Vibration Monitoring System: Improved Reliability, Decreased Maintenance Cost

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by SURFOR Public Affairs

SAN DIEGO, Calif. - Initial results of a two-ship pilot program show an estimated cost avoidance of $170,000 per ship and more than 1,000 annual man-hours. This pilot program is a Surface Force initiative to improve equipment reliability and to reduce maintenance costs utilizing a new vibration-monitoring module. The results also suggest that time spent in port for maintenance will be reduced significantly. This initiative is another example of how Naval Surface Forces (SURFOR) partners with other organizations, such as Naval Ship Systems Engineering Station (NAVSSES) Philadelphia, to improve warfighting readiness.

NAVSSES and SURFOR's Future Readiness Team, a part of the Surface Warfare Enterprise (SWE), have updated the Integrated Condition Assessment System (ICAS) to incorporate a vibration module. The new module automatically analyzes vibrations in engineering equipment and generates an automatic work order that is sent into the Organizational Maintenance Management System - Next Generation (OMMS - NG), which then routinely sends the ships vibration data to a central NAVSSES server.

According to Warrant Officer John R. Desgrey, SURFOR Maintenance and Material Management System (3M) Officer, "The module's highest payoff is that it enables ships to implement true condition-based maintenance. Now the ship can take action on equipment degradation in a timely manner, before catastrophic equipment failures occur. Additionally, ships can avoid unnecessary maintenance and increase the timeliness of repairs. During one sea trial test of the system, the Port Engineer met the ship with the work orders in hand ready to broker the work."

The upgraded ICAS, currently installed aboard the guided missile destroyers USS Ross (DDG 71) and USS Nitze (DDG 94), includes the following features:

- [SpriteMAX™] Continuous online vibration monitoring (21 pieces of critical and high maintenance cost equipment on Ross and 22 on Nitze).

- [Azima DLI DCA-31B] Manual monitoring for 64 additional critical pieces of equipment.
- ExpertALERT™ Analysis Engine resident in the ICAS vibration module.

A generator that produces an automated work order stating the problem and the repair recommendations that are compatible with OMMS NG/Regional Maintenance Automated Information System (RMAIS)

Business Rules established ensuring the reliability and validity of the work orders produced from vibration data.

The benefits have already been noted onboard the ships.

"Ross benefited early on from the installation of the [Azima DLI] Vibration Monitoring System through its identification of failing bearings on several pieces of equipment," said Lt Danny Madison, Chief Engineer in Ross. "We recognize the extraordinary potential this system offers the fleet and are proud to have been selected as a participant in the test program. As with any new system, there have been some growing pains, such as erroneous jobs being automatically entered into the ship's Current Ship Maintenance Project (CSMP), but we are confident that continued feedback will bring further improvements."

Nitze's chief engineer echoed the comments from Ross.

The system also employs the previously installed Remote Monitoring Utility (RMU) software that automates the download of data through the ship's Navy Information/Application Product Suite (NIAPS) system. Once the data arrives in Philadelphia, vibration experts at NAVSSES and Azima DLI can authenticate the data validating the expert analysis engine and the business rules, although human analysts will eventually be phased out.

Vibration information will be integrated into the ship's integrated Performance Appraisal Report (iPAR) report in the near future. The iPAR, including subject matter expert (SME) comments for recommended equipment checks, is uploaded to the ship from the Maintenance Equipment Library Server (MELS) for Hull, Mechanical & Electrical (HM&E) material health visibility and assessment beyond the ship's alarms and control systems. It provides the same information to shore sources of support (SoS) for possible maintenance follow up. If a red condition is noted requiring technical help from shore based SoS organizations, the iPAR can provide operating data, which an SME can also access through MELS.

While the ICAS improvements have been significant, NAVSSES continues to refine and upgrade the system. These improvements allow ICAS to provide key remote monitoring lessons learned. This represents a significant step forward in the Navy's way ahead to providing viable condition-based maintenance approaches, reducing repair costs and extending the life of a ship's systems.

Metrics are being collected and analyzed, via a web application, drawing from the Navy's 3M database measuring the effectiveness of the systems. To date, the system has identified problems

leading to timely repairs on Fuel Oil Service Pumps, Potable Water Pumps, Fuel Oil Purifiers and other equipment.

Other changes and benefits that will be realized as the vibration monitoring system spreads across the fleet include changes in the frequency of preventive maintenance and how it is done.

"It's already replacing the current process we're using on the equipment that is being automatically monitored (i.e., manually gathering vibration data on the equipment, interpreting the data, writing a work order, etc.)," Desgrey said. "The entire process is done automatically, which saves man-hours as well as administrative time and outside technical assistance.

"But it's a hybrid system in which some equipment vibration readings are being automatically taken and others are being manually gathered by personal digital assistant," according to Desgrey. "Regardless of which is employed, an automated analysis engine is used (ExpertALERT) and an automated work order is produced to describe the problem and the work required to repair it. The big drivers affected are cost and man-hour savings.

"Once we compile enough trends and data this technology will be useful in forewarning us of problems that, if left unattended, will result in catastrophic failure. In addition, based on the condition of the equipment, we will be able to determine if maintenance can be pushed out further or done earlier, depending upon the results of the data."

This is another example of a successful SWE initiative demonstrating how the SWE, with the help of other naval partners, is meeting its mission using sound work principles and processes to optimize warfighting readiness.

Continuous process improvement allows the SWE to fulfill that mission in each core area: maintenance, modernization, logistics, manning and training. The SWE is a $25 billion enterprise committed to providing the most powerful, dominant, and adaptable surface warfighters and ships with maximum efficiency and careful stewardship of resources.

NAVY Message

 CNO Guidance 2009

 Department of Navy Objectives 2008