

Integrated Shipboard and Shore-based Maintenance Management decision Tool

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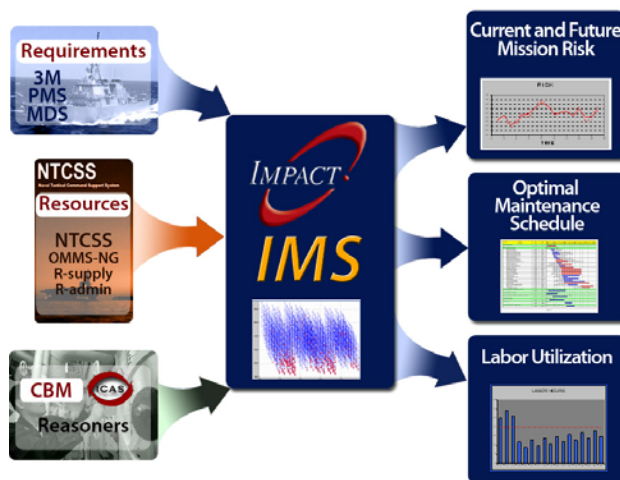
Need

The Navy requires improved maintenance management decision support systems based on several emerging trends. Existing and future Naval Ships are increasingly utilizing sensors and other automated technologies to monitor shipboard system health and availability. Significant support cost and efficiency improvements are being realized from efforts to right-size on-board manning levels and by moving required shipboard maintenance and repair work to shore-based Full Service Operations (FSO). Therefore, the Navy is developing new technologies to quickly and efficiently determine, prioritize, and optimize shipboard maintenance efforts to maximize operational availability and minimize cost.

Technology Development

Impact Technologies, LLC is developing an Integrated Maintenance Scheduling (IMS) application that determines the optimal time to perform shipboard and shore-based maintenance while maximizing ship availability. The application also supports optimal ship manning by scheduling actions during shore availabilities when possible. The IMS application evaluates mission requirements, Condition Based Monitoring (CBM) data, shore-based maintenance availabilities, available parts and labor, budget constraints, and complex system interdependencies to determine the optimal maintenance schedule that minimizes operational risk and cost. The application is integrated with Navy Programs of Record (PORs) such as Navy Tactical Command Support System (NTCSS) and Preventative Maintenance System (PMS) Viewer. IMS is being developed according to the Open Systems Architecture for Condition-Based Maintenance (OSA-CBM) standard architecture to facilitate implementation into existing OSA-CBM compliant systems.

The Integrated Maintenance Scheduler provides decision support capability to the maintainer with clear visibility to the complex trade-off decisions required for optimal maintenance management. Through direct connections to the various PORs, IMS determines the required time-based and corrective maintenance tasks, and the available maintenance resources. CBM data is incorporated to



ensure incipient equipment failures are addressed before they affect mission readiness.

The optimization method employs a genetic algorithm that has been tuned to the characteristics of Navy maintenance. The optimization considers the probability and consequence of each system failure in light of their complex interdependencies, such as dependant and redundant systems, to achieve the best overall system readiness. Novel post-processing techniques identify the active solution constraints.

The user is presented with an intuitive graphical representation of the schedule solution, which supports additional decisions through the presentation of important maintenance metrics such as labor loading, estimated risk, and future mission capability. Tasks can be rescheduled by simply dragging and dropping and the effect on risk and cost is instantly visible. Information regarding active constraints on the solution is also presented to allow immediate visibility to situations that affect readiness.

Technology Transition

The primary customers of the IMS application are CBM-enabled Navy ships and commercial facilities management systems. Current efforts are underway to implement the IMS application in the DDG-1000 Element Mission Readiness Subsystem (EMRS).