



## INNOVATIVE MARITIME SOFTWARE

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

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Tanker Operator– Athens 2015



## Presentation Topics

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

**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

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- 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:**

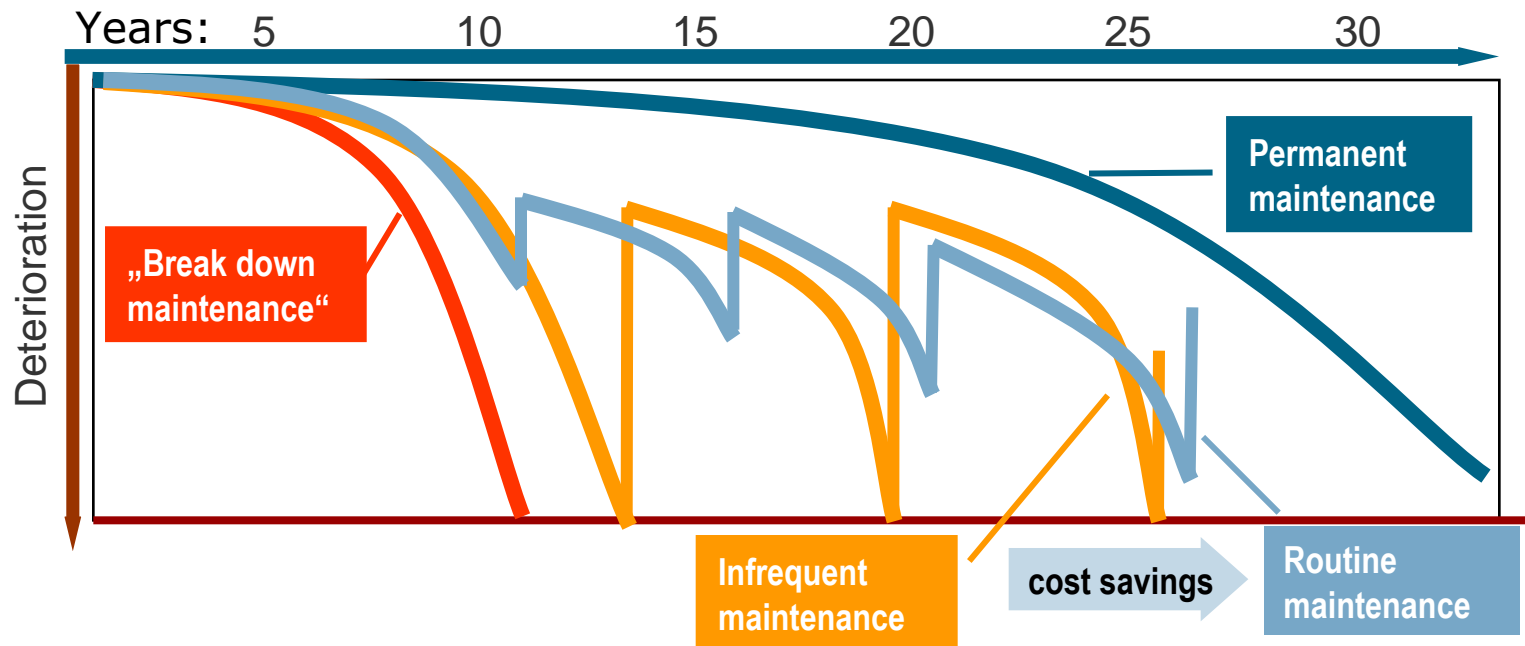
**USD 102,500**

# 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

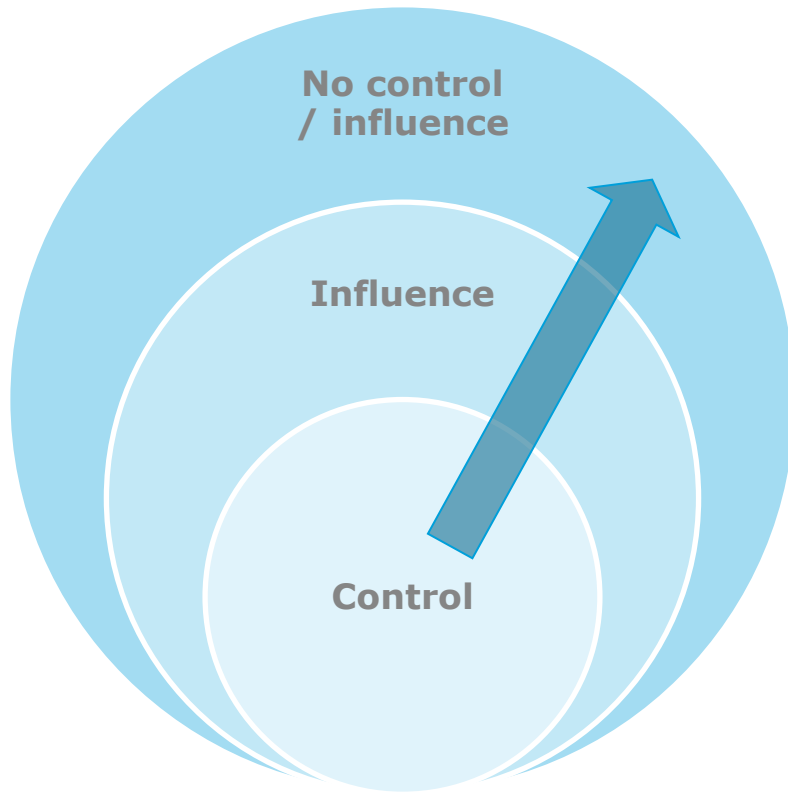
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## How do you keep your vessel well-maintained?

- 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!**



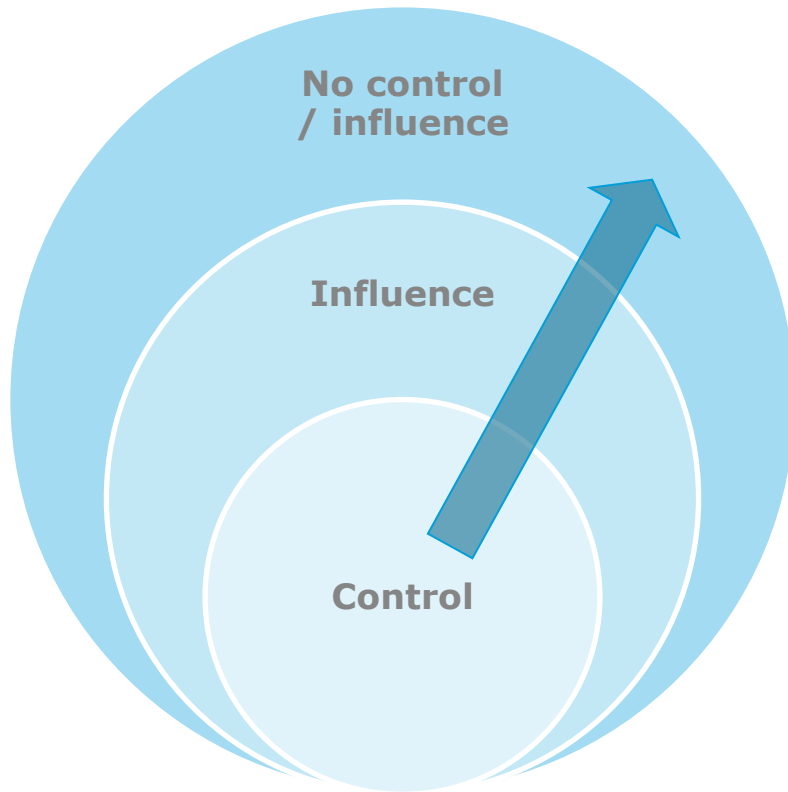
# Expanding your sphere of influence with systems and tools



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

# Expanding your sphere of influence with systems and tools



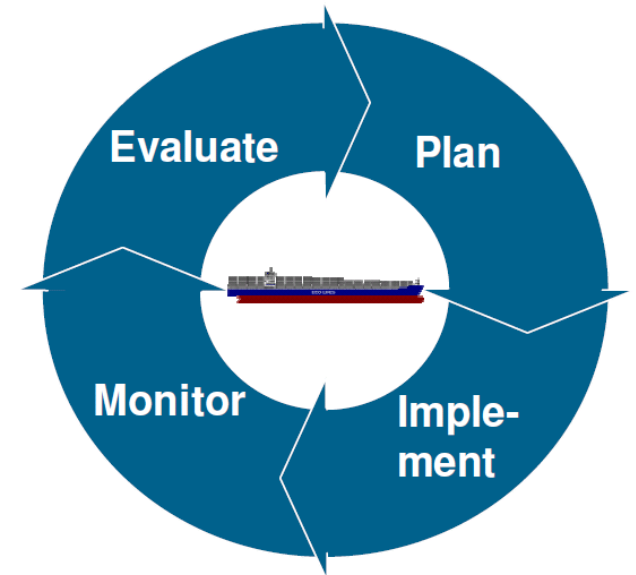
The same logic applies to optimizing other aspects of operations, including:

- **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

# 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**

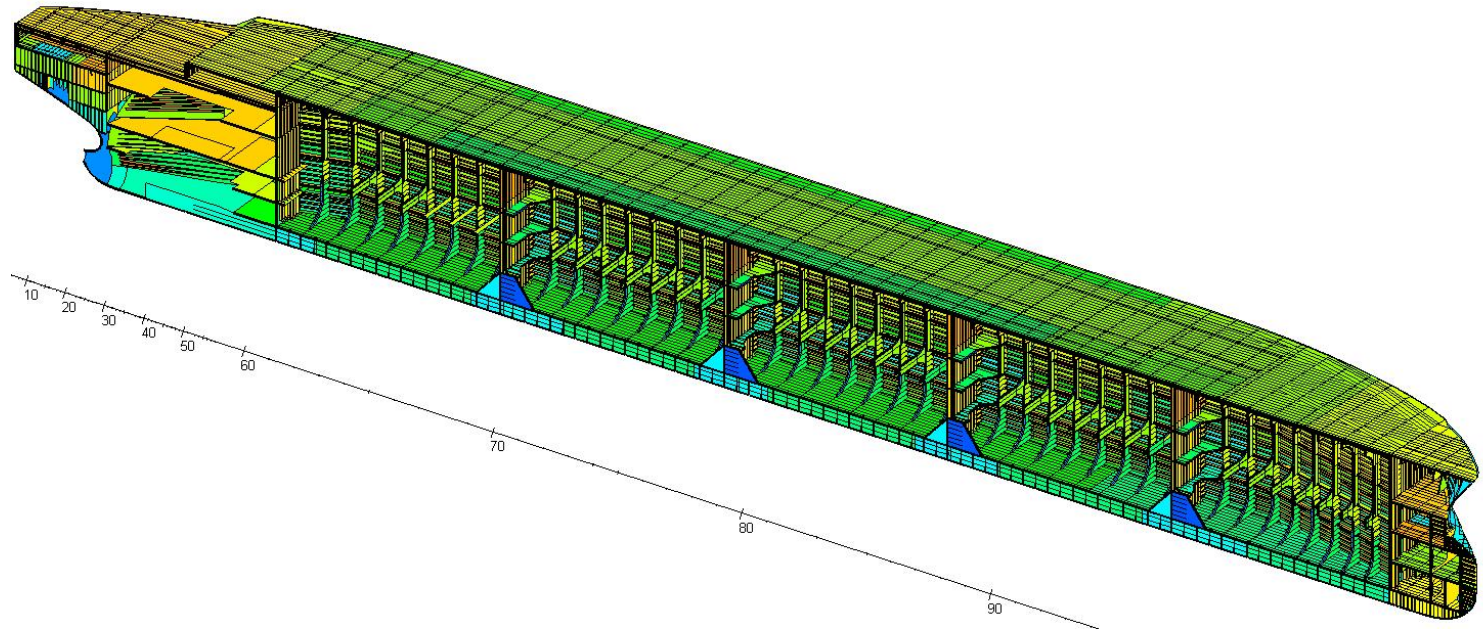


# Let's investigate how:

- The toolset

# New Toolset: Use of digital 3D models to support ship operations

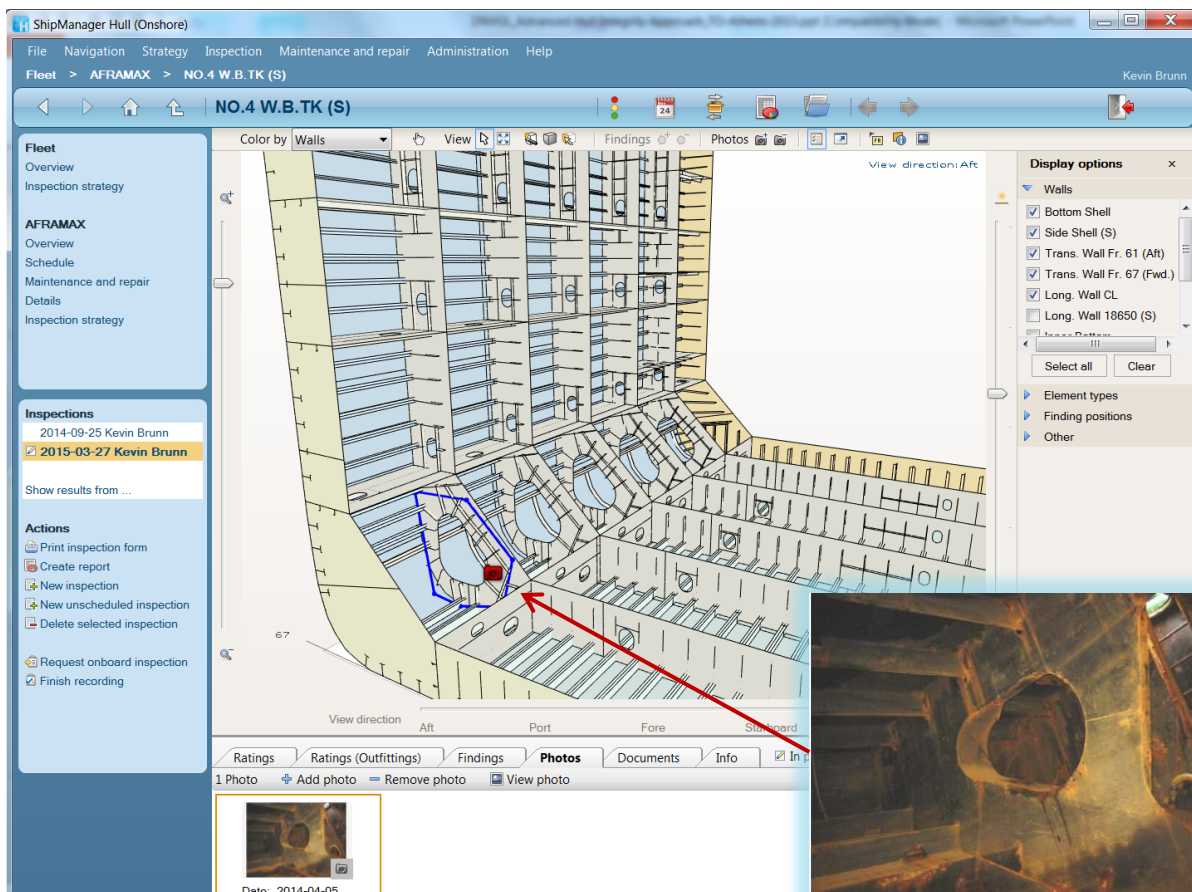
- For many years digital 3D models have been used successfully in ship design phase
- How can 3D structural models help in operation phase?
- Harnessing modern IT advancements:
  - Make 3D data from construction phase usable in subsequent ship operations
  - Enabling effective interaction with model
  - 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 3<sup>rd</sup> parties
- Provide lifelong access to all information on hull condition

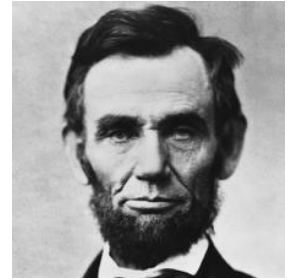




# The right tools to support your management system

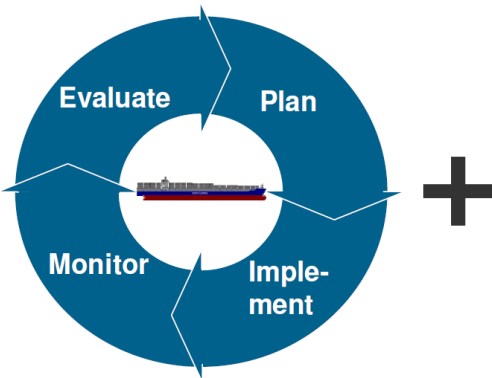
***"Give me six hours to chop down a tree and I will spend the first four sharpening the axe."***

- Abraham Lincoln (US President, 1861 – 1865)

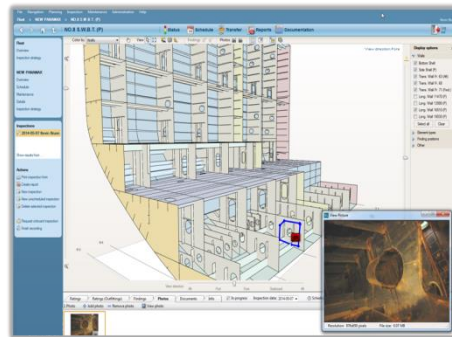


Using the right tools enables you to accomplish more, with better accuracy, using less effort

- 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



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**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

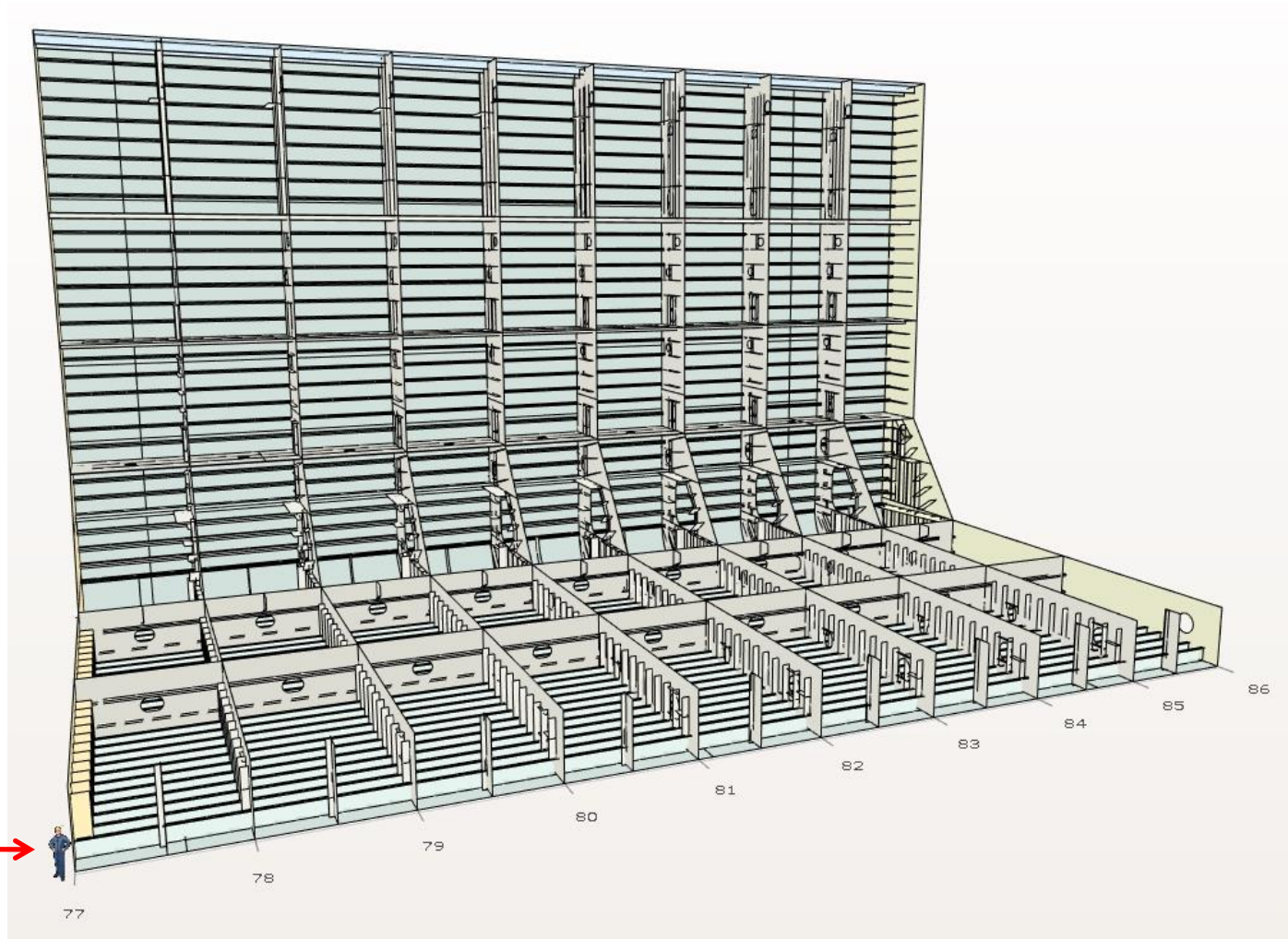
# Let's investigate how:

- **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?

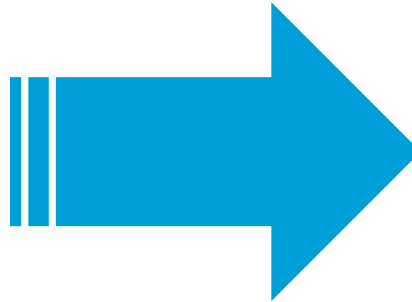


# Building internal expertise and enabling crew

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## How can you help this guy do his job better?

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

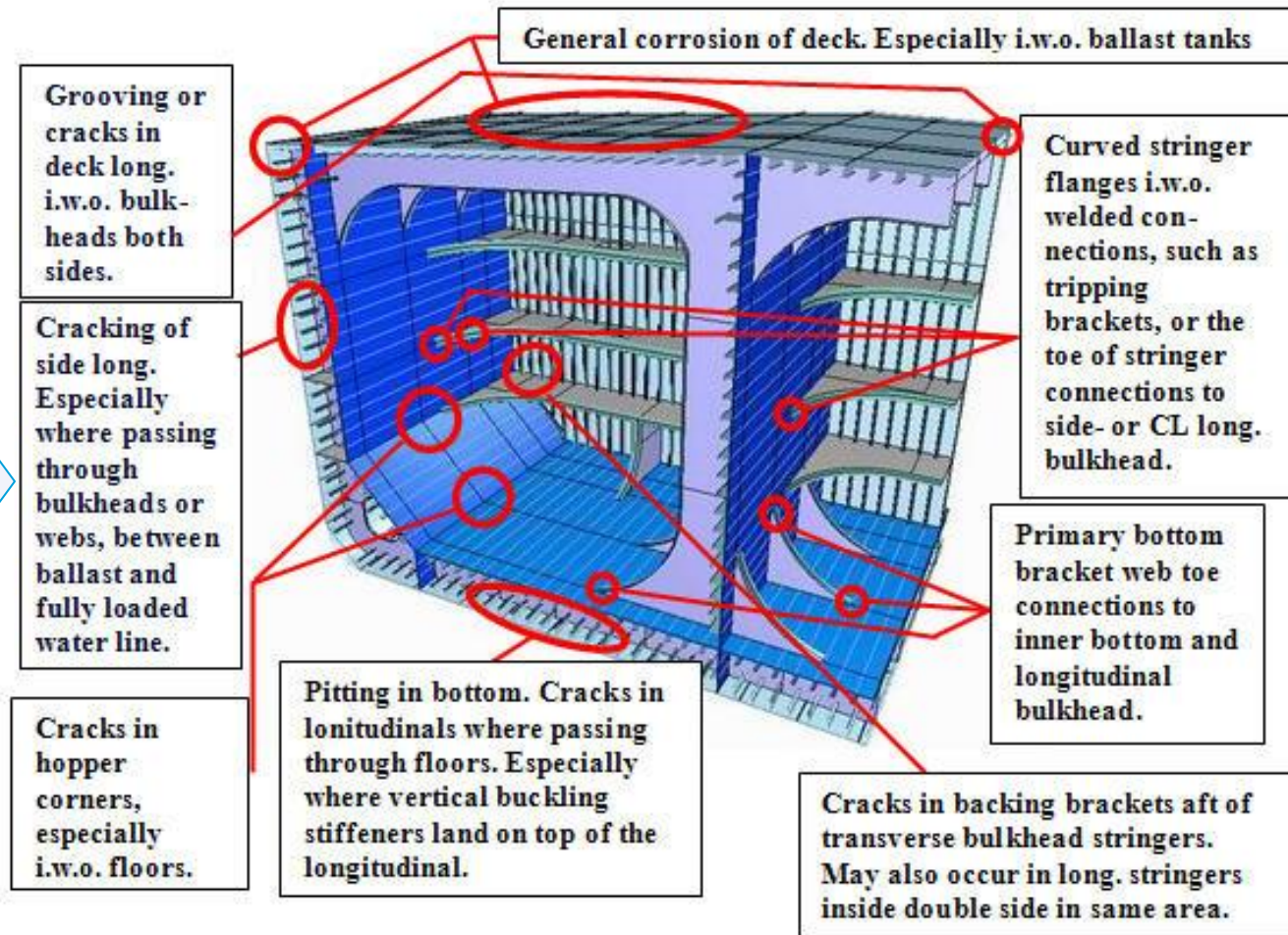


1. Integrate best practice and external expertise into your management system
2. Training for crew and staff
3. Use the new toolset

# 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

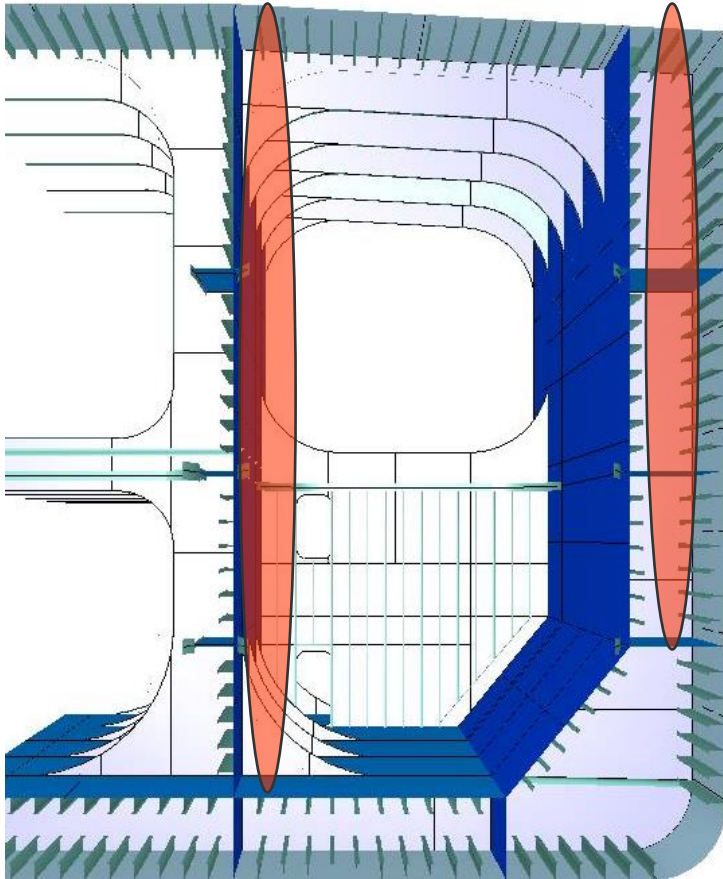


Crack on the web



## Building internal expertise and enabling crew

**Transfer best practice and external expertise into training:**



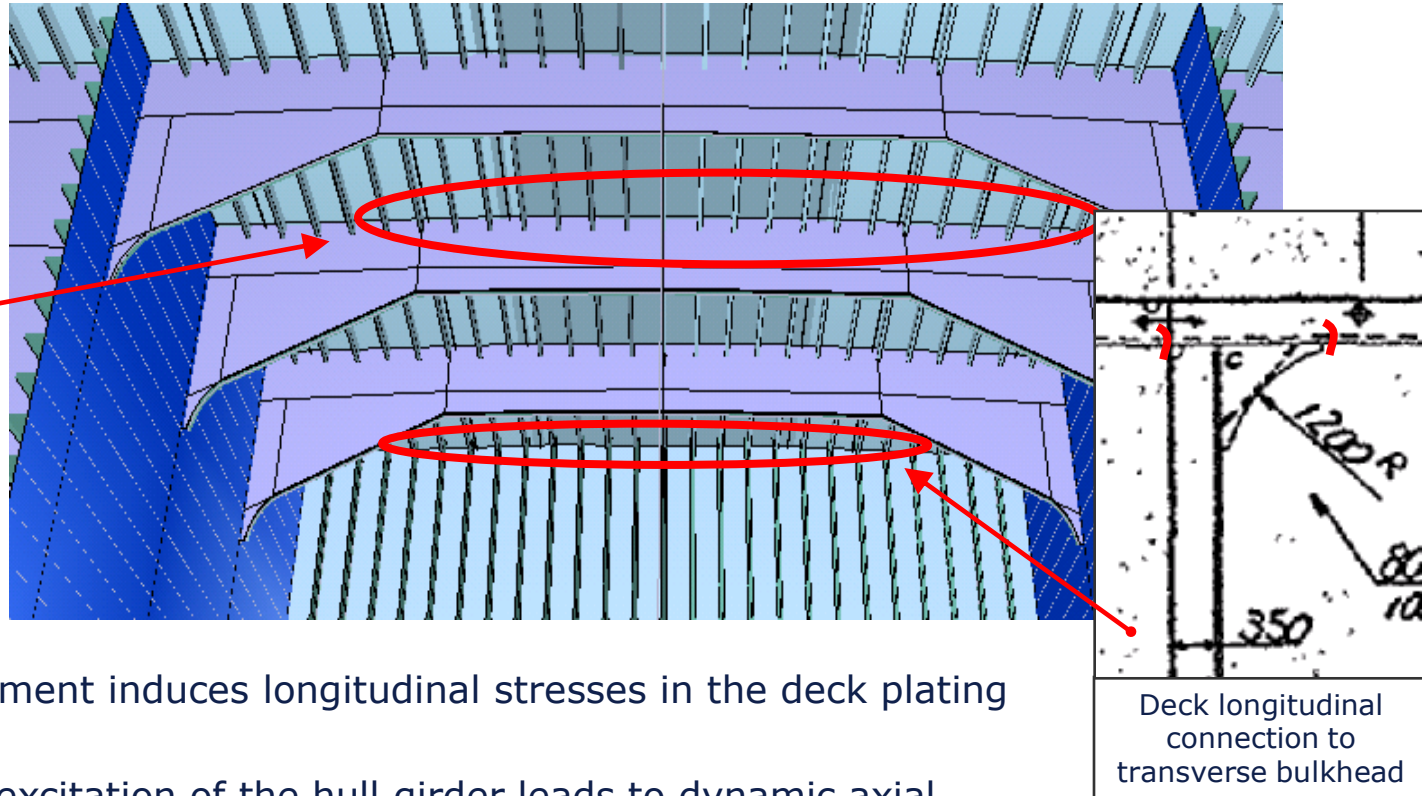
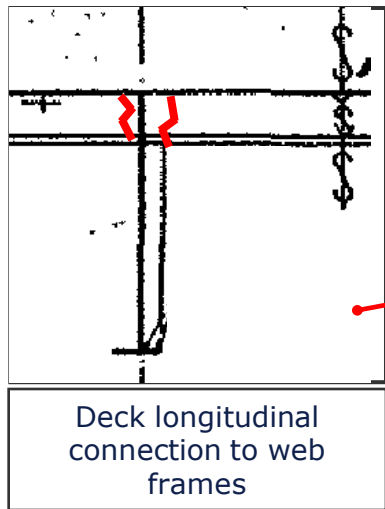
### **For Example:**

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

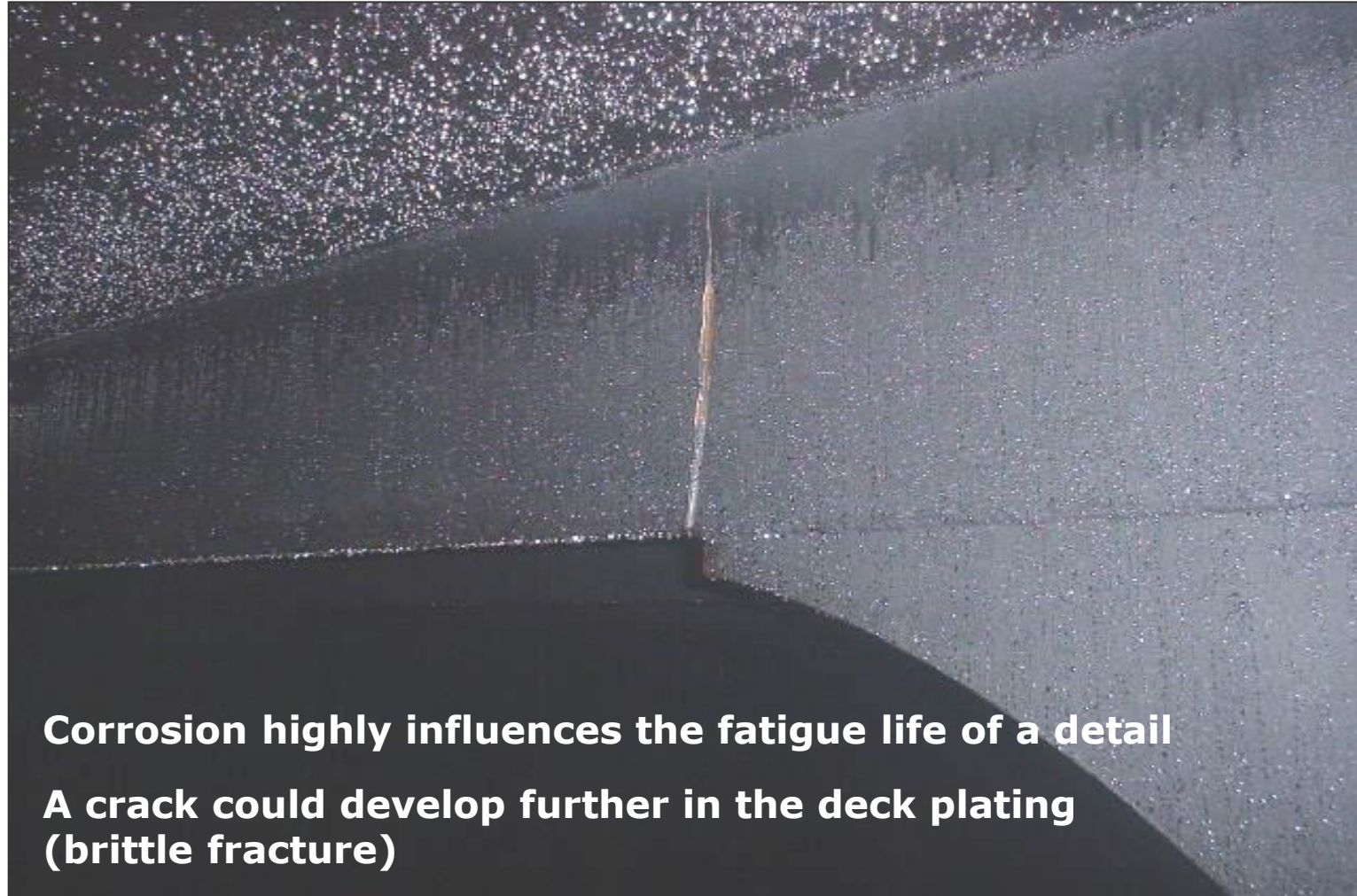
## Transfer best practice and external expertise into training:



- 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

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**Corrosion highly influences the fatigue life of a detail**

**A crack could develop further in the deck plating  
(brittle fracture)**

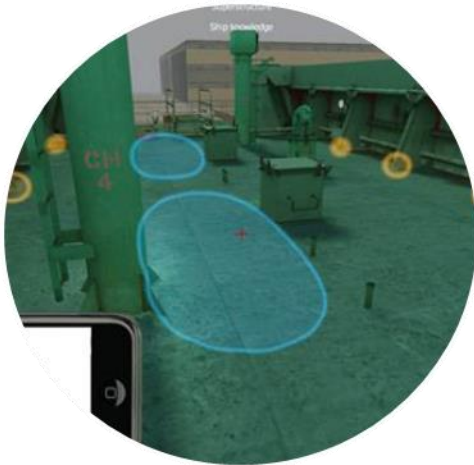


# Building internal expertise and enabling crew

## 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



Assessment Scale:

10% Localized Corrosion



33% Corrosion



Figure 3.1.7: Coating condition evaluation



Figure 3.1.8: General breakdown of coating

# 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**

The screenshot displays the ShipManager Hull (Onshore) software interface. The main window shows a 3D model of a ship's hull with a highlighted 'Area of attention' for corrosion. The interface includes a menu bar (File, Navigation, Strategy, Inspection, Maintenance and repair, Administration, Help) and a toolbar with icons for Status, Schedule, Transfer, Reports, and Documentation. The left sidebar contains navigation options for 'Series Linda Series', 'MS Linda', and 'Inspections'. The 'Area of attention' pop-up window provides details about the defect, including its type, comment, position, and criticality. The main 3D view shows the hull structure with a yellow highlight indicating the area of concern. The bottom status bar shows the overall rating as 'No rating' and the inspection date as '2015-03-11'.

**Area of attention**

Typical defect	weld line coaming/deck
Type	Corrosion, General
Comment	check weld line between coaming and deck
Position	FR 125 + 0.270 m CL + 8.573 m (P) BL + 30.904 m
Criticality	
Photos/Documents	<a href="#">corrosion2.i</a>

View direction: Portside/down

View direction: Aft Port Fore Starboard Aft

**Ratings** Ratings (Outfittings) Findings Photos Documents Info In progress Inspection date: 2015-03-11 Unscheduled

Overall rating: No rating

Position	Coating	Coating Comment	Corrosion	Corrosion Comment	Deformation	Deformations comment	Crack	Cracks comment
Transversal Aft								
lower								

# Let's investigate how:

- In practice



# A new and pro-active approach to hull management

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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

AFRAMAX

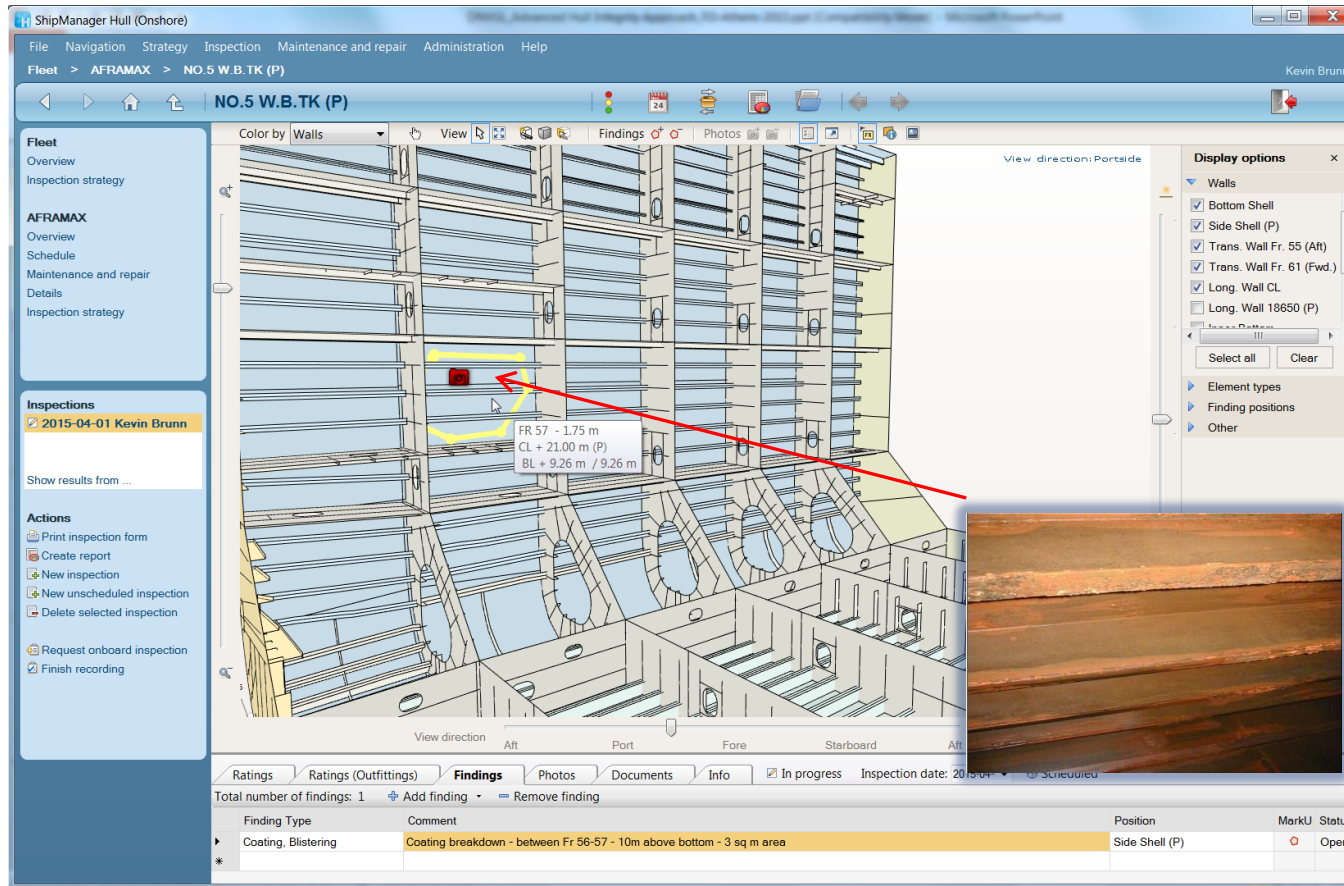
Ship inspection strategy

	Compartment	Interv (Month)	Time Window	Time Window	Initial due date	Unscheduled inspection due	Coating	Corrosic	Deforme	Cracks	Pipes	Ladders	Valves	Heating Coils	Anodes	Sedimer
▶	<input type="checkbox"/> Shell / Weather Deck...	12	1	1			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	SHELL	12	1	1	2014-09-01		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	UPPER DECK	12	1	1	2014-09-01		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/> Cargo (14)	12	1	1	2014-10-01		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NO.1 CARGO OIL...	12	1	1	2014-10-01		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NO.1 CARGO OIL...	12	1	1	2014-10-01		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NO.2 CARGO OIL...	12	1	1	2014-10-01		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NO.2 CARGO OIL...	12	1	1	2014-10-01		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NO.3 CARGO OIL...	12	1	1	2014-10-01		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NO.3 CARGO OIL...	12	1	1	2014-11-01		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NO.4 CARGO OIL...	12	1	1	2014-11-01		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NO.4 CARGO OIL...	12	1	1	2014-12-12		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NO.5 CARGO OIL...	12	1	1	2014-10-01		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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	NO.6 CARGO OIL...	12	1	1	2014-10-01		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	SLOP TK (P)	12	1	1	2015-01-23		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	SLOP TK (S)	12	1	1	2015-02-07		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/> Ballast Water Tank ...	12	1	1	2014-09-25		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	AFT PEAK TK (C)	12	1	1	2014-09-25		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	FORE PEAK TK (C)	12	1	1	2014-09-25		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	NO.1 W.B.TK (P)	12	1	1	2014-09-25		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	NO.1 W.B.TK (S)	12	1	1	2014-09-25		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	NO.2 W.B.TK (P)	12	1	1	2014-10-25		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	NO.2 W.B.TK (S)	12	1	1	2014-10-25		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

- 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

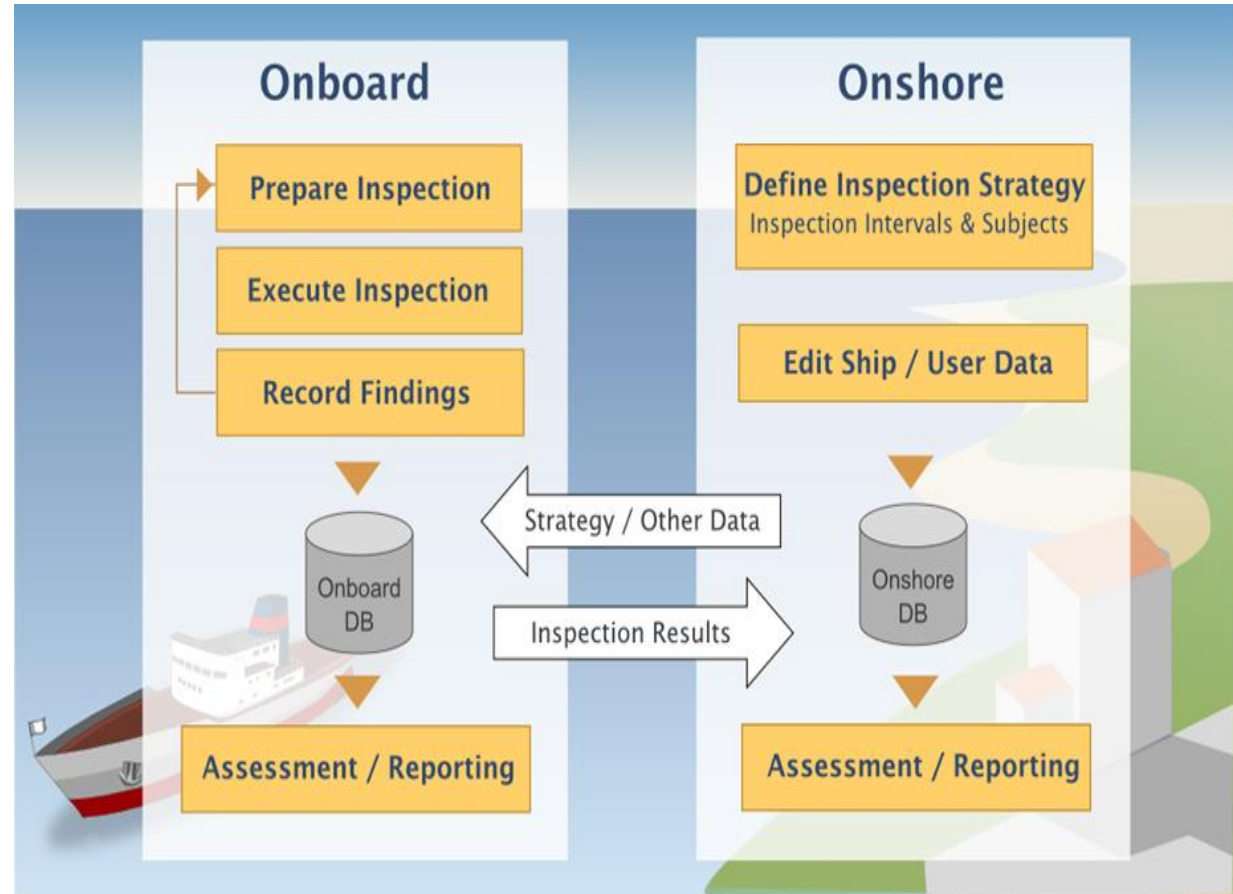


- Easy-to-use interface for crew
- Better description with 3D model – no ambiguous terminology
- Mark scope of problems directly in the 3D model
- Attach photos at exact location in model
- Standardized reporting
- Increased data quality - “smart” model suggests name of wall when clicked (standardized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

# A new and pro-active approach to hull management

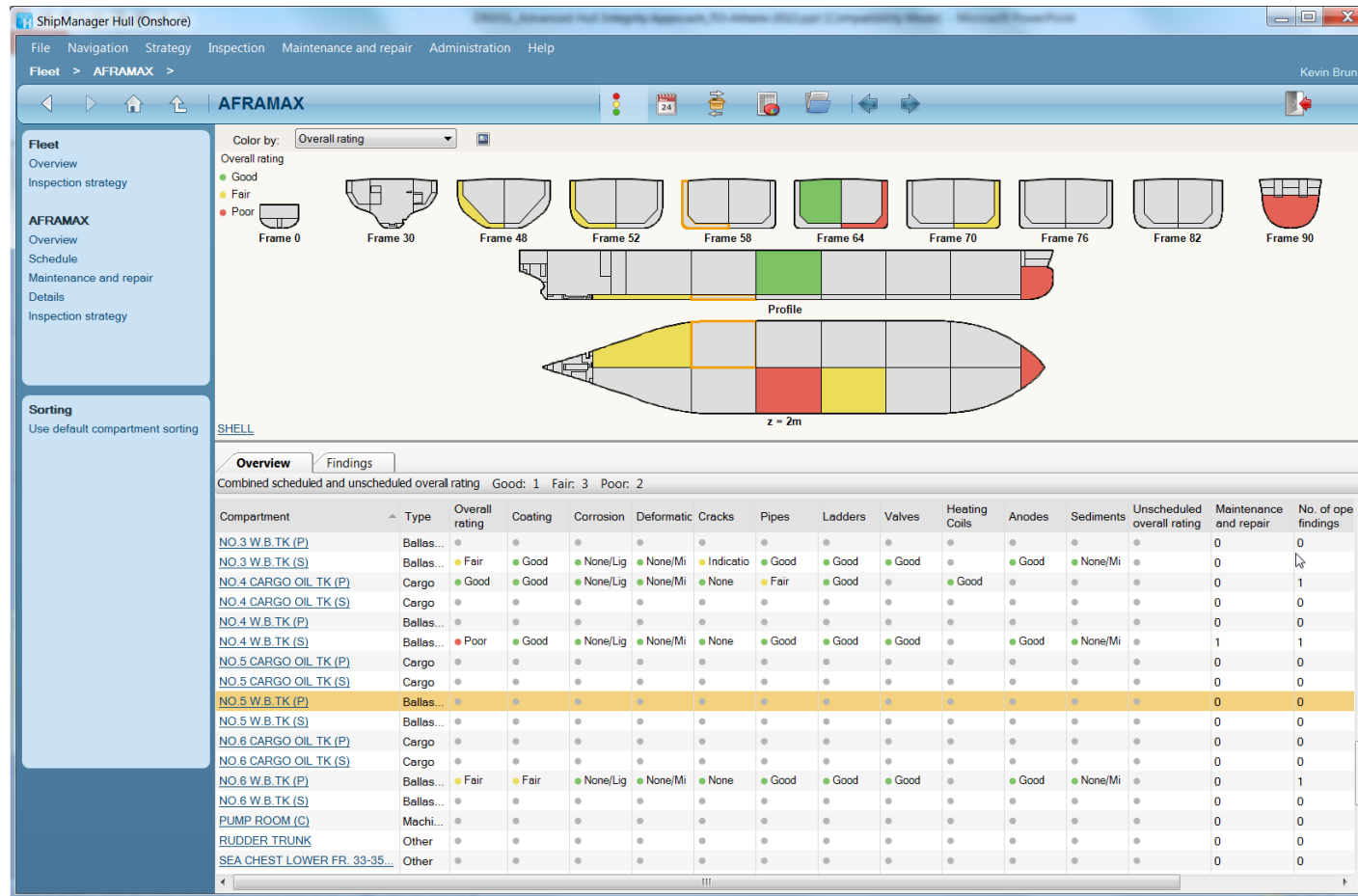
## Inspections reported on vessel are transferred back to office

- 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

**ShipManager Hull (Onshore)**

File Navigation Strategy Inspection Maintenance and repair Administration Help

Fleet > AFRAMAX >

Kevin Brunn

**Maintenance and repair**

Status: Open and closed Date created: 2015-01-01 - 2015-04-01

Compartment	Type	Referen Identifier	Priority	Date created	Date finished	Due date	Status	Finding Type	Responsible
NO.4 W.B.TK (S)	Permanent Maintenance	M-11	Normal	2015-01-01			Open		
FORE PEAK TK (C)	Permanent Maintenance								
UPPER DECK	Permanent Repair								
NO.5 W.B.TK (P)	Permanent Maintenance								

**Permanent Maintenance**

View direction: Aft Port Fore Starboard Aft

**Details** Inspection photos Documents Planning

Activity status: Permanent Priority: Normal Due date: 2015-04-17 Responsible: KB Description: Blasting - Painting

**Details** Inspection photos Documents Planning

Activity status: Permanent Priority: Normal Due date: 2015-04-17 Date finished: Responsible: KB Description: Blasting - Painting

**Planning**

In progress Compartment: NO.5 W.B.TK (P) Status: Open

Total number of findings: 1 Select finding Deselect finding

Finding Type	Comment	Inspection Date	Position
Coating, Blistering	Coating breakdown - between Fr 56-57 - 10...	2015-04-01	Side Shell (P)

- 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



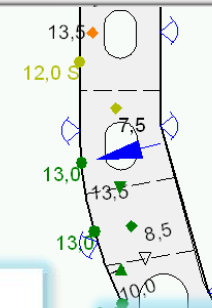
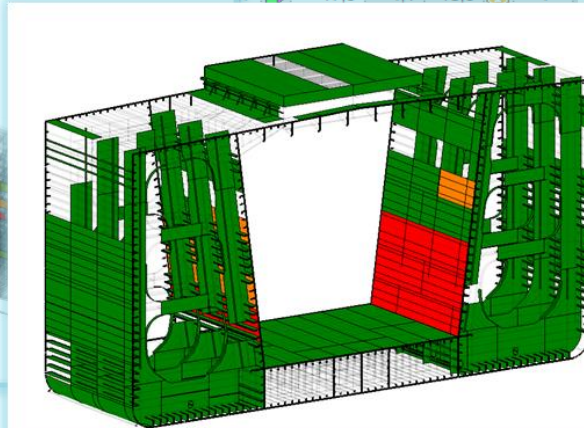
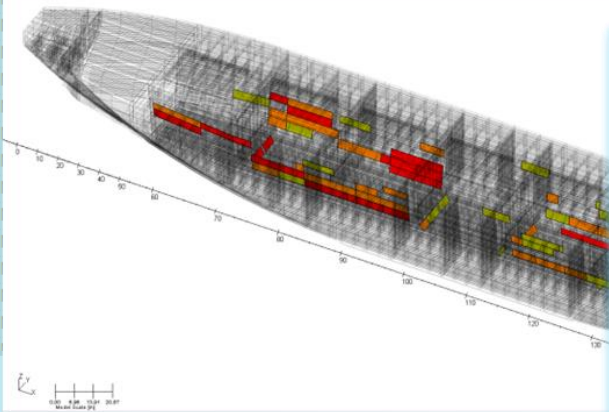
# Plan Repairs More Accurately

## 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

### Hotspots

Compartment		Structural Part										
Name	P	Name	Structural Member	Side	Org. Thk.	max. Diminution	T	Value	Diminution			CAP
									mm	%	A	
▶ No. 3 W.B.Tank (P)		LONGITUDINAL BULKHEAD	LONGITUDINAL BULKHEAD	P	17,0	2,2		15,1	1,9	11,2		3
No. 3 W.B.Tank (P)		LONGITUDINAL BULKHEAD	LONGITUDINAL BULKHEAD	P	17,0	2,2		14,9	2,1	12,4		3
No. 3 W.B.Tank (S)		LONGITUDINAL BULKHEAD	LONGITUDINAL BULKHEAD	S	18,0	2,3		16,0	2,0	11,1		3
No. 3 W.B.Tank (S)		LONGITUDINAL BULKHEAD	LONGITUDINAL BULKHEAD	S	22,0	2,7		19,2	2,8	12,7		4
						9		14,1	1,9	11,9		3
						7		17,9	4,1	18,6		4



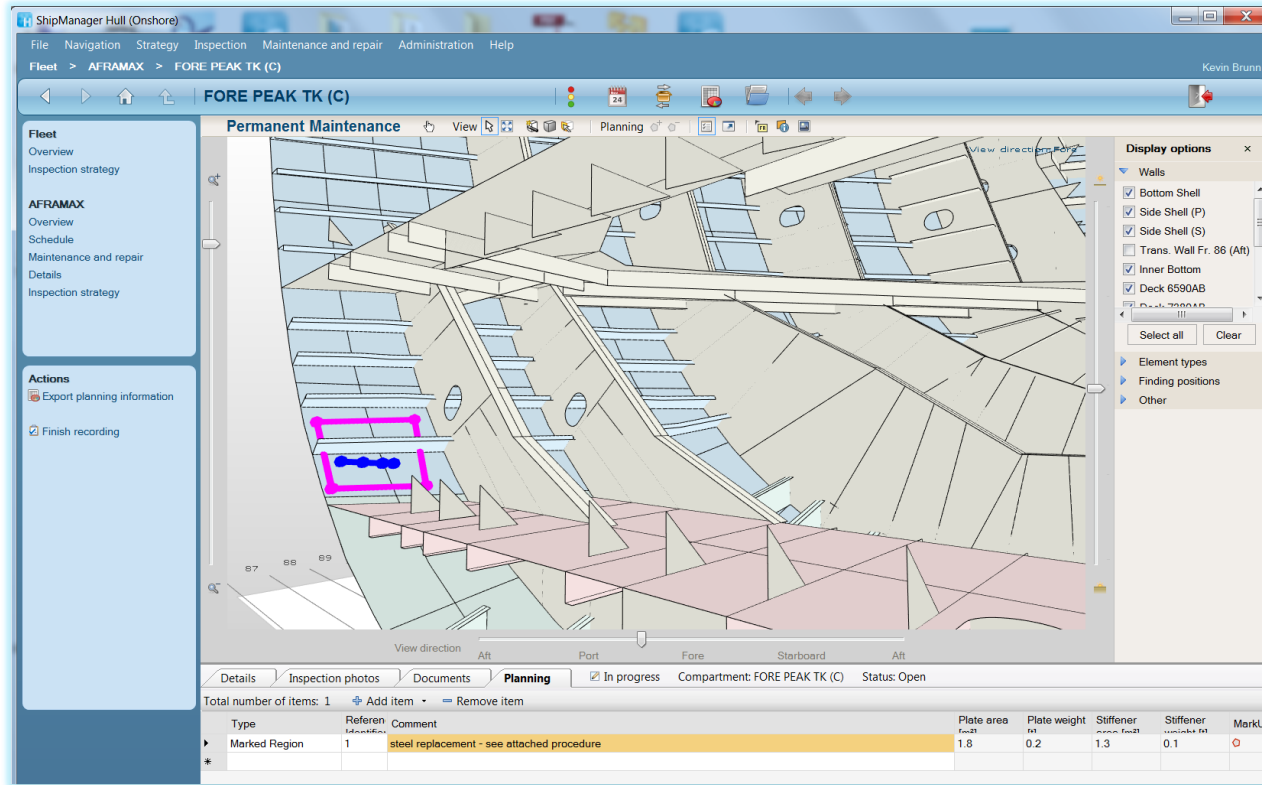
### Thickness Measurement Point

Compartment Name:	0303 WB WT (S)
Part:	Stiffener
Structural Member:	TP:170A (TRANSVERSE_PLATE)
Original Thickness [mm]:	17
Max. Diminution[mm]:	4.2
Measured Thickness [mm]:	12
Diminution [mm]:	5
Diminution [%]:	29.4
Assessment:	Structural part to be renewed
X-Coordinate:	FR 170 + 0.30 m
Y-Coordinate:	CL + 14.38 m (S)
Z-Coordinate:	BL + 13.06 m

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# Plan Repairs More Accurately

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



- **Calculation of steel weights and surface areas (painting)**
- **Whole compartment, whole wall, or selected areas**
- **Fewer surprises in the dockyard!**

- 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



## 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**

# Thank you!

## **Kevin Brunn**

Head of Clients and Markets, Maritime Software, DNV GL

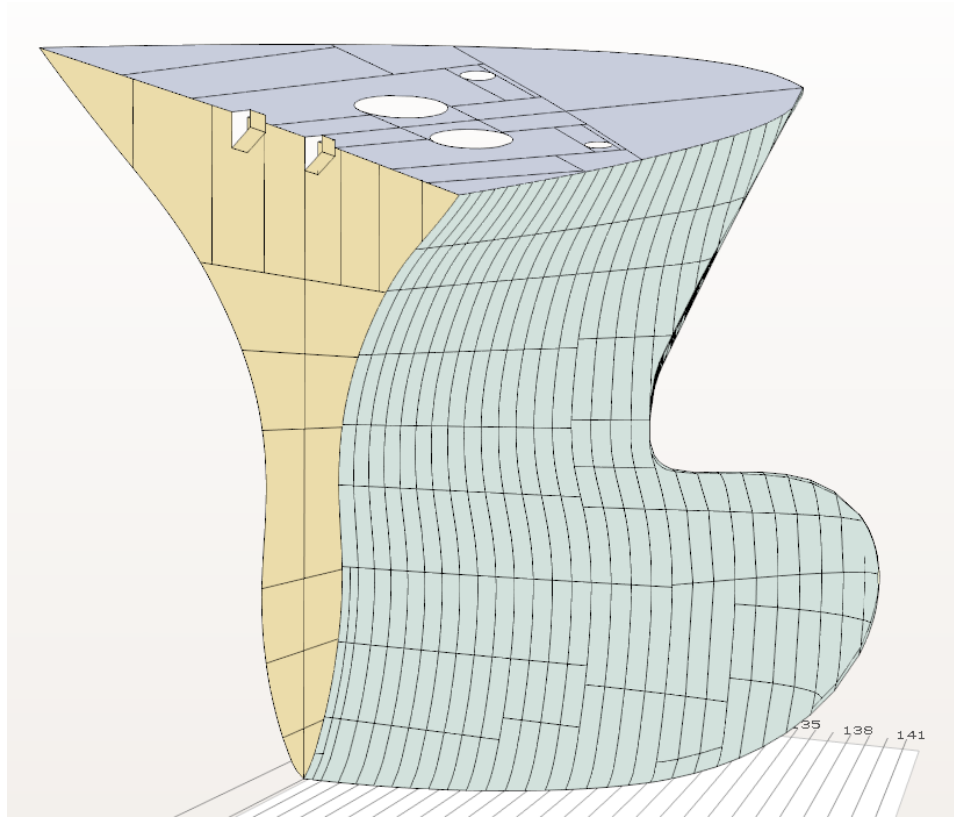
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**[www.dnvgl.com](http://www.dnvgl.com)**

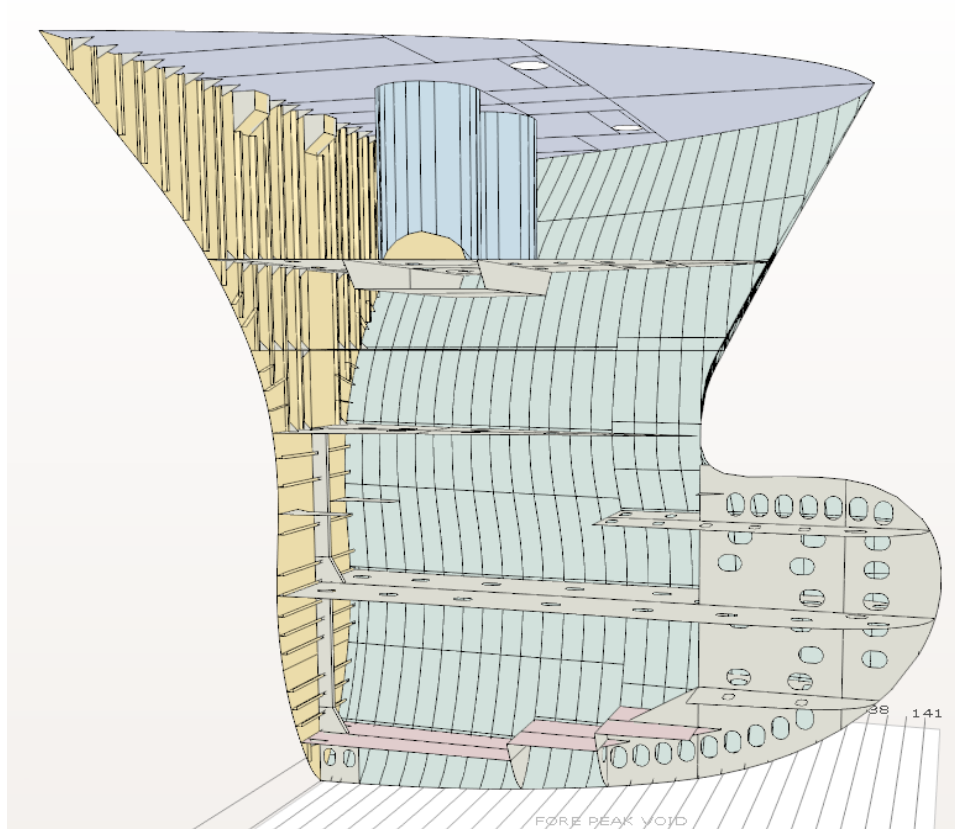
**SAFER, SMARTER, GREENER**

# Flexible modelling with varying degrees of detail





# Flexible modelling with varying degrees of detail



# Flexible modelling with varying degrees of detail

