



# PLANT ENGINEERING & MAINTENANCE

## Chair's Message—JAY GERMAIN

It's Spring 2006, so it must be time for the Plant Engineering & Maintenance Division Newsletter. Let me begin by wishing everyone a healthy and prosperous 2006. During the past year, your executive and technical committees, supported by some great folks at ASME headquarters, have been putting a lot of time and effort into growing and reformulating PEMD into an active, self-sustaining division that provides value to its membership.

During the past year, the division has participated in National Manufacturer's Week in Chicago, the ASME Power Conference in Atlanta and IMECE in Orlando and we plan to continue to participate in each of these conferences in the future. Additionally, we have revised the division's By-Laws and updated the division web site (<http://divisions.asme.org/pemd/>). We also spent a lot of time surveying the division membership and analyzing responses.

The response to our membership surveys identified two general areas in which the division can provide value to the membership. One of

these areas is COMMUNICATION. Members would like to communicate with other members regarding topics of mutual interest as well as learn what resources ASME has to offer to help them deal with their responsibilities. In response to this need, the division executive committee has established a communications subcommittee which will be responsible for all division communication activities including keeping the web site updated and establishing a PEMD Community of Practice (CoP) on the ASME web site that will allow members to post questions and responses to the membership.

The other general area of need expressed in the survey responses is what I will call REGIONALITY. Members would like to see division activities taking place closer to their locations. It's hard to justify the time and expense to attend a conference that's halfway across the country. To address this need, the executive and technical committees will be investigating establishing relationships with a) other technical organizations with similar interests (e.g. the Society of Maintenance and Reliability Professionals) and b) trade show exhibitors that focus on short, regional exhibitions.

Typically in these messages the writer points out how large a division we are. Unfortunately, size means nothing without involvement. We need your involvement. We need a

wannabe web master to work with the Communications subcommittee to keep the web site and Community of Practice updated. We need PEMD members who are active in regional Sections to help us establish Plant Engineering and Maintenance sub-Sections. We need Technical Committee members. Contact anyone on the Executive Committee or the Technical Committee chairs.

Get the most out of your ASME membership. Get INVOLVED. ●

## Help Needed

The PEMD Executive Board is seeking an individual who would like become a member of our Communications Committee by acting as our web-site facilitator. If you have an interest in this activity, please contact Wally Walejeski (Division Vice-Chair) at [w.walejeski@att.net](mailto:w.walejeski@att.net).

Also, we are seeking individuals who may want to become a member of the PEMD Executive Committee. Board positions as well as Technical Committee Chair positions sometimes become open and we are eager to have new persons become an active participant. Please consider becoming involved and taking on a PEMD leadership role. ●

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# Best Practices in Reliability and Maintenance Work Management Processes

—ERIC HUSTON, SKF RELIABILITY SYSTEMS

## Abstract

A key aspect of any world-class asset management program is a proactive, efficient work management process. A work management process is designed to ensure effective and efficient maintenance is performed on physical plant assets. Maintenance is considered as time-based and condition-based activities to restore, or know when to restore an asset. It should also take advantage of work performed by all facility departments / disciplines, such as operations, maintenance (including electrical, mechanical and instrumentation and controls) and engineering.

## Introduction

A key aspect of any world-class asset management program is a proactive, efficient work management process, designed to ensure the effective performance of maintenance on critical assets. Maintenance is considered as time-based and condition-based activities to restore, or know when to restore an asset. It should also take advantage of work performed by all facility departments / disciplines, such as operations, maintenance (including electrical, mechanical and instrumentation and controls) and engineering. To achieve maximum return on investment and maintain the greatest degree of productivity, it is pivotal that organizations have a process that effectively translates asset information to knowledge, and ultimately gain value from that knowledge.

## Four Key Elements

A best-practice work management process encompasses four key elements: strategy, identification, control and execution. Within each of these elements, the coordination and participation of three essential factors within the organization - process, culture, and technology - is paramount to the overall success of the reliability and maintenance function.

1. Maintenance strategy involves the evaluation of work activities in relationship to a facility's business objectives, a

procedure that creates the documented basis for the maintenance program.

2. Work identification is where "work" is identified from the evaluation of a comprehensive flow of data in conjunction with an integrated decision-making process. Key to the success of identification is a comprehensive CMMS (Computerized Maintenance Management System).

3. Work control involves establishing procedures for planning and scheduling the work identified by the CMMS. Tasks are organized based on several parameters, including time and condition; job plans or procedures; man-hours required; data feedback; special requirements and many other factors.

4. Work execution is where identified, planned and scheduled work is performed. Once work is completed, feedback from the field plays a key role in measuring the overall effectiveness of the work management process and making refinements for even greater efficiency in the future.

One element on its own cannot achieve success. For example, in the identification element, a facility can have state-of-the-art data collection technology; however,

if the people and organization are not aligned to make maximum use of the data and information, or if they do not follow a formal process (procedure), the chances of failure greatly increase. Thus, when discussing each element of a work management process, it is crucial for one to always consider and include the three fundamentals of people, process and technology for success.

## Maintenance Strategy

The maintenance strategy element is designed to align work activities performed (daily and outage) with the facility's business objectives. This alignment can be initiated for new and existing facilities. There are several proven methods / tools to consistently derive the proper mix of activities. These include Risk-Based Maintenance (RBM), Streamlined Reliability-Centered Maintenance (SRCM), and Reliability-Centered Maintenance (RCM). They use the business objectives of the facility for defining potential equipment failures that are critical to plant objectives concerning production, quality, environmental and personnel safety. The results are

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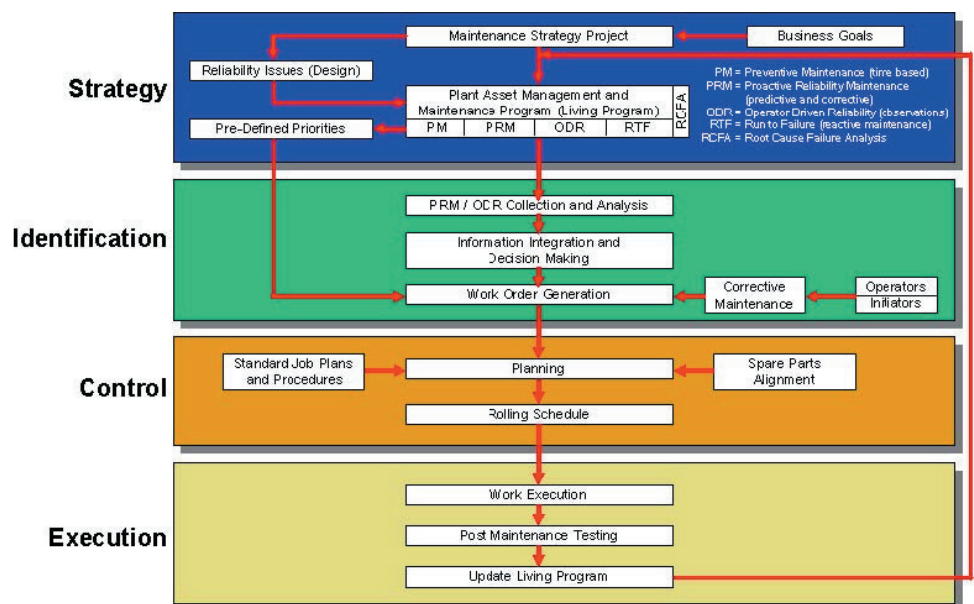


Figure 1. A best-practice work management process and its key elements. (courtesy of SKF Reliability Systems)

## Best Practices in Reliability

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time-based tasks (clean, inspect, calibrate, lubricate, etc.), predictive (vibration, oil, thermography, etc.) and condition-based tasks (trend differential pressure for filter change out). Performance and functional testing and operator tasks (visual inspections, data collection) are also identified as actions to prevent or mitigate critical failures, or prevent costly failures for less critical equipment. Run-to-failure may be acceptable for those components that do not have critical impact or significant cost.

These methods create the documented basis for the maintenance program. Additionally, certain single point failures are identified that may require design changes to lessen the severity of failure.

The Living Program is essentially a process and procedure for continuous improvement. It takes into account several variables, such as corrective and preventive work order feedback, operational and industry issues, design changes, and Root Cause Failure Analysis (RCFA) of significant failures. Key Performance Indicators (KPI) are established and used to ensure the work management process is achieving business goals. It also allows a quicker means to make strategy adjustments if business objectives change.

### Work Identification

The identification element represents the portion of the work management process where work gets identified. It is the heart of a truly cost-effective process. Both time-based and condition-based tasks are driven from here. The key to success for this element is a comprehensive Computerized Maintenance Management System (CMMS) for work order management of time-based Preventive Maintenance (PM) (set frequency) as well as corrective and proactive work (prompted by condition triggers). It is vital that the conditional / proactive parts of this process work effectively. This requires that a culture, a process and tools are in place to support the organization when making informed decisions from condition (e.g. vibration, oil, thermography, pressure, flow, temperature, etc.). An organization must be able to collect the right data as defined by the strategy effort, and interpret the data to

convert it into information. All available information on an asset should be integrated to make an informed decision and take appropriate corrective action.

Data collectors, on-line vibration analyzers and other equipment are used. For a facility to manage this information as a process, it is essential that all data on an asset is reviewed collectively prior to making a decision. For example, a facility does not want to make a decision to rebuild the bearing of a pump one week, and then discover three weeks later that the impeller is worn and requires change out. On the other hand, a facility does not want to rebuild the pump entirely just because they are working on the bearings when other parts still have significant remaining life. It can be difficult to pull together information regarding real-time process data, historical data, vibration, oil, performance, operator observation, testing, etc., to support an integrated decision-making process. Modern decision support tools facilitate the efficient organization and presentation of this data. Equally important is their ability to assist decision-making by using user-defined rules for interpreting data and correlating it with other data. These tools elevate the level of readily available expertise and history retention of data. In today's environment, it is quite challenging to obtain and retain the proper level of expertise at each facility in condition-based maintenance.

Since operators are an integral part of asset optimization, the maintenance strategy considers them as the 'first line of defense' through visual inspection, operation of equipment and data collection. It is essential in today's environment to obtain the insights efficiently and effectively. This requires these insights to be electronic to facilitate their use. Paper routes are no longer acceptable.

### Work Control

A proper planning and scheduling process needs to be in place in order to manage the strategy and work identified through a CMMS prompted by time or condition. All time-based tasks should be pre-planned and ready for scheduling. This pre-planning includes defining what needs to be done through job plans or procedures, parts binning (ready to go from warehouse), man-hours required, data feedback and special requirements. For condition-based

work, typical for most critical rotating assets, a rolling schedule is needed. A rolling schedule (usually 4 – 6 weeks) is a schedule of all daily work that requires scope and good definition in advance. This allows a facility to organize resources, plan for parts, deal with special requirements, and incorporate unexpected work without compromising other critical work, and make decisions based on equipment importance via predefined priorities from the strategy effort. Outage work is also organized and managed well in advance of the outage.

This type of planning and scheduling process requires a procedure, scheduling tool, and a culture that manages scope and scope creep. Knowing a schedule in advance allows well-informed decisions on emergent work and what work can be rescheduled. This program puts critical PM work ahead of non-critical corrective work. This is not to say non-critical work does not ever get done. It just means critical work (both PM and CM) is done first.

### Work Execution

This final element of the work management process is where identified, planned and scheduled work is performed. This requires skilled craft personnel to conduct and execute the work correctly.

Work orders generated with all material, references, etc. are completed in the field. Once work is completed, verification that work has restored, or not impacted the asset functionality is confirmed from an appropriate Post-Maintenance Testing (PMT) activity. For example, tightening the packing on a valve requires the valve to be stroked before returning it to operations. A more extensive PMT example is a pump rebuild that requires a performance test and re-base lining of vibration and other parameters.

A key aspect of execution is to obtain the proper feedback from the field on work performed. For unplanned, corrective work this means: what was found, what was done, parts replaced, cause of failure, man-hours, etc. (at least). This should be reported in a consistent way via the CMMS to facilitate further analysis for the individual asset and the group of similar assets. For planned preventive and/or proactive work, information needs to be reported that details what was done, needed to be done on the frequency it was performed, man-hours,

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parts used, other observations and parameter data that can be used for trending to optimize the frequency and content of the task. This information should be delineated on job plans/procedures.

### Achieving Best Practice Requires Balance

The experience gained in real world conditions in a wide range of industries shows that achieving competitive productivity and increased profitability through asset management depend on a balance of key factors:

- Corporate culture – It is important to have a culture where employees are willing to embrace changes and the need for change. Often the required changes involve the shifting of responsibilities among plant personnel, which means a company must be willing to invest the time and energy to re-train employees and bring them emotionally and intellectually into the culture.
- Technology – Successful companies use technology as a tool to facilitate improvements in products and productivity. In addition, they commit the financial, educational and personnel resources necessary to make the best use of new and emerging technology.
- Processes – to be most effective and to achieve long lasting results, updated and enhanced processes must support technology. In the case of machine asset management, incorporating new technology into the data collection, knowledge management and decision-making processes is critical for success.

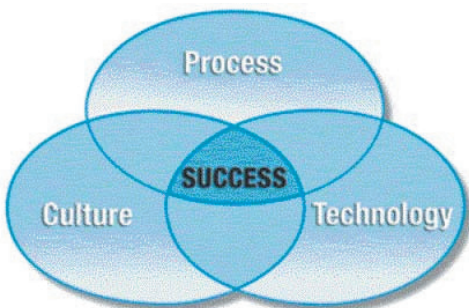


Figure 2. The right processes, technologies and culture are required.

## Integrated Capabilities

Logically, each process connects to or has a relationship to others, so the health of one area affects the overall system in a positive or negative way. Industry surveys have shown that most companies have one or more maintenance programs in place, but it is actually a rare situation where they are integrated into the overall plant activity and thought of as a strategic component of the enterprise. Viewing reliability maintenance from the asset management standpoint means that all improvements are important, and can be made at any and all levels of the plant.

### References

[1] Barratt, Mel  
*Investing in Reliability*. MB03001,  
<http://www.apitudexchange.com>

For additional information on best practices in asset management, benchmarking,

KPI, RCM, SRCM, RBM, RCA, PdM, CMMS, etc., please visit [www.apitudexchange.com](http://www.apitudexchange.com).

### List of Abbreviations

CMMS	- Computerized Maintenance Management System
CBM	- Condition Based Maintenance
DCS	- Distributed Control Systems
KPI	- Key Performance Indicator
MRA	- Machine Reliability Assessment
MSR	- Maintenance Strategy Review
ODR	- Operator Driven Reliability
PdM	- Predictive Maintenance
PM	- Preventive Maintenance
PMT	- Post Maintenance Testing
PRM	- Proactive Reliability Maintenance
RCFA	- Root Cause Failure Analysis
RBM	- Risk Based Maintenance
RCM	- Reliability Centered Maintenance
RTF	- Run To Failure ●

# PEMD Opportunities

The Plant Engineering & Maintenance Division (PEMD) of ASME has been a supporter of and participant in a number of conferences over the past several years. We typically support certain conferences but we also seek out other opportunities. Our support of these conferences provides opportunities for our membership to be presenters, panel participants, or simply to network with other industry persons.

We are regularly involved in developing plans for support of these various conferences. If you would like to participate in some way by possibly chairing a track or session, providing a presentation, authoring a paper, or participating in an industry discussion panel, PEMD would be glad to support and promote your involvement.

Below are the upcoming conferences PEMD is involved in.

**National Manufacturing Week (NMW)**  
March 21-23, 2006; Chicago, IL

### Electric Power Conference & Exhibition

May 2-4, 2006; Atlanta, GA  
(changed from New Orleans)

### ASME International Mechanical Engineering Conference and Exposition (IMECE)

November 6-9, 2006; Chicago, IL

### National Manufacturing Week (NMW)

March 12-15, 2007

### Electric Power Conference & Exhibition

May 1-3, 2007

PEMD may also participate in other ASME sponsored as well as other specific industry conferences, so please watch for announcements in our e-mailings and on the ASME web site.

Please consider and, more so, plan on participating in our involvements at what ever role you feel comfortable with. We look forward to and would appreciate hearing you.

Thank you in advance for your participation. ●

## Livelihoods to Division Bylaws and Business Plan

<http://divisions.asme.org/pemd/divisionadmin/pemdbylaws.pdf>

<http://divisions.asme.org/pemd/divisionadmin/businessplan.pdf>

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