Lifecycle Management in Shipbuilding and Shipping: the use of ship models to improve communication

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“The consistent use of information, data and knowledge along the entire life cycle can drastically increase production performance and the competitiveness of all actors along the chain.” *)

Agenda

• PLM and models in the ship lifecycle
• Information exchange between design and operation
• Maintenance and operational requirements for the need for information integration
• BI applications for data analytics
PDM and PLM

- Product Data Management (PDM) covers the creation, management and publication of product information.
- In shipbuilding, PDM mainly focuses on the product development phases such as planning, design, engineering and manufacturing.
- Product Lifecycle Management (PLM) is a methodology that assists a business to improve products from a total lifetime perspective: lower cost, lower environmental impact, higher safety.
  - Focus today: the technical aspects of ship operations and especially the maintenance activities, such as inspection, servicing, repair and overhaul.
  - Operational information has to be captured and assessed.

Shipbuilding

Shipping
IT Systems and models in the ship’s lifecycle

Yard
- Initial design
  - Drawings, FE model global construction, strength assessment, loads
- Detailed design
  - Simple 3D geometric model, subdivision, stability, seakeeping,
  - Local models for strength assessment

Supplier
- Contract
- Class approval
- Construction
- Production
- 3D production models
- Drawings, manuals

Ship Owner
- Operation
- Refit
- Maintenance
- Repair
- Emergency Response Service

IHM
Different 3D model types

Newbuilding FE Model

In-service FE Model

Hull Condition Model

as-built / measured thickness

actual plate boundaries
Data Transfer from Design to Operation

Today: ship drawings and suppliers maintenance instructions
Tomorrow: idealized structural models and CBM knowledge
The need for new maintenance concepts

A modern ship is a complex asset:
- optimized steel structure,
- mechatronic solutions in machinery

which is operated by a permanently changing crew:
- optimised and flexible crew management

Maintenance becomes more complex
- Maintenance requirements become less apparent (risk based design, ...)

Risk acceptance of society is going down and environmental awareness is going up

But today maintenance decisions are often based on on-site decisions of senior crew members
→ Information integration and software support are the keys
**Maintenance Regimes in Shipping**

- **Break Down Maintenance**
  - Machinery
  - Hull

- **Planned Maintenance**
  - Planned Maintenance:
    - GL ShipManager

- **Condition based Maintenance**
  - Condition based maintenance:
    - GL MachineryManager
    - Hull integrity:
      - GL HullManager
      - GL Pegasus

- Virtual (digital) representation of the ship is necessary to document the condition (corrosion, coating, damages) on-board and to communicate and to assess it on-shore (office)
  - Machinery: geometry can be helpful, but is not necessary
  - Hull: geometry is necessary to identify locations

⇒ Advanced maintenance requires design information
⇒ Intellectual property rights and maintenance efficiency must be balanced.
Models for Hull Maintenance

A software and service package focusing on monitoring and assessing the condition of a ship’s hull - e.g. tanks, cargo holds and coatings - throughout its entire lifecycle

- To move from isolated assessment of details plate assessment via thickness measurement, periodical inspections to a more integrated approach

- **Degradation prediction**, consequence assessment, RBI connection to the actual part in the construction is necessary

- The **3D model** enables communicating the inspection results between onboard, and onshore and Class for assessment.
Shipping and environment

Ocean-going vessels are the most efficient mode of transport, but ...

Resource consumption
* Fuels (HFO, MDO/MGO)
* Water

Garbage and chemicals
* Sludge from separators and filters
* Garbage
* Chemicals

Emissions
* CO₂ – Carbon dioxide
* SO₂ – Sulphur dioxide
* NOₓ – Nitrogen oxide
* Particulate matter

Water use
* Ballast water: invasive species
* Sewage
* Anti-fouling paint
Data captured onboard a ship

- Cargo data
- Bunker notes
- Garbage/sewage documentation
- Tank inspection reports
- Voyage data, weather data, log book
- Crew data, payroll
- Purchasing, spare parts
- Planned maintenance machinery
- Trim assistant
- Energy monitoring
- Ballast water management
- Coating, corrosion, crack information
- Condition monitoring machinery

And onshore:

- Ship master data
- Finance/accounting
- Purchasing, logistics
- Crew management
- Quality management
- Repair planning
- Emission certification
- Inventory Haz. Mat.
- Chartering
- Freight management

**Categories:**
- Environment
- Operation
- Commercial
- Maintenance
Today’s voyage data collection is a challenge

Today: Data is collected temporarily and lost for further usage
So, the journey towards performance monitoring and performance-based ship management begins...

Stage 1: See no evil, hear no evil

Stage 2: Overcoming the data disaster

Stage 3: Structured reporting and analysis
Typical ship management applications support a process in the first place ...

... and by doing so, produce a lot of data and information...
But aggregated, it can be combined into information that is highly relevant

- Maintenance performance
- Maintenance & repair costs per machinery item
- Open repair and maintenance tasks in a fleet wide comparison
- Budget performance by vessel / cost centre
- Items purchased per supplier (identifying A-suppliers)
- Delivery performance of supplier
- ...

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**Lifecycle Management**

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That’s where business intelligence (BI) systems come into play

One Reporting and Analyzing window into your information source

In Memory (RAM) concept of data extraction / transformation / loading
(no datawarehouse OLAP-cubes needed)

Source systems from several software vendors

Inspections, Maintenance, Repair, Overhaul
Purchasing & Logistics
Quality, Safety, Compliance
HR, Crewing
Voyage Management
Chartering
Finance, Controlling
Simplify data collection, ship-to-shore reporting, and dissemination of data

Combine the right data collection and reporting methods, data processing

Onboard recording of all Emissions and Performance related data

Analysis on shore - for the entire fleet
  • automatic processing and dissemination of data to e.g. owner and manager with tailored content
The challenge: how to properly account for information ownership?

-ability to exchange information
-benefits from exchanging information

CBM
LCC
Rule Development

Reliability Databases

parts of object or lifecycle
single objects
many objects
Scope of information exchange
Thank you for your attention!

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