Integrating CMMS with Predictive Maintenance Software

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To operate a world-class maintenance organization, you need precise information combined with the ability to act quickly in response to impending emergencies. Today, both Computerized Maintenance Management Systems (CMMS) and Predictive Maintenance (PdM) technologies can help you reach the goal of eliminating the vast majority of unscheduled equipment repairs. While using a good version of either technology can bring you closer to your maintenance goals, combining the two into one seamless system can have exponentially more positive effects on your maintenance group's performance than either system alone might achieve. Imagine combining the strengths of a top-notch CMMS (preventive maintenance (PM) scheduling, automatic work order generation, maintenance inventory control, and data integrity) with the wizardry of a leading-edge PdM system (multiple-method condition monitoring, trend tracking, and expert system diagnoses) in such a way that work orders are generated automatically based on information provided by PdM monitoring and diagnostic capabilities. The possibilities are enormous and are central to the predictive maintenance concept.

Just a few years ago, linking CMMS and PdM technology was mostly a vision easily dismissed as infeasible or at best too expensive and difficult to warrant much investigation. Now, the leaders in CMMS and PdM technology have made it possible to achieve such a link relatively easily and inexpensively. Let's explore some relevant features of CMMS and PdM systems and how these features might be shared to the benefit of a maintenance operation.

CMMS: Fix It Before It Breaks

A top-shelf CMMS can perform a wide variety of functions to improve maintenance performance. It is the central organizational tool for world-class maintenance operations. Among many other critical features, a CMMS is primarily designed to facilitate a shift in emphasis from reactive to preventive maintenance. It achieves this shift by allowing a maintenance professional to set up automatic PM work order generation. A CMMS can also provide historical information which is then used to adjust PM system setup over time to minimize repairs that are unnecessary, while still avoiding run-to-failure repairs. PMs for a given piece of equipment can be set up on a calendar schedule or a usage schedule that utilizes meter readings. A fully-featured CMMS also includes inventory tracking, workforce management, purchasing, and more -- all wrapped in a package that stresses database integrity to safeguard your vital information. The final result is optimized equipment up-time, lower maintenance costs, and better overall plant efficiency.

PdM: Fix It When It Really Needs to be Fixed

At a minimum, a PdM system should accurately monitor real-time equipment performance, and alert the maintenance professional to any changes in performance trends. There are a variety of measurements that a PdM package might be able to track including vibration, oil condition, temperature, operating and static motor characteristics, pump flow, and pressure output. These measurements are squeezed out of equipment by monitoring tools like ferrographic wear particle analysis, proximity probes, triaxial vibration sensors, accelerometers, lasers, and multichannel spectrum analyzers. The very best PdM systems are expert systems that can analyze measurements like vibration and diagnose machine faults. Expert system analysis like this puts maintenance procedures on hold until absolutely necessary, thus extracting maximum equipment up-time.

In addition, the best expert systems offer diagnostic fault trending where individual machine fault severity can be observed over time.

Both CMMS and PdM systems have strong suits that make them indispensable to maintenance operation improvements. CMMS is a great organizational tool, but cannot directly monitor equipment conditions. A PdM system excels at monitoring those equipment conditions, but is not suited to organizing your overall maintenance operation. The logical conclusion, then, is to combine the two technologies into a seamless system that avoids catastrophic breakdowns, but eliminates needless repairs to equipment that is running satisfactorily. In other words, a joint CMMS/PdM setup can help you walk a tightrope that previously was too risky to attempt.

The CMMS/PdM Link: Challenges to Overcome

The measurements and analysis made by a PdM package must be available to maintenance planners who work with a CMMS for the purpose of scheduling predictive and other types of work orders. In the past, maintenance organizations that used both CMMS and PdM technologies linked the two systems by inputting PdM data manually into the CMMS. While this is an acceptable way to transfer data for the purpose of scheduling predictive maintenance work orders, it is also time-consuming.

Another PdM data transfer method that has been used recently is a passive data exchange, which involves writing pertinent PdM data to a specified local or network directory. Relevant data to be exchanged includes equipment identification, date and time stamps, repair priority, repair recommendations, and observations. The CMMS program would routinely check this directory, and if a transfer file is found, the CMMS reads it and imports it into the CMMS database. Historically, this method of data transfer has been very specific to formal cooperation between various manufacturers of PdM and CMMS software. The passive data transfer method is better than manual data entry, but still falls well short of the total automation and instant access to information that is possible when the CMMS and PdM program are totally integrated.

Today's Integration Method

The first step to integrating a CMMS and PdM package into an automatic system is setting up a way for the two systems to communicate. This is analogous to helping a Frenchman and a German communicate when neither understands the other's language. In the case of CMMS and PdM technologies (two systems that cannot initially understand each other's language), the first step is setting up consistent data in

each system that will allow them to communicate using a common base of information. For example, all equipment monitored by the PdM system must also exist in the CMMS database, and must be called by the same name in each. Next, there must be a system of data cross-references between the sensors, meter tags, or other measurement tools in a PdM system and the appropriate module in the CMMS that associates readings in one system with readings in the other. Meter readings or alarm triggers that are out of the acceptable range set up in the CMMS should trigger a pre-defined work order. Any discrepancy in this cross-reference for a piece of equipment will
nullify the link for that piece of equipment, making the ability to predict problems that much less comprehensive. This makes up-front planning of data entry rules and database setup a critical part of the pre-integration process.
The third step in fully integrating a CMMS and PdM package is to provide a direct link between the systems' data tables. This is referred to as an "active exchange" of data. In today's environment, the best CMMS databases feature open architecture such as ISAM (External Indexed Sequential Access Method; MS Access, Dbase, FoxPro, Btrieve, Paradox and others) or ODBC (Open Database Connectivity; Microsoft SQL Server, Sybase SQL, Oracle and others). These CMMS databases can be read from and written to by PdM programs with ISAM and ODBC capabilities.
Individual PdM technology programs can perform these tasks. However, the best approach is to utilize a fully integrated PdM parent program to gather and assess all of the individual PdM child program data, rather than having individual technology components interacting with the CMMS. Any PdM data, whether accessed by simple overall alarm screen or reduced by sophisticated expert systems, must ultimately be reviewed by a human analyst. Once the resulting PdM data is presented in a single diagnostic profile, the analyst can easily review the PdM results and submit them to the CMMS. Also, the integrated approach provides CMMS with a single condition statement and repair action rather than many smaller and potentially unaligned statements by separate PdM technology programs.

Features to Look for in CMMS and PdM Packages

Once the method of data transfer is established, the decision of which CMMS and PdM packages to use is largely determined by the features offered by each package, and how these features interact to form the most useful and seamless system.

- The ability to set up alarms in a PdM program that automatically generate work orders based on pre-defined tasks in the CMMS is paramount to the successful function of an integrated CMM/PdM system. Alarms should be displayed on screen or stored on disk, and the user should be able to view records on logged alarms, acknowledged alarms, unacknowledged alarms, recorded/unrecorded meter readings, and statistical predictive maintenance (SPM) readings that are used to track performancetrends. Alarms might be set up as pop-up warnings that provide critical information about possible impending trouble instantly.
- The PdM system should transfer necessary information to the CMMS by priority, but with some way of tagging the level of urgency attached to alarms that indicate critical problems. Similarly, the PdM package should only send one alarm for a given diagnosis, rather than repeated alarms for ensuing measurements that also fall outside of the acceptable range. The PdM software should transferinformation based on the severity of the diagnosis and the critical priority of the equipment. If a vital piece of equipment has a problem, the CMMS should be informed immediately; if a non-critical piece of equipment suffers a break-down, the message probably should not be sent to the CMMS.
- At user-defined intervals, a PdM system should be able to take meter readings that are transferred to the CMMS and stored there in order to generate PM work orders in cases where preventive maintenance is preferable to predictive maintenance.
- It is also important that the CMMS features a comprehensive SPM module that allows careful analysis of performance trends through reports, graphs, and charts. The CMMS should log all undefined meter readings, performance parameter readings, and alarms onto a log table. There should also be a display of the total number of SPM, meter and alarm records -- possibly on a status bar. Unacknowledged alarms in each category should appear at the top of any form in the CMMS for easy identification and immediate action.
- The PdM system should be able to predict potential equipment failure. The PdM system should also include an advanced automatic diagnostic system that is based on logic and empirically derived from human analyst experience. When an imminent failure diagnosis is made, the information should be transferred to the CMMS, which can then schedule appropriate PdM action. The CMMS or the PdM package should be able to screen duplicate alarms, replacing an alarm with a long time-to-failure diagnosis with any new alarm that predicts a failure to occur sooner.
- Of course, once predictive maintenance work is scheduled and completed, with the results sent to work order history, the CMMS should feature enough reporting and graphing functions to allow the maintenance professional the opportunity to analyze past history in order to isolate particularly troublesome areas that need to be watched closely or treated differently in the future.

Tomorrow's Integration

Consumers of PdM and CMMS products have been applying increasing pressure on system vendors to establish a common data exchange framework. This pressure spawned the birth of MIMOSA, the Machinery Information Open Systems Alliance. MIMOSA has been organized for more than a year and has made remarkable advances in the area of open information exchange. Recently, PdM vibration data was successfully exchanged between four leaders in the PdM development industry.
At this time, only the conceptual model of linking PdM and CMMS data has been established. To date, the Common Information Exchange Schema (CRIS) has been designed and MIMOSA has concentrated efforts on defining the information model and extending MIMOSA data tables

toinclude information that should be communicated to a CMMS. Members of MIMOSA recognize the necessity to move forward quickly to a programmatic exchange. Because of this, MIMOSA is likely to be a key part of maintenance technology in the future. For now, rest assured that CMMS/PdM integration is within reach of the vast majority of maintenance operations. The technology is becoming more reliable and financially approachable every day. This is the next frontier in world class maintenance.
