Living RCM

BACKGROUND

Work order and condition monitoring systems provide data to the maintenance organization. Why collect data? To support making the best decisions regarding what maintenance to perform, where, and when. An "optimal" decision rule or policy will apply the right maintenance at the right time to the right components in a way to achieve highest long term profitability. Maintenance managers and engineers have long believed that within their data lie the secrets to achieving optimal decisions. That realization has driven the growth of high technology services and tools to collect, display, manipulate, store, and analyze limitless quantities of data.

THE PROBLEM

Given that the amount of data available is infinite, the maintenance engineer faces new questions:

- Which data will support optimal decision making?, and
- How should one transform the relevant data into optimal maintenance policies?, and
- How should one verify the performance of those policies in order to improve them continuously?

THE LRCM SOLUTION

The "Living" RCM (LRCM) methodology addresses Four Challenges to Achieving Reliability from Data:

1. Management of the relationship between the work order system (CMMS, EAM, ERP) and the RCM knowledge base,
2. Data extraction and transformation,
3. Sample generation, and
4. Reliability analysis.

Of these challenges, the first is the most difficult. It is the one that requires creative collaboration among managers, supervisors, engineers, technicians, and support staff. Challenges 2, 3, and 4, on the other hand, are mostly technical in nature. Nevertheless, they may be accomplished only upon the success of Challenge 1. The innovative LRCM methodology confronts Challenge 1 squarely, by unifying theory as embodied in a RCM knowledge base, with practice as recorded in the work order system. Consequently, LRCM ensures that the correct reliability enabling information is available for extraction (Challenge 2), followed by sample generation (Challenge 3) and reliability analysis (Challenge 4). Reliability analysis, assisted by software, processes a sample in order to generate optimal decision policies, called "*models*". Reliability analysts periodically update those maintenance policies thereby ensuring maximum performance consistent with the latest data and knowledge available.

FEATURES OF LRCM

1. Provides a simple and understandable approach.
2. Integrates with the natural maintenance environment regardless of which technology platforms are in use.
3. Links significant work orders to the RCM knowledge base, allowing for superior quality management and also transfer of critical knowledge
4. Generates unbiased samples for reliability analysis.
5. Eliminates duplication of information on work orders that is already contained in related knowledge records.
6. Improves the RCM knowledge base dynamically as daily work order related experience accrues.
7. Provides the rich expressiveness of the RCM knowledge base when planning, executing and closing work orders.
8. Represents work orders as *instances* that define failure mode life cycles or "points" in a sample.
9. Develops, verifies, and continually improves optimal maintenance policies.
10. Provides an RCM knowledge audit trail for regulatory compliance. Safety, Health environmental, and quality standards audits and verifies continuous improvement
11. Integrates with **EXAKT** and all other Reliability Analysis software.
12. Ensures that the RCM Function, Failure, Failure Mode, and Consequences remain valid by continuous revision of the Effects narrative.
13. Complies with and extends SAE JA1011 / (RCMII) by bringing RCM principles into daily use within the work order process.

BUSINESS PROCESS IMPROVEMENTS OF LRCM

More management control. LRCM procedures and software support the principle of management by objectives (MBO) wherein desirable behavior towards clear goals and benefits is measured and rewarded. The performance indicators generated by the LRCM process demonstrate, daily, that personal and corporate reliability objectives align.

Less work load in documenting work orders. Referencing a RCM knowledge record is quicker and more consistent than restating the same knowledge each time. It is quicker and easier to select from precisely formulated RCM knowledge records than from ambiguous, general failure codes or alternatively from large numbers of very specific failure codes.

Higher motivation. Motivation is an undeniable key factor in maintenance effectiveness. LRCM addresses motivation in the following ways:

- **Empowerment**. Those persons most impacted by decisions related to failure will participate in policy, by contributing to RCM knowledge base, and thereby, to the maintenance strategy.
- **Recognition**. Their contribution will be permanently and automatically recognized in the knowledge base by the LRCM software.

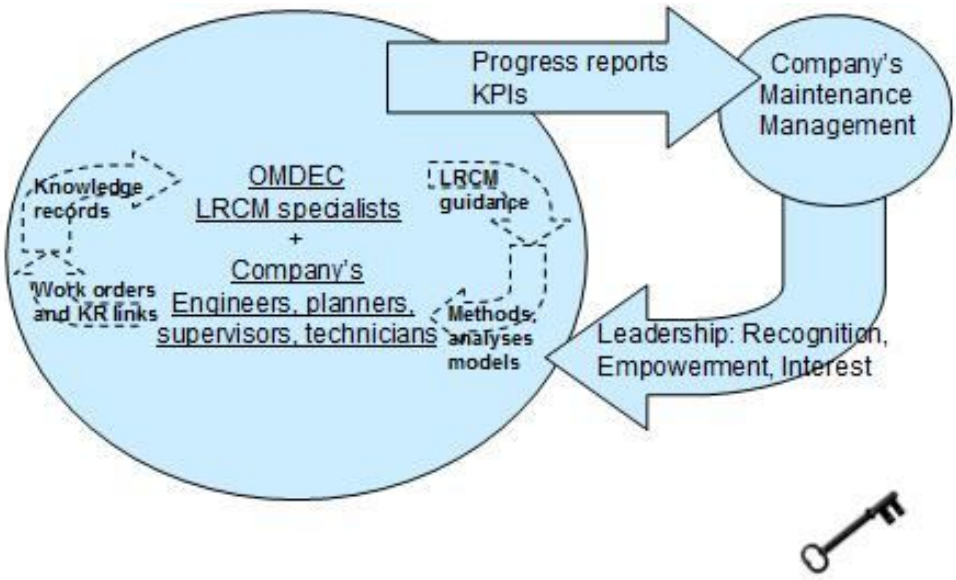
Targeted leadership: The LRCM process generates its own performance indicators. These include:

- Number of new and revised knowledge records.
- Number of new links between work orders and knowledge records

- MTBF and MTTR
- LRCM filters and groups all of the above in a variety of ways, for example by equipment, location, equipment type, and LRCM user.

Higher Efficiency. Symptoms, actions, and events, at the moment of closing a work order, will be fresh in the minds of those involved in the work order. Therefore, less time will be needed to capture relevant RCM knowledge at the most opportune moment.

Greater accuracy (than failure code methods). RCM records pinpoint failure causes in precise syntax in the context of (FMEA) function, failure, and effects with the right level detail.



EXAKT Reliability Analysis Module Features

1. A decision support tool for predicting reliability and optimizing Condition-based Maintenance so as to improve reliability, to reduce failures and save maintenance costs
2. Applies statistical methodologies to equipment history
3. Identifies the critical variables affecting reliability
4. Predicts equipment failure based on combining multiple equipment condition measurements and correlating them with failure modes
5. Produces a formula for continuous monitoring of failure predictions
6. Estimates remaining useful life of equipment – how long until failure
7. Defines the probability of failure in a given time period
8. Applies statistical confidence levels – how confident are we of our prediction?
9. Defines the mix of preventive replacement and run to failure in order to:
   Optimize costs, Reliability - Achieve the optimum balance of risk, cost & reliability
10. Calculates lead time available to prevent failure
11. Requires LRCM