Implementing an Advanced Hull Integrity Management System to Reduce Technical Operating Costs and TCO

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OR

(How) can we achieve $100k savings with a dedicated management system focusing on hull inspection and maintenance?
Presentation Topics

- It is possible to achieve direct and significant savings on hull maintenance and repair
- Indirect (financial) benefits include
  - reducing risk
  - reaching higher TMSA Levels
  - improving your positioning with charterers / Oil Majors
  - higher resale value of vessel
  - more accurate budgeting of repairs (scope & amounts of steel)
- To do this, you need a new and dedicated management system focusing on hull integrity (lifecycle approach)
- Making this new management system work involves
  - Employing the right tools to support it
  - Building internal expertise and enabling crew
- This enables a pro-active approach to hull management (inspection / condition monitoring, maintenance and repairs)
- Through this pro-active approach it is possible to achieve direct and significant savings on hull maintenance and repair
Let’s look at an example of savings
Cost saving examples by timely hull maintenance

- 4 additional **deck boys** for 2 months:  
  (including travelling, provision, insurance, paint)  
  **USD 15,000**

- 1 **tank cleaning gas-free** for preparation of steel repair:  
  (500 cbm capacity, excluding pumping and storage)  
  **USD 22,500**

- 1 **scaffolding** for preparation of steel repair:  
  (5m x 5m including transportation to compartment)  
  **USD 7,500**

- 1 **steel repair** for shell and structural elements:  
  (2m x 3m, including longitudinal high tensile steel and web frame)  
  (and that’s only 1 repair – maybe you have more)  
  **USD 30,500**

- 1 **inflated steel repair invoice**:  
  (around plus 30% on “correct” price due to imprecise specification)  
  **USD 15,000**

- 1 day **off-hire**:  
  (depending on vessel size & charter market)  
  **USD 12,000**

**Total:**  
**USD 102,500**
Let’s investigate how:

- The management system
A dedicated management system focusing on hull integrity (lifecycle approach)

Continuous and pro-active approach to monitor, and conduct preventive and corrective maintenance activities to avoid larger, costlier problems later on.

- Maximize asset lifespan
- Reduce risk and better serve clients
- Ensure operational availability - less unplanned downtime
- Reduce Total Cost of Operating over vessel’s lifespan
**Background: Overcoming challenges of hull maintenance**

**How do you keep your vessel well-maintained?**

• For equipment and machinery it is easier
  – Most attention within technical management is focused there
  – There are systems for ensuring proper maintenance planning and execution
  – Onboard engineers are in their domain
  – You focus attention there continually and not just every 5 years

• For hull structure it isn’t as easy
  – Typically, there is less attention focused there
  – Systems for equipment and machinery maintenance aren’t so useful
  – People onboard are not naval architects

• **A different approach is needed!**
Expanding your sphere of influence with systems and tools

Most focus of optimization initiatives is directed towards operational efficiency

- Rightly so – Attacking prime cost driver: Fuel!
- We have devised **systems and toolsets** for measuring, managing, and improving
- Fuel costs are beyond our influence, but how much we spend on fuel – optimized through efficient vessel operations – has become easier to influence
The same logic applies to optimizing other aspects of operations, including:

- **Technical Management (and associated repairs and maintenance)**

- Now there are also systems and toolsets for better managing and improving hull inspection and condition monitoring, maintenance and repair processes

- Giving you more influence over scope of maintenance and repairs as well as what you spend on repairs and steel replacements

- This pro-active approach to hull integrity management also benefits you in terms of competitive position, positioning towards charterers, oil majors, external stakeholders

**Expanding your sphere of influence with systems and tools**

- **No control / influence**
- **Influence**
- **Control**
A new and dedicated management system focusing on hull integrity (lifecycle approach)

What is a systematic and pro-active hull integrity management approach?

- Devise inspection and maintenance strategy for hull structures
- Integrate best practice / external knowledge into strategy (where to focus inspections, what to focus on, how to report findings) – also guidance from class advisors
- Use new / advanced toolset to support the management system - 3D structural model of vessel as central lifecycle database on hull condition
- Training / guidance for structural superintendents and crew
- Carry out inspections and report results with high degree of transparency, directly in 3D structural model
- Evaluate hull condition more easily - better overview - plan preventive and corrective maintenance activities to avoid larger, costlier problems later on
- Perform TM gauging prior to docking and integrate into condition assessment
- Plan replacements and repairs more accurately
- **Do this continually and decrease TCO over vessel’s lifespan**
Let’s investigate how:

- The toolset
New Toolset: Use of digital 3D models to support ship operations

- For many years digital 3D models have been used successfully in ship design phase
- How can 3D structural models help in operation phase?
- Harnessing modern IT advancements:
  - Make 3D data from construction phase usable in subsequent ship operations
  - Enabling effective interaction with model
  - Enabling use of model onboard vessels
Benefit of using digital 3D models to support ship operations

In a 3D model you can navigate, perform measurements, calculate values, and display, select, filter, localize and annotate objects.

- Use information gathered over whole lifecycle of ship
- Increased transparency of condition monitoring
- Enable fast overview and clear communication through 3D structural models
  - ship’s crew
  - onshore staff
  - external 3rd parties
- Provide lifelong access to all information on hull condition
The right tools to support your management system

"Give me six hours to chop down a tree and I will spend the first four sharpening the axe."

- Abraham Lincoln (US President, 1861 – 1865)

Using the right tools enables you to accomplish more, with better accuracy, using less effort
- It is easier to do the tasks
- Quality of information collected increases
- You have a much better basis (increased transparency) to use information comprehensively over the lifecycle of the ship to reduce costs

Systematic monitoring and reporting procedures for early detection of critical or disadvantageous hull conditions and corresponding assessment / action

- Based on planned and unplanned visual inspections, surveys, UTM evaluation
Let’s investigate how:

- Building expertise and enabling crew / staff
Building internal expertise and enabling crew

How can you help this guy do his job better?

- To follow up on hull / structural defects?
- To perform and document inspections better?
Building internal expertise and enabling crew

How can you help this guy do his job better?

• To follow up on hull / structural defects?
• To perform and document inspections better?

1. Integrate best practice and external expertise into your management system
2. Training for crew and staff
3. Use the new toolset
Building internal expertise and enabling crew

Best practice and external expertise

- Know where to focus inspection activities
  - Critical Areas
- Collect best practice from experts
- Use expert’s knowledge of similar ships
- Use experience from own fleet over time
- Analysis to identify fatigue-prone areas, e.g. for a specific vessel series
Building internal expertise and enabling crew

Best practice and external expertise – For example:

- Vibration induced crack in connection to web frame
- Lately we have seen more vibration induced fatigue damages in a relatively short period of time
Building internal expertise and enabling crew

Transfer best practice and external expertise into training:

For Example:

Longitudinal bulkhead – critical areas / damage to look for:

1. Crack in longitudinal bulkhead knuckle line for hopper tank
2. Fracture of inner side plate due to local heavy grooving corrosion
Building internal expertise and enabling crew

Transfer best practice and external expertise into training:

- Global bending moment induces longitudinal stresses in the deck plating and longitudinals.
- The wave induced excitation of the hull girder leads to dynamic axial stress in the deck longitudinals.
- The cyclic variation of axial stress may lead to fatigue cracks initiating at hot spots.
Building internal expertise and enabling crew

Corrosion highly influences the fatigue life of a detail
A crack could develop further in the deck plating (brittle fracture)
Building internal expertise and enabling crew

Transfer best practice and external expertise into training:

**SurveySimulator** consists of high reality 3D Model available for realistic survey simulations

- Areas of attention mode - Highlight of areas where hull structural deficiencies are likely to occur
- Survey requirements mode - Visualization of class and statutory survey requirements
- Findings mode - Display of built-in deficiencies and descriptions
- Develop common understanding of reporting criteria among crew
- Common terminology basis
Building internal expertise and enabling crew

Transfer best practice and expertise back into your vessel model - Hot spots / critical areas for attention are visualized in model for further crew guidance.
Let’s investigate how:

- In practice
A new and pro-active approach to hull management

ISM and TMSA lay out requirements to inspections of structures and reporting of non-conformities / defects

- Inspections are carried out at appropriate intervals
- Any non-conformity is reported with possible cause
- Findings are described properly, with location, sketches and pictures
- Appropriate corrective action is taken
- Records of these activities are maintained

Fulfill, and go above and beyond!
A new and pro-active approach to hull management

1. Devise inspection and maintenance strategy for hull structures – enable pro-active approach

- Planned from shore-side in collaboration with vessel
- Define what to inspect (which steel structures)
- Frequency and window of inspections
- Inspection criteria
A new and pro-active approach to hull management

2. Carry out inspection and report results in system

- Easy-to-use interface for crew
- Better description with 3D model – no ambiguous terminology
- Mark scope of problems directly in the 3D model
- Attach photos at exact location in model
- Standardized reporting
- Increased data quality - “smart” model suggests name of wall when clicked (standardized terminology)
A new and pro-active approach to hull management

Inspections reported on vessel are transferred back to office

- 3-D model of vessel available onboard
- Inspection history available onboard
- Guidance for how to systematically report inspection results available onboard
- Full fleet data in onshore system for hull condition evaluation
- Synchronize onboard and onshore databases
- Plan repairs
A new and pro-active approach to hull management

3. Assess condition of hull / tanks / shell / deck, etc.

- Assess overall condition
- Assess status specific criteria, e.g. corrosion, cracks, coating breakdown, etc.
- Document for guarantee claims (for new vessels)
A new and pro-active approach to hull management

4. Update inspection strategy & Plan corrective / preventive maintenance

- Plan maintenance based on inspection findings
  - Preventive maintenance
  - Corrective maintenance
- Monitor status and close-out of jobs
- Update inspection strategy
  - Plan follow-up inspections
- Order unscheduled inspections
- Compile report for guarantee claims
Plan Repairs More Accurately

Evaluate structural condition based on UTM reading

- UTM Campaign several months prior to docking
- Evaluate UTM data graphically / spatially or statistically, for sections, compartments or elements
- Focus easily on areas needing steel replacement
Plan Repairs More Accurately

Use model / calculations for more accurate planing of repairs based on assessments

• Calculation carried out for selected areas of the compartments, the as-built thicknesses, the steel grades, the sizes and forms of the plates and stiffeners
• Export to excel for further processing
• Calculation of steel weights and surface areas (painting)
• Whole compartment, whole wall, or selected areas
• Fewer surprises in the dockyard!
• **It is possible to achieve direct and significant savings on hull maintenance and repair**

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Thank you!

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