

KNOWLEDGE SHARING ON VESSEL CONDITIONING MONITORING

MARITIME

All seats were sold out, when Roving Dynamics in September gathered key players in the maritime industry for seminars during the SMM trade

fair to exchange views and experiences on Vessel Condition Monitoring for Condition Based Maintenance – What to gain and how to get there.”



“The seminar was very informative. I like your focus on customers’ experience and challenges instead of the typical sales presentations at similar events I have attended. This kind of event makes it possible to establish collaboration between

the different business parties and ship owners across borders. It was really nice to hear third parties like classification societies and their implementation experience. It all created good discussions.”

Paal Gilde, Dyvi, Norway.

“I joined to hear about the situation in online monitoring in the maritime industry. The combination of several lectures from class and examples of maritime use of condition monitoring was very useful and

fulfilled my expectations. The seminar was also worthwhile with respect to networking. I established new contacts and am now going to meet with other Dutch companies also interested in this topic.”

Harry Lijzenga, Royal Dutch Navy.

SHIP OWNERS MOTIVATION - What to gain?

Three of the ship owners who have implemented OPENpredictor™ monitoring solutions from Roving Dynamics shared their goals and experience.



Both technical, financial and image related aspects counted, when the Russian tanker owner **PRISCO**, specialized

in operation in freezing sea conditions, decided to monitor main engine bearing wear on their new Ice Class crude oil carriers. Technical Director Konstantin Globenko said that the company’s key objectives are to

- Increase fleet efficiency & safety
- Prevent main engine damage
- Maintain image & reputation
- Avoid indirect expenses/ losses
- Condition Based Maintenance

For full benefit PRISCO will integrate condition monitoring information with their maintenance planning system DANAOS, and use the knowledge of machinery health to benchmark vessels in their fleet.

For the German



F. LAEISZ

Reederei F. Laiesz Bearing Wear Monitoring of the long and small 9-cylinder engines of 500 mm bore onboard of their new Pure Car & Truck Carriers is a new tool to improve operational safety, and to meet customers’ high demand for uninterrupted service. Manfred Zimmermann stated that the company sees it as a way to:

- Optimize maintenance planning, vessel reliability & availability
- Reduce time for maintenance & surveys
- Minimize risk, cost & off-hire time, and human factor influence

Condition monitoring is Reederei F. Laiesz’s first step towards Condition Based Maintenance with operational benefits and monetary savings. Next step for the diversified fleet owner is integration into their GL Shipmanager software and AMS planned maintenance system.



Scandlines, who operates ferries between Denmark and Germany around the clock, shared experience from 1,5 year’s thruster monitoring.

Compared to an ordinary shaft/propeller arrangement the Aizimuth thruster is more complex and costly to repair. An online monitoring solution was therefore developed together with Roving Dynamics and Rolls Royce to:

- Warn before expensive damages
- Avoid loss of direct cost (repair) and indirect cost due to non-availability of a vessel at traffic peaks
- Reduce unplanned overhauls (30% dry-docking and EUR 100-200,000 per year)

Superintendent Henrik Lethin demonstrated how Scandlines use monitoring information to optimize ferry operations. They also learned about quite unexpected machine behaviours.

Keep your knowledge in-house

Mr. Lethin raised the topic whether to let internal or external people review and analyze monitoring data. His recommendation was clear:

- Measure and analyse using your own tools; Pick-up your operational data, and keep your knowledge in-house to be in control of your assets.
- Ask each equipment manufacturer to offer their own Condition Monitoring philosophy.

He emphasized that Condition Monitoring for Condition Based Maintenance requires a high degree of automation, where all messages in the man-machine interface are uniform.

We also presented **other examples** e.g. a tanker owner, who anticipates annual savings of up to USD 7 million per year

from only conducting condition based overhauls of main engine bearings and turbochargers on their Very Large Crude Carriers.

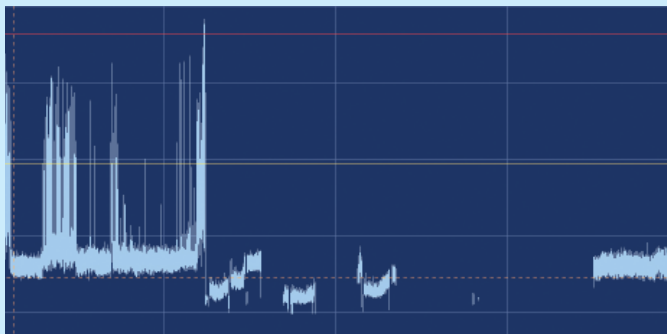
PREVENTED TURBOCHARGER DAMAGE SAVED HAPAG-LLOYD CONSIDERABLE COSTS

In October 2007 the German shipping company Hapag-Lloyd installed an advanced OPENpredictor™ condition monitoring solution on three 4,000 teu containerships in service since 2002: Dublin Express, Glasgow Express and Liverpool Express. The systems monitor both the vessels 9-cylinder Wärtsilä engines and their Napier turbochargers.

Within 6 months this investment paid off, when OPENpredictor™ detected increased vibration level of one of the turbochargers at Glasgow Express. The warning was fortunately given in due time for the crew to replace the

turbocharger's turbine rotor. Thereby they avoided the risk of significant consequential damage, which could have resulted in significant repair or turbocharger exchange costs.

Following the successful field test on the three vessels in service, Hapag-Lloyd decided to also equip their six new 8,750 teu containerships under construction with an OPENpredictor™ online condition monitoring solution for the 12-cylinder MAN B&W main engines. Read more in our press release and Dynamic News July 2008.



The OPENpredictor™ graph shows how the turbocharger's vibration level increased beyond both the yellow alert level and the red alarm level

THE ENGINE DESIGNER'S VIEW Why omit open-up inspections?

Torben Wiik and Niels Nøjgaard from **MAN Diesel** explained why they now recommend ship

owners to omit regular open-up inspections of the crank-train bearings of certain engine types and only conduct Condition Based Maintenance supported by various types of monitoring. The overall aim is to increase



Courtesy: Lloyd's Register

vessel reliability and reduce operational costs.

The human factor is the main reason why the engine designer advice against open-ups, which are said to only identify <1% of the problems, while generating >2% of the damages. Grave examples of open-up induced engine damages e.g. due to forgotten tools inside the engine were presented along with other cases. Only one hour into her maiden voyage, a brand new vessel suffered severe engine damage and 3 ½ months repair due to wrong assembly of a main bearing after inspection.

Other damages are: Lube oil contaminated with water, white metal or other foreign particles, thin/thick shell fatigue and steel-to-steel contact.

According to MAN Diesel's statistics, bearing damages registered over the last 7 years have had huge consequences:

- Repair costs of \$ 40 million
- 4.3 years off-hire resulting in losses of \$ 25-50 million

In many cases traditional systems like oil temperature measurement and oil mist detection warned far too late - when bearing damage had occurred - or not at all.

Tests and experience since 2003 has convinced the company that **Bearing Wear Monitoring is a far more dependable solution**, which fulfil their key requirements:

- No false alarms
- Reliable detection of wear of <50% of the bearing lining ~0.5 - 0.7mm
- Integration with vessel alarm & slow-down system

Therefore, MAN Diesel now support omission of open-up bearing inspections for engines with monitoring of

- Bearing Wear
 - Water in Oil
 - Bearing Temperature
 - Shaft Line Earthing Device effectiveness
- as the ideal basis for carrying out Condition Based Maintenance.

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CLASS PERSPECTIVES ON CBM - How to get there?

Classification societies' views and guidelines for a successful implementation of Condition Monitoring (CM) and Condition Based Maintenance (CBM) were presented by Erik Sanderlien, Dr. Jörg Rebel and Chris Holland from DNV, Germanischer Lloyd and Lloyd's Register. All expressed full support and added more benefits to the list:

- Lower maintenance costs & improved spare parts control
- Reduced fuel consumption from optimized operation
- Reduced crew workload & improved motivation

Each of the three societies has developed guidelines which seem to follow the same **necessary steps for implementation of CBM**:

Phase I

1. Develop Condition Monitoring system
 2. Field test onboard a ship*
 3. **Hard ware type approval***
- *if required by classification society*

Phase II

4. Develop CBM concept based on failure mode & cost-benefit analysis incl.
 - Maintenance strategy, training program etc. for **company approval** for owner & operator
 - Description of CM methods, equipment, pre-defined alarms & actions for **vessel specific approval**

5. Implement CM system & CBM procedures

6. Initial CM implementation survey onboard (some requires min. 6 months operation): documentation, crew familiarity with CM system, data interpretation etc. for class approval of survey arrangement.

Phase III

7. Operating CM & CBM with **annual surveys** to confirm that the system is working as intended, and verify crew familiarity with objectives, CM equipment, routines etc. Examples of monitoring data to be presented:
 - Operating hours
 - Machinery condition status
 - Measurements & trend curves since last survey
 - Log file with warnings etc.
 - Inspection protocols
 - Documentation of maintenance & repair, if any



DNV emphasized that the annual CM survey is credited, not the machinery items, which are only credited after overhaul.



Germanischer Lloyd and DNV shared their experience from field test of various monitoring solutions, comprising e.g. check of long term stability of measuring results, and test of reproducibility of sensor position after exchange for bearing wear monitoring systems for 2-stroke diesel engines.

Barriers for adoption of CM and CBM were also mentioned:

- Lack of management commitment
- Failure to change traditional practice
- Concern about acceptance from OEM, insurance & class
- Technical complexity
- Lack of independent advice
- Overworked crew

Success factors

- Clear maintenance strategy & criticality analysis
- Choose appropriate techniques, measurement intervals & limits
- Work processes & responsibilities
- A CBM company culture
- Training programme, taking into account frequent crew changes, onshore & offshore organisations
- Follow-up on training, analysis, routines & actions taken
- Measure CM performance & follow-up that CBM benefits are achieved. Allow 2-3 years for the new scheme to prove its worth.

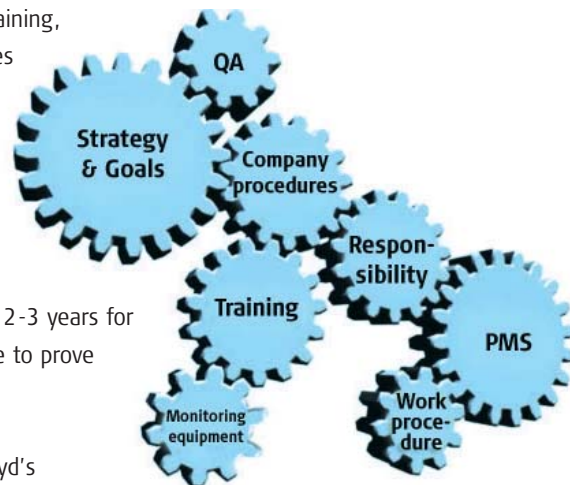


Lloyd's Register noted that classification societies also face challenges e.g. the need to provide industry leadership, clear procedures and surveyor training.

Last but not least, all presenters emphasized that CBM requires **close cooperation among all parties involved**: ship owner, operator, machinery maker, class and condition monitoring system supplier.

SEMINAR CONCLUSION

The high attendance and lively discussions confirmed that the potential of vessel condition monitoring and Condition Based Maintenance is widely recognized. More and more ship owners request and implement this approach, now actively supported by the first equipment manufacturer, MAN Diesel, and several classification societies. The knowledge sharing sessions showed that a considerable step change has taken place in the maritime industry since last SMM two years ago.



For seminar presentations or information about vessel condition monitoring contact us on info@rovsing-dynamics.com.