindSpeed

Data Uniformity

- auto unit conversion of data pooled from different locales to single measures



e.g. **M/E Power**

- Vessel A: from LAROS in kW
- Vessel B: from MARORKA in BHP

**Data Quality Layer**

**Incorrect Data → Misleading Conclusions**

Corrupted/inaccurate pieces of data are filtered out

- validation against...
  - range constraints (negative power values, ...)
  - mandatory constraints (null values, ...)
  - set-membership constraints



Data Integrity

- accuracy
- validity
- consistency



**Data Access Layer (enormously large volumes of data)**

Semi-Structured Data (typical organizational structure, although not so strict and formal)

MS, PDF, Cloud



Fuel Analysis Forms (sulphur, density...)  
 Port calls / Formalities  
 Int'l Safety Mgmt Forms...

**Sensory Data Acquisition Systems**



Online Sensor Data Streams  
 LAROS, MARORKA, KONGSBERG...  
 (Power, RPM, Flow Meter, FO TEMP.)

Structured Data (strictly formatted - known meaning & relations)

Operational Data



Telegrams...

HR Data



Crewing...

Financial Data



Costs, supplies...

Unstructured Data



Logs, Reports...