# First OPENpredictor™ solution for maritime use

Rovsing Dynamics has recently extended our OPENpredictor™ product range with condition monitoring of rotating and reciprocating machinery on maritime vessels e.g. diesel engines, gas & steam turbines, turbochargers, gearboxes, pumps and a newly released function: Bearing Wear Monitoring.


The predictive maintenance information system helps operators of oil tankers, containerships, LNG/LPG carriers, cruise liners, naval and other large vessels to optimize reliability, availability and maintenance planning.

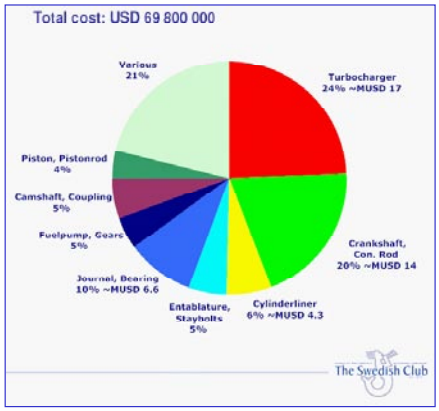
### *From time based to condition based maintenance*

Today, a ship's engine crew inspects vital engine parts e.g. bearings for wear and damage on a regular basis to comply with requirements from the classification societies. With three bearings per cylinder, a large two-stroke diesel engine has up to 44 bearings, a big challenge for the crew. This can, however, lead to open-up induced damages to previously well-functioning engine parts. Engine manufacturers' statistics show that open-up inspections double the risk of damages to main engine bearings. The risk can be minimized if open-up inspections are limited to faulty parts, while healthy operational machinery is left untouched. The key is a reliable, on-line, real-time condition monitoring system such as OPENpredictor™, which enables ship operators to move from time based maintenance to condition based maintenance.

Rovsing Dynamics is in dialogue with diesel engine designers and ship classification societies. These support condition based maintenance strategies, and are willing to approve changed machinery survey arrangements – provided a continuous, on-line condition monitoring system, ensuring storing of applicable data, and an alarm system are in place.

### *Why monitor?*

Even the most modern and reliable ship engine parts require maintenance and can be subject to wear and break down. Seven years' statistics from an insurer of more than 1,000 ships (www.swedishclub.com), shows that main engine damage is a frequent and expensive problem, accounting for 46% (USD 69 million) of all claims. The majority are related to the turbocharger, crankshaft, journal bearings and cylinder liners.




Breakdown and repair of critical machinery is even more inconvenient and costly at sea, and can cause significant delay further down the value chain. Limited time is available for maintenance - and each day saved can save more than USD 30,000. Reliability of operations has such a high priority, that one service provider has established a worldwide set-up to replace defect turbochargers within 24 hours.

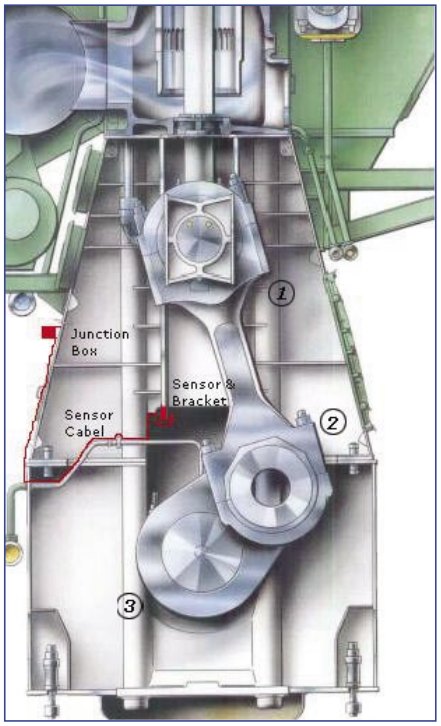
To help overcome these challenges, Rovsing Dynamics has further developed OPENpredictor™ to suit the maritime industry's need for automatic identification of faults and prediction of lead time to inspection for vital engine components. It can also integrate data from other types of machinery, oil analysis and process data from a vessel's control systems.

### *Crank Train Bearing Wear Monitoring developed for A.P. Moller – Maersk*

The first step towards a maritime OPENpredictor™ solution was taken in 2004. Together with the Danish shipping company A.P. Moller – Maersk we initiated a pilot project to evaluate the possibility for conditioning monitoring of critical engine components with special focus on monitoring crank

train bearing wear on two-stroke diesel engines.

Tim Krarup Sørensen, Vice President Technical Organisation A.P. Moller – Maersk explains: "The decision to install OPENpredictor™ to monitor bearing wear on a number of vessels is part of our strategy to move towards condition based maintenance. We expect the system to provide up-front information in case of a negative development of the main engine's crank train bearings. This allows us the time and opportunity to plan maintenance and make corrective actions, thereby minimizing the influence on the daily operations of our vessels.




***Crosshead - (1), crankpin - (2) and main bearings (3) are very sensitive to wear, which can ultimately lead to crucial damage to the crank shaft bearing (Example below).***

***Top of the main engine of one of A.P. Moller - Maersk's container vessels.***

Today, by the time our existing engine instrumentation detects and informs about engine problems, these have already progressed to a stage, where action is needed here and now."

To meet these requirements, we developed a new OPENpredictor™ function – Crank Train Bearing Wear Monitoring - in close cooperation with A.P. Moller – Maersk and the engine designer. To ensure early warning, the system is equipped with sensors capable of very frequent measurements and detection of bearing wear with a precision of ±10 µ. The automatic fault detection initiates the first alarm when 10% of the 1 mm white metal crank train bearing has gone. The predictive maintenance system is integrated with the containership's control system. It also identifies the bearing with the most dominant wear problem, plus predicts wear development and time for required inspection/repair, estimated from the wear history.

The pilot project lasted for 16 months, and confirmed that the new Crank Train Bearing Wear Monitoring function fulfils the requirement for condition monitoring of vital main engine components with regards to risk reduction and maintenance optimization.

After a thorough evaluation of the OPENpredictor™ technology and experience from the test installation, A.P. Moller – Maersk decided to install the new system on a number of container vessels. The first full scale OPENpredictor™ Bearing Wear Monitoring system was installed in April 2006 on the Mitsui B&W 12K90MC diesel engine of a 318 m long containership built in 1997 with a capacity for 6,000 pcs. of 20 ft containers.

"With the OPENpredictor™ technology, it is expected to obtain class approval to avoid open-up inspections of the crank train bearings and thereby eliminate the risk of damaging a bearing, which is always present during open-up inspection procedures. In other words, we expect to be able to introduce condition based maintenance and survey for the crank bearing train," Tim Krarup Soerensen concludes.