OSD Maintenance Challenge

Abstract Form	
Paper Title:	Condition Based Maintenance for Combat System Elements
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Abstract: (300-500 words)

Reliability Centered Maintenance (RCM) and Remote Maintenance Monitoring (RMM) are increasingly recognized as essential techniques for minimizing the life-cycle cost of maintaining complex distributed systems, such as those used in defense systems, Air Traffic Control, power utilities, shipping and remote plant installations. We present an architectural framework for implementation of RMM and RCM for such systems, and an application using this approach for radar and other complex combat system components used worldwide by the U.S. Navy.

The systems to be monitored are at remote locations, and require a secure, robust and scalable network infrastructure for data collection and distribution. The data collected may include leading indicators such as system states and modes, parametric data from dedicated sensors; and manually collected data. We have found that an RCM solution for complex distributed systems must be based on three core pillars: smart sensors for heterogeneous data collection, scalable and generically applicable predictive analysis methodologies, and a secure network infrastructure.

Model-based prognostics offers an algorithm-agnostic methodology for RCM of complex distributed systems. It can use heterogeneous data from disparate sensors and sources, and is scalable using hierarchical models. The analysis transforms RMM data into actionable information by predicting specific failures tied to maintenance actions.

Mikros Systems is currently deploying a “Condition Based Maintenance Plus” (CBM+) solution for combat systems on the U.S. Navy’s Littoral Combat Ship (LCS). In this application, a custom smart sensor is used to collect maintenance data from combat system equipment. The data collected is transferred securely from ships deployed around the world to a central server for analysis, and the Prognostics Framework (PF), a model-based prognostics reasoning engine, is used to analyze all data. PF outputs include prognostic alarms, maintenance action needs, and Remaining Useful Life (RUL) estimates for key components, providing a comprehensive health management capability for the LCS fleet.