White Paper

PM OPTIMIZATION
6X FASTER THAN RCM

Asset strategy methodology to generate a maintenance plan for all your assets

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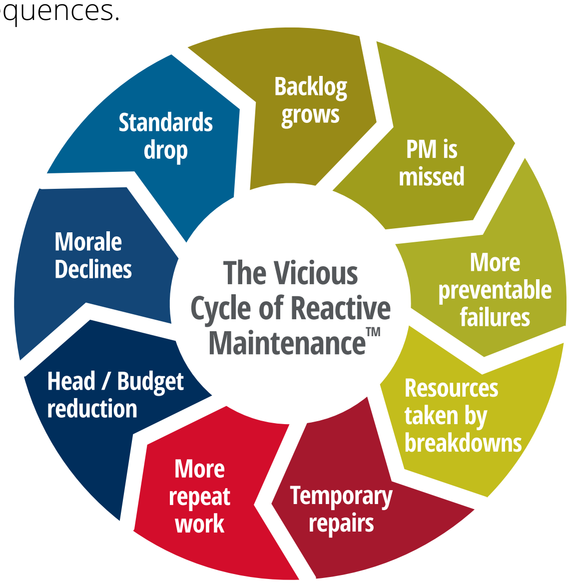
INTRODUCTION

Maintenance is often the largest controllable operating cost in asset intensive industries. It is also a critical business function that has direct impact on plant output, product quality, production cost, safety, and environmental performance. For these reasons, maintenance is regarded, in best practice organizations, not simply as a cost to be avoided but, together with reliability engineering, as a high leverage business function. It is considered a valuable business partner contributing to asset capability and continuous improvement in profitability.

THE REACTIVE MAINTENANCE SPIRAL

Many maintenance organizations face an excessive level of reactive or breakdown maintenance. This is expensive in terms of both maintenance cost and downtime consequences.

Excessive reactive maintenance also contributes to a negative performance spiral that counters other valuable improvement initiatives and in the worst case, leads to an almost entirely reactive environment. This can be explained quite simply.



When breakdowns occur unexpectedly, resources are deployed to reactive work at the expense of Preventive Maintenance (PM). PM is missed due to scarce resources being consumed by breakdowns. As PM is missed, more preventable failures occur adding to (or increasing) the level of reactive maintenance. In many cases, the situation is compounded by band-aid maintenance and morale is adversely affected by long working hours under high pressure and continual firefighting.

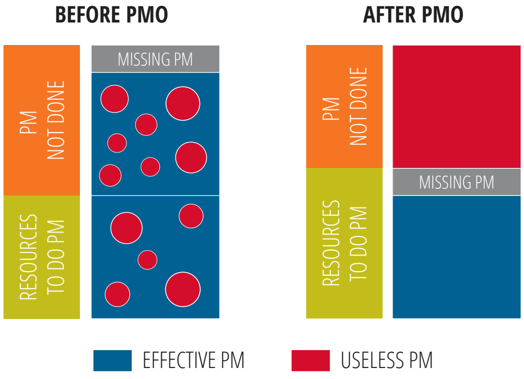
REVERSING THE REACTIVE MAINTENANCE SPIRAL

The Options

A challenge for many companies is to move out of a reactive maintenance cycle. Intuitively, the answer lies mostly in the ability of an organization to obtain more labor resources or gain better access to the assets for maintenance. Most commonly, the option of increasing labor resources is not available and asset maintenance periods are constrained by factors external to the maintenance department. The only option therefore is to increase the productivity or effectiveness of existing personnel and make better use of the time allocated to maintenance.

The truism that, "*By changing nothing, nothing changes." - Tony Robins,* has never had a greater meaning than in organizations caught in a reactive maintenance spiral.

The Solution



In 1996, Strategic Industry Research Foundation (SIRF)[1] responded to industry concerns that while RCM was a useful analysis tool, it did not suit the needs of organizations that had existing maintenance programs and could not afford to start all over again. Capital intensive industries recognized that the fundamental problem with RCM was that it is a tool designed for use in the design phase of the asset lifecycle, but not once the asset has been in use. Consequently, it contains steps that add little or no value to the objectives of the analysis. Conversely, PM Optimization (PMO) is a tool specifically designed to review the maintenance requirements, failure history, and technical documentation for assets that are in use or are in design where the components of the assets are common or have a OEM recommended maintenance strategy. PMO had been applied in the North American Nuclear Industry when it had faced goals of increased asset performance, increased environmental and safety targets, and reduced maintenance costs. As a result, PMO received credit from the North American Nuclear Power industry regulator as a "major strength" based on the work completed in a number of plants.

PMO2000® was developed as an alternate approach applicable to many industries looking to improve their asset strategies. Almost without exception, the companies involved in applying the methodology found the following weaknesses in their maintenance strategies:

- Many PM tasks duplicated other tasks
- Some PM tasks were done too often
- Some PM tasks were done too late
- Some PM tasks serve no purpose
- Many tasks were intrusive and overhaul based; whereas being far more effective, less costly, and in harmony with production needs if condition-based
- Some condition-based inspections were overly intrusive and sufficient failure data was available to set a safe life and eliminate the frequent shutdowns for inspection
- Some condition-based tasks could be far more effective and efficient if modern diagnostic tools were used

In almost every environment, a significant amount of misdirected maintenance labor was found. In some, it was found that no more than 13% of the PM was properly focused. This low level of PM effectiveness contributed massively to poor maintenance labor productivity and low availability of the plant.

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[1] *In June 2000, State Government funding was removed from SIRF.*

In addition, most organizations were surprised to find that a significant part of their maintenance strategies were done informally or outside of a controlled system and therefore difficult to plan and organize.

PMO programs have been implemented and continue delivering benefits to hundreds of companies around the world in manufacturing, mining, mineral processing, utilities, and oil and gas.

THE COMPLETE GUIDE TO PMO2000®

Overview

The PMO2000® process has nine steps. These steps are listed below and discussed in the following pages.

Step 1	Task Compilation
Step 2	Failure Mode Analysis
Step 3	Rationalization and FMA Review
Step 4	Functional Analysis (Optional)
Step 5	Consequence Evaluation
Step 6	Maintenance Policy Determination
Step 7	Grouping and Review
Step 8	Approval and Implementation
Step 9	Living Program

Step 1- Task Compilation

PMO starts by collecting or documenting the existing maintenance program (formal or informal) and loading it into a database via spreadsheet. It is important to realize that maintenance is performed by a wide cross section of people including operators. It is also important to realize that in many organizations, most of the PM program is done by the initiative of the craftsmen or operators and not documented formally. In this situation, task compilation is a simple matter of writing down what the people are doing. It is common for organizations to have an informal PM system in operation, while it is rare for an organization to have no PM at all (Figure 1).

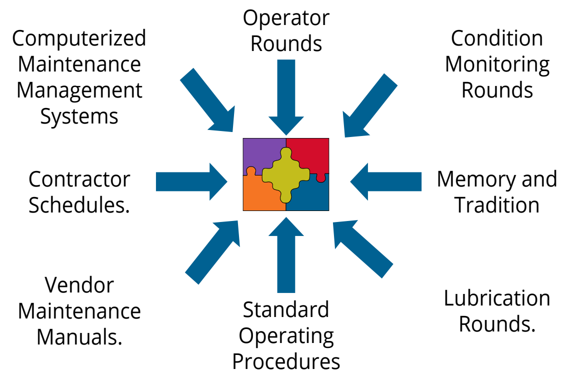


Figure 1 - Sources of Preventive Maintenance

Step 2 - Failure Mode Analysis

Step 2 involves people from the shop floor working in cross-functional teams identifying what failure mode(s) each maintenance task (or inspection) is meant to address (Figure 2).

Task	Interval	Trade	Failure Mode
Task 1	Daily	Operator	Failure A
Task 2	Daily	Operator	Failure B
Task 3	6 Months	Fitter	Failure C
Task 4	6 Months	Fitter	Failure A
Task 5	Annual	Electrician	Failure B
Task 6	Weekly	Operator	Failure C

Figure 2 - Illustration of Step 2

Step 3 - Rationalization and Failure Mode Review

Through grouping the data by failure mode, task duplication can easily be identified. Task duplication occurs when the same failure mode is managed by PM conducted by more than one section and is most commonly found between operators and crafts, and crafts and condition monitoring specialists. In this step, the team reviews the failure modes generated through the Failure Mode Analysis and adds missing failures to the list. The list of missing failures is generated through an analysis of failure history, technical documentation (usually Piping and Instrumentation Diagrams (P&IDs)), or the experience of the team (Figure 3 - Note the addition of a new failure cause "D" that has been identified during this step.).

Task	Trade	Cause
Task 1	Operator	Failure A
Task 4	Fitter	Failure A
Task 7	Greaser	Failure A
Task 2	Operator	Failure B
Task 5	Electrician	Failure B
Task 3	Fitter	Failure C
Task 6	Operator	Failure C
		Failure D

Figure 3 - Illustration of Step 3

Step 4 - Functional Analysis

The functions lost due to each failure mode can be established in this step. This task is optional and may be justified for analysis on highly critical or very complex equipment items where a sound understanding of all the equipment functions is an essential part of ensuring a comprehensive maintenance program. For less critical items, or simple systems, identifying all the functions of an equipment item adds cost and time, but yields no benefits (Figure 4).

Task	Trade	Cause	Function
Task 1	Operator	Failure A	Function 1
Task 4	Fitter	Failure A	
Task 7	Greaser	Failure A	
Task 2	Operator	Failure B	Function 1
Task 5	Electrician	Failure B	
Task 3	Fitter	Failure C	Function 2
Task 6	Operator	Failure C	
		Failure D	Function 1

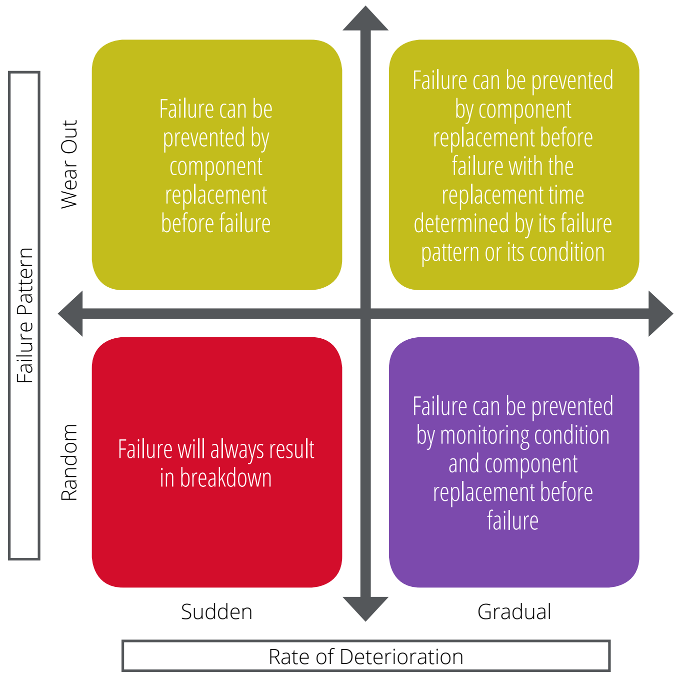
Figure 4 - Illustration of Step 4

Step 5 - Consequence Evaluation

In Step 5, each failure mode is analyzed to determine whether the failure is hidden or evident. For evident failures, a further determination of hazard or operational consequence is made (Figure 5).

Task	Trade	Cause	Function	Effect
Task 1	Operator	Failure A	Function 1	Operation
Task 4	Fitter	Failure A		
Task 7	Greaser	Failure A		
Task 2	Operator	Failure B	Function 1	Operation
Task 5	Electrician	Failure B		
Task 3	Fitter	Failure C	Function 2	Hidden
Task 6	Operator	Failure C		
		Failure D	Function 1	Operation

Figure 5 - Illustration of Step 5



Step 6 - Maintenance Policy Determination

Modern maintenance philosophy stems from the premise that successful maintenance programs have more to do with the consequence of failures than the asset itself.

In this step, each failure mode is analyzed using Reliability Centered Maintenance (RCM) principles to establish new or revised maintenance policies. As a result, the following become evident:

- Elements of the current maintenance program that are cost effective, and those that are not (need to be eliminated).
- Tasks that would be more effective and less costly if they were condition-based rather than overhaul-based.
- Tasks that serve no purpose and need to be removed from the program.

Cause	Function	Effect	Policy	Interval
Failure A	Function 1	Operation	Inspect	Daily
Failure B	Function 1	Operation	No PM	
Failure C	Function 2	Hidden	Test	Annually
Failure D	Function 1	Operation	Inspect	Weekly

Figure 6 - Illustration of Step 6

- Tasks that would be more effective if they were done at different frequencies.
- Failures that would be better managed by using simpler or more advanced technology.
- Data that should be collected to predict equipment life more accurately.
- Defects that should be eliminated by root cause analysis.

Step 7 - Grouping and Review

Once task analysis has been completed, the team establishes the most efficient and effective method for managing the maintenance of the asset given local production factors and other constraints. In this step, it is likely that tasks will be transferred between crafts and operations for efficiency and productivity gains.

Step 8 - Approval and Implementation

In Step 8, the analysis is communicated to local stakeholders for review and comment. The group often does this via a presentation and an automated report generated from the PMO software. This software details all the changes and the justification for each asset strategy recommendation.

Following approval, the most important aspect of PMO2000® then commences with implementation. Implementation is the step that is most time consuming and most likely to face difficulties. Strong leadership and attention to detail are required to be successful. The difficulty of this step increases significantly with more shifts and also with organizations that have not experienced much change.

Step 9 - Living Program

Through Steps 1 to 8, the PMO process has established a framework of rational and cost effective PM. In this step, the PM program is consolidated and the plant is brought under control. This occurs as reactive maintenance is replaced by planned maintenance. From this point, improvement can be easily accelerated as resources are freed to focus on plant design defects or inherent operational limitations.

During this step, several vital processes for the efficient management of assets can be devised or fine-tuned as the rate of improvement accelerates.

These processes include the following:

- Production / maintenance strategy
- Performance measurement
- Failure history reporting and defect elimination
- Planning and scheduling
- Spares assessing
- Workshop and maintenance practices

The intention is to create an organization that constantly seeks to improve its methods by continued appraisal of every task it undertakes and every unplanned failure that occurs. To achieve this requires a program where the workforce is adequately trained in analysis techniques and is encouraged to change practices to improve their own job satisfaction and to reduce the unit cost of production.

DECIDING WHEN TO USE RCM AND WHEN TO USE PMO

There is no doubt that conventional and statistical approaches to RCM have assisted the industry to gain better control of their assets and manage them more intelligently. However, it has long been considered that both methods have weaknesses and have not lived up to expectations.

Review of the RCM Approach

According to the SAE JA1011 standard, any RCM program should ensure that all of the following seven questions are answered satisfactorily and are answered in the sequence shown below:

1. What are the functions and associated desired standards of performance of the asset in its present operating context (functions)?
2. In what ways can it fail to fulfill its functions (functional failures)?
3. What causes each functional failure (failure modes)?
4. What happens when each failure occurs (failure effects)?
5. In what way does each failure matter (failure consequences)?
6. What should be done to predict or prevent each failure (proactive tasks and task intervals)?
7. What should be done if a suitable proactive task cannot be found (default actions)?

Functional Differences

RCM and PMO are both methods used to define the complete maintenance requirements of physical assets.

Nowlan and Heap (1978)[†] coined the term Reliability Centered Maintenance (RCM) as a process to be used to draw up maintenance programs for new types of aircraft ***before*** they entered service (Moubray, 1997)[††]. Thus it was a zero-based tool developed for use in the design phase of an asset's lifecycle.

In the absence of better methods, since Nowlan and Heap, RCM has been applied retrospectively to plants well into their lifecycle. In over 20 years since its derivation, RCM has failed to become a day-to-day activity performed by most organizations. Few organizations have applied RCM to anything other than their most critical assets, suggesting that there needs to be alternate paths to the creation of maintenance policies rather than starting from scratch.

In response to this need, PMO was developed as a process of review for assets that have an established maintenance program (formal or informal) where that maintenance program was inefficient or misaligned with business needs.

Methodology Differences

The central difference between RCM and PMO is the way in which failure modes are generated.

- RCM seeks to analyze every failure mode on every piece of equipment within the system being analyzed.
- PMO generates a list of failure modes from the current maintenance program, an assessment of known failures, and by hazard analysis of technical documentation - primarily P&IDs.

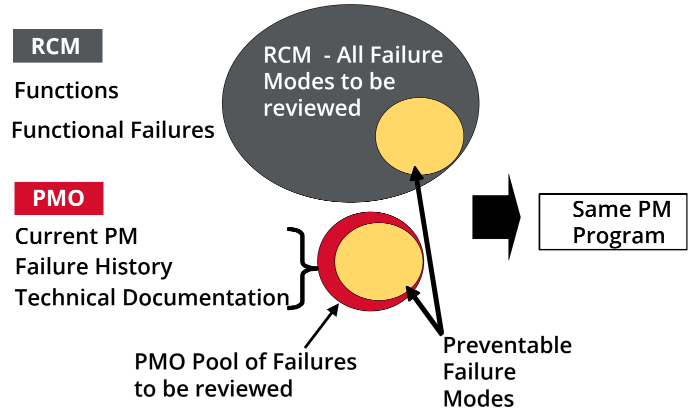


Figure 7 - Illustration of how RCM and PMO produce the same result.

The differences in the two approaches mean that PMO deals with significantly less failure modes than RCM and arrives at the failure modes in a far quicker timeframe. PMO selective coverage means the maintenance program that results will be the same regardless of whether PMO or RCM is used (Figure 7). Other differences are discussed in the following paragraphs.

1. Failure Mode Analysis

The focus of good equipment design is to ensure high levels of reliability, maintainability, and operability over the equipment lifecycle. At the design stage, this means attempting to eliminate all high likelihood and high consequence failures.

It is therefore, not surprising that when reviewing the complete set of likely failure modes using RCM analysis, by far the greatest number of outcomes, or recommendations, are "No Scheduled Maintenance." This is to say that for the failure modes left in the design, either:

- Their likelihood is very low therefore the cost of a preventive or predictive task is likely to be more than the cost of failure
- There is no technically feasible predictive or preventive maintenance task known to manage them

Based on experience, rigorous RCM analysis of equipment, in accordance with the standard shows that, on average, about 80% of failure modes result with the policy of "No Scheduled Maintenance."

This number increases with electronic equipment, such as a PLC, and falls with equipment that has a high number of moving parts, such as a conveyor.

2. Rolling up of Failure Mode Analysis where Logical

RCM treats each failure mode independently. This results in the same analysis being documented many times, but resulting in only one task being recommended for all the failure modes listed. Using RCM, this is unavoidable no matter how experienced the analysis team may be.

PMO2000® starts from the maintenance task and therefore many failure modes can be listed against the one task. This significantly reduces the analysis time by reducing the number of records that need to be analyzed. The concept can be best described by reference to Tables 1 and 2.

Task	Failure mode analyzed (rolled up)
Perform Vibration Analysis on the Gearbox	Gear wears, or cracks. Gear bearing fails due to wear. Gearbox mounting bolts come loose due to vibration. Gearbox coupling fails due to wear.

Table 1 - Illustration of Failure Mode Analysis using PMO

Function	Functional Failure	Failure modes
To provide 20 hp of power to the fan such that the fan spins at 200 rpm.	No power	Gear wears.
	No power	Gear cracks due to fatigue.
	No power	Coupling fails due to wear.
	No power	Gearbox bearings fail due to wear.

Table 2 - Illustration of Failure Mode Analysis using RCM

It can be seen from Table 1 that providing vibration analysis was a technically feasible and cost effective task to prevent all these failure modes from occurring unexpectedly as PMO2000® would consider the failure modes as a group.

Conversely from Table 2, RCM can be seen to have created a lengthy analysis process compared with PMO2000®. Accepting that the resulting maintenance program will be the same route to this result covered four times the administration and probably double the analysis time. Furthermore, with decomposed failure modes there is additional administrative effort required to roll them back up and link the four failure modes to the one task.

3. Optional Functional Analysis

RCM begins with a complete functional analysis of the equipment. Whereas with PMO, the effort expended on functional analysis is discretionary. This is primarily because consequence evaluation is performed at Question 5 of PMO2000® (see page 11). As consequence evaluation implicitly involves understanding what loss of function is incurred, additional functional assessment is a duplication of effort[2].

Done properly, functional analysis consumes 30% of the total RCM analysis time and is the lowest value adding activity of the process.

[2] This point is also relevant where functions are hidden, as the loss of hidden functions will result in consequences that are conditional on some other failure occurring.

Flexibility Comparisons

Filtering of failure modes by craft

RCM analysis cannot regulate or filter which failure modes are analyzed at which time. Therefore, RCM analysis requires the presence of all crafts simultaneously. With PMO2000® it is possible to review the activities of a particular craft on a particular piece of equipment or site. This is because PMO2000® begins with maintenance tasks that can be filtered by craft. This is particularly useful when the activities of one craft are ineffective or inefficient and need to be reviewed in isolation from other crafts.

There have been highly successful PMO2000® analyses performed exclusively on either operator rounds, instrumentation rounds, lubrication rounds, vibration analysis rounds, etc. This type of focus is not possible using RCM.

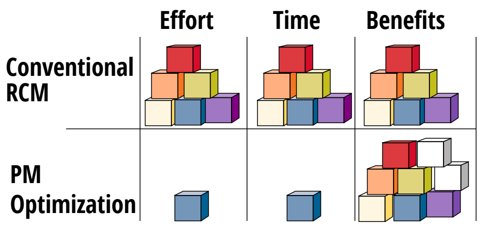
PMO is self-regulating in terms of investment and return

PMO2000® is highly effective where equipment has numerous failure modes, but where the vast majority of these are either random, instantaneous, or not of high consequence. A simple example would be a mobile telephone. Mobile phones have hundreds of functions. To define the functions of a mobile phone would take many hours depending on how rigorous the group was in defining performance standards.

RCM, if done diligently, would require the input of specialist electronics engineers to define the failure modes properly[3]. Conversely, PMO2000® would require only the operators as electronic failure modes would not form part of the pool of failure modes that are currently addressed by PM nor part of the failure history to any great extent. PMO2000® would take no more than 20 minutes to complete the analysis in total and realize that the only maintenance required has to do with managing the consequences of battery deterioration.

Benefits of Speed

Experience in the US Nuclear Power Industry over a large number of analyses, revealed that PMO2000® was on average six times faster than RCM (Johnson, 1995)[†††]. PMO2000® is considered to be a much faster approach than the approach taken by Johnson.



PMO is six times faster than Conventional RCM for existing plant.

The positive effect of deploying a process of maintenance analysis that is six times faster than RCM for the same given outcome cannot be overstated. The benefits include, but are not limited to:

- Resources to perform analysis are generally the most valuable and scarce on site. The less resource intensive the program (for the same results), the less the organization will suffer from the loss of its most valuable people.

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[3]Readers interested in learning more about where these algorithms are flawed can contact the author.

- Efficient analysis allows the organization to be implementation intensive rather than analysis intensive.
- Maintenance analysis is subject to diminishing returns. PMO2000® is cost effective on all items of the plant, whereas it is difficult to justify RCM on any other than critical assets because of the high fixed cost and the inflexibility of the process.
- When the maintenance of failure modes have safety or environmental consequences which are considered suspect, the use of PMO2000® will allow these issues to be dealt with much faster than by using RCM, as they will be eradicated plant wide six times faster.
- First line supervisors who invest in the program get rewarded with labor productivity improvements six times greater. PMO2000® targets a return on analysis time of 5 to 1. That is for every man-hour invested in analysis, five man-hours will be returned to the department every year. At this rate, line supervision is prepared to invest in their resources. At a rate six times less, they often become unlikely to invest in the program.

Weaknesses of Statistically Based Methods

Many organizations that have tried statistical methods found the outputs are frequently poor and misdirected due to the guesswork needed to compensate for a lack of data and other subjective production and accounting inputs. They also tend to ignore the valuable contribution to condition monitoring made by the operators.

Another resulting drawback in the use of statistical packages is the low involvement of shop floor personnel. This leads to omissions in the analysis.

The overall results of an incomplete or misdirected program are problems with implementation with the shop floor personnel failing to embrace the schedules.

By contrast, PMO2000® decision diagram conforms to SAE JA1011, Issue August 1999. This means that analysis is more experiential and empirical than purely statistical methods. PMO2000® therefore relies heavily on the knowledge of the shop floor personnel and their understanding of the data. This creates a high degree of ownership and a direct responsibility to make maintenance work.

In final contrast, many statistical methods use algorithms that are based on flawed assumptions and do not conform to SAE JA1011, even though their name suggests they do[4]. This amplifies the errors caused by poor data and can result in serious levels of reactive maintenance in over expenditure.

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[4] *Readers interested in learning more about where these algorithms are flawed can contact the author.*

KEY FEATURES OF A PMO PROGRAM

PMO Quickly forms the Baseline for Effective Reliability Engineering and Defect Elimination

There are two important points that allow effective reliability engineering and defect elimination. These are discussed below:

1. Bring the plant failures from unexpected events to controlled corrective action

In many organizations, reliability problems are seen mostly as problems with design or production methods. Experience tells us the majority of reliability problems experienced by plants that are overly reactive, is a result of lack of maintenance or care rather than the design. Before expensive redesign is considered, organizations need to ensure that appropriate maintenance is being performed and then decide if the equipment is fit for purpose rather than assuming the maintenance is adequate and the problem must be a design issue. The fundamental strength of a PMO2000® program is that all maintenance tasks add value so it makes good business sense to complete 100% of the program. Through the program, a move reducing breakdown maintenance creates productivity improvements that clear the path to allow this to occur. After a short while, failures caused by lack of maintenance are rare.

2. Have a system where all the maintenance strategies (including operator rounds, condition monitoring rounds, lube rounds, contractor PM, etc.) are stored in one place and stored in such a way that each strategy or task is linked to a specific or set of failure modes.

In most, if not all Computerized Maintenance Management Systems (CMMS), there is no link between the equipment, its failure modes, and the maintenance strategy. As much of the maintenance strategy is stored outside of the CMMS, the effort required to first assess if an unexpected failure was a result of lack of maintenance is a very time consuming and often a "hit and miss" affair. PMO allows for quick and efficient reference to the equipment failure modes and the current strategy. Moreover in the living program, PMO2000® software allows for an efficient and controlled means of changing the strategy.

PMO is Based on Sound Engineering Principles

PMO utilizes the RCM principles and concepts that have been successfully applied in the airline industry for over 30 years and in other industries for nearly 20 years. These principles have successfully improved operational reliability of civil aviation aircraft by over 10,000% during this time. While PMO2000® utilizes the RCM principles; the implementation approach that is utilized by the airlines and other providers of "classic" RCM consultants has serious practical weaknesses in an industrial environment, as discussed earlier. PMO2000® applies the RCM principles and concepts in a manner that is more highly focused on benefits realization in an industrial environment than conventional RCM approaches.

PMO Recognizes and Resolves Problems with Data Accuracy

While PMO2000® utilizes existing failure history as one input to the PM review; it also recognizes that in most organizations today, the data that is contained in CMMS systems is likely to be inaccurate and incomplete. Frequently, one benefit that arises from using in-house personnel in this way is a significantly increased recognition, among shop floor people, of the need for accurate data recording on Maintenance work orders. When successfully harnessed, this can drive significant cultural change towards increased data accuracy and a focus on "management by the facts."

PMO Makes Effective Use of Scarce Labor Resources

In these days of "lean" organizations, any improvement effort that requires the involvement of in-house labor, whether from the shop floor or support staff, must be sure to use these labor resources in a highly productive and effective manner.

Unlike other approaches, PMO2000® is strongly productivity focused to encourage best utilization of shop floor personnel:

- Have an analyst collect and consolidate existing failure data prior to review by shop floor work teams.
- Focus efforts on those failure modes which are currently causing problems, or which are currently subject to some form of PM. In classic RCM analysis, more than 50% of failure modes that are analyzed result in No Scheduled Maintenance. PMO2000® reduces the time and effort wasted on these failure modes.
- Take a more targeted approach to the development of equipment function statements than classical RCM and in many cases, eliminate the need for function statement definition at all.

In effect, PMO rationalizes what is being done, and adds to that what needs to be done that wasn't previously in place. In doing this, PMO2000® can be six times faster at analysis than conventional RCM, thus shifting the resource intensity from analysis to implementation.

PMO Improves the Productivity of Operators and Maintenance Personnel

Not only does PMO2000® make more effective use of operators' and maintenance professionals' time during the course of the PMO analysis, it also significantly improves the productivity of operators and maintainers during the course of their daily duties. It achieves this in two ways.

1. PMO2000® successfully identifies areas where there is overlap between operators', maintenance personnel' and contractors' duties, and effectively resolves any duplication or communication issues involved. For example:
    - Vibration Analysis Contractors may be used to monitor bearing vibration on certain pumps on-site
    - Operators may be required to monitor these same bearings for

audible noise during the course of their daily rounds

- Craftsmen may be expected to replace these bearings on a routine basis during scheduled pump overhauls

In this case, PMO2000® would rationalize this situation by resolving the conflicting maintenance strategies in place for the bearings (condition-based vs scheduled replacement), and resolving the duplicate inspections being performed by both contractors and operators. In most organizations where PM programs have grown in an informal manner in response to specific situations and events, our experience has shown there is significant duplication of this type.

2. PMO2000® ensures that the person with the appropriate skills to perform a specific task is the one that is allocated to that task.

   In most organizations, skilled craftsmen are being utilized to perform routine visual inspections that require no specialist craft skills. On the other hand, operators are already working in the area, and have the necessary skills, and time, to perform these inspections. In the team-oriented forum of the PMO review meetings, it is frequently found that operators volunteer to take on these additional duties, and craftsmen are happy for the operators to perform them. This releases craftsmen's time to perform work that better utilizes their specialist skills, and which they find more interesting. The result is a general up-skilling of the craft's workforce, with a focus on performing higher quality, precision maintenance.

PMO Is Adaptable to Suit Specific Client Situations and Objectives

A major feature of the PMO2000® process is the ability of the technique to be applied with various levels of rigor whether the system depending on the criticality assessment. This contrasts with other approaches, which apply the same level of rigor (and time, effort, and expense) to the analysis of all systems, regardless of their criticality and regardless of the size of the benefits to be obtained from the analysis. For highly critical equipment items where a more "classic" RCM approach is required, including identification of all equipment functions, consideration and analysis of all possible failure modes, and where compliance with International Standards for RCM Analyses are required, PMO2000® applies this level of rigor. Even in these situations however, the nature of the PMO2000® process means that these rigorous analyses are still completed more quickly than "classic" RCM processes. For less critical items, where the time and effort involved in a high level of rigor cannot be justified, PMO2000® takes a more streamlined and focused approach. In this way, PMO2000® is highly focused on maximizing the return for effort involved in reviewing routine operations and maintenance tasks.

PMO Motivates Personnel

PMO2000® quickly revitalizes the motivation of the people working within the process of maintenance. In doing so, performing the analysis can result in step improvements in both human resource and plant productivity. The PMO2000® approach also motivates improvements in many other aspects of asset management apart from the maintenance analysis, including:

- Production / maintenance strategy
- Performance measurement
- Failure history recording
- Defect elimination
- Work order management
- Spares management

IMPLEMENTING PMO2000®

A full scale PMO2000® implementation program generally starts with some workshops or briefings introducing key decision-makers to the process. The objective of these sessions is to lay the groundwork for ensuring successful implementation.

Prior to this however, most organizations choose to trial the PMO2000® process on one or more equipment items (production assets) or systems. In this environment, the workshop is strongly facilitator led. Following the trial, the benefits, costs, and implementation issues are assessed and a decision reached on whether, and how, to roll out PMO2000® on a wider scale within the organization. Following a trial, the take up rate has been 100%.

Three implementation options are available, as outlined below.

Option 1 - PMO2000® Consultant provides full time project management, training, and facilitation

This approach is suitable for companies in the following situation:

- Limited internal management resources to drive the program
- Poor asset management systems and documentation
- Large opportunity to improve uptime and this opportunity translates to significant increases in profitability
- Moderate or poor record of implementing new systems and modern management philosophies

Option 2 - PMO2000® Consultant provides part time training, workshop facilitation, and limited project support

This approach is suitable for companies in the following situation:

- Can dedicate one full time resource to the project
- Good standard of asset management systems and procedures
- Isolated areas of opportunity to improve and moderate impact on profitability
- Good record of successfully implementing new systems and modern management philosophies

Option 3 - PMO2000® Consultant provides Training only

This approach is suitable for companies in the following situation:

- Can dedicate a team of specialist craftsmen and engineers to the project full time (this usually applies to sites that have a full time reliability group or section)
- Advanced asset management systems
- Deriving profitability through advanced reliability engineering practices
- “Implementing change” is a way of life

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