Belgian Navy Saves Big Money with Predictive Maintenance Based on Vibration Monitoring and Oil Analysis

RESULTS

- Saved nearly 1.5 million Eurodollars per year by applying predictive maintenance technologies in seven minehunters.

- Extended the mean time between maintenance (MTBM) for gas turbines from 2500 hours to 4000 hours, saving 71,000 € with each cycle.

- Saved additional Eurodollars through condition-based maintenance of other shipboard equipment including motors, pumps, and fans.

APPLICATION
High reliability maintenance of gas turbines and other rotating equipment.

CUSTOMER
The Belgian Navy, which traces its origins to 1831 and which continued as a section of the British Royal Navy during World War II, now operates two frigates and six minehunters in carrying out its peacekeeping and Mine Counter Measure missions. The Navy is responsible for managing crisis situations arising from infringements to the principles of International law and/or human rights, exercising sovereignty in Belgian maritime zones. In times of peace, naval operations support diplomacy, aid foreign trade, and provide technical and military assistance to allied countries.

CHALLENGE
Operational readiness is essential, and that depends in large degree on maintenance. No amount of training and proficiency will make up for a ship that is not seaworthy. Navies have traditionally had plenty of time and manpower to do whatever preventive maintenance was necessary, but traditional marine maintenance practices may not be adequate today, especially with respect to highly complex mechanical equipment like gas turbines.

According to LtCdr (OF3) (T) Ing M. Bentein, "In the past, we had a certain number of people available who were able to perform our maintenance. This is no longer possible. A reduction in headcount over the past years and government influences have forced us to work in a very efficient way with limited resources."

> *"Emerson's vibration analysis technologies have been crucial in helping us reduce costs. I conservatively estimate the savings on all naval equipment to be in the order of 0.5 M € /year. Emerson is a real good partner in understanding our needs and providing solutions."*
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> **M. Bentein,**
> LtCdr (OF3) (T) Ing, Belgian Navy

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SOLUTION

Recognizing the changes that were coming due to reduced funding and personnel as well as the challenges of increasingly complex equipment, the Belgian Navy introduced Emerson's predictive maintenance strategies as early as 1992. Predictive maintenance was seen as a way to spot an impending failure in advance, prevent unexpected breakdowns at sea, keep costs under control, and give workers confidence rather then having them overhaul machines (often unnecessarily) based only on a schedule.

The Belgian Navy began vibration analysis using CSI Machinery Health™ Analyzers and later added the AMS™ Suite: Machinery Health Manager software application. Recently, a "state of the art" dual channel CSI 2130 Machinery Health Analyzer was purchased, giving the Belgian Navy cutting-edge technology. Routine measurements and trouble-shooting tasks are enhanced, producing more accurate data and more actionable information than ever before.

CPO Paul Plasmans and Technical Assistant Johan Vanhixe of the Predictive Maintenance Department are responsible for the use of this equipment, gathering measurement and diagnostic data from gas turbines, pumps, motors, fans, and other rotating equipment on the ships involved in the program, analyzing the data, and coordinating repairs as necessary.

Up to last year, the Belgian Navy had seven CMT (Chasseur de Mines Tripartite) minehunters, each equipped with three gas turbines for propulsion and power generation. In the past, each gas turbine was overhauled after 2,500 hours of operation. Since each gas turbine overhaul costs approximately 118,500 €, the total cost of overhauling all 21 turbines was about 2,488,500 €. By applying vibration and oil analysis, the Mean Time Between Maintenance (MTBM) for this machinery was extended to 4,000 hours, generating a saving of 71,000 € per turbine. Savings through this predictive maintenance program add up to 1,491,000 € over the last seven years.

Lubricating oil sampling and analysis is an important part of the Navy's predictive maintenance. Samples are collected periodically from various pieces of equipment by fleet engineering personnel and delivered to the shore-based Maintenance Group for testing and analysis. The condition of a lube oil can reveal significant information regarding the equipment from which the sample was taken.
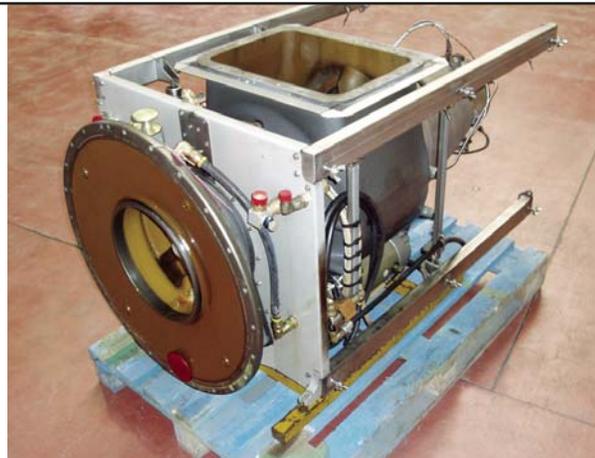
The Belgian Navy is now acquiring two M-class frigates, each with two 33,800 hp Rolls Royce gas turbine prime movers, from the Dutch Navy to replace two older Belgian frigates. Predictive maintenance will be implemented on both new ships.

"Emerson's Machinery Health Management group has done a great job for us, supporting and helping us in defining our predictive program. We have used CSI equipment for years now, and I can say it is the best in this field. We look forward to putting our new CSI 2130 Machinery Health Analyzer to use."

Paul Plasmans,
CPO, Belgian Navy

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