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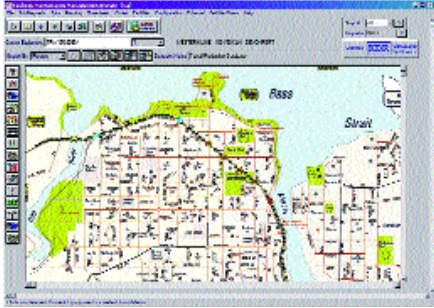
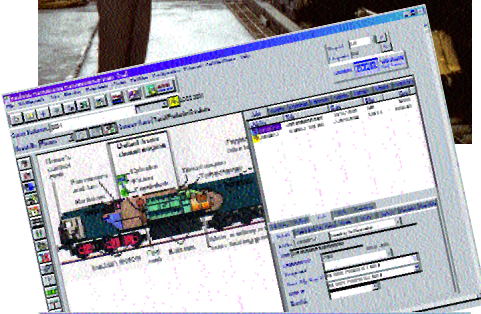
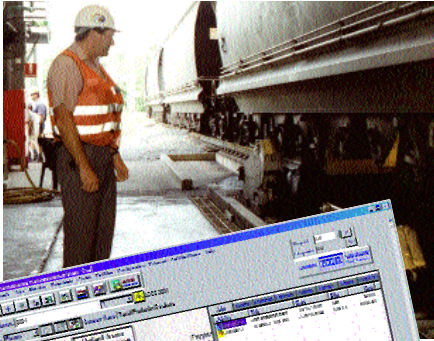
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COVER SHOT

The May 2005 cover shot is provided courtesy of Rockwell Automation. See their news item "The Challenge of Change" that discusses managing and maintenance of industrial automation systems' configuration code.

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**2005 CMMS Survey** A regular May issue feature is the Computerised Maintenance Management Systems (CMMS) survey. For the 2005 survey we have 50 CMMS responses. There has been a marked increase in the number of CMMS that are now Web Enabled or entirely Web Hosted systems. There is a short article on "Web Based CMMS" that discusses this type of CMMS. The other common trend is that virtually all CMMS now offer Mobile Communication via PDA's, etc, and also an increasing number of CMMS offer integration to condition monitoring, process control and SCADA systems.

**Root Cause Analysis - Recognition of Excellence** RCA Rt Software wishes to play a part in recognizing and encouraging defect elimination by conducting a quarterly award; "Root Cause Analysis Recognition of Excellence". Submissions are invited from anyone Worldwide using any RCA process. Each quarter a panel of specialists in the RCA field will assess submissions and award a certificate plus Aus\$1000 to the person or team assessed as submitting the best example in that quarter. Examples will also be offered for publication in the Maintenance Journal to further gain recognition for this important work. See page 27 for more details or visit the RCA Rt website at [www.rcart.com.au](http://www.rcart.com.au)

**Women In Maintenance** This issue includes an article titled "Are Women Welcome". The article suggests that women employed in maintenance are not always made welcome. Certainly there are still very few women working in maintenance. Joel Leonard of Mpack Learning (USA) the author of "The Maintenance Crisis Song" has penned a second song, "Find Me a Maintenance Woman," which asks the boss man to hire a woman. Leonard states that currently women comprise only 5% of the maintenance workforce. Free downloads of "Find Me a Maintenance Woman" and "The Maintenance Crisis Song" can be found at [www.mpacklearning.com/maintenance\\_resources/useful\\_links.asp](http://www.mpacklearning.com/maintenance_resources/useful_links.asp)

**SPECIAL FEATURE**  
in the  
August 2005 issue

### Survey of Condition Monitoring Equipment & Services

If your organisation wishes to be included in the survey, then you may obtain the appropriate survey form by contacting:

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Completed Survey Form must be returned by 20 May 2005

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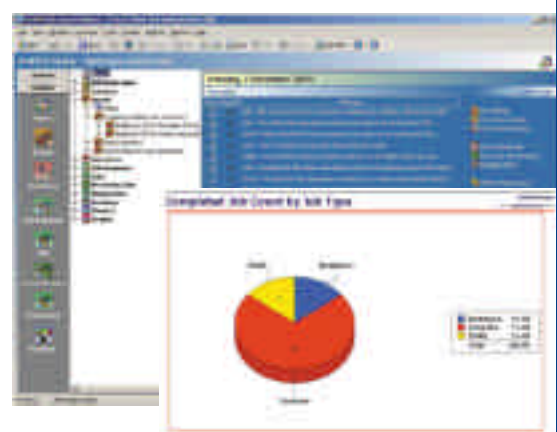


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# Productive Maintenance

**Dave Porrill**

Eli Lilly + Company, Basingstoke Operations, UK

(Previously published in Maintenance & Asset Management Journal)

**W**hile this article is not intended to be the final answer to every Production Manager's dreams, it does hopefully illustrate the benefits that can be achieved, by considering some of the factors that can contribute to overall productivity improvement and deliver sustainable bottom-line results when applied in a practical, balanced and focused way across the organisation.

## The Lilly Basingstoke Approach

*"The only thing that is constant in this world is change."*

### About 1997

Initiated "Project World Class". This started with a benchmark visit to Japan encompassing several Japanese facilities that have implemented TPM effectively. Thereafter, the site set up an off-line team charged with the implementation of TPM across production, starting in Packaging. This was a watershed event for the site, which helped to establish a solid foundation upon which several subsequent productivity improvement activities have been built.

### About 2001

According to plan, the Project World Class off-line team was dissolved and the personnel who had been leading the implementation were reassigned to other roles within the production structures. These people carried an understanding of TPM methodology with them back to the operational areas. This implementation of TPM has forced a level of discipline across production, combined with a greater understanding of the World Class Manufacturing work ethic.

### Today

The foundation created by the TPM implementation has supported a variety of improvement activities across the site over the past 3 to 5 years. Whilst each one may have been launched under a different name, driven in its own particular way or focussed on a specific area of the business, they all reflect the spirit of TPM. The significant realisation emanating from the launch of TPM has been the importance of having people in all operational areas who really understand the equipment and the production processes very well.

Building on past experience, the author believes that the most appropriate way forward concerning any workplace improvement activity is simply to "do it" without necessarily giving it a name. Also, by causing the production personnel to bring about the improvements as part of their normal jobs (guided by an effective facilitator), they will feel a sense of ownership and commitment to the new way of working, especially if they can see the benefits. The improvements could come by increased productivity, reduced waste, or through simplified processes.

One area in which there has been significant improvement over the past 7 years is that of maintenance and equipment reliability. There are several reasons for this success:

- AMIS' Audit conducted annually to assess the state of our maintenance organisation and identify areas for improvement. This helps to "keep us honest".
- Restructured the maintenance teams on site and alignment to support specific areas of production.
- Increased the numbers and technical expertise of Equipment Engineers<sup>2</sup> to support production.
- Thorough engineering planning processes in place.
- Materials management and asset delivery processes formalised.
- Set up metrics to monitor maintenance performance.
- Training programme to improve the maintenance knowledge of engineering personnel.

## Maintenance and Equipment Reliability

Several years ago, there were no specialist Equipment Engineers on site to take care of the equipment reliability issues. The first Equipment Engineers to be appointed were aligned to support one or more products and as such they were required to cover a variety of different equipment types. Because some equipment is used to process more than one product, there was the potential for two engineers to be focussing on the same machine, and not always with a common purpose! This arrangement was clearly unsatisfactory. The Equipment Engineers have now been realigned to support an equipment type rather than a product. In this way they are able to develop deeper specialist knowledge of their equipment rather than being "spread too thinly".



In another more recent development, formalised steps have been introduced to ensure that every significant failure is thoroughly analysed by the Engineers and Craftsmen to identify the root cause/s of failure. The root causes are then incorporated into the RCM-style analysis and the preventive maintenance checklists are updated accordingly with the appropriate tasks. By closing the loops in this way we hope to ensure that the root causes of failure are eliminated thus preventing recurrence of the failure and we remain confident that the preventive tasks added to the checklists have been identified via the same rigorous analytical process that was used for the original analysis. The long-term integrity of the preventive maintenance programme is therefore ensured.

As part of the continuing efforts to improve productivity, Operator recording of all stoppages in certain key work centres has been introduced. Every interruption to the production process is now recorded on a log sheet showing the nature of the stoppage, the start and end time, and what remedial action was taken. These results are recorded daily and used to calculate Machine Availability and Overall Equipment Effectiveness for those work centres. This has been a revolutionary advancement in a department where equipment capacity was always believed to be sufficient and it was assumed every interruption to the process was caused by an equipment breakdown. This fresh revelation has brought about a completely new understanding of workplace effectiveness across all disciplines and has resulted in focused attempts to fix the problems, not fix the blame.

It is furthermore possible to measure the effectiveness of an Equipment Engineer's performance by the improvement in his equipment's Machine Availability. Caution must be exercised however, to ensure that all factors are taken into account and that any improvement in Machine Availability has been brought about by a sustainable long-term solution and not just a series of "quick fixes".

## Implementation Techniques

*"Stop looking at where you have been and start looking to where you are going."*

### 1. Set a clear vision

A successful TPM implementation is always preceded by a clear vision of where the corporation wants to be after a certain time. To convert this vision into reality requires a well-structured strategy and process roadmap. Without a clear definition of where you want to be and the steps to take in order to get there, it will be impossible to achieve that goal.

The strategy must describe not only the steps to take and the sequence of activities, but also the detailed mechanics of how to accomplish each of those milestones. The strategy and roadmap must be comprehensive and succinct - i.e. it must cover everything, but remain simple. Figure 1 below illustrates a very simple example of such a roadmap describing the maintenance environment.

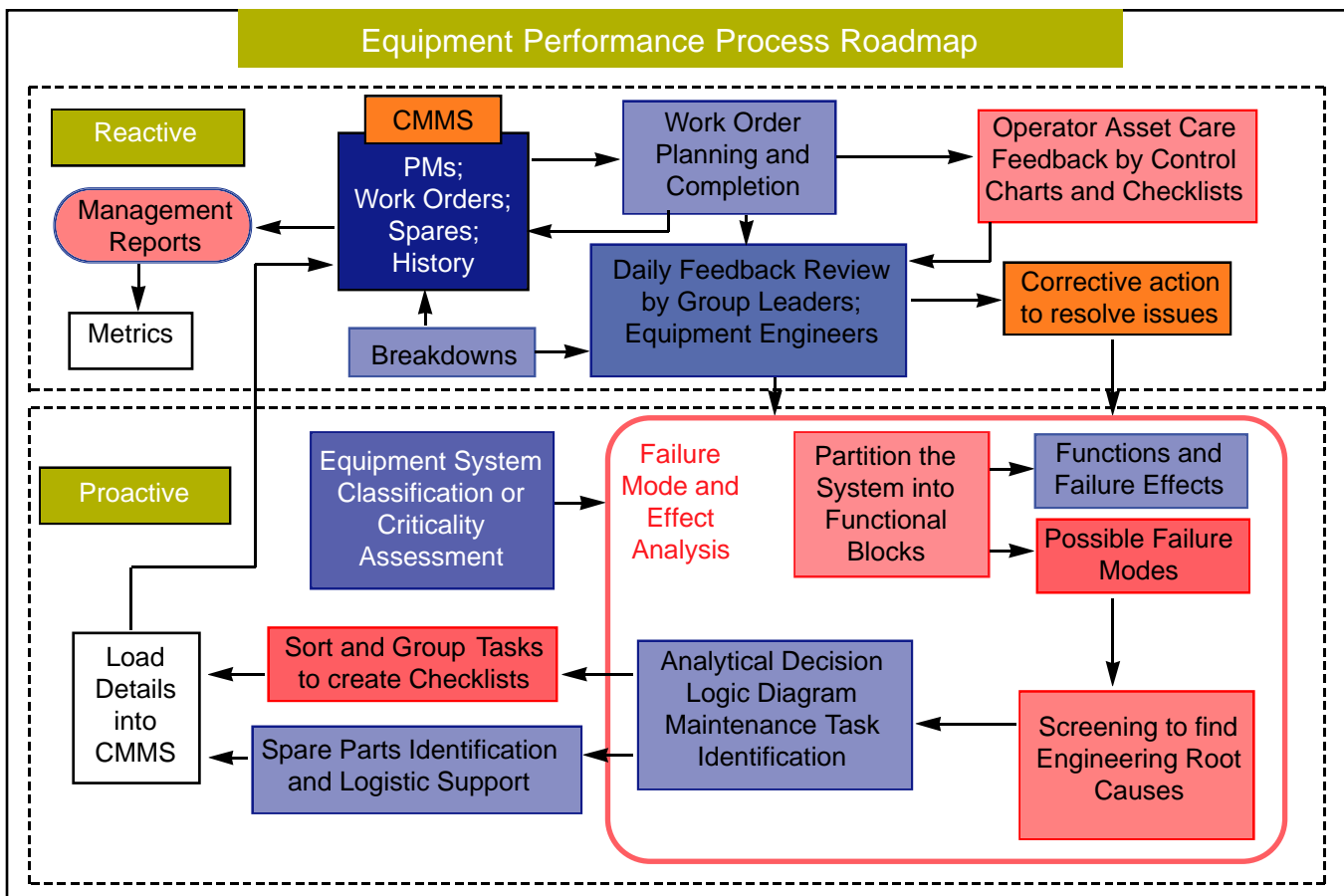


Figure 1: Equipment performance process roadmap

## 2. Multi-disciplinary team structures

By definition, TPM is a multi-disciplinary process, involving participants from all areas of the business and across all functions within the production environment. For a successful implementation, all participants and the functional teams they belong to must be clearly identified. This does not mean that the organisational hierarchy must change so that people have different reporting structures. What it does mean is that the people must all understand the roles they play in co-operation with the other members of their team and they must understand that as a unit they carry shared accountability for the successful operation of the production processes they own.

In a truly integrated approach, the productivity goals and objectives for that work centre should be reflected in the personal performance management goals of each team member. Each individual should therefore receive the same appraisal result for those aspects where they share accountability for delivering the production results. Even if this integrated approach is not adopted, the team members' personal goals should nevertheless reflect their own contribution to the overall performance of the team and their performance management appraisal should be based on the achievement of these objectives.

## 3. Support from senior leadership

*"The amount of visible support given by the organisation's leaders to the TPM implementation is directly proportional to its successful long-term sustainability."*

It is impossible to overemphasise the value added at the shop floor by the presence, tangible support, involvement, encouragement and visibility of senior leadership. This management tactic gives the workforce and their supervision a sense of purpose, importance, recognition and belonging as well as reinforcing the company's commitment to the process.

## 4. Monitoring and tracking of progress

Having a clearly defined strategy and implementation plan is good, but it is also important to know where you are in relation to the implementation of the plan. Milestones and targets for completion are of no value unless they serve to highlight possible irregularities in order to trigger a corrective response.

## 5. Competency-based training and coaching

Any new implementation will require a significant amount of training and coaching both before and during the launch phase. The tone and professionalism with which this training is conducted will define the mood for the rest of the implementation from that point onwards. If the training is conducted in an unprofessional manner, the lasting impression in the minds of the trainees is that the new initiative is not very important and that the company is not taking it particularly seriously. The converse is also true.

The content and approach of the training course/s is vitally significant. The purpose of any training programme is to increase the level of competency of an employee to enable them to perform their job better. The objective of the training must therefore be to transfer knowledge and skills to the student. Failure to achieve this objective from the training will result in a frustrating and disappointing waste of time for all concerned.

The starting point when developing any training programme must be a well-written performance objective. This performance objective must encapsulate the desired behaviour in the workplace and the content of the training material must be so constructed that it meets the performance objective. The ability to measure the effectiveness of the training intervention is also important in order to demonstrate the transference of competency to the student. This subject is discussed in more detail later in this paper.

## 6. People involvement

The TPM programme belongs to the workforce, not to "the company". It is therefore imperative that the workforce should be involved in setting up and implementing the programme of which they will ultimately become the custodians. The guaranteed approach to ensure that a shop floor worker will reject any new idea is to thrust it upon them as a "fait accompli" without offering them the courtesy of being able to provide their opinions or recommendations.

There is a subtle technique when introducing a new concept to people in such a way as to ensure you secure their buy-in:

- Describe the business need for a new approach
- Ask for their ideas
- Listen to their suggestions
- Involve them in a discussion through which they are made to feel like they have participated and contributed to the outcome, but do not be patronising
- Make sure that the end result includes at least some of the dimensions and ideas that they contributed during the discussion
- Give them something tangible to take away and use at the end - something that they feel committed to as a result of their participation in the development activity
- Continue to "hold their hand" by providing on-line training, coaching and support particularly during the early stages of the implementation
- Be sure to report back with any answers to queries that arose during the discussions - show them that you care

An off-line facilitator of the implementation process is a worthwhile investment. Production line personnel are usually so deeply focussed on delivering the required production outputs that they are unable to recognise the improvement opportunities all around them. The process facilitator would, by definition, be a specialist in all aspects of the development activities as well as maintaining the vision on behalf of the team. Furthermore, the endless flow of daily demands on the line personnel often means that, if left to their own devices, the development activities toward the implementation of a fresh initiative would be demoted to a lower priority. If this tendency remains unchallenged, it is very easy for the implementation to lose momentum and disappear altogether.

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2005 SKF expands Proactive Reliability Systems, Australia, Condition Monitoring (continued)



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## 7. Recognition and praise

The workforce thrives on recognition. People need to know that their efforts are recognised and appreciated. There is a basic human desire to feel important and needed.

Where productivity has improved, those responsible need to know that their contribution has been noticed. A personal word of thanks and congratulations is often worth a few percentage points of productivity and several rungs on the motivation ladder. The decision about reward and recognition is not a matter of whether to do it, but rather how to do it. The good leader will be sensitive to the personalities of his/ her team members and will seek to praise without embarrassing individuals.

There is often a healthy rivalry that exists among teams on the shop floor. When praise for a job well done is blended with this natural competitiveness, the results can have a snowballing effect that may surprise even the most ambitious managers! Recognition and praise is often an untapped powerhouse of energy and enthusiasm within our people.

## Challenges

*"Consider how hard it is to change yourself and you'll understand what little chance you have of trying to change others."*

### 1. People motivation

*"People in an organisation generally become what their leaders give them reason to believe they can and should become."*

The modern work environment places employees under greater pressure to deliver than ever before. There is a difficult challenge that faces every manager - that of striking the correct delicate balance between driving one's people to deliver the maximum possible output without overloading them to the point where they feel swamped and their performance suffers as a result. Therein lies the subtle art of motivation.

In an already busy working day, people often feel reluctant to take on any additional activity. The implementation of a TPM initiative will require people to put in that bit of extra effort for a season until the new work ethic has stabilised. This, coupled with the inevitable stresses that accompany a change process can frequently dilute people's motivation levels. The organisation has a moral obligation to remain sensitive to this fact.

### 2. Overcoming people's cynicism

*"Consider the Postage Stamp ..."*

*Its usefulness consists in its ability to stick to something until it gets there."*

The ever-increasing competitiveness of the industrial arena over the past few decades has caused many organisations to embark on one or more productivity improvement programmes such as TPM. The consultants that prowl the passageways of industry have exploited this improvement drive by marketing a vast range of techniques and methodologies to the corporate leader, each accompanied with a glamorous promise of reduced waste and increased profits. The inevitable result of such a proliferation of improvement opportunities is that by now, many companies have already tried to implement a few different approaches, often delivering disappointing returns, largely fuelled by the impatience of the corporate leaders to see short-term results. The implementation of a sustainable new workplace ethic usually takes longer to settle down than the current financial year.

Consequently, the workforce in many organisations has seen improvement initiatives come and go several times before. The cynical response from many shop floor personnel is, "It's just another initiative. We've seen it all before. What is going to make this one any different from the last one they tried?" The challenge for those people leading the initiative is to provide a plausible response that does not sound like a worn out cliché. It is important to the overall success of the process that such negative perceptions are eradicated quickly and calmly, and replaced by a message of positive enthusiasm and sincere credibility.

### 3. Consistency across shifts

There is a direct relationship between the importance of a production work centre and the shift pattern that drives it. Generally, the more high profile work centres will be the logical candidates for the launch of a productivity improvement initiative. The challenge however, is to ensure that people across all of the shifts are kept involved and appraised of developments that took place since the last time they were on site. Inter-shift communication is vitally important for this reason.

There is no one-word answer providing the optimum solution to this problem. Each team will identify the options that fit their circumstances and meet their needs most comfortably. A few popular options may be:

- Shift handover meetings to allow communication from one shift to the next. These need not last longer than 10 minutes at a time.
- A shift communication book. The format can be extremely flexible. Such a book will provide a consistent place for messages and information to be recorded and passed on between shifts.
- A team communication notice board is a very visible option. The drawback with this is that it can often become cluttered and untidy if it is not carefully updated. Also, many people find it difficult to write on a notice board.
- There is no substitute for face-to-face verbal communication by the team leader or facilitator, although the practicality of this is sometimes difficult.

Consistent training and coaching support across all shifts is therefore of paramount importance.

### 4. Maintaining visible support from leadership

*"TPM is not a flavour-of-the-month initiative. It is a way of life."*

The dynamic energy that inspires many business leaders often has the undesirable side effect of frequently diverting their attention to new activities. When the launch and implementation of a TPM initiative is new and fresh in the minds of leaders, it is easy for them to provide support and sponsorship for the idea. The challenge comes with maintaining that level of visible support and drive after the initial honeymoon period is over. The astute business leader will realise the importance of this ongoing support.

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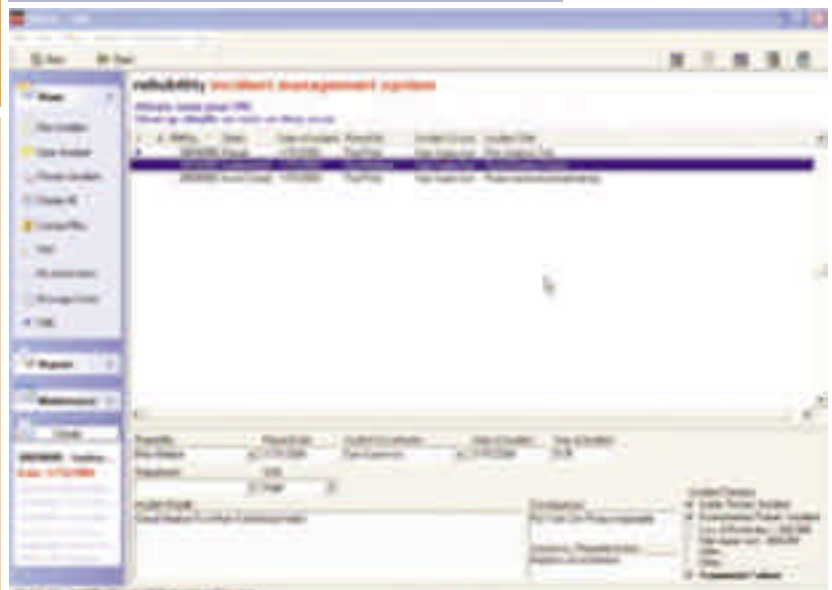
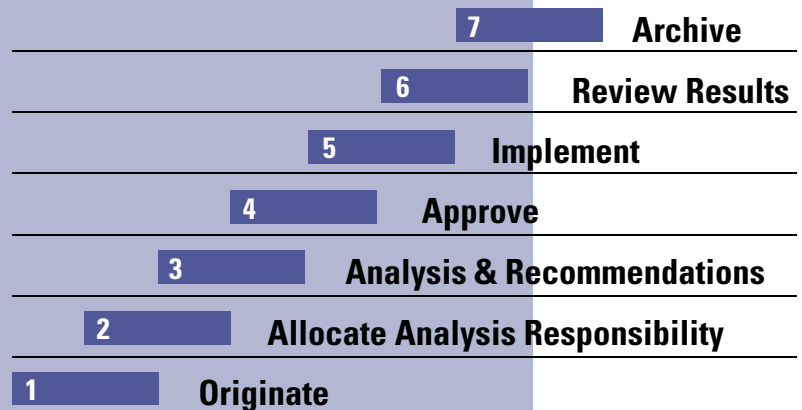
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## What We Have Learned

### 1. Good, accurate information is critical.

*“Given all the facts, anyone can make the right decision. But it takes an exceptionally good person to gather all the facts.”*

Decisions based on bad or incomplete information will be bad decisions. Plans made with bad or incomplete information will be bad plans. In the absence of full, accurate information, any implementation is destined to fail, or at best, it will fall far short of realising its full potential. Set yourself up for success rather than for failure. An easy and absolutely critical way to do this is to make sure that all the information you require to effectively implement and manage your improvement process is available and comprehensive. This could include, but is not limited to the following:

- Machine specifications and critical operating parameters
- Process flow rates and settings
- Production operating capability and tolerances
- Product specifications and quality standards
- Methods of recording production data at the shop floor

### 2. Machine Availability and Reliability is key

*“The skill of the operator is of no value if the machine is falling apart.”*

The cost arising from equipment that is unreliable or unable to perform to the required standard will far outweigh the potential value that can be added by the operator. The best will in the world, the best leadership style, the best training programmes, the best production processes and logistic support, the best workflow patterns are all of no effect if the equipment at the heart of the process is not able to play its part.

Equipment availability and reliability is, and always will be, the cornerstone of an efficient production operation without which the organisation will crumble. Every penny spent on good maintenance to ensure that the equipment is always able to deliver what you require when you require it, is worth a pound of profit to the organisation. Every time.

It is therefore imperative that the equipment preventive maintenance routines must be developed using a thorough, methodical, analytically sound process and that the effectiveness of the maintenance is continuously monitored through the analysis of operational and failure data. Continuous improvements made to the original maintenance programme are as important as the original analysis, but it is equally important that all amendments made to the maintenance checklists must be derived via the same rigorous analysis process as was used originally. Failure to do this will cast a shadow of doubt over the integrity and long-term validity of the total maintenance programme.

### 3. Keep the focus

*“Just because everything is different, it doesn’t mean that anything has changed.”*

Many shop floor improvement programmes fail because senior leaders misinterpret an initial upturn in productivity as the conclusive proof of a complete cultural reform throughout the organisation. Thereafter they divert their attention to fresh priorities before the new ways of working have had time to become entrenched with any long-term sustainability. Consequently, as soon as the initial fanfare is over, people have a tendency to revert back to their old familiar comfort zones.

A change can be made very quickly, but the organisation’s resilience is strong. A transition to a new work ethic takes significantly longer, requiring focus, tenacity, motivation, encouragement, support and patience.

### 4. Involve the shop floor

*“Improving everything we do means rising above established ways of thinking.”*

The operators and craftspeople are the ones who have all the knowledge and experience of the shop floor production processes and the working of the equipment. They are therefore best suited to contribute their knowledge and ideas to the new improvement process. Additional benefits of this approach are:

- Buy-in from operators and craftspeople
- A sense of ownership of the new approach
- Greater probability that the new ideas and processes will be workable
- Commitment to making it work
- Reduced likelihood of cynical disbelief or malicious compliance

People operating at the shop floor have the power and the ability to make the new implementation succeed or fail. Given the necessary support, coaching, guidance and involvement they are able to deliver the desired success. Failure to acknowledge the contribution these people can offer will create an unstable foundation and jeopardise the implementation.

### 5. Effective training and coaching is vital

“I taught my dog to sing.”

“I don’t hear him singing.”

“I said I **taught** him. I didn’t say he **learned** it.”

A training strategy centred around “bums-on-seats” is a waste of time.

In any organisation, employees are required to perform a job to a certain standard. The ability to perform to that standard is

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determined by three things:

- Employee attitude
- The working environment
- Employee competency

Good performance is only possible where all three of these exist together in balanced harmony. Training generally serves to address only the third of these three. The purpose of training people is to increase their level of competency to enable them to be able to perform their job better. The need for training must therefore be identified based on an assessment of the employee's current level of competency. A training programme should then be set up to address those weaknesses in competency. Figure 2 illustrates this relationship.

Competency to perform the task is also determined by three things:

- The person's **knowledge**
- The person's **skill**
- The person's **attributes**

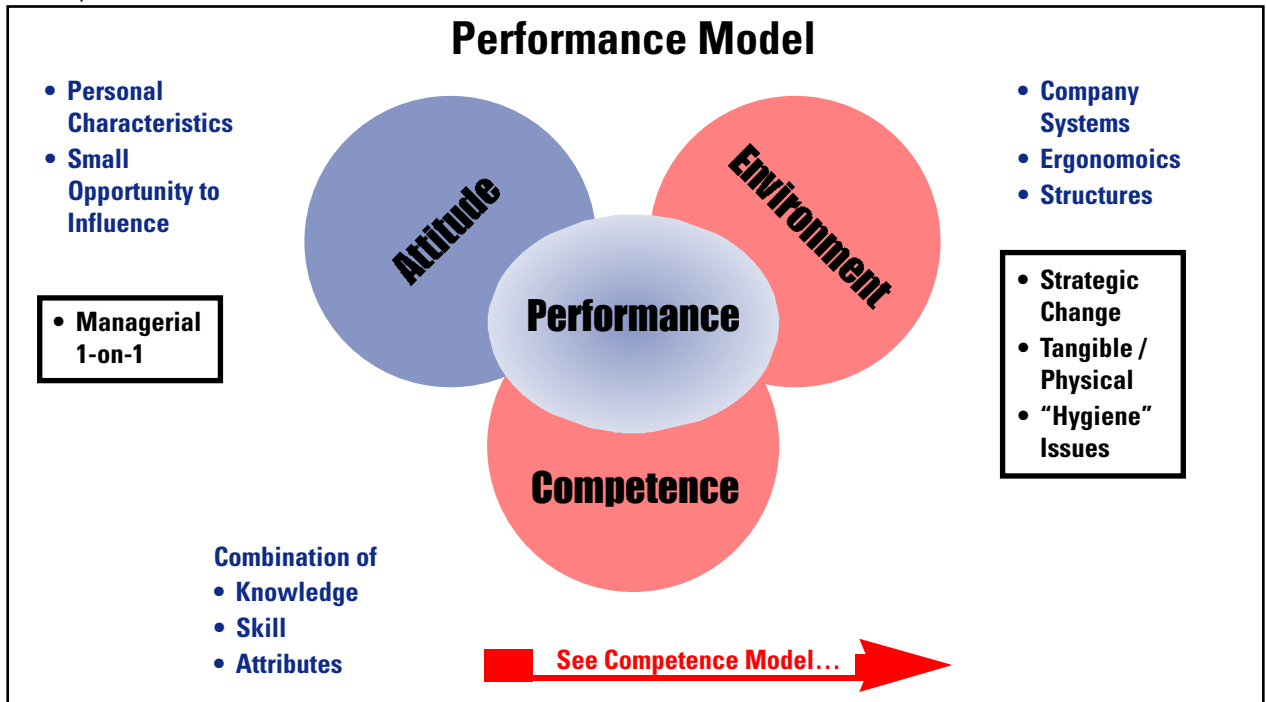


Figure 2: Performance model

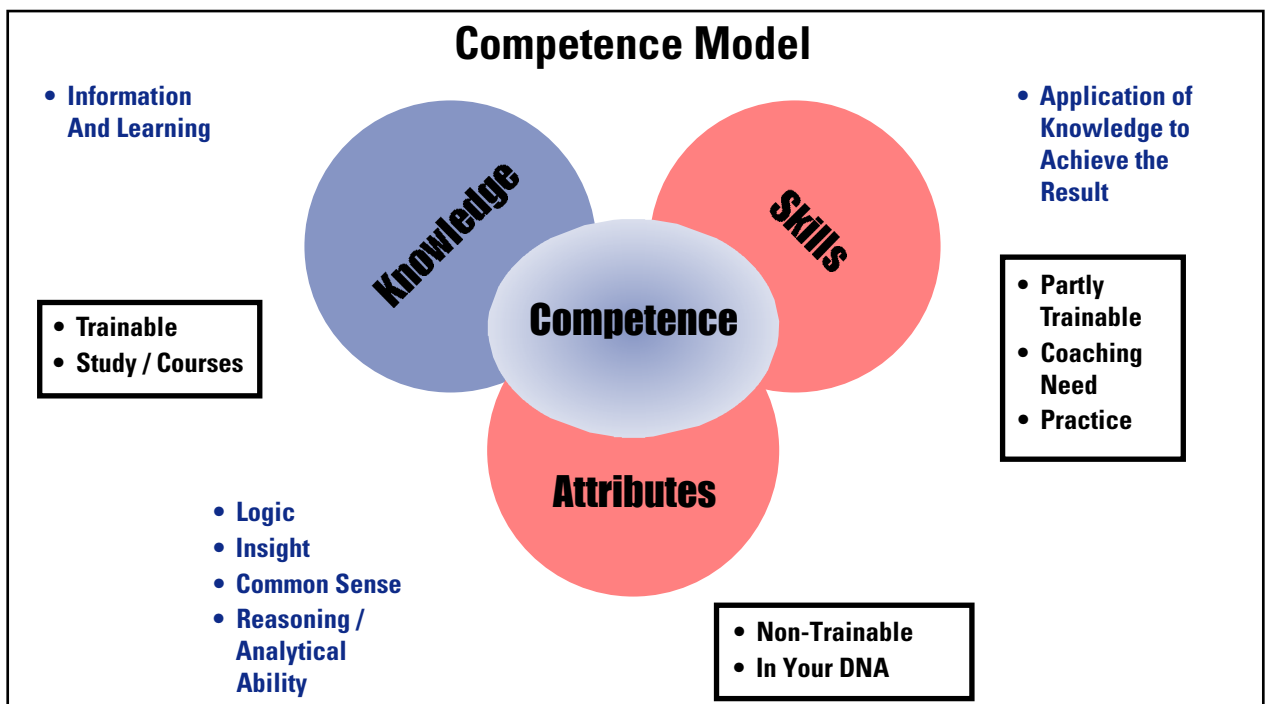


Figure 3: Competence model



It must be noted however, that although a person's attributes will affect their competency and hence their ability to perform, this cannot be improved through training. *(For example, I will never be able to run 100 metres in 10 seconds. No matter how hard I train, I was simply not built with that attribute.)* So to be even more specific, any training activity must be designed to increase a person's knowledge and/or skill. The training programme must have this as its stated objective and it must be possible to measure the improvement achieved as a result of the training intervention. Figure 3 illustrates this relationship.

A well-designed, competency-based training programme is a valuable investment into the long-term success and profitability of the company. The ability to measure the improvement in an employee's performance after being trained can be directly linked back to justify the investment in creating and running that training programme.

Conversely, a poorly designed training programme, or training people in the wrong things or for the wrong reasons is at best a waste of time and money.

#### 6. Rigorously track the metrics

*"You cannot manage what you cannot measure."*

The ability to measure productivity within any organisation is crucial. In an environment of change and uncertainty however, where so much is new, people feel the need to hold on to something familiar. In such circumstances, there is a seductive temptation to measure everything. Many times people retreat to where they can hide in relative safety behind the mechanistic activities of "crunching the numbers and drawing the graphs" which provides them with that comfort blanket.

One must be cautious however, to avoid getting into "analysis paralysis". The effective approach to measuring progress is to select just a few key metrics that reflect the most important dimensions of the production environment and to track these rigorously. The same applies to monitoring the effectiveness of the improvement activity being implemented.

The purpose of metrics should be to monitor the health of the organisation. Where everything is in control, the metrics will reflect the success that has been achieved. Conversely, they should also be used to highlight problem areas and irregularities in order to drive the desired behaviours or areas for improvement. Time and energy spent monitoring performance is wasted if one takes no corrective action in response. Long-term benefits will be realised if the measures are also used to drive specific improvement activities through the site production/ operational strategy.

*"Profitability is a symptom of corporate health, not a predictor; figures, even when accurate, describe the past."*

#### Notes:

1. AMIS - Asset Management Information Service. Site-wide maintenance audit conducted by MCP Management Consultants.
2. Equipment Engineers at Lilly Basingstoke fulfil the role of typical Reliability Engineers

## Maintenance Spares Optimisation

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# Enterprise Asset Management Survey

## (Summary Report)

**Brian Dunks**

Industry Solution Director EAM, Intentia, [www.intentia.com](http://www.intentia.com)

### Introduction

The management of plant, equipment, facilities and other assets to maintain peak performance is vital to productivity and profit. Downtime and unplanned stoppages can present serious issues for business continuity, service levels, operational costs and revenue generation.

Today, firms are under increased pressure to deliver more for less, with reduced resources and budgets. Intentia believes that factors such as preventive maintenance, criticality analysis and diagnostic management are some of the few operational areas left that offer true improvement potential, and that ultimately impact a company's profitability.

In 2003, Intentia set out to create the first global enterprise asset management survey. This 2004 survey continues to provide maintenance professionals with the key guide to help benchmark and judge their performance on key maintenance and asset management issues.

This survey included responses from over 400 global manufacturing and operations-related organizations, encompassing multiple asset-intensive industry sectors. Industries covered included food and beverage, pharmaceutical and chemical, general manufacturing, facilities and infrastructure, and power and utilities.

The report considers whether organizations actually regard maintenance as worthwhile and, if so, how they view its effectiveness and what effort is being put into achieving the best possible results.

In essence, the results of the survey produced some clear messages, most predominantly that there appears to be a troubling disparity between the views businesses hold about the value of preventive maintenance and the actual commitment of sufficient resources or budgets for these needs. As a result, Intentia believes that many businesses are failing to take advantage of what could be one of the few remaining truly untapped business benefit areas that can directly impact bottom line performance.

The survey looks at how such trends and considerations vary from industry to industry, the key inhibitors that influence these apparent disparities, and the typical outcomes.

We hope that you find the survey results to be both insightful and a powerful source of information in helping you plan your future plant maintenance activities.

### Key Findings

- Over 85 percent of respondents agreed that preventive maintenance increases operational output and almost two thirds report their belief in the competitive advantage it offers.
- Nearly 60 percent view maintenance as an investment.
- The majority of organizations actually commit less than 10 percent of total cost of operations to maintenance.
- Over two thirds of respondents indicated that less than half of their maintenance budgets were allocated to preventive work.
- A 'fix it when broken' approach still appears to be predominant within most industries and is becoming more prevalent in comparison with 2003 survey results.
- More than half of survey respondents indicated that individual annual production losses due to plant equipment failure could be anything up to USD 50,000.
- Almost 7 percent reported average annual lost production costs in excess of USD 1 million.
- Over 15 percent of all organizations surveyed reported some shutdowns that lasted for over 90 hours.
- Poor comprehension of maintenance problems by other line managers is seen to be a key issue and appears to be a growing problem with a 10 percent increase on the previous year's survey.



Intentia is the only global enterprise solutions provider 100 percent dedicated to bringing software applications and consulting services to companies whose core processes involve manufacturing, distribution and maintenance. Intentia customers are typically medium to large organisations that operate in complex supply chains with tough competition and limited internal resources. Intentia solutions are built from the ground up with the specific needs of these customers in mind, and the ability to grow and change easily with their businesses. Solutions currently comprise enterprise asset management, customer relationship management, supply chain management, value chain collaboration, enterprise performance management and workplace management.



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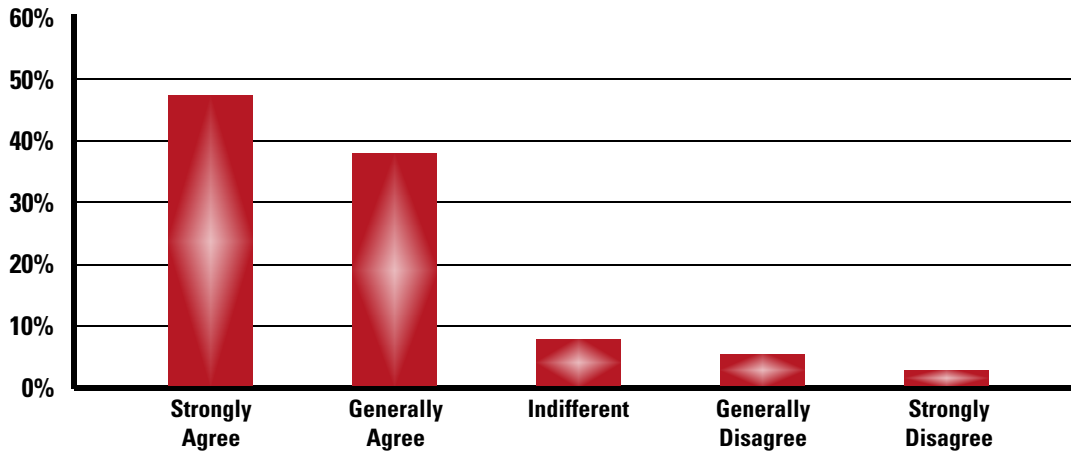
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## Is Maintenance Worth the Effort?

Intentia’s aim was to find out how organizations viewed and addressed their maintenance needs, how much they are spending on maintenance and how much of this was allocated to preventive work.

**Q. Does your preventive maintenance increase plant production/operations capacity?**



Preventive maintenance can take many forms and over the years has gained many names. Ultimately, it’s a process that provides the business with the right asset availability at the right time.

For preventive maintenance to be worth the effort, it has to provide clear and undeniable benefits.

A resounding 85 percent of all survey respondents agree that preventive maintenance increases their plant production or operations capacity.

Brian Dunks, the EAM industry solution director at Intentia says, “The result of this survey question offers a clear indication that preventive work is seen to have true value for an organization. Increasing the availability of equipment can clearly have an impact down the entire supply chain. Reliable equipment enables the operation group to complete customer orders on time and at the predetermined unit cost. This in turn, delivers what the customer wants, when they want it, and at the right price.”

Such capabilities provide a clear competitive advantage over suppliers with less reliable plants.

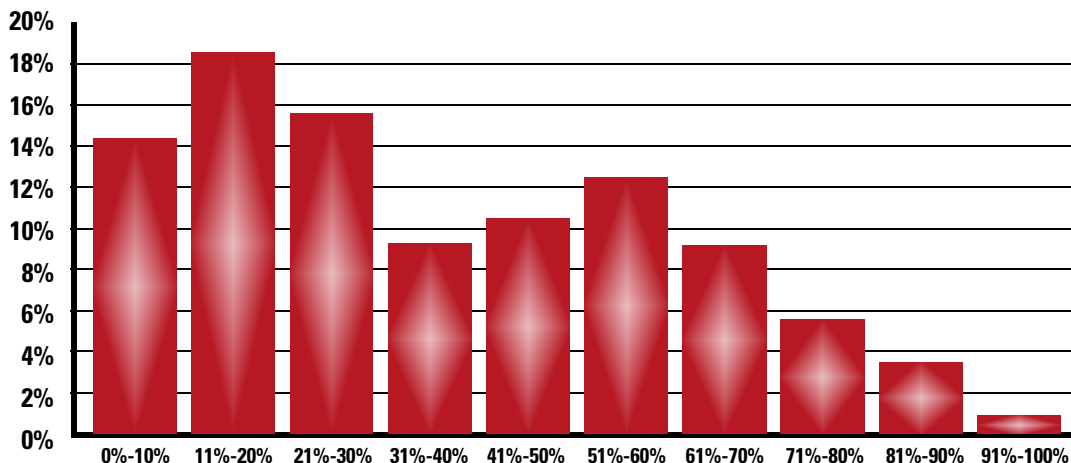
Almost two thirds of the organizations surveyed reported that their preventive maintenance program gave them a competitive advantage. In general, this was a consistent view across all industries.

## Is Industry Spending Enough on Preventive Maintenance?

From such encouraging results, it is clear that preventive maintenance is deemed to be worth the effort. What remains to be seen is this: If maintenance is worth doing, are companies putting enough effort into securing the potential results and benefits?

Overall the results showed that the majority of survey respondents are spending less than 10 percent of the total cost of operations on maintenance, with smaller organizations making up a higher proportion of this figure. Interestingly, despite the views to the contrary about the value of preventive maintenance, it seems even less budget is being allocated to this particular maintenance work.

**Q. Of your total maintenance budget per annum, what percentage is allocated to preventive as opposed to corrective maintenance?**



Over two thirds of organizations allocate less than half of their maintenance budget to prevention, suggesting that perhaps many businesses still continue to adopt a 'fire fighting' approach to maintenance.

Dunks explains, "For many businesses, a planned maintenance strategy is critical to reducing the risk of equipment failure and downtime, meeting industry safety requirements, and ensuring business continuity and plant availability in order to maximize productivity and profitability.

"A 'corrective' strategy is not necessarily the wrong thing. Some businesses are actually more suited to a 'run to fail' approach, where repairing an asset online may not be feasible, or reliance on redundant systems is more cost effective than preventive maintenance."

"However, for those operating in conditions where lean organizations are dominant, or where safety and continuity is paramount (such as pharmaceutical/chemical businesses and facilities/infrastructure type organizations), businesses need to understand the potential savings a preventive maintenance strategy can provide."

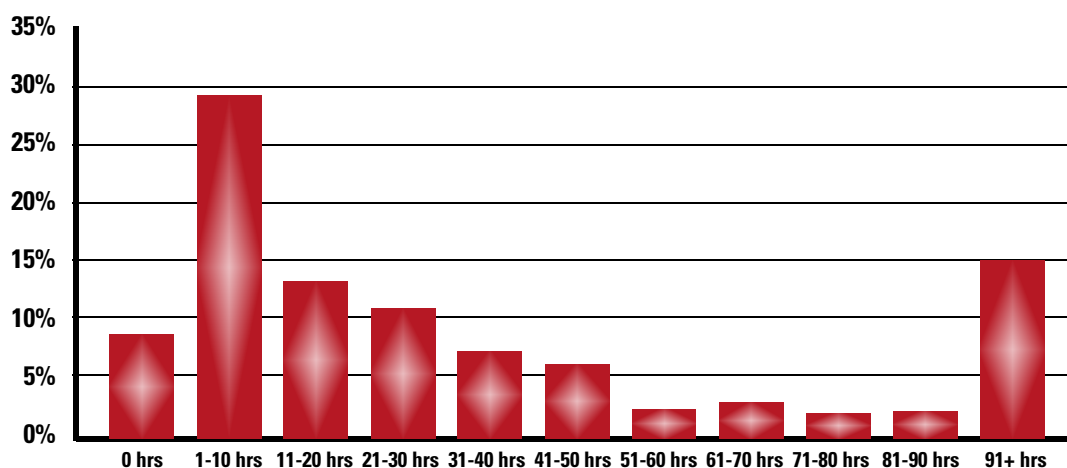
Intenia believes that organizations are still spending insufficient amounts of money on preventive maintenance, which it sees as one of the few untapped areas of real improvement potential for many businesses.

## The Impact of Inadequate Maintenance

The survey went on to investigate the extent to which plant and equipment failures occur and impact the profitability of organizations in the current economic climate.

Nearly 60 percent of all organizations reported that they experienced up to 5 percent downtime per month across their production/manufacturing resources. Additionally, just under 30 percent of all organizations reported that the longest period of downtime they experienced last year was one to ten hours in duration. Unfortunately, over 15 percent of all organizations surveyed reported some shutdowns that lasted for over 90 hours.

### Q. Last year, how many hours did your longest period of downtime last, which was caused by a single breakdown?



Intenia believes that many major stoppages could have been avoided with better preventive maintenance or could have had less of an impact with better preparation.

"Downtime and protracted stoppages raise some serious risks and concerns for profitability and survival in a highly competitive market, since many of these issues and potential inefficiencies must eventually be passed on to customers and stakeholders," Dunks says.

Over 50 percent of firms surveyed were able to claim that they did not have a single breakdown that stopped production in more than half of their plant during the last year, and over three quarters reported two or fewer major plant shutdowns in the last year. Some industries were more prone to report more and longer shutdowns than others.

When also questioned about the average annual cost for lost production as a result of plant or equipment failure, only half of the organizations surveyed were able to limit their average annual cost of lost production to under USD 50,000. Even more troubling, nearly 7 percent reported that their average annual losses were more than USD 1 million.

"In reality, the losses faced by many organizations are most probably much more costly than they initially believe, when considering other factors that may be overlooked such as scrap, lost customers, additional labor and utility overheads," Dunks says.

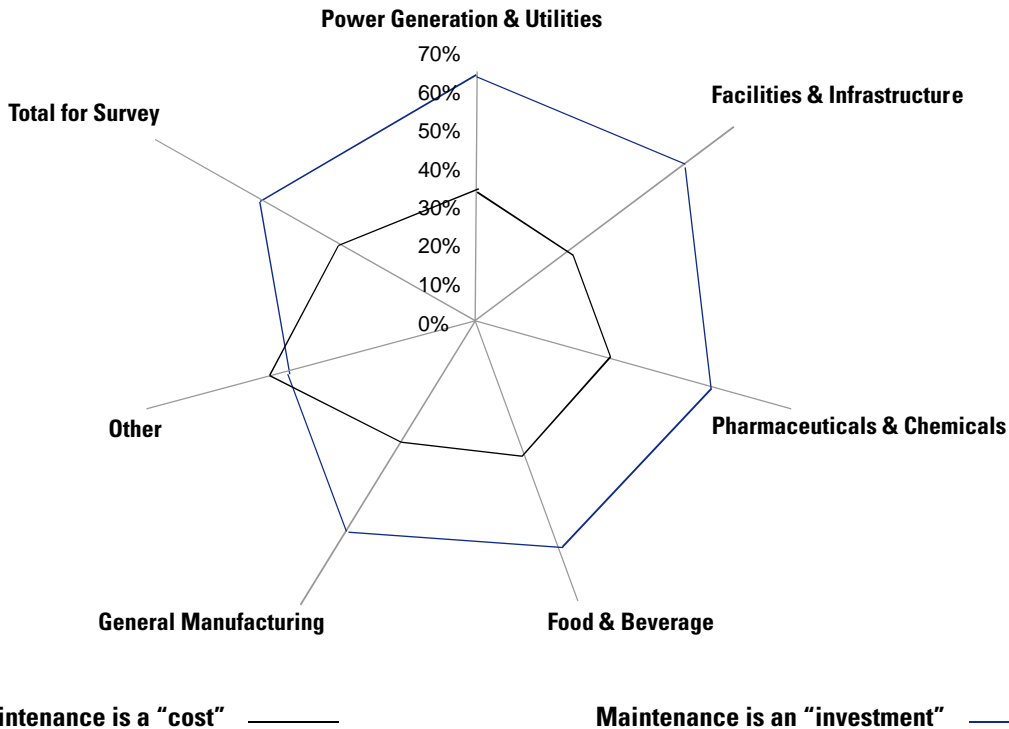
These figures underscore the lost income potential that may have been avoided through higher equipment and facility availability.

## Cost or Investment?

It seems there is some disparity, depending on the industry type, between the views many maintenance professionals hold about the value of maintenance, and the actual spending allocated to such work.

The survey results showed that the majority of organizations view maintenance as an investment. Nearly 60 percent took this view, an increasing figure over the 2003 survey.

**Q. Do you describe money spent on maintenance as a cost or an investment?**



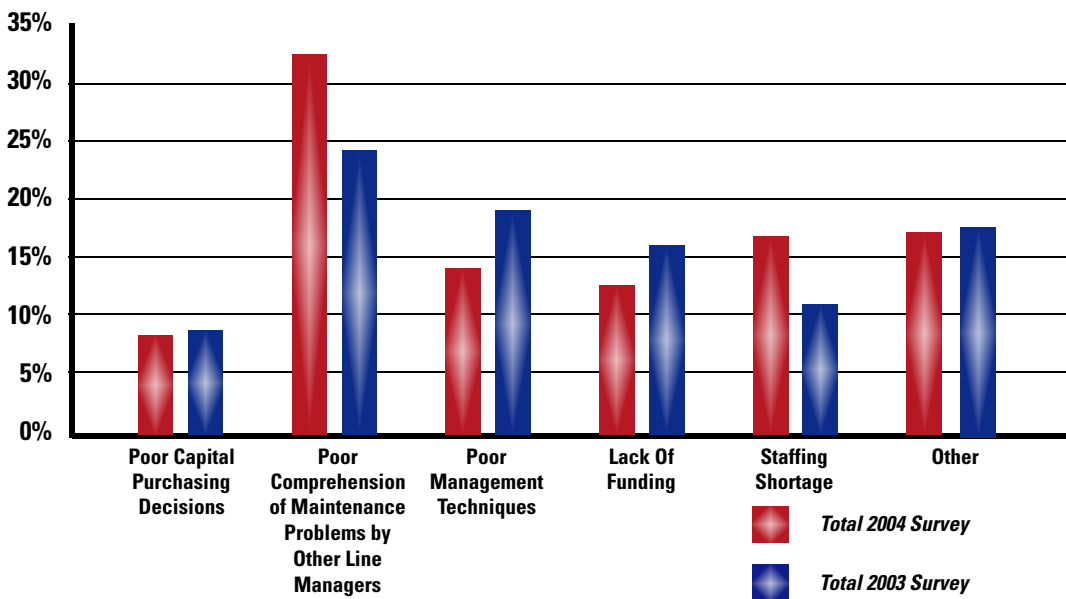
Dunks comments, "Over the last 12 months we have seen an increasing percentage of respondents reporting their belief in maintenance as an investment. The number of respondents who strongly agree with this view has increased by nearly 7 percent over 2003, indicating a growing awareness in the value of, and potential return on investment from, enterprise asset management.

"Intenia believes that organizations that see maintenance as an investment are much more likely to be successful in combating the causes of downtime. We hope that this indicates a growing trend for organizations to consider maintenance operations in a more positive light.

"However, what remains apparent is that there are still many inhibitors in translating this view into a reality, in particular with preventive maintenance where there are many businesses who are suited to and could benefit from such a strategy, but are perhaps not doing so."

**Inhibitors to Change**

**Q. What do you believe is the greatest problem faced by maintenance managers?**



Poor comprehension of maintenance problems by other line managers came out above other issues cited as inhibitors to change in maintenance programs, with 32 percent of respondents indicating this to be a key issue. The survey showed a growing problem in this area with an almost 10 percent increase over last year's results.

Larger organizations in particular reported this as more of a concern than smaller ones.

Dunks says, "This may be the result of more formal management systems in larger organizations, which are perhaps more removed from day-to-day issues than those found in smaller companies."

Other issues raised (including poor management techniques, lack of funding, staffing shortages and poor capital purchasing decisions) were reflected evenly depending on the industry sector.

Continuing on the same theme, the survey also delved deeper into whether a 'fix it when broken' approach is still predominant among those managers not directly responsible for manufacturing.

The survey showed a disconcerting trend upwards based on comparison with the 2003 results, illustrating the difference between what maintenance departments view as an investment and the issues they face in gaining broader support from decision makers.

#### INDUSTRY SPOTLIGHT:

##### **Food and Beverage**

This industry demonstrated a clear belief in the investment qualities of maintenance and its ability to increase competitive advantage, but paradoxically also reported higher-than-average unscheduled downtime.

#### INDUSTRY SPOTLIGHT:

##### **Facilities and Infrastructure**

Facilities and infrastructure organizations are the leaders in outsourcing maintenance and many are also likely to believe strongly in the value of maintenance in increasing operational capacity. However, the maintenance professionals within these organizations also reported issues in poor comprehension of their problems from other line managers.

#### INDUSTRY SPOTLIGHT:

##### **Pharmaceutical and Chemical**

Maintenance spending in this sector is relatively low compared to other industries and of this spending, few companies spent more than half on preventive maintenance. The majority opt for corrective strategies, and suffer from substantial downtime issues.

## Conclusion

From the survey results, it is evident that although there are positive upward trends in attitudes towards maintenance strategies and the impact they can have on the bottom line of a business, there is still a way to go before many firms realize in real terms the potential gains to be made from such a proactive approach to maintenance.

Different industries are impacted to varying levels by those issues and considerations that have been explored in this survey, with each sector characterized by its own industry-specific pressures and needs.

But a common thread among all industries is that close cooperation between maintenance and operations during planning processes can help reap significant rewards for most businesses and that maintenance professionals need to become more effective internal marketers to help achieve this.

If carried out correctly, integrated processes provide a win-win opportunity across the entire business. Operations produce what they expect and when they expect it, without unplanned stoppages due to equipment failures, thus influencing profitability. Maintenance gets the equipment when they need it and can ensure they provide the highest level of availability.

### **For a copy of the full report please contact your nearest Intenia office.**

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# Maintenance Management Legends

*Torbjorn Idhammer*

VP & Partner, IDCOM, [www.idcon.com](http://www.idcon.com)

**T**here are many paradigms and legends surrounding maintenance management in plants. Often, the legends are known to be untrue, but people live with them because it is politically correct, or simply convenient. To be successful in improving equipment reliability and maintenance management, plants must break the legends that exist in their organizations. Some of the legends will be addressed in this article. You may find that these legends are uncomfortably close to describing how your plant operates.

## Legend 1: Maintenance cost must be reduced quickly

Plants should reduce maintenance cost. But there are many variables that can be affected by lowering the maintenance budget. It is therefore important to consider how the cost cut is implemented.

Most of us can cut maintenance costs in any plant in the world very quickly by 40%. We simply get rid of some people and stop doing certain maintenance jobs. If you get the opportunity to take a job like this, don't plan on staying more than a year. The consequences of short-term maintenance management will most likely be devastating to the total cost, and problems will start to show after a year or two due to ill-maintained assets.

Mandating a plant to lower maintenance costs quickly can be compared to asking a hockey team to increase the average number of goals per game from two goals to four without any coaching or guidance. The team can most likely produce four goals per game, if no other variables are considered. Obviously, we want the hockey team to win, not just score four goals per game. There is a balance between goals scored and goals given up. It is a mystery why many plants don't pick up on this simple concept of balance. It is not uncommon to see an organization completely focused on cost without considering the total picture.

If we lower the maintenance budget and don't change other aspects of the business practice, the results will most likely be very poor.

Changes in maintenance cost are inter-related to product quality and production output. A reduction in maintenance cost will not lead to improved quality and production output. But an improvement in equipment reliability will most likely improve production output and quality. Improved quality and production output will reduce maintenance cost.

Maintenance cost cannot be reduced quickly because it takes time to improve equipment reliability. Improved reliability will reduce cost, but reduced cost will not improve reliability.

## Legend 2: People don't like change

I often hear that people don't like change. In my experience, people love change - they just don't want to be changed by someone else. People are often very receptive to change as long as they are part of the change process. The problem is when a project improvement plan goes through the usual number-crunching, while the involvement of people is often forgotten.

For example, people in the plant typically can identify planning and scheduling improvement opportunities, yet most of us are reactive by nature; we don't want to work to strict guidelines, such as planning and schedule exactly what to do three days from now. Improving planning and scheduling requires a culture change together with detailed, agreed-upon processes and procedures. Even though we know this, plants sometimes try to improve planning and scheduling by talking over a cup of coffee, or at best sending a couple of planners on a two-day planning and scheduling course.

Production and operations changes are often 80% to 90% dependent on technical solutions including process automation. An equipment reliability and maintenance change initiative is 95% dependent on changing peoples' behavior. Management must address the issues of involvement and acceptance while encouraging the few enthusiastic souls in a project. Project success can be expressed as  $R = Q \times A \times E$  (Results = quality of actions x acceptance for change x enthusiasm for change).



### Legend 3: People are our biggest asset

If you work in plant management or as a corporate officer, it is politically correct to say "people are our biggest asset." Most managers would agree to that statement. I don't agree. People are not a company's biggest asset - the right people are a company's biggest asset, and the wrong people are liabilities.

I confirmed this opinion during a recent seminar for a group of supervisors and craftspeople. One of the discussions started with the question, "Isn't it true that if any given crew in this plant would lose its poorest performing people (about 10% to 20% of the total), the loss would hardly be noticed?" After the laughs and pointing had subsided, several people confirmed that there were always a number of people in any given crew who had "never accomplished an honest day's work." These people destroy morale, and in some cases, even slow the rest of the crew down.

Management must deal with underperforming people. If you have a decent relationship with your union or your nonunion workforce, they are usually receptive to discussing these matters. Poor performers are a big problem for them as well. It is also true that people cannot be more effective than the system in which they work allows them to be. Management can minimize the amount of wasted time and energy by implementing good maintenance and reliability processes.

### Legend 4: Having more maintenance people on shift reduces downtime

If you have many problems in your plant, operations typically requests more people on shift to fix the breakdowns. If this is the situation in your plant, you are going down the wrong path.

If you have a multitude of problems in your plant, you need to find out why and fix the source of the problems. What is the solution for your plant? Most likely you don't have enough time to repair all equipment problems found in your area, and you don't always find the problems before a breakdown. So we need more people, right? In the short run possibly, but not necessarily. Definitely not in the long run. Here is a checklist of possible problems:

- Do operators perform detailed equipment inspections? If not, make sure operators know how to inspect a bearing, motor, coupling, hydraulic motor, fluid coupling, etc.



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- Do your maintenance people have detailed inspection lists, take readings, and analyze trends in order to identify symptoms on equipment?
- Do you use your craftspeople by having well-planned jobs for them? Do you schedule maintenance jobs in coordination with operations? By executing high-quality inspections, we can make sure that we know about most symptoms.

### **Legend 5: We can't motivate maintenance craftspeople to improve reliability because they make more money when things break down**

Maintenance people typically do make more money when things break down. A perceived "Catch 22" by maintenance management is that crews can't be motivated to improve reliability and maintenance because higher equipment reliability will reduce the amount of overtime.

However, the answer to the question goes back to Legend 3. Only a minor percentage of people don't contribute as well as others; the rest of us want to be good performers. The key word is pride. Pride matters more than overtime pay. Pride drives a relatively low-paid U.S. Marine to risk his or her life for months at a time. Pride drives a maintenance craftsman to spend an extra hour or two to align a pump to one thousandth of an inch even though few will notice.

Management can instill pride in an organization by developing clear expectations for reliability and maintenance, and by training and supporting people long term in achieving these expectations. For example, develop a clear definition of preventive maintenance and develop an action plan and training initiatives on how to improve inspection routes, lubrication, cleaning practices, operating procedures, alignment, and other preventive maintenance practices.

Since money also is a motivator, provide incentive pay for equipment reliability. One of the fastest preventive maintenance program setups we have seen was at a car manufacturing plant in Europe that offered its crews (operations and maintenance) a bonus on each percentage over 97% line efficiency. The results appeared on reports just weeks after the announcement - the actual equipment reliability improvement probably started hours after the announcement.

### **Legend 6: New computer software (CMMS) will improve reliability and maintenance performance**

It is not unusual to see a maintenance organization implement a new CMMS with the hopes that this new computer software will improve plant reliability. In truth, new software can be a great help, but it is only a tool.

If plant performance improves following a software change, it is not the software itself that contributes the majority of improvements. Improvements will be a synthesis of the implementation and execution of better work processes, behavior changes, and higher-quality data from the software. The obvious question then becomes, "Can't the plant improve work processes, behaviors, and data quality with the old CMMS?"

Sometimes maintenance software updates become so cumbersome that a plant disregards obvious fundamentals due to work overload. For example, the bill of material for equipment isn't always up to date in the old system, and it will not be up to date in the new system unless an effort is made to improve the data. It is a common argument that it costs too much to update the bill of materials, yet we accept the cost of having each craftsman use a significant amount of time every day looking for parts.

In some plants, training is reduced to a minimum and often performed several months before the system is put in use. The result is that, at best, about 30% of the CMMS functionality is used and that only 30% of the people know how to use it effectively. This results in a 9% usage of the system.

If your organization is ready to implement a new CMMS, make sure you update the bill of materials, standard job plans, equipment numbering, and asset numbering in the old system. Also, ask yourself if you plan and schedule jobs well today. If not, the problem is usually not the software. People will blame the software because it can't talk back, but the real problems are lack of discipline in backlog management, prioritization issues, and the inability of operations and maintenance to coordinate production and maintenance schedules.

### **Legend 7: Equipment criticality decides inspection frequency**

It is common to see plants base component inspection frequency on a criticality analysis study. At first, it may seem sensible to base inspection frequency on criticality of equipment, but let's illustrate the misconception with an example.

Let's assume we are setting the inspection frequency for a very simple component such as a bolt. Let's assume the bolts in question are holding a mechanical seal on a pump. The pump and seal are very critical according to the criticality study. The inspection frequency for the highest criticality score is often recommended to one inspection every shift.

Intuitively, you notice that it doesn't make any sense to inspect a bolt every shift. Why? Because the inspection frequency must be based on how long, on average, it takes to develop a failure in a component. The bolt in our example will not fail from one shift to another unless there is a completely random event. The most likely failure is that the bolt comes loose over a 2-6 month period. We should therefore set the inspection frequency according to the Failure Developing Period (FDP), by estimating the FDP, and set the inspection frequency to FDP over two. In our example, we estimate an FDP of 4 months and set the inspection frequency to 2 months.



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The elimination of repeating failures is an essential ingredient in reducing maintenance costs and increasing plant reliability. People at all levels in the organization can contribute to identifying repeating problems and understanding the real reasons for these problems. It is through this understanding of the "Root Cause" that appropriate actions can be taken to prevent or reduce undesirable effects.

The need to eliminate defects is known by all reliability professionals however the task of encouraging people to lift their eyes above the immediate problems to think more deeply can be challenging. An important part of the solution is recognition. We need to recognize those that prevent failure rather than only those "midnight heroes" who restore operations after we have failed to prevent the breakdown.

RCA Rt wishes to play a part in recognizing and encouraging defect elimination by conducting a quarterly award; "Root Cause Analysis Recognition of Excellence". Submissions are invited from anyone Worldwide using any RCA process. Each quarter a panel of specialists in the RCA field will assess submissions and award a certificate plus Aus\$1000 to the person or team assessed as submitting the best example in that quarter. Examples will also be offered for publication in the Maintenance Journal to further gain recognition for this important work.

Analysis of Root Cause can apply to so many fields and be used in so many ways that the review panel must apply criteria in a flexible way. The panel will certainly be looking for evidence of a systematic and approach, cost effectiveness and impact on the enterprise.

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# Web Based CMMS, New Concept or Accepted Technology?

**Rob Saare**

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www.tero.ca

## **A** Brief History

The Computerized Maintenance Management System or CMMS is certainly not a new idea. Maintaining our organizations assets whether plant, facility, fleet or other, has been the daunting task of maintenance personnel for many years. Whether using a pegboard or an extremely sophisticated software program to manage maintenance operations the basic idea and concepts behind good maintenance practices are generally the same.

The good old days of chalk board PM schedules and logbook entries are gone. Replaced by sophisticated predictive maintenance software programs and reliability centered maintenance systems connected to our e-procurement packages and B2B systems. Of course our Human Resources and Accounting software programs must also be considered for this discussion, and let's not forget our Computer Department and their influence!

A recent article in a Plant Maintenance magazine indicted that most organizations only utilize 30% of the features and functions in their CMMS. If this truly is the case then we may be better off saving the time and money spent on these advanced software systems, and instead use our knowledge and expertise along with the pegboard and log book approach.

As a maintenance consultant and supplier I believe fully in the advantages of a CMMS. However many organizations are not ready and do not have the resources required for maintaining and properly operating a sophisticated high-end management system.

Most, if not all, large scale Client/Server based CMMS packages fit into this mould. Yes, they will provide the tools to predict and manage your maintenance departments and Assets, however at what expense. A maintenance system that does not require hours of input and maintenance (software upkeep) is the goal of all maintenance software developers, however sometime during the development cycle the idea of sound maintenance in an easy to use uncomplicated software package falls victim to the over designed complicated, complex and expensive software programs we see today.

## **Quote:**

*"We have spent over \$1 million on a glorified Work Order system. I wish we were still using our old paper system."*

--- Recent Plant Maintenance and Safety Show. ---

Is the Internet and the power and ease of use it offers going to be the answer we are looking for?

## **Today's Web Based CMMS**

It would be foolish to believe that a change in technology (client/server vs. web based) is going to solve all our problems and we simply need to throw away our current system and purchase another software program (yet again), this time web based, and we are off to the races. Any program, web based or not, without the proper design will require far too much time and effort to operate and maintain, without the benefits we are looking for.

However, with the new systems being developed and redesigned to be 100% web based, it may very well be the opportunity we are looking for. It may be time for developers and CMMS vendors to simplify and redesign the CMMS to be an effective easy to use tool. Providing all the features and functions required in a CMMS and using a web browser to access the program sounds like the answer we have been waiting for. Or is it...

All too often traditional client/server CMMS vendors advertise a "web enabled" system, or "web module(s)" etc. Typically this type of system requires the purchase of another software program that must be installed onto your computer network, maintained and updated yearly by your computer people and has only added another layer of complexity. Having a work request module that is web enabled may suffice in your operations and is generally the first step in moving to a complete web based CMMS. If you are working in a localized environment where web is not important then perhaps the "devil you know is better than the devil you don't."

Back in the mid 90's when we embarked on building web based CMMS modules for existing client server installs, we were told by many CMMS developers that the internet was no place to run a CMMS. Today we see the same developers launching their "new"

web based technology and declaring that web-based applications are the future. From our standpoint, the future is here and has been for over seven years.

## Web Based vs. Web Enabled

For several years only a few vendors have been marketing their products as Web Based. Most traditional CMMS suppliers have changed their marketing strategies to indicate that their solutions are Web Enabled. Of the few suppliers who offer a true Web Based system only a select few offer a web based system that does not require any third party "client side" or "download" programs that must reside on the client side pc. If you have made the decision to move to a 100% web based CMMS then you should insist upon a system that will operate with nothing but a web browser as the user interface. If the system you are evaluating requires third party client side software (other than a standard web browser) then look elsewhere.

***Any vendor offering a true 100% web based system will allow you access to view (at a minimum), that system on-line. This does not require any download or installation of other software.***

An important feature of a true web based system is the programming behind the software. The program will be designed to operate (or run) from a central server and the database typically from another. This typical setup then requires both a database and application server. More powerful systems require specialized hardware and software to function. Ask yourself if this is any better than before and does this meet my expectations of easy to use and maintainability. If my computer staff has to spend all their time maintaining computers and software simply to allow my CMMS to function have I actually achieved any significant benefit in moving to a web based system?

Look carefully at the hardware and software requirements of a web based CMMS. Do not get into a situation where your computer and network requirements are great. Typically if you are installing a true web based application you will not require any new hardware or software. Most organizations have spent enough over the last 3 years up-dating their computer systems to meet the requirements for a web based CMMS. When we say keep it simple we must include the maintenance and operation of the software program itself.

## Benefits of a true web based CMMS

If a true web based CMMS is right for your organization, you will find many significant benefits:

- Low cost of ownership
- Easy to maintain client and server components
- User friendly interface (web browser)
- Remote system access
- Faster more efficient support from vendor
- Open architecture and interfaces

An extremely important feature of a true web based CMMS resides in the web browser itself. We have seen in the past few years a number of significant changes in the web browser interface and in fact (although Mr. Gates may deny it) our standard Microsoft operating system is becoming a web browser. If this trend continues in the near future all of the programs we use on a day-to-day basis will operate through a web browser. It is not unreasonable for us to then utilize all of the built in features of the web browser with our CMMS. These features include:

- Copy, Paste - either from field to field within the CMMS or to other applications
- Email - built in email for work order/requests, equipment data or drawings
- Help systems
- Security and history
- Colors, sizes and regional settings
- Multi language support

Every day the web browser has more features added to it that will allow us more flexibility and provide more features that we can take advantage of.

## A Look at the Future

When it comes to computer programs and technology the crystal ball is extremely opaque. It seems that predicting the next few years or even months is impossible. We do know that XML is offering great alternatives to expensive interfaces to legacy data and the jury is still out as to the advantages of the new .Net platform. One thing that is certain is that we are better off to align ourselves with a vendor and a platform (i.e. Microsoft) and let them worry about the future.

I will offer my opinion that Web based programs are here to stay and we will see even more applications move to this technology as consumer acceptance takes an even greater hold. From our standpoint and those of many of the web based development pioneers, this is not new technology, but it is certainly going to be more prevalent as companies find new ways to deliver applications across the network in a more efficient and cost effective manner.

Procuring a web based CMMS shouldn't require any difference in the way your IT department evaluates technology, the only difference is that the desktop requires nothing more than a web browser. Security is up to IT, place the application on a server between your firewalls and voila, instant deployment. For those people who like to customize the applications, ask the vendor if open source code is available. If they have nothing to hide and use standard web development tools, you'd be surprised at what you can do to make those little changes much more easily than standard compiled code.

Whether you're running a local operation with three locations or you're a multi tiered international business, web based CMMS can streamline software delivery and offer a centralized data repository for accessing and analyzing real time data. The cost savings are enormous; the question is, are you ready for it?

# Impact Of TPM On Manufacturing Productivity

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*Extracts from a paper by Attia Hussien Gomaa -  
Contact attiaomaa@yahoo.com for the full paper.*

**T**PM is an integrated approach for maintenance management to maximize equipment effectiveness by establishing a comprehensive productive-maintenance system. TPM was defined by Japanese Institute of Plant Engineers (JIPE) in 1971. TPM involves operational and maintenance staff working together as a team to reduce wastage, minimize downtime and improve end-product quality [Tsang, 2000 and Eti et al., 2004].

In literature, TPM is defined in a number of different ways, which are as follow:

- TPM is an organizational philosophy which focusing on equipment and operations to achieve optimum results. It is a manufacturing program designed primarily to maximize equipment effectiveness throughout its entire life through the participation and motivation of the entire work force [Nakajima, 1989].
- TPM is a partnership between the maintenance and production organization. It is an attitude, process, culture change to operate equipment under optimum conditions [Hartmann, 1992].
- TPM provides a comprehensive life cycle approach to equipment management that minimizes equipment failures, production defects, and accidents. It involves everyone in the organization, from top level management to production mechanics, and production support groups to outside suppliers. The objective is to continuously improve the availability and prevent the degradation of equipment to achieve maximum effectiveness. These objectives require strong management support as well as continuous use of work teams and small group activities [Hamacher, 1996].

TPM is an approach to continuously improve productivity of plant and equipment, through the following:

- Improving and maintaining equipment at optimum conditions,
- Improving end-product quality (e.g. by insisting on purchasing better designs) and services (e.g. through better-maintained plant and machines),
- Education and training of manpower, so empowering them and raising morale, to keep pace with the complexity of evolving technologies,
- Technological base of a company by enhancing equipment technology and improving the skill of manpower, and
- Information availability for all maintenance and production tasks.

There are many different TPM approaches; however, the common elements in all of them are training, implementation, and stabilization plus careful management for planning and execution. TPM procedures may be considered to be in five phases; the following are the major activities in each phase:

- **Phase 1. TPM feasibility study:** This phase focuses on the cost benefits analysis and decision making processes;
- **Phase 2. Problem identification and developing equipment awareness:** It includes study the organization, analyze the existing maintenance problems, analyze the working conditions, start the equipment awareness program, and identify the critical machine and components.
- **Phase 3. TPM procedure development:** This phase deals with collect all information on machines, development standard servicing procedures, development proper operator communication channels, development continuous feedback for operator response, development quality consciousness among operators, develop self-maintenance procedures, develop data collection procedures, develop training materials, and develop quality feedback system.
- **Phase 4. Initial implementation program:** It focuses on customize the servicing procedure for the specific machine, conduct training, implement procedures and policies, problem solving through problem solving techniques, and feedback from operators and audits.

- **Phase 5. TPM Program Maintenance and stabilization:** This phase deals with develop the structure and policies for the TPM steering committee, develop information flow, develop guidelines for maintenance scheduling, conduct advanced training, develop guidelines for machine trend reports and improvements, develop procedures for document control, feedback and improvement, and company-wide TPM implementation program.

Hartmann (1992) emphasized the need to customize the TPM process to work for the specific manager, in the specific environment, with the specific people. He indicates that there are country, plant, and management specific aspects of TPM implementation.

Finally, Bamber et al. (1999) outlined ten main reasons for TPM failure within UK manufacturing organizations. These are: (1) the program is not serious about change; (2) inexperienced consultants/trainers are used; (3) the program is too high level, run by managers for managers; (4) there is a lack of structure and relationship to strategic needs; (5) the program does not implement change on the shop floor and is not managed; (6) a lack of education and training for those expected to take it on board and provide support; (7) programs are initiated and run exclusively by engineering and seen by production as a project that does not involve them; (8) attempts to apply TPM in the same way it is implemented in Japan, using the standard approach found in Japanese publications; (9) TPM teams lack the necessary mix of skills and experience; and (10) poor structure to support the TPM teams and their activities.

Refer to [McKone et al. 1999], Figure (1) considers the relationship among the environmental, organizational, and managerial factors, and the autonomous and planned TPM elements. They hypothesize that there are significant differences in the level of TPM development and implementation that can be explained. Also, he showed that the implementation level of TPM was closely linked to the implementation level of Just in Time (JIT), Total Quality Management (TQM), and Employee Involvement (EI). Companies with higher implementation levels of JIT, TQM, and EI also had higher implementation levels of TPM.

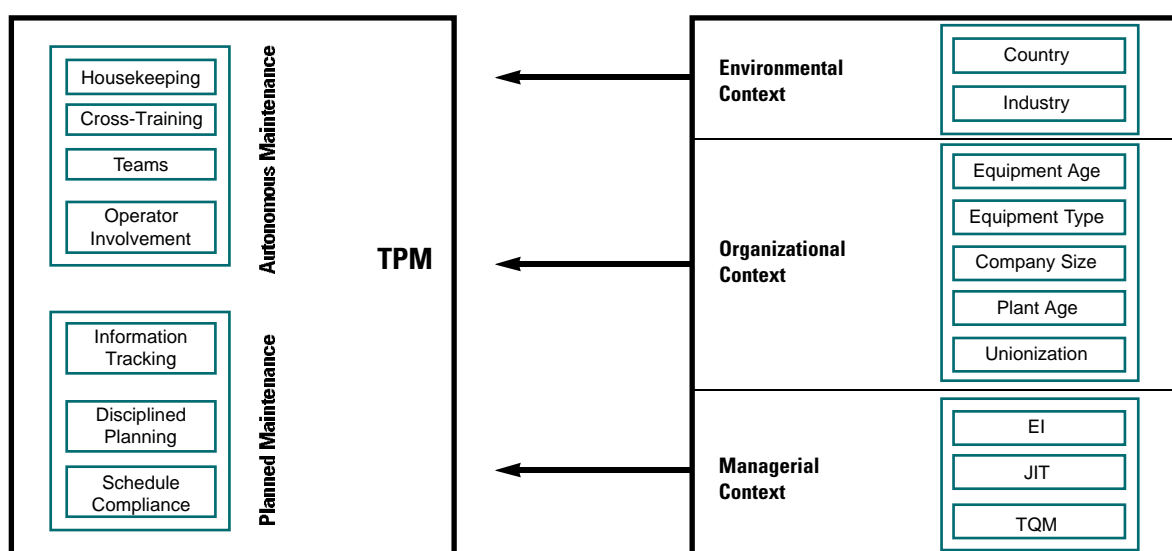


Figure 1: TPM framework, [McKone et al. 1999].

## MEASUREMENT OF TPM EFFECTIVENESS

TPM classifies equipment losses into six major categories. As shown in Table (1), the first two losses are defined as down-time losses, which refer to time when the machine should be running, but it stands still. The third and fourth losses are speed losses, in which the equipment is running, but it is not running at its maximum designed speed. The last two losses are regarded as quality losses, in which the products do not fully meet the specified quality characteristics [Johnson et al., 1999 and Dismukes, 2002].

Table 1: Equipment Losses Categories

Category	Equipment losses	Indicator
Down-time losses (lost availability)	Equipment failures Set-up and adjustments	Equipment availability
Speed losses (lost performance)	Idling and minor stoppages Reduced speed operation	Equipment performance efficiency
Defect losses (lost quality)	Scrap and rework Start-up losses	Equipment quality Rate

$$\text{Availability Rate} = \frac{\text{Operating Time} - \text{Downtime}}{\text{Total Operating Time}} \quad (1)$$

$$\text{Performance Rate} = \frac{\text{Total Output}}{\text{Potential Output at Rated Speed}} \quad (2)$$

$$\text{Quality Rate} = \frac{\text{Good Output}}{\text{Total Output}} \quad (3)$$

Overall equipment effectiveness (OEE) is used as a main measure for TPM, which is a function of equipment availability, performance rate, and quality rate. The goal of measuring OEE is to improve the equipment effectiveness.

$$\text{OEE} = \text{Equipment Availability} \times \text{Performance efficiency} \times \text{Quality rate} \quad (4)$$

Raouf (1994) described a new method of computing OEE, using different weights. He concluded that traditional means of evaluating maintenance management systems could not yield higher capital productivity. Factors affecting OEE are not equally important in all cases and different weights should be established. Furthermore, Lungberg (1998) stated that the definition of OEE does not take into account all factors that reduce the capacity utilization, for example, for planned downtime, lack of material input, lack of labour, etc. In order to make the OEE meaningful, the losses should be subdivided into further sub-groups.

Referring to the work of Chand and Shirvani (2000), the true performance of the equipment productivity is measured by total effective equipment productivity (TEEP), which is a combined measure of equipment utilization and OEE. The latter can be improved at the expense of equipment utilization by scheduling PPM and product changeovers during planned downtime. The OEE is not an exact measure of equipment effectiveness as set-up, changeovers and adjustments are included. Therefore, to provide a more accurate analysis, the net equipment effectiveness (NEE) can be measured that reflects the true quality and effectiveness of the equipment when running.

$$\text{TEEP} = \text{Utilization} \times \text{Availability} \times \text{Performance efficiency} \times \text{Quality rate} \quad (5)$$

$$\text{NEE} = \text{Uptime ratio} \times \text{Performance efficiency} \times \text{Quality rate} \quad (6)$$

Chan et al. (2003) developed a simple method for monitoring the performance of machine was the Mean unit between assists (MUBA) instead of OEE.

$$\text{MUBA} = \text{Total number of units produced} / \text{Number of stoppages} \quad (7)$$

According to the studies of Campbell (2001) and Tsang (2002), there are many different ways of measuring manufacturing productivity (MP). The commonly used maintenance-performance indicators are measures of the following: (1) equipment performance, such as availability, reliability and OEE; (2) process performance, such as the ratio of achieved to planned work, as well as of schedule compliance; and (3) cost performance, such as labour and material costs of maintenance.

In conclusion, OEE is a basic fundamental measurement method for TPM. It requires a wider classification of losses for better understanding of machine utilization. Furthermore, levels of OEE measurement and the factors affecting it different in various business sectors and industries. Thus, a tailor-made OEE in different industries or business sectors is required.

## IMPACT OF TPM ON PRODUCTIVITY IMPROVEMENT

The impact of TPM on improving productivity has been stated in many studies, and there is a lot of excellent case studies, for examples; Varughese (1993) studied the effectiveness and implementation of TPM program for SEMD Company for wood products. He concluded that, TPM model contributes the following tangible benefits: reduction in emergency maintenance hours (almost 35%), improving in production quantity (about 25%), reduction in manufacturing cost (almost 15%), and improving in product quality (about 2%). Moreover, TPM achieved many intangible benefits such as: reduce the communication problem, and promotion of team approach, and improve operator satisfaction.

Koelsch (1993) and Mckone et al. (2001) referred to that, the benefits from implementing TPM have been well documented at numerous plants. Constance Dyer, Director of Research and TPM Product Development, Productivity Inc., says that companies that adopt TPM are seeing 50% reductions in breakdown labor rates, 70% reductions in lost production, 50-90% reductions in setups, 25-40% increases in capacity, 50% increases in labor productivity, and 60% reductions in costs per maintenance unit.

Sivalingam (1997) stated that, an integrated TPM when properly implemented can lessen emergencies by 75%, cut purchasing by 25%, increase warehouse accuracy by 95% and improve preventative maintenance by 200%. He pointed to, with maintenance costs raising from 9% to 11% per annum, the potential for savings is very high in the short and long term. Good management of maintenance can reduce costs by as much as 35%. Renner et al. (2003) reported that TPM has a very high success rate in improvement of equipment effectiveness, ownership of equipment productivity and maintenance, increased maintenance skills, more effective management of equipment and even predictive maintenance. Typical manufacturers are experiencing up to 65% OEE improvements, quality improvements up to 50% and maintenance expenditure reductions of up to 50%.

Hutchins (1998) reported results of two TPM case studies. The first one was Nissan, Tochigi car manufacturing with 7000 employee, in which the results are concluded as follows: (1) number of cars passing QC first time (no rework) increased by 70%; (2) number of plant breakdowns reduced by 80%; (3) overall equipment efficiency increased by 30%; and (4) comment from the company: "we cannot management our plant without TPM". The second case was Nippon Lever, Utsunomiya plant (Manufacturing Lux soap, household cleaners), in which the results are as follows: (1) reduction in operating costs - £2.8 Million; (2) cost of introducing TPM £90000!; (3) production efficiency (Domestic filling line - up from 76% to 95% and high speed soap line - up from 54% to 85%); and (4) comment from company "the ideal status of a machine is to have no defects, no breakdowns. You may think that's impossible.



But when you see the Nippon Lever plant, you realize it is possible". Also, he reported that, typical calculations for OEE usually range between (40 to 50%), but experience indicates that it is possible to raise this to between (80 to 90%) in a period of some two to three years from TPM start up.

Chand and Shirvani (2000) applied a TPM program within a semi-automated assembly cell. The production output of the cell over the observed period was 26 515 unit. This represents 97% good components, 0.33% scrap and 2.67% rework. The number of stoppages recorded was 156, where the 10 most common causes were identified. The OEE was 62% and the six big losses represent 38% loss of the productive time.

Chan et al. (2003) achieved a TPM program for an electronics manufacturing company in Hong Kong. This company is a multi-national company, which employs more than 2500 people. TPM is implemented in the first quarter of 1998 and ended in 2000. In conclusion the following benefits were observed after TPM implementation: (1) Effective equipment management: the equipment productivity was improved by about 83%. Also, the equipment stoppage rate was reduced from 517 to 89 times. This tremendous improvement enhanced the equipment in both effectiveness and quality in product produced; and (2) Empowerment of employees: empowering the workforce caused a development of a bright, cheerful and relaxed workplace for production people.

Moreover, many case studies have told similar success stories, such as:

- Steel [Koelsch, 1993];
- Tennessee Eastman [Garwood, 1990];
- Nissan [Suzuki, 1992];
- Nippondenso [Teresko, 1992];
- Automotive Compressor [MACI, 1995];
- Boeing Commercial Airplane [Hamacher, 1996];
- A semi-automated assembly cell [Chand and Shirvani, 2000];
- Large Global companies [Ireland and Dale, 2001];
- Pulp and Paper [Van-der-Wal and Lynn, 2002];
- Ceramics [Ferrari et al., 2002]; and
- Electronics [Chan et al., 2003].

# ARMS Reliability Engineers

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In summary, TPM benefits may be concluded as follows:

- Tangible benefits:

- (1) Improvement in OEE (25 to 50%);
- (2) Improvement in labour productivity (30 to 40%);
- (3) Reduction in product defects (25 to 30%);
- (4) Reduction in maintenance cost (10 to 30%);
- (5) Reduction in unplanned maintenance (20 to 50%);
- (6) Reduction in manufacturing cost (5 to 15%); and hence;
- (7) Improvement in total system productivity (20 to 30%).

- Intangible benefits:

- Promotion of team approach;
- Improve operator satisfaction;
- Empowerment of manpower; and hence
- Reduce the communication problem.

## PROPOSED TPM INFORMATION SYSTEM

Information availability is a back-bone of TPM. It should be at such a detailed level that it fulfils its objectives. So, an outline of TPM Information System (TPMIS) is addressed. As shown in Figure (2), the proposed system comprises six modules, which are master plan, equipment, production, human-resource, risk analysis, and finally overall system analysis module, (refer to Figures (3 through 7)). This system should help the TPM program to be more effective and easily adaptable to any manufacturing set up. In the future development of this system, more modules should be added, and the content of each module should be carefully elaborated.

## CONCLUSIONS AND RECOMMENDATIONS

This study emphasizes the importance of TPM implementation in manufacturing plants, and its impact on improving plant productivity. TPM benefits may be concluded as follows: 25 to 50% improvement in OEE; 30 to 40% improvement in labour productivity; 25 to 30% reduction in product defects; 10 to 30% reduction in maintenance cost; 20 to 50% reduction in unplanned maintenance; 5 to 15% reduction in manufacturing cost; and hence, 20 to 30% improvement in total system productivity. In conclusion, these benefits resulted from the change of organizational culture, human-resource management, communication management, and the relationship between maintenance, productivity and quality.

However, to gain the full benefits of TPM, it should be customized and applied in the proper amounts, in the proper situations, and be integrated with the manufacturing system and other improvement approaches such as TQM and JIT. TPM depends on the information availability to achieve its target, so, an outline of TPMIS has been developed. In future development of this system, more modules should be added, and the content of each module should be carefully elaborated upon.

Based on this research, the author recommends that practitioners pay closer attention to their maintenance management practices and their impact not only on costs but also on quality and delivery performance. Hopefully, this type of research will support and encourage successful implementation of TPM.

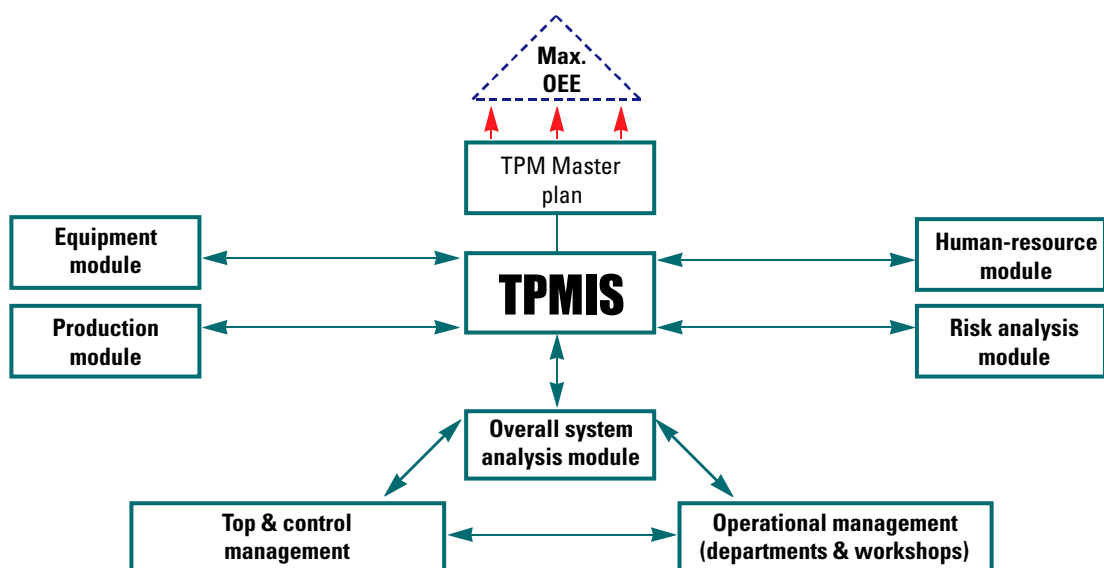


Figure 2: Proposed TPMIS Outline

However, some critical factors are required to be considered during the future research of TPM implementation:

- Information Management: the TPM effectiveness measurement is usually made by the OEE measurement, which is a function of availability, performance efficiency and quality rate. Large amount of data collection related to the three factors are required, so information management is the crucial factors for successful data collection.
- Resources management: Resources allocation is one of the crucial factors for TPM implementation, as the need of manpower for maintenance training is increased with the implementation of TPM for the remaining production equipment.
- RCM approach in PM system: The ultimate goal for TPM, with respect to equipment, is to increase its effectiveness to its highest potential and to maintain it at that level. In this connection, a development of an effective preventive maintenance system using RCM is required to optimize preventive maintenance strategies.

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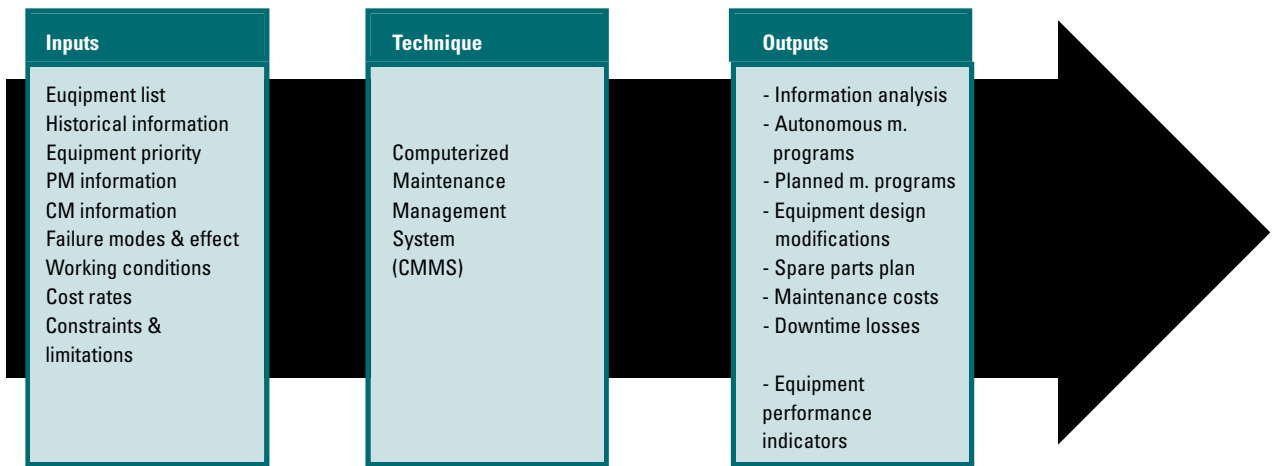


Figure 3: Block Diagram for Equipment Module

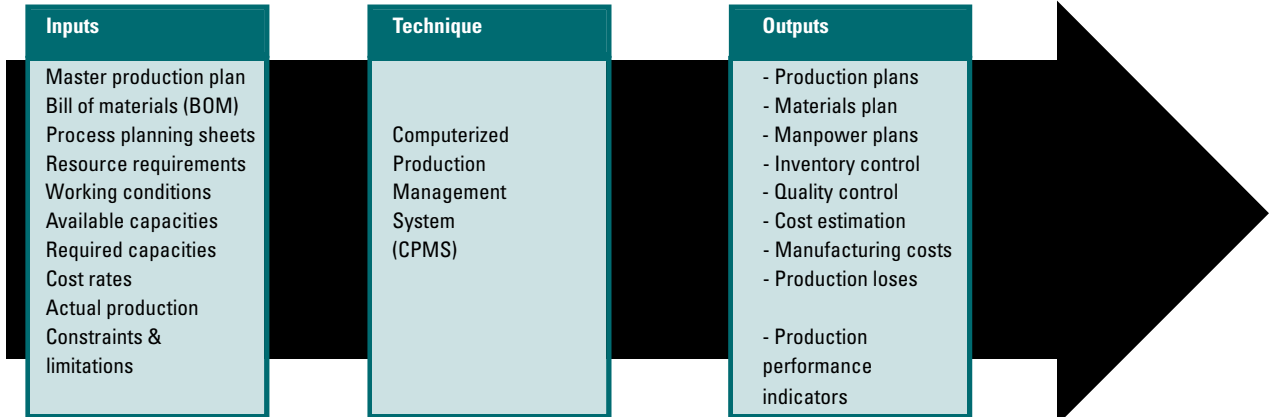


Figure 4: Block Diagram for Production Module

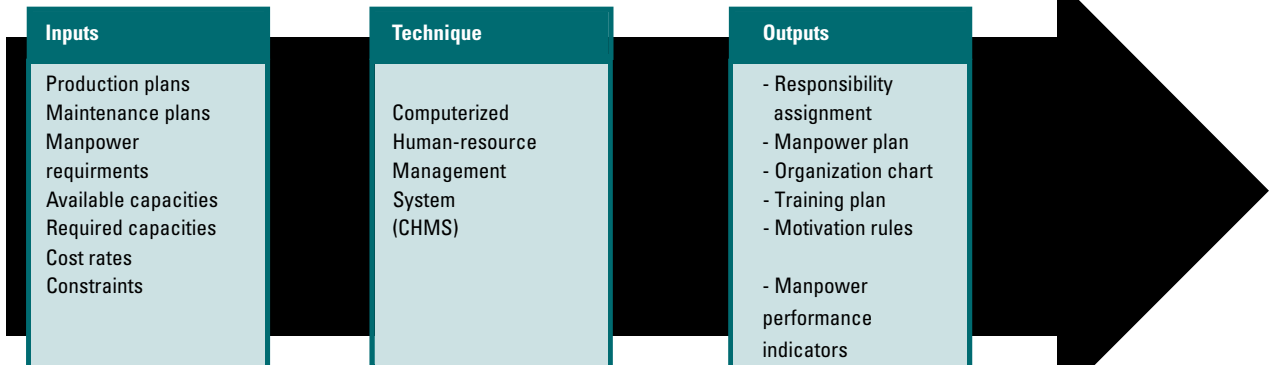


Figure 5: Block Diagram for Human-resource Module

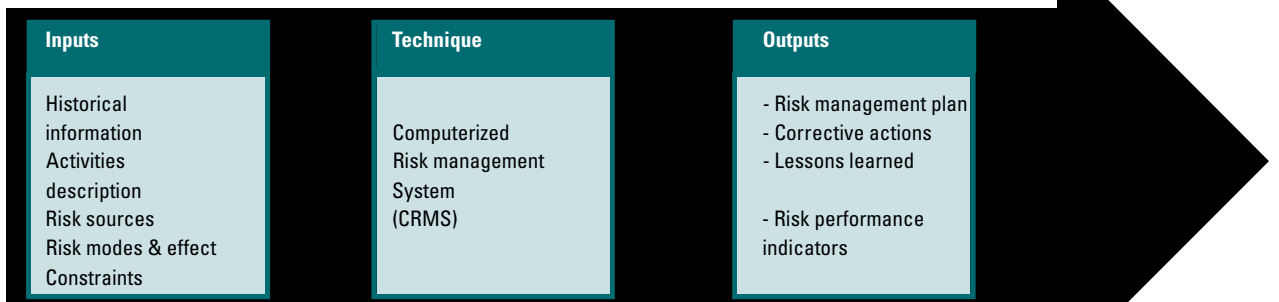


Figure 6: Block Diagram for Risk Analysis Module

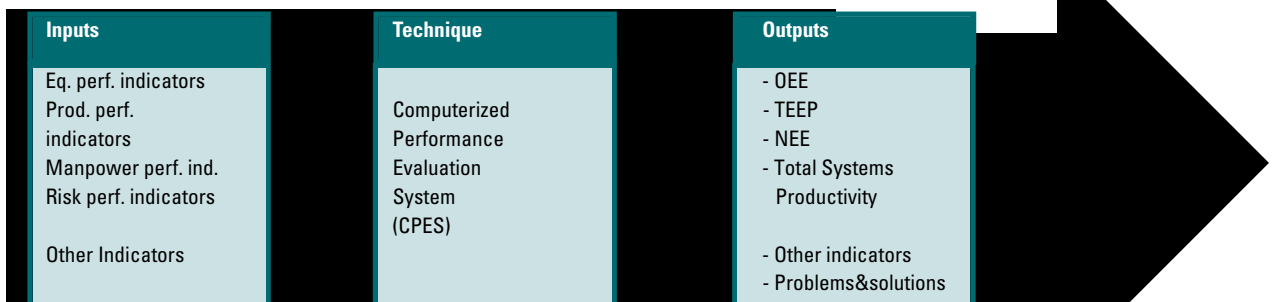


Figure 7: Block Diagram for Overall System Analysis Module

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### General

- Access & SQL Versions available
- Alternate colour rose listings
- Easy to use graphical format
- Drag & drop Equipment movements
- True view search function
- Text sensitive searches
- System Security by Group and/or User
- Predefined Security Groups
- Global Security settings
- Spell checker
- Export to excel or word
- Import all existing data into MEX
- Security access includes hidden, no access, add/edit/read, delete
- Customisable security groups
- Audit trails
- Customise each users settings
- Email address for each user
- Incorporates multiple data files
- Archive / restore data
- Multiple taxation codes
- Multiple currency
- Colour coded dates for items overdue
- performance dashboard

### Asset /Equipment Register

- Complete equipment register
- View, add and update all details from within a selected record
- Record and report on details of supplier, costs, purchase date etc
- 40 User Definable fields
- Equipment movement tracking
- Location hierarchy to any branch of equipment
- 7 hierarchy levels
- Inclusion of all equipment details including graphics/pictures
- Security and User access levels
- Depreciation
- Rename equipment
- Bills of material / application parts lists
- Track registrations of all equipment
- Safety notes for every item of equipment
- Calculate current values of assets

### Regions (SQL only)

- Segregate sites with regionalization
- Share or localize assets
- Customise system for particular users
- Restrict access to suppliers
- Track equipment movement between sites
- Set global options
- Search other stores for spare parts
- Regionalisation applies to Equipment, Work Orders, History, Readings, Maintenance Policies, Stores, Suppliers, Trades, Inspections, Requests, Keys, Drawings, Customers, Departments, Invoices, Purchase Orders.

### Work Orders

- Multiple jobs for a Work Order
- Resource and plan Labor, Materials and Time
- Prioritise, report on and control work in progress
- Estimated and actual job costs
- Network and Internet Work Requesting
- Graphical schedules & tracking of Work
- Multi-select Work Order Listing for print, delete and close

- Prompted when equipment in warranty
- Synchronise with MS Project
- Allocate work with plod sheets to each tradesperson
- Assign contractors to work order
- Dispatch and receive work performed by contractors
- Resource scheduling
- Bill work of a customer internal or external
- Multiple departments
- Assigned tasks can generate subsequent work orders
- Email work orders

### To Do List

- Flag and track incomplete tasks from Work Orders
- Mark tasks as incomplete and add to next Work Order
- Create ToDo items for assets for next time Work Orders
- Recall and add ToDo's to Work Orders
- View any ToDo's outstanding on any equipment
- Automated notification of task existence for Work Orders raised

### Maintenance Policies

- Schedule work by conditions, hours used, km, months etc
- Automatic Work Order creation
- Standard Jobs
- Allocation and management of job spares, people and costs
- MS Project scheduling interface
- Attach files to policies
- Automatic budget figures for all work for any time period
- Produce calendars of all work due
- Fixed or floating scheduling
- Group PM's by equipment type

### Permits

- Electronic Permit and Certificate Approval
- Modify and create permits
- Bulk approval of permits via email
- Attach and track permits with work
- 2 levels of approval
- Restrict work commencement until Approval
- Hot Work Permits, Confined Space Permits, Electrical Certificate of Compliance, Safety Certificates, Lock Out, Fire Protection Equipment Impairment Notice, Hazardous Work Permit, Working at Height Permit.

### History

- Life cycle costing and comparative analysis
- Failure analysis codes
- Full work details including description, labour and parts
- Account code charges
- Down time/Repair time
- Add "costs" to second line
- MTBE MTTR
- Import readings from other systems
- Add post entry work orders after the fact

### Equipment usage performance

- Record and report on any reading type, hours, Kpa, Km, Amps etc

- Calculate average usage rated for equipment
- Report on equipment performance

### Readings

- Monitor Plant Readings
- Track plant usage times
- Graph results

### Invoicing

- Invoicing of work completed
- Create invoices directly from Work Orders
- Complete breakdown of costs, labour and parts
- Invoice matching to line item level
- Customer specific pricing
- Create credit notes for any invoice
- Sell in foreign currency
- Email invoices

### Drawings

- Complete drawings register
- Store equipment listing for each drawing
- View any drawing format including cad

### Reports

- Ease of data capture
- User customisable reports in MS Access
- Export data quickly and accurately
- Add your own reports to reports menu
- Over 150 reports and graphs come standard

### Keys

- Record and monitor key register
- Report on key allocations
- Know what person has keys when they leave

### Downtime

- Record downtime on any plant or equipment
- Report on downtime of plant and equipment

### Inspections

- Create Inspections based Work Orders
- Question & Answer format
- Question Set creation
- Group Inspections by Equipment Type
- Inspections recorded against individual assets
- Inspection flag on Work Order and MP Listings
- Define readings, tasks, check and action

### MEX Stores

- Catalogue
- Complete catalogue of all Store items
- Multiple warehouses/Stores
- Parts listing for particular equipment

### Suppliers

- Preferred suppliers for stock items
- Multiple suppliers per item
- Supplier listing

### Inventory

- Stock level control
- Item markup by % or \$ amount
- Complete stocktaking

- Adjustment notes
- Report capabilities
- Multiple suppliers for any part
- Multiple bin locations for any part
- Transfer stock between locations
- Pick slips

### Purchasing

- Purchasing any material
- Goods received
- Manage all purchased
- Invoice matching
- Partial receipt of goods on Purchase Orders
- Adjustment notes for any returns
- Purchase in foreign currency
- Email purchase orders
- Direct charge purchasing

### Easytime

- Fast, easy entry of times into Work Orders
- Create Work Orders for everyday jobs that would otherwise go unrecorded
- Download times for Payroll
- Register all your employees

### Web Applications

#### MEX Ops

- Maintenance Requests can be made from any location
- Manage request priority
- Review, approve and create Work Orders from a single screen
- Fully web enabled, so use it on the Internet, your network or local Intranet
- Respond to or cancel requests

### PDA Applications

#### HandiMEX

##### Store Issues>Returns

- Issue parts directly to Work Orders
- Carry out stock returns
- Instant stock level adjustment

##### Ad Hoc Work Orders

- Create new Work Orders remotely
- Allocate the trade required to do the task
- One touch upload to MEX

##### Stocktake

- Perform stocktake of whole store or selected areas
- Utilise barcode for accurate inventory identification
- Produce stock adjustment reports

##### Readings

- Remote gathering of asset readings
- One touch upload of readings
- Readings can be used to trigger scheduled maintenance

##### HandiWork

- Download active Work Orders from MEX to Handi-held Device
- Filter by department, site, trade code, trade name, store etc
- Issue spares
- Add notes, comments and history
- Close Work Order
- One touch upload to MEX
- View tasks

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it drives well,  
and under  
the hood  
it's a high  
performance  
vehicle.

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m e x

# Computerised Maintenance Management and Enterprise Management Systems

This listing of CMMS and EAM systems was compiled by Ian Bradshaw, March 2005. The information provided is as received from those organisations responding to the survey. The Maintenance Journal does not therefore accept any responsibility for information given in this survey.

## AMPRO

Address: Third City Solutions Pty Ltd  
93 Links Ave South Eagle Farm, 4009, Queensland, Australia  
Name: David Powell Phone: 61 07 3868 4190 Fax: 61 07 3868 4191  
Email: dpowell@thirdcitysolutions.com Web: www.thirdcitysolutions.com

**Countries Supported:** Australia

**Typical Cost:** Small site: \$2,390 Medium: \$7,052 Large: POA (Aus\$)

**Available as a stand-alone system:** Yes

**CMMS part of larger management/corporate system:** No

### CMMS Details - Technical

AMPRO is a Window based application, which utilizes Client/Server methodologies to increase system performance and efficiency. AMPRO can be installed stand-alone or on a network with the database installed on a network server or client computer.

AMPRO is available with a choice of database engines, being either MSDE (Microsoft SQL Server 2000 Desktop Engine), a data engine built and based on core SQL Server technology or Microsoft Access 2000/XP, utilizing Microsoft's Jet database engine, a file-based data management system.

AMPRO uses Crystal Reports as its main reporting engine and enables you to export your reports into many different formats. AMPRO allows you to use Crystal Reports and/or Microsoft Access 2000/XP to develop your own custom reports which can be seamlessly integrated into AMPRO.

### CMMS Details - Functionality

AMPRO Was designed with the user in mind, keeping it intuitive whilst moving through the windows, as each module has the same look and feel. You do not need extensive training programs to implement as the comprehensive user guide and online help will assist in the early days of implementation.

Contacts only need to be set-up once in AMPRO. Just tell AMPRO what type of contact they are. Supplier, Manufacturer, and/or Contractor etc AMPRO will allow you to set-up your assets that best suit your needs. There is no need to follow a rigid process to achieve the required results.

Costs can be tracked against an asset and cost centres. AMPRO allows you to have individual cost centres assigned to each inventory item and labour used on the job.

Whether you want to maintain a fleet of vehicles or a hotel chain, AMPRO will do this with ease. You may be charged with all types of assets, this not a problem with AMPRO.

1. Modules are seamlessly integrated with each other.
2. Colour coded modules and the same 'look and feel' throughout makes the application intuitive for users.
3. Post messages, for users of AMPRO can see.
4. Option to use up to six (6) levels in asset register.
5. The ability to export reports in many common formats.
6. Filter and format the Listings and then print them out gives you power and flexibility to customise your own reports filter and format listings.

## AMPRO PE [Portable Edition]

Address: Third City Solutions Pty Ltd  
93 Links Ave South Eagle Farm, 4009, Queensland Australia  
Name: David Powell Phone: 61 07 3868 4190 Fax: 61 07 3868 4191  
Email: dpowell@thirdcitysolutions.com Web: www.thirdcitysolutions.com

**Countries Supported:** Australia

**CMMS Designed For:** Most

**Typical Cost:** Small site: \$2,000 Medium: \$5,000 Large: POA (Aus\$)

**Available as a stand-alone system:** No

**CMMS part of larger management/corporate system:** Yes

### CMMS Details - Technical

AMPRO [Portable Edition] is an application that runs on a PDA (Personal Digital Assistant) - to perform various tasks related to asset maintenance. No need to have specialized equipment as AMPRO PE works with most PDA's on the market.

Created using the latest development methods AMPRO PE takes the maintenance management to a whole new level away from the restrictions of the office. With the ability to incorporate barcode scanners where scanning assets and / or inventory makes data collecting that much easier. Working within AMPRO, data is upload and downloaded quickly and easily.

AMPRO PE is made up of a number of easy to use modules that will run on Windows Mobile® and Palm/E OS based PDA's. The modules included are Assets, Inspections, Jobs, Readings, Inventory and Job Requests.

### CMMS Details - Functionality

**Assets** Like in AMPRO, the Assets module is the core module of AMPRO [Portable Edition]. Existing assets can be updated and moved and new assets can be added on the PDA. Use the Bulk Move feature to move large numbers of assets around.

**Inspections** Inspections are created in AMPRO, and then linked to assets they are to be performed on. Instructions for each asset are then check off as they are done recording predefined results against them as they go.

**Jobs** Existing jobs can be uploaded to the PDA, Jobs can be filtered before being uploaded to the PDA. New jobs can also be raised on the PDA with the ability to add Labour, Inventory and Instructions records to the new job. Journals can also be added at anytime to a job as well as completing the job on the PDA.

**Readings** The Readings module will allow the user to record up to date meter and condition monitoring type readings against an asset. This reading will be validated against the last reading stored in AMPRO at the time the reading data was uploaded to the PDA.

**Inventory** Use the Inventory module to perform stock takes by simply scanning or selecting the inventory item and recording the new quantity on hand.

**Job Requests** The Job Requests module allows you to create new job requests on the PDA for submission to the person or department responsible for managing.

## API Pro

Address: Suite 22, 450 Elizabeth Street, Surry Hills NSW 2010 Australia  
 Name: Ian Jones Phone: 02 93180213 Fax: 02 93180776  
 Email: info@aptgroup.com.au Web: www.apipro.com

**Countries Supported:** within more than 40

**Typical Cost:** Small site: \$6,000 Medium: \$35,000 Large k\$100+ (Aus\$)

**Available as a stand-alone system: Yes**

**CMMS part of larger management/corporate system: No, but it can be interfaced to CRM, & ERP systems if required.**

### CMMS Details - Technical

API is designed to be installed within today's industry IT systems and major database structures, Progress, Oracle, MS SQL Server, DB2/400. Interfacing to Condition Monitoring, Palm Pilot, Bar Code, Data Loggers, ERP systems, Financial systems.

Technology: System Security: API is controlled by the system supervisor who assigns users access to specific zones. Systems Structure: API Pro is powered by Progress providing multi-tier client/server technology. Its query tools allow for advanced reporting and statistical analysis.

### CMMS Details - Functionality

API Pro V5 Overview: API Pro is used within 500 leading companies worldwide in a variety of industries maintaining high-value capital assets, plant, facilities, building & equipment. API Pro is designed to generate continuous management improvements within your company by optimising production output, utilisation of human & financial resources.

Example of Modules: Plant Documentation & Information Searching;

Maintenance, Inspection, Stock Control, Purchase Management, Job Ordering, Internal Purchase Requests, Drawing and Documents and Graphical Navigator, Production Calendar, Project Management, Resource Planning, WEB, Analysis & Performance, Palm Pilot, Condition Monitoring Interface, SKF @ptitude, Documentation validation (FDA), Standard interface to SAP, MFG/Pro + others

## ASSET GUARDIAN

Address: SKILLED Group Limited  
 850 Whitehorse Road, Box Hill, Victoria, 3128 Australia  
 Name: Greg Kastes Phone: (03) 9924.2214 Fax: (03) 9924.2423  
 Email: gkastes@skilled.com.au Web: http://www.skilled.com.au

**Countries Supported:** Australia, Canada, USA

**CMMS Designed For:** All Asset, Equipment and Facility Maintenance

**Aprx.Cost:** Small: \$2,500 Med:\$15,000 - \$40,000 Large: k\$40,+ (Aus\$)

**Available as a stand-alone system: Yes**

**CMMS part of larger management/corporate system: No - but the system can easily integrate with many corporate applications.**

### CMMS Details - Technical

SKILLED Asset Guardian is a scalable, modular system that can be effectively implemented in sites ranging from a single user, all the way up to large sites that require comprehensive security and integration features. The core system includes all the most sought-after features that are required for the day-to-day operation of the maintenance/procurement departments. Other features can be added as optional modules and concurrent user licensing allows clients to purchase only the number of users that will be accessing the system at any time, while being able to install the software on as many PC's as required.

The ability to integrate with other systems is built into the software and links to a number of popular systems currently exist. The software will run in most network environments and utilizes the powerful Microsoft SQL Server database. Client PC's running W98 and higher can effectively run the software.

### CMMS Details - Functionality

SKILLED Asset Guardian has been designed so clients can "cherry-pick" only the features that they wish to use. The unused features will not get in the way or slow down the way the system is used. Data entry is kept to an absolute minimum by utilizing wizards and providing the ability to process many entries at one time as in PM compliance or Work Order Planning along with the use of barcoding for additional speed and accuracy.

Key Features/Modules of the system include:

- Comprehensive Equipment Register • Purchase Order Processing
- Flexible PM Scheduling • Labour & Material Costing
- Work Order Management • Storeroom Management

- Configurable Planning Screen • Ad-Hoc, On-Screen Reporting
- Spare Parts Cross Reference Lists • Drgs and Technical Documents
- Web-based Work Requests • Approvals System
- Exceptionally Powerful Searching • Custom. Screens and Toolbars
- Barcode Capability • Toolcrib Management

There is no need to spend months loading the system before you can start reaping the benefits. Using our "Quick-Load" spreadsheets, you can have the system up and running the same day it is installed. Using the industry-leading Crystal Reports, custom reports can be quickly and seamlessly added to the system to provide the key data required to manage your operations.

Training can be customized to fit your requirements - whether it is a "train the trainer", classroom or on-site user training scenarios.

Finally, a common-sense approach to Maintenance Management Systems. Check out SKILLED Asset Guardian today.

## Avantis

Name: Joe Wone  
 Phone: 62-21-75909331  
 Email: joe.wone@ips.invensys.com  
 Web: www.avantis.net

**Countries Supported:** In the Asia Pacific region these countries include Australia, New Zealand, China, Indonesia, Vietnam, Singapore, Thailand, Malaysia and Japan.

**Aprx. Cost:** Small accounts start at about 20K USD and some large enterprise accounts can hit over \$1M USD in licenses fees.

**Available as a stand-alone system: Yes**

**CMMS part of larger management/corporate system:**

Yes, for the last 20 years, Avantis has stood on its own as a world class asset management solution. Today Avantis is also a critical element to the Invensys plant asset management strategy (see below) for complete proactive and predictive maintenance strategies. In addition, Avantis provides web services for easy integrations that enable turnkey standard package offerings such as GIS, hand-helds, and ERP integrations (Oracle, SAP, Peoplesoft).

### CMMS Details - Technical

At Invensys, our definition of asset management extends to all the critical assets and processes within the environment that contribute to the performance of the plant and ultimately to the performance of the business.

At the lowest level, this encompasses the device layer and the plant network environment. At the highest level, this extends to the overall performance of the plant against the customer defined key performance indicators.

Our asset management solution is an integral part of a complete offering encompassing four major components:

- Decision support
- Enterprise Asset Management
- Condition Monitoring
- Field Device Management

These components each provide strong independent value, but when combined they allow our customers to move to a fully predictive and pro-active management environment that allows you to focus on asset and plant performance and the overall return on assets (ROA) of the plant.

### CMMS Details - Functionality

Traditional Enterprise Asset Management products can accumulate more raw data than most can handle. But can they truly help you anticipate the unexpected? The Avantis solution can. It integrates extraordinary software and services, going beyond traditional asset management to provide the relevant asset intelligence you need.

Only the Avantis solution leverages real-time plant-floor data and leading-edge predictive technology to empower confident decision-making at every level of your enterprise. So you can optimize every interaction with your supply chain to maximize return on assets.

Our unique InRIM (Rapid Implementation Methodology) approach applies a preformatted database and standard template driven tools to produce a quick implementation with minimal taxing of customer personnel complete with industry best practices.

Avantis consists of entity managements, work management, preventive maintenance, condition monitoring, scheduling, approval/workflow, MRO Inventory, Procurement, and an Integration Toolkit.



## AyaNova

Address: Ground Zero Tech-Works Inc. Suite #310, 1434 Island Hwy.  
Campbell River, BC CANADA V9W 8C9  
Email: support@ayanova.com Web: http://www.ayanova.com

**Countries Supported:** AyaNova is supported around the world via free online and email technical support

**Typical Cost:** Small site:US\$125 per scheduled user

Medium Site: US\$125 per scheduled user (US\$)

**Available as a stand-alone system: YES**

**Is CMMS part of larger management/corporate system: NO**

### CMMS Details - Technical

Network or stand-a-lone. No special server hardware required. Minimum Pen 75. Windows 98/ME/NT/2000/XP/2003 compatible. Minimum screen resolution of 800X600. Network access requires at minimum 10MBps, otherwise utilize the optional remote web access via standard HTTP 2.0.

Common database format for custom application add-ons and import/export.

### CMMS Details - Functionality

No support fees and free maintenance updates. Pricing matches the size of your organization and business. Enter, track, print, schedule and search all service data entered on work orders. Manage customers and equipment and maintain all history. Schedule preventative maintenance for clients, equipment, by model. Parts management - enter and track parts used in service. Project management - create service projects and assign work orders to them to report and track costs and billing by a project. Internal search engine for retrieving any service and other information entered. Internationalized date/time and currency settings. Customizable reports.

Optional remote access and optional QuickBooks integration.

## BEIMS

Address: Mercury Computer Systems  
Level 5, 501 La Trobe Street, Mlebourne VIC 3000 Australia  
Name: Reveka Konstan Phone: 03 9602 2255 Fax: 03 9602 2595  
Email: sales@beims.com Web: www.beims.com

**Countries Supported:** Australia, New Zealand, China

**CMMS Designed For:** BEIMS clients include Universities, Facility Management Companies, Councils, Sporting and Leisure Centres, Hotels, Casinos, Hospitals, Entertainment Complexes, with facilities ranging in size from multi-campus universities to smaller single building hospitals.

**Typical Cost:** Small site: k\$10+ Med: k\$40+ Large: k\$100 (Aus\$)

**IS THIS CMMS available as a stand-alone system: Yes**

**IS THIS CMMS part of larger management/corporate system: No**

### CMMS Details - Technical

BEIMS operates on WIN9X, NT, 2000 and XP supporting SQL Server, Oracle and Access databases.

**Graphics Capabilities:** Visual planned maintenance calendars. Links photos, CAD drawings, Word and EXCEL documents to Work Orders, Assets, Buildings, etc. **Ability to interface:** Links with Building Management and Financial Systems. **Reporting:** Multi-parameter reporting, exports to Word, Excel, etc. **GIS:** BEIMS SISfm links to CAD drawings, maps, etc. **Web Based capabilities:** ContractorWeb/E - contractors access jobs online. WEB Remote Request System - online requests and responses

### CMMS Details - Functionality

**Main Functional Capabilities:** BEIMS is the only purpose built facility management software developed specifically for the management and maintenance of buildings and assets. **Modules:** Core - Asset Management, Planned/Preventative Maintenance, Work Orders, Cost Control, Crystal Report Writer, Document Linking & Auto Manager View.

Optional - ContractorWeb/E, WEB & LAN Remote Request System, Help Desk, Wireless Work Orders, Materials Management, Interfaces to Building Management & Finance Systems, Fax/Print/Pager/SMS Agents, Task Library and DOMAINS (Virtual Databases).

### Special Features:

- Wireless and WEB capabilities • KPIs and Corporate Reporting
- Deployable over multiple sites, while keeping data separate
- High level of consulting and support services.

## COGZ

Address: COGZ Systems, LLC  
58 Steeple View Lane, Woodbury, CT 06798 USA  
Name: Jay Ambrose Phone: 203-263-7882 Fax: 203-263-7882  
Email :jay@kogz.com Web: www.kogz.com

**Typical Cost:** Small site:\$995.00 Med:\$2,995 Large:\$9,995 (US\$)

**IS THIS CMMS available as a stand-alone system: Yes**

### CMMS Details - Functionality

COGZ is an integrated maintenance system consisting of:

- Equipment Management • Work Order Management
- Preventive Maint • Inventory Management • Purchasing

As data is entered in one part of the system all related data is updated automatically. You never have to enter data twice since all the modules of COGZ are fully integrated.

Additional modules available are:

- Custom/Translation Module • Properties/Multiple Database Module
- Downtime Tracker Module • Work Order Request Module
- Email Reports Module • Report Writer (to create custom reports)
- Cad View and Print Module • Bar Code Software Module
- ODBC Data driver

## collectiveFleet Pro 5.0

Address: collectiveData, Inc.  
655 Liberty Way, STE 3, North Liberty, IA 52317 USA  
Name: Rob Kinney Phone: 800-750-7638 Fax: 319-665-4894  
Email: sales@collectivedata.com Web: http://www.collectivedata.com

**Countries Supported:** USA

**Typical Cost:** Medium Site: \$10,000-\$25,000 (US\$)

**IS THIS CMMS available as a stand-alone system: Yes**

**IS THIS CMMS part of larger management/corporate system: No**

### CMMS Details - Technical

collectiveFleet Pro 5.0 incorporates an open SQL database as the standard. Other SQL and oracle database options are available. Unlimited graphic file, including .jpg, .xpm, .bmp and others can be associated with a particular item. A variety of data import and data entry paths are supported. A host of filter, query and editor tools are standard with the package.

### CMMS Details - Functionality

collectiveData gives fleet maintenance shop managers the tools they need to stay on top of the day-to-day demands of managing a fleet and an in-house maintenance shop. Schedule, track and report on the tasks that are crucial to your organization. With any collectiveData maintenance management program you can: create work orders, monitor efficiency track fuel usage, monitor inventory, maintenance schedules and many many more crucial tasks. The unique desktop design coupled with the uniform navigation and control features provides a familiar work environment that is robust yet user friendly. The program is designed with our proprietary core technology which allows for an extraordinary level of customization with out the excessive costs traditionally associated with custom software. This ensures that our users have a program that meets their unique needs.

Additional features include advanced tire tracking, a maintenance request system, recall campaign management, accident and claims management, advanced reporting, depreciation monitoring and much more. Detailed equipment histories provide a powerful tool for assessing lifetime costs and replacement for both fixed and rolling assets. A detailed employee section expedites time and evaluation tracking, certification and licensing requirements and a host of other important information.

## Coswin 7i

Address: SIVECO GROUP  
BP 41, 78185 ST QUENTIN EN YVELINES CEDEX, FRANCE  
Name: STEPHANIE MORET Phone: 33.1 30 45 98 80 Fax: 33. 1 30 45 98 88  
Email: contact@siveco.com Web: www.siveco.com

**Countries Supported: Many countries worldwide.**

**IS THIS CMMS available as a stand-alone system: yes**

**IS THIS CMMS part of larger management/corporate system: yes**

**CMMS Details - Technical**

Oracle capabilities, Java and Html fully configurable according to the user profile : KPI, change of vocabulary, simplification of screen layouts, addition of fields, links to external applications amongst others thus allowing contextual navigation. Compatible with the main ERPs in the market, COSWIN interfaces also with various software applications ( supervision, GIS, process control etc..)

**CMMS Details - Functionality**

COSWIN 7i helps companies to increase their profitability - by improving the management of corporate assets, improving employee productivity and reducing costs. COSWIN 7i provides a central register of corporate facilities and assets: managing and optimising all the maintenance activities and recording a full history of work completed - including spares, tools, resources and costs. For a full picture COSWIN 7i integrates the management of, and purchasing of spare parts and services.

**Enterprise Asset Management**

Address: Intentia Australia & New Zealand  
 33 Herbert Street, St Leonards, Australia  
 Name: Sharon Jackson Phone: 02 8437 5600 Fax: 02 8437 5699  
 Email: Sharon.jackson@intentia.com.au Web: www.intentia.com

**Countries Supported:** All regions include Australasia, Asia Pacific, The Americas, Northern Europe, Central Europe and Southern Europe.

**CMMS Designed For:**

Manufacturing and asset intensive industries - such as mining, facilities and infrastructure, food and beverage, power generation and utilities, pharmaceutical and chemical.

**IS THIS CMMS available as a stand-alone system: YES**

**IS THIS CMMS part of larger management/corporate system: YES**

**CMMS Details - Technical**

Intentia's solutions are built with a flexible architecture using 100% Java and open standards including XML and web services., Intentia's solutions can be installed on Java virtual machines such as IBM's iSeries and Sun's Solaris.

Integration to external applications, such as condition monitoring equipment and process control systems, is simplified through Intentia's web services - a state-of-the-

art method of simplifying application integration. Intentia offers a framework that provides web service interfaces for any function within its enterprise solution, ready to be used from any application, in any programming language, across any operating system.

Intentia's Workplace application provides a single point of access to all of a company's information, no matter where it is stored, via all its applications. Workplace is a browser-based, role driven user interface that combines portal and web technology with predefined work flows. Using strong graphical representation, it also provides employees with fast and easy access to work-related information and applications thus increasing productivity and efficiency.

**CMMS Details - Functionality**

Intentia's EAM is specifically designed for all types of asset and maintenance intensive industries. Its functionality can be easily tailored to suit simple processes often required in light industries maintaining production equipment, or fully activated to offer comprehensive support for heavy and complex fixed and mobile asset demands.

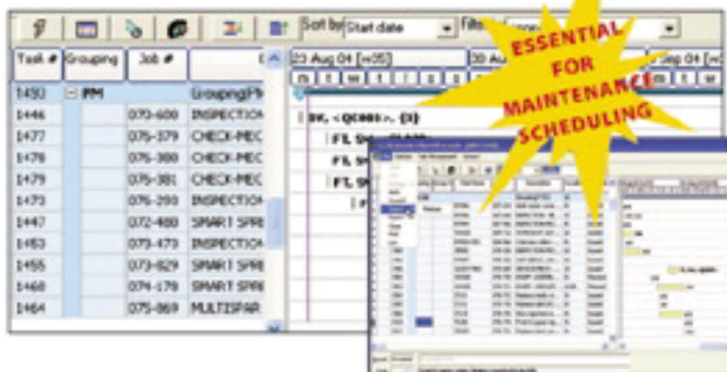
Intentia EAM helps customers develop the best maintenance strategy for their equipment for the most cost effective and operational efficiency gains. For instance, the responsiveness of a businesses maintenance organization will be increased through better work management - the work will be completed on time, first time. Spending on replacement spare parts will decrease as the improved maintenance strategy increases the useful life of components.

Intentia EAM modules encompass requirements such as asset registration, preventive maintenance, diagnostic management, equipment and component control, advanced work order management, preventive maintenance functionality and cost and statistical information. Intentia EAM also offers spare parts management, procurement management, project management and financial management. It also supports techniques such as Reliability Centred Maintenance (RCM).

Intentia provides its solution as a highly configurable application that can be integrated into most existing corporate applications - or as a fully integrated package, using a selection of its own components, including warehousing, purchasing, finance, and manufacturing applications.

Intentia's vision extends to the concept of synchronized operational planning where maintenance and production planning are fully integrated. Intentia's unique advance production planning (APP) solution has made this vision a reality, a powerful simulation tool that synchronises both operational and maintenance demands on each asset.

**Wells Work Scheduler**



**Makeover your work planning and scheduling with Wells Work Scheduler**

Automatically Schedule work around equipment availability, work priority and maintenance resources.

Link Operations and Maintenance to maximise resource utilisation and minimise equipment downtime.

Ideal for Shutdown Planning to efficiently schedule and allocate work packages.

Integration with CMMS applications for seamless generation and scheduling of maintenance tasks.

This advanced scheduling application provides the missing link between Maintenance and Operations so that Jobs can be easily scheduled around the availability of equipment. It also enables the maintenance schedule to react quickly to windows of unexpected equipment availability to optimise maintenance utilisation and reduce future downtime.

The Wells Work Scheduler will vastly improve maintenance scheduling in order to maximise resource utilisation and minimise equipment downtime.

The Wells Work Scheduler comes with a 30-day money back guarantee, so can you afford not to try!

**Take control.** Gantt and Resource Usage views clearly shows the automatically generated task schedule and resource utilisation. Tweak the schedule with manual overrides to control specific tasks, if required.

**Easy for Shutdown planning** Work can be broken down hierarchically, as required, to efficiently schedule and allocate work packages. Work can be structured as modules including Equipment Group, Location, Responsibility and Task Type.

**Manage resources** graphically by setting calendar rules and resource availability. Adding extra shifts or contract resources can be accomplished in seconds.

Save Time... Save Money... with Wells Work Scheduler  
 www.thesoftwarewell.com.au | info@thesoftwarewell.com.au  
 Phone 0417417133 | Fax 02 9402 4531

## Fast Track PPM

Address: iIS Ltd. 7 St Andrews Crescent. Cardiff. CF10 3 DA. U.K.  
 Name: Gareth Morgan Phone: 44 (0)29 2039 6300 Fax: +44 (0)29 2034 4140  
 Email: gareth.morgan@iisfm.com Web: www.iisfm.com

**Countries Supported:** U.K.

**Typical Cost:** Small site: 495 Med: 1195 Large: 2495 (UK Pounds)

**IS THIS CMMS available as a stand-alone system: yes**

### CMMS Details - Technical

Software can be both Network (Windows) or Web-based. Runs on Windows '95, '98, Me, NT, 2000 & XP operating systems. Runtime MSDE database issued with 1 user system, multi-user systems can be run on SQL, Sybase and Oracle databases. Can interface with CAD systems.

### CMMS Details - Functionality

Planned preventative maintenance software providing the automatic scheduling of maintenance, service and inspection tasks. The system acts as a register of assets, and schedules tasks against each asset, issuing work-orders to the relevant contractor/engineer by automatic email and/or print. It keeps lists of both outstanding jobs and completed tasks with information on who did what and when. Features include the recording of readings taken, breakdown logs, labour hours and materials used, maintenance costs and a spare parts/stock control inventory. Incorporates graphical reporting and displaying of data to make identifying clashes or patterns easier.

## FastMaint CMMS

Address: SMGlobal Inc., 2911 Waterford Forest Circle, Cary NC 27513, USA  
 Name: Sanjay Murthi Phone: 919-434-5146  
 email: sales@smglobal.com Web: www.smglobal.com

**Typical Cost:** Small site: < US \$1000 Medium Site: < US \$5000

**IS THIS CMMS available as a stand-alone system: Yes**

**IS THIS CMMS part of larger management/corporate system: No**

### CMMS Details - Technical

FastMaint requires Windows 98 or better and supports Microsoft Access 2000/ SQL Server for the maintenance database. It is available in stand alone/ networked editions. An add-on web work request module is also available. Data can be imported/ exported to comma delimited files or Excel spreadsheets.

### CMMS Details - Functionality

FastMaint CMMS is preventive maintenance management software for small to midsize maintenance teams that need to perform plant, facility and other equipment maintenance. Designed to be fast to setup & use - no training required. Features - equipment register; task templates for planned & breakdown jobs; plan work, balance workloads and detect conflicts; track & update work status; embed pictures and hyperlinks to other documents in work orders; manage inventory; calculate labor and material costs; a variety of analysis & audit reports and more. Add on bar code support & web based work request modules are also available.

## FleetMEX

Address: Maintenance Experts,  
 320 - 326 Ipswich Rd, Annerley, QLD, 4102.  
 Name: Matthew Ward Phone: +61 7 3392 4777 Fax: +61 7 3392 4888  
 Email: sales@mex.com.au Web: www.mex.com.au

**Countries Supported:** Australia; United States of America; Malaysia; China; Indonesia;

**CMMS Designed For:** FLEETMEX is utilised in a number of industry sectors including bus and transport companies, local councils and heavy machinery operators.

**Typical Cost:** Small site: \$3000 Med: \$10 000 Large: k\$30 (AUSS)

**IS THIS CMMS available as a stand-alone system: YES**

**IS THIS CMMS part of larger management/corporate system: NO**

### CMMS Details - Technical

- Windows 98 or later, or Windows NT Server/Workstation 4.0 or later
- 128 MB of Memory (RAM) • 152 MB of available hard disk space
- Display adapter capable of 1024x768-screen resolution 256 Colour.

**Optional** To modify FleetMEX reports and/or create your own reports for FleetMEX a copy of Microsoft Access 2000 is required.

**Web Components** FleetMEX Ops - Web Enabled Job Requests System

- Internet Information Server (IIS) V 4.0 or above
- Or Personnel Web Server (PWS)

**PDA Components** FleetMEX has developed maintenance specific PDA application where data is exchanged between FleetMEX and palm devices for efficient collection of information. Palm Operating System 3, 4, & 5 and Pocket PC. • FleetMEX Inspections - Paperless inspection routines

### CMMS Details - Functionality

FleetMEX is a Microsoft compatible maintenance management system designed for companies looking to improve the efficiency and effectiveness of their vehicle performance. FleetMEX is particularly effective in implementing preventative maintenance strategies.

FleetMEX is utilised in a number of industry sectors including bus and transport companies, local councils and heavy machinery operators.

### Core functions of FleetMEX

**Equipment Register** - record all of your equipment in this register. Include details such as suppliers, costs, purchase dates, warranty dates, dimensions and much more. **Work Orders** - create Work Orders for work to be done. Include start dates, departments, tradespeople, costs, parts, tasks, safety information etc. **Maintenance Policies** - create preventative maintenance work to be carried out on equipment. Schedule the work based on conditions, hours used, km, month's etc. **History** - access a complete history on all works ever carried out on a piece of equipment. **Reports** - accurately measure and analyse your equipment and operation performance. **Invoicing** - invoice for all work completed including a complete breakdown of costs, labor and parts. The modular configuration of FleetMEX enables companies to implement additional functionality as required. These modules provide an extra level of system integration including requests, mobile palm applications and stores. Stores adds to FleetMEX the capability of Inventory Management. The module enables you to maintain an appropriate balance between having what you need on hand, while keeping the capital tied up in stores to a minimum.

### MEX Ops

MEX Ops is a Web enabled job requesting system. It allows requests to be made anywhere at anytime and maintenance staff can easily prioritise and schedule work. It also allows the requestee to track their job.

### FuelMEX

FuelMEX allows you to integrate your Fuel Data system with FleetMEX. With FuelMEX, data from fuel charge cards is electronically transferred into the FleetMEX system. Fuel data is automatically allocated to the correct vehicle, with odometer readings, date, fuel type and other relevant information.

### EasyTime

A time cards module that efficiently records hours worked on multiple work orders, providing accuracy of costings and history records.

With FleetMEX you control your maintenance with knowledge. Whether you require detailed information on every aspect of your operation or simply an overview of workshop efficiency or work scheduled and completed, FleetMEX delivers.

## FM Works

Address: Facilities Management Resource Group  
 563 W 500 South #460, Bountiful, UT 84010 USA  
 Name: Curt Van Hove Phone: 801-294-8444 Fax: 408-228-0660  
 Email: curt@teamfmg.com Web: www.fmworks.com

**Countries Supported:** Australia, Canada, Ireland, United Kingdom, USA

**Typical Cost:** Small site: k\$9 Medium: k\$35 Large: k\$65 (US\$)

**IS THIS CMMS available as a stand-alone system: YES**

**IS THIS CMMS part of larger management/corporate system: YES**

### CMMS Details - Technical

Optimal combination of Windows and Web technologies using Outlook and Explorer-style interfaces. Compatible with Windows 98, 2000 and XP. Includes the ability to attach and view images, documents, web page links, etc to work orders. Features an application server that processes data to and from the web and also allows "server based" processes, such as PM Generation, Archiving, etc. Web components developed with ASP and ASP.NET. Compatible with Sybase, MS-SQL and Oracle.

Fully compatible with ARCHIBUS/FM.

### CMMS Details - Functionality

FM Works is a powerful work order/maintenance management system offering: Ease-of-use; Web-based work request submittal/review, Outlook/Explorer-style interfaces, full scalability from entry to full enterprise-level, combined with outstanding and cost-effective performance.

Effectively manages primary work flow of work requests/orders and preventive maintenance scheduling, resources, priorities, and charge-back accounts with automatic work assignment routing through built-in e-mail and hand-held (including wireless) technologies. The "drag & drop" PM interface easily manages procedures, steps and schedules. Also includes a built-in parts inventory manager.

Maintenance workers can directly access (web and windows) their own work orders and make updates, record time, parts usage, etc.

**FMMS - Facilities Maintenance Management System**

Address: KDR Creative Software Pty Ltd  
 Suite 15, 85 Turner St., Port Melbourne, Victoria 3207 Australia  
 Name: Geoff Montgomery Phone: 03 96461788 Fax: 03 9646 9680  
 Email: gmontgomery@kdrinc.com Web: www.kdr.com.au

**Countries Supported:** Australia, South Africa, USA, Central America, Italy, Singapore, New Zealand

**Typical Cost:** Small site: \$2,000 Med: k\$25 Large: k\$100 (Aus\$)

**IS THIS CMMS available as a stand-alone system: Yes**

**IS THIS CMMS part of larger management/corporate system: No. However FMMS has been seamlessly interfaced to several corporate ERPs.**

**CMMS Details - Technical**

FMMS compliments Corporate ERP Systems by utilizing a library of interface procedures in order to access data that resides outside of the core application. A number of such interface libraries have already been built by KDR for existing customers with the predominant ones enabling bi-directional access with ERPS such as SAP, Oracle Financials and Mincom. In addition, this approach has been adopted to interface to in-house products built by FMMS customers and to a wide range of external product types, including Condition Monitoring, SCADA, Configuration Management, GIS, Supply Logistics and Project Management.

**CMMS Details - Functionality**

FMMS has been designed and purpose-built to accommodate the following key

functional areas of Asset Management:

- Definition and Navigation of Asset Hierarchy
- Preparation of Standard Activity Libraries
- Initiation, Monitoring, Feedback and Recording of Maint. Activities
- Maint. Planning, including Resource Capacity, Prioritization and Criticality Indicators
- Business Metrics via on-line inquiries, report writing and user-defined Key Performance Indicators
- Serial Number Tracking of Essential Components and Certified Items
- Spare Parts Cataloguing, Purchasing, and Inventory Management
- Contracts and Project Management • Timesheet Recording
- Budget/Forecast Preparation, Review and Monitoring
- Workflow Definition and Management • Field Deployment via Mobile Devices
- Real-time Wireless access • Work Packaging • Certified Items

Does your Organisation have geographically dispersed Workshops?

Working closely with Australian blue chip railway operators, KDR solved the problem of effectively maintaining mobile assets over geographically dispersed workshops.

Are Linear Assets difficult to identify and maintain?

FMMS boasts a unique solution to asset identification in relation to linear assets like railway lines, channels and power-lines. Visual display of GPS locations for linear assets has resulted in economic benefits hereto unheard of for owners of such assets.

Are you concerned about Eliminating Materials Losses?

The FMMS bar-coding functionality manages uncontrolled, unmanned materials stores. The easy to use, wireless, bar-code based stores issuing system, enhances materials tracking, thereby eliminating materials losses.

Are Safety Issues Important to you? Modifications to Assets for test purposes can lead to safety issues should the maintainer not be aware of the modification. FMMS Facility Alert notifies the maintainer of any modification previously applied to the asset.

## Infrared Camera Specialists

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15/634-644 Mitcham Road, Mitcham VIC 3132  
Ph: 03 9872 5055 Fax: 03 9872 6055

## IFS Maintenance

Address: IFS Australia Pty Ltd  
86 Denmark Street, Kew 3101, Melbourne, Australia  
Rob Simmons Phone: +61-3-9854 9600 Fax: +61-3-9854 9699  
Email: rob.simmons@ifs.aust.com Web: www.ifsworld.com

**Countries Supported:** Many Countries worldwide.  
**Typical Cost:** Medium Site: 150,000 Large Site: 250,000 (US\$)

**IS THIS CMMS available as a stand-alone system:** Yes  
**IS THIS CMMS part of larger management/corporate system:** Yes

### CMMS Details - Technical

- Software •Web-based •Using J2EE, J2ME and .Net
- Non-platform dependent • Oracle database Hardware
  - No specific hardware as long as it supports Oracle database
  - Non-OS dependent Links
  - Can be easily linked to external systems using IFS Connect
  - OPC compliance, with links to major SCADA and DCS eg. fully integrated to ABB's Operate IT system.

### CMMS Details - Functionality

IFS Maintenance components make up a complete maintenance system that provides the proactivity, openness and flexibility to develop and adapt to keep pace with the rapidly changing demands of the world. Easy to work with and access, it contains a depth of functionality that provides comprehensive support for day-to-day maintenance requirements, as well as continuous development and improvement.

Key functionalities included in the latest version of IFS Maintenance are:

- Equipment •Equipment Monitoring • Equipment Performance
- Equipment Metering • Work Order •Preventive Maintenance
- Scheduling •Process Automation Integration
- Vehicle Information Management • Complex MRO

## iMaint

Address: DPSI  
4905 Koger Blvd., Suite 101, Greensboro, NC 27407 USA  
Name: Steve Miller Phone: 336-854-7700 Fax: 336-854-5972  
Email: sales@dpsi.com Web: www.dpsi.com

**Countries Supported:** Many Countries Worldwide  
**CMMS Designed Typical Cost:** Small site: \$10,000 Med: k\$30 Large: \$80 (US\$)

**IS THIS CMMS available as a stand-alone system:** Yes

**IS THIS CMMS part of larger management/corporate system:** No

### CMMS Details - Technical

iMaint is an n-tier client/server, Web-enabled solution. iMaint requires a Windows 2000 server (plus IIS 5.0 for iMaint Web), or can be remotely hosted; clients may be Windows 98, NT/2000/XP rich-GUI (Web module uses IE 4.0 or later, or Netscape Navigator 6.1 or later); databases supported are Microsoft SQL Server 2000 or 7.0 and Oracle 8i or 9i. iMaint systems range from single-sites on a LAN to global installations across the Web.

### CMMS Details - Functionality

iMaint enterprise asset management (EAM) software combines state-of-the-art maintenance practices with state-of-the-art technology to plan, control, and monitor all maintenance activities. This EAM system provides accurate and timely maintenance tracking, cost-effective inventory control, and thorough and in-depth reporting and analysis. Major capabilities include asset management, maintenance scheduling, labor and craft management, work order management, cost tracking and containment, parts inventory management, and purchasing. iMaint integrates with Crystal Reports and Microsoft Great Plains. iMaint has a bar code interface and Web interface, and a mobile PDA option. FDA compliance check for 21 CFR Part 11 is also available.

## Impactxp

Address: SoftSols(Asia/Pacific) Pty Ltd  
5 Park Road, Glen Iris, Vic 3146 Australia  
Name: David Gillard Phone: +61 3 98094566 Fax: +61 3 98094566  
Email: asia@impactxp.com Web: www.softsolsgroup.com

**Countries Supported:** Many countries Worldwide  
**Typical Cost:** Small site: k6-k10 Med: k15 - k25 Large:+k75 (Aus\$)

**IS THIS CMMS available as a stand-alone system:** Yes

**IS THIS CMMS part of larger management/corporate system:** No. Provides a standard ODBC compliant interface to allow for integration into the corporate reporting structure

### CMMS Details - Technical

Developed in a major 4GL, therefore platform independent. Will address multiple databases including Progress, Oracle and Microsoft SQL. Fully scaleable, from 1-10,000 users and User configurable. Generic Interface allows import/export of data to corporate systems e.g. MFG/PRO, SAP, Baan, PeopleSoft. Data from Hand Held Devices, BMS, SCADA systems can be imported into Condition Monitoring and Run Time Scheduling Modules. Allows two-way communication to PDA's, Radio Terminals and email. Interfaced to Aperture Visual Information System. Full CAD display facilities plus documents and images. Real-time on-screen scheduling using "drag and drop". Full drill down from graphical reporting. Web enabled Help Desk providing on-line access. Uses Crystal Reports and Corvu. Developed under ISO 9000. Translated into 13 languages

### CMMS Details - Functionality

Impactxp is a fully functioned asset maintenance management system that can be tailored to meet most requirements. Discrete modules allow users to select the functionality required and then format the system to suit. With a sophisticated Generic Interface, Impactxp can successfully transfer data to most corporate systems. The system manages the 3 elements of maintenance - Labour, Materials and Tools with comprehensive scheduling facilities. These include calendar, meter, condition and project based scheduling. Materials (spares) can be purchased, issued and paid for through Impactxp To meet the requirement of mobile engineering Impactxp talks directly to PDA's, sending out work instructions and collecting completion information, whilst providing enquiry facilities. For the Engineering Contractor there is fully integrated Contracts Module that manages contracts as well as generating Invoices. Documents, drawings and images are used throughout the system. Those in manufacturing can choose calibration and utilize the Repairable Spare capabilities. The system will collect data from machine monitoring systems. Cataloguing can be used to rationalize stock holdings. Those in Facilities Management can utilize the Help Desk to manage client requests through to completion and even provide a room booking service. Requests can be received via the Web, email, directly entered or from another system. Even testing of Electrical Appliances can be managed through the system. Day-to-day scheduling could not be easier. By using the Drag-and Drop planning board, work can be allocated to resources in real time. A comprehensive range of management reports is available including specific KPI reporting. These standard reports can be complemented by using Crystal Reports and CORVU to provide further analysis.

## Impactxp

Address: Matrix Australia Pty. Ltd.  
38 Pearce Street, North Fremantle, WA, Australia 6159  
Name: Bill Shanklin Phone:+61 (08) 9430 7819 Fax: +61 (08) 9430 7809  
Email: sales@matrixoz.com.au Web: WWW.IMPACTxp.COM

**Countries Supported:** Many countries Worldwide  
**CMMS Designed Typical IS THIS CMMS available as a stand-alone system:** YES

**IS THIS CMMS part of larger management/corporate system:**

**YES: Best of Breed with standard Interfaces for many corporate systems**

### CMMS Details - Technical

IMPACTxp is an integrated, modular, windows based maintenance and supply system with standard interfaces for leading ERP, Manufacturing, Financial and GIS systems. The IMPACTxp Generic Interface module provides an easy interface to Process Control, Building Management Systems and Hand Held Computers. IMPACTxp scalability and flexibility supports WANs to 200+ users (typically 10-35 users) Multiple deployment options include browser based Internet operation and operating on Oracle, Progress or SQL server. System parameters, user defined fields and screens allow extensive user tailoring.

### CMMS Details - Functionality

IMPACTxp is the product of more than 20 years specialisation in maintenance and supply management solutions and the input of hundreds of user companies. IMPACTxp strengths are based on the combination of powerful scheduling, management and reporting tools with exceptional ease of use and flexibility. IMPACTxp is a Best-of-Breed packaged solution offering more than 20 standard modules and a

high degree of user defined parameters, screens, etc. to accommodate widely varying needs and maintenance strategies. IMPACTxp is designed for use by owners and contractors. IMPACTxp design for rapid implementation and low ongoing cost ensure an excellent Return On Investment.

**Impact.NET**

Address: SoftSols (Asia/Pacific) Pty Ltd  
5 Park Road, Glen Iris Vic 3146  
Name: David Gillard Phone: +61 3 98094566 Fax: +61 3 98094566  
Email: asia@impactxp.com Web: www.softsolsgroup.com

Countries Supported: Many Countries Worldwide  
Typical Cost: Small site: k6-k10 Med: k15 - k25 Large: +k75 (Aus\$)

Also available as a hosted service subject to rental

IS THIS CMMS available as a stand-alone system: Yes

IS THIS CMMS part of larger management/corporate system: No but the development toolset provides for easy integration to corporate systems

**CMMS Details - Technical**

Impact.Net is a Microsoft .NET browser-based application. It provides a zero footprint at the client end with no downloads required, just login. User interface is completely soft and can be changed on the fly by the user with no recompilation. It can run against multiple databases including Microsoft SQL Server, Progress and Oracle. The look and feel is controlled by Style Sheets, which can be modified to meet company standards by the user. New fields can be added to the system without any programming - no consulting or waiting for suppliers. Data from other corporate systems can be incorporated. Documents, images, drawings, video, and web references can be attached to any record. Impact.NET uses Crystal Reports or Microsoft Reporting Services to generate reports. Provides for resequencing columns on screen, selecting sort criteria and individual filtering of data. The system provides the functionality but the user determines how it is displayed. This is the new generation of software, literally designed by the user

**CMMS Details - Functionality**

As with other products from SoftSols Group Impact.NET is a fully functioned Asset Maintenance Management System but with built-in flexibility. Access to the system is available immediately from anywhere that has access to the internet - no downloads. Login and go. Once installed, the user can decide on the format/layout of the system. The user can decide the layout of each screen and can change them as required. The layout of screens can change depending on key data that is entered e.g. the work order screen can be different for different types of maintenance, not just the print layout. Impact.NET incorporates KPI measures as graphs on the main screen, immediately highlighting significant information and these measures can be different for different users. Reporting tools include Crystal Reports. Each record can have unlimited attachments i.e. documents, images, drawings etc. There are immediate links to relevant websites such as manufacturers catalogues, technical help sites etc. Impact.NET can access other corporate systems and display associated information, providing a common user interface. The system is no longer modular; the user chooses which functions to include in the installation. SoftSols group can add new functionality very quickly using patent pending design tools. Each user can have an individual menu and view information in a format to suit their own requirements. Access from external sources can be allowed and managed - customer enquiries, sub contractor queries. Impact.NET is the next generation of system that allows the user access whenever, wherever and in whatever format is required. Changes are done "on the fly" - no waiting for the consultant or the supplier. What do we want - information. When do we want it - now!


**IREES Integrated Real Estate Enterprise System**

Address: Buildfolio Inc, 1895 El Camino Real, Palo Alto, CA 94306 USA  
Name: Alex Lau Phone: (650) 321 9005 ext. 115 Fax: (650) 321 5664  
Email: alau@buildfolio.com Web: www.buildfolio.com

Supported: USA, Singapore, Australia, Malaysia, Hong Kong SAR

CMMS Designed For: Commercial Real Estate Industry  
Typical Cost: Medium Site: USD 30,000 Large Site: USD 150,000  
IS THIS CMMS available as a stand-alone system: Yes

IS THIS CMMS part of larger management/corporate system: Yes

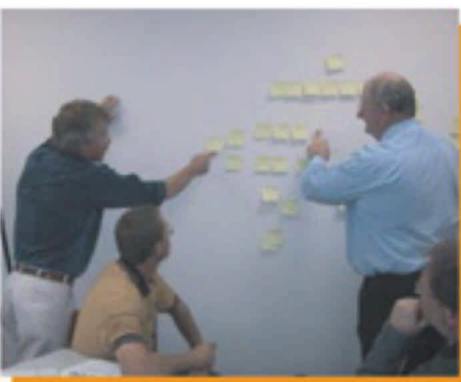


# Root Cause Analysis

training workshops

For defect elimination, incident management & process improvement


Eliminate unnecessary failures by using a systemic approach to problem solving.  
Teach your personnel how to identify the "root cause" of failures and increase productivity, reduce downtime and increase profits.



RCA Rt provides training and coaching programs to grow a culture of defect elimination and continuous improvement. Training options include:


- Public workshops
- Onsite workshops
- Ongoing coaching
- Instruction for infomal trainers

**★ new incident management software**

**★ Boost your incident management & keep track of RCA investigations by using the RCA Rt Software**

- Locally designed and supported.
- User friendly and easily configurable for specific site requirements.
- Integrates to enhance existing incident management systems.
- Input screens and reports may be customised for your particular site
- Facilitates RCA Rt methodology.



**contact: 03 9248 1381**

**melissa.cameron@sirfrt.com.au**

**www.rcart.com.au**

**CMMS Details - Technical**

IREES is a RDBMS-driven web-based solution powered by the Microsoft .NET framework. It schedules recurring preventive or corrective work and dispatches them wirelessly to a PDA or Tablet. Notifications and escalations can automatically be dispatched via SMS, Fax or e-mail. Work details can be downloaded onto and updated on a mobile device, and synchronized back with the server. IREES integrates with major BAS/SCADA systems, with work generation triggered by condition-breaches and digital run-time limits.

**CMMS Details - Functionality**

IREES is an integrated FM software solution that caters to the real estate industry's diverse maintenance information requirements on properties, assets, MRO inventory, parts and labor rates, contracts and service levels. IREES connects facilities, equipment, vendors, contractors, field technicians, FM call center staff and managers in real-time, enabling seamless information exchange between maintenance operations, customers and management. IREES allows organizations to maximize their facility/asset lifecycle and minimize cost of ownership while ensuring compliance with EHS/OHS regulatory requirements. Organizations using IREES show marked improvements in the cost, quality, productivity, customer service levels and transparency of their maintenance functions.

**Mainpac Version 6**

**Address:** Mainpac Pty Ltd  
Suite 201, 10 - 12 Clarke St, Crows Nest, NSW, 2065 Australia  
**Name:** Peter Bates **Phone:** 0412 046 428 **Fax:** 08 8431 9818  
**Email:** peterb@mainpac.com.au **Web:** www.mainpac.com.au

**Countries Supported:** Australia, United Kingdom, New Zealand, South Africa, Singapore & Indonesia

**Typical Cost:** Small site: 5-10k Med: 10-25k (Aus\$)

**IS THIS CMMS available as a stand-alone system: YES**

**IS THIS CMMS part of larger management/corporate system: NO**

**CMMS Details - Technical**

Mainpac Version 6 is the perfect CMMS solution for operations that require a stand alone or networked system for up to 10 concurrent users. It is a true 32-bit application designed to run on 32 bit operating systems and is written in Borland Delphi using the robust and flexible Paradox database. Mainpac Version 6 performs well in a Citrix or Terminal Services environment. Operating Systems supported include: MS Windows, 98, ME, 2000, XP & NT. Hardware: Pentium class PC (recommend 233MHz), 64Mb RAM (recommend 128Mb) 50Mb Hard disk space, CD ROM & MS

**CMMS Details - Functionality**

Mainpac Version 6 is a functionally rich, easy to use asset management solution with hundreds of satisfied users throughout the world. Seamlessly integrated modules include maintenance management, inventory control, purchasing, financial asset management, remote job entry, work safety, rotables equipment, and data import/export utilities.

Mainpac provides all the functionality required for comprehensive asset and maintenance management. Mainpac can be configured to meet the specific requirements and workflows of different industry types. Screens can be fully customised to reflect local terminology and data entry requirements. Powerful search and mass update functions enable efficient scheduling and planning of all maintenance activities. Mainpac's usage and condition based functions make it particularly well suited for fleet and other non-calendar based maintenance applications. Integration with SCADA, barcode scanners and field service applications is available to increase maintenance responsiveness and optimise staff efficiency.

Web-based functions provide access for remote users to request maintenance work, raise and close Jobs.

The Mainpac Asset module provides a Total Asset Management view of an asset or group of assets. Combining maintenance costs with financial costs and KPI's, such as condition, downtime, utilisation and production, enables analysis of asset contribution and life-cycle planning.

MainView is a key performance indicator (KPI) based approach to asset and maintenance management. Drawing data from Mainpac, it offers an executive analysis and easy to use visual reporting system with which to assess maintenance performance.

The Worksafe module is a comprehensive work safety instruction and hazardous equipment isolation facility, which has been integrated within the core Mainpac Job Management System.

Interfaces allow Mainpac to communicate with MRP, ERP and Financial systems. Mainpac also Interfaces to other software systems such as GIS, project planning (MS Project) and CAD.

Inventory and Purchasing modules can operate independently or integrated with Maintenance module.

**Mainpac Version 7**

**Address:** Mainpac Pty Ltd  
Suite 201, 10 - 12 Clarke St, Crows Nest, NSW, 2065 Australia  
**Name:** Peter Bates **Phone:** 0412 046 428 **Fax:** 08 8431 9818  
**Email:** peterb@mainpac.com.au **Web:** www.mainpac.com.au

**Countries Supported:** Australia, United Kingdom, New Zealand, South Africa, Singapore & Indonesia

**Typical Cost:** Small site: 5-10k Med: 10-25k Large: 25k+ (Aus\$)

**IS THIS CMMS available as a stand-alone system: YES**

**IS THIS CMMS part of larger management/corporate system: NO**

**CMMS Details - Technical**

Mainpac Version 7 is the perfect CMMS solution for operations that require functionality across multiple sites using an SQL database. There is no limit to the number of concurrent users. Mainpac Version 7 is a true 32-bit n-tiered application designed to run on 32 bit operating systems and is written in Borland Delphi. Mainpac Version 7 performs extremely well in a Citrix or Terminal Services environment or across a LAN or WAN. Operating Systems supported include: MS Windows, 98, ME, 2000, XP & NT

Hardware: Pentium class PC (recommend 233MHz), 128Mb RAM (recommend 256Mb) 50Mb Hard disk space, CD ROM & MS Windows compatible printer.

**CMMS Details - Functionality**

Mainpac Version 7 is the perfect solution for the medium sized enterprise. It provides all the functionality required for comprehensive asset and maintenance management activities and can easily be configured to meet the specific requirements and workflows of different industry types. Screens can be fully customised to reflect local terminology and data entry requirements and powerful search and mass update functions enable efficient scheduling and planning of all maintenance activities.

Mainpac Version 7 is a functionally rich and easy to use asset management solution. Its seamlessly integrated modules include maintenance management, inventory control, purchasing, financial asset management, remote job entry, work safety, rotables equipment, and data import/export utilities.

Mainpac Version 7 usage and condition based functions make it particularly well suited for fleet and other non-calendar based maintenance applications. Integration with SCADA, barcode scanners and field service applications is available to increase maintenance responsiveness and optimise staff efficiency.

Web-based functions provide access for remote users to request maintenance work and raise and close jobs.

The Mainpac Asset module provides a Total Asset Management view of an asset or group of assets. Combining maintenance costs with financial costs and KPI's, such as condition, downtime, utilisation and production, enable analysis of asset contribution and life-cycle planning.

MainView is a key performance indicator (KPI) based approach to asset and maintenance management. Drawing data from Mainpac, it offers an executive analysis and easy to use visual reporting system with which to assess maintenance performance.

The Worksafe module is a comprehensive work safety instruction and hazardous equipment isolation facility, which has been integrated within the core Mainpac Job Management System.

Interfaces allow Mainpac to communicate with MRP, ERP and Financial systems. Mainpac also Interfaces to other software systems such as GIS, project planning (MS Project) and CAD.

Inventory and Purchasing modules can operate independently or integrated with Maintenance module.

**Mainpac Mainet**

**Address:** Mainpac Pty Ltd  
Suite 201, 10 - 12 Clarke St, Crows Nest, NSW, 2065 Australia  
**Name:** Peter Bates **Phone:** 0412 046 428 **Fax:** 08 8431 9818  
**Email:** peterb@mainpac.com.au **Web:** www.mainpac.com.au

**Countries Supported:** Australia, United Kingdom, New Zealand, South Africa, Singapore & Indonesia

**Typical Cost:** Medium Site: 25k AUD Large Site: 50k+ AUD

**IS THIS CMMS available as a stand-alone system: YES**

**IS THIS CMMS part of larger management/corporate system: NO**

**CMMS Details - Technical**

Mainpac Mainet is the perfect CMMS solution for the multi-site enterprise. Utilising SQL or Oracle databases, Mainpac Mainet is a state of the art .NET, web services compatible application. There is no limit to the number of users or the number of sites and all functionality is available at the site level. The technology infrastructure of this web-enabled solution is based on industry standards for XML, UML, web services and open standards and the .Net business framework.

Hosted internally and deployed via a corporate intranet or hosted externally and deployed via the Internet, Mainpac Mainet is always accessible via the web. Mainpac Mainet seamlessly integrates to GIS, PDAs & corporate information systems as well as condition monitoring, process control and SCADA systems.

**CMMS Details - Functionality**

Mainpac Mainet is the perfect solution for the larger enterprise. With true multi site capability including multiple warehousing it provides all the functionality required for comprehensive asset and maintenance management. Mainet can easily be configured to meet specific requirements and workflows of different industry types and its screens are fully customisable to reflect local terminology. Mainet contains specialised and simplified data entry screens specific to logon details and contains powerful search and mass update functions to enable efficient scheduling and planning of all maintenance activities.

Mainpac Mainet offers the functionality of Mainpac's hugely popular versions 6 & 7 plus enhancements and new features such as Key Performance Indicators on the home page. Mainet presents state of the art functionality in a familiar and easy to use interface. Its seamlessly integrated modules include maintenance management, inventory control, purchasing, financial asset management, remote job entry, work safety, rotables equipment, and data import/export utilities plus multiple warehousing and multiple meters.

Usage and condition based functions make it particularly well suited for fleet and other non-calendar based maintenance applications. Integration with SCADA, barcode scanners and field service applications is available to increase maintenance responsiveness and optimise staff efficiency.

The Mainpac Asset module is a comprehensive total asset management view of an asset

or group of assets. Combining maintenance costs with financial costs and KPI's, such as condition, downtime, utilisation and production, enables analysis of asset contribution and life-cycle planning.

Interfaces allow Mainpac to communicate with MRP, ERP and financial systems. Mainpac also Interfaces to other software systems such as GIS, project planning (MS Project) and CAD.

**MainPlan**

Address: Dbase Developments  
1 Neptune Street, Sandringham Vic 3191  
Name: Tracey Francis Phone: 03 9502 0250 Fax: 03 9502 0250  
Email: tracey@mainplan.com Web: www.mainplan.com

**Countries Supported:** Australia

**Typical Cost:** Small site: k\$1- k\$3 Med: k\$2.5-k\$6 Large k\$10+ (Aus\$)

**IS THIS CMMS available as a stand-alone system: Yes**

**IS THIS CMMS part of larger management/corporate system: No**

**CMMS Details - Technical**

MainPlan allows small to medium operations to achieve the benefits of computerised maintenance management in a low cost, easy to implement system. Low cost does not mean low performance and this product is being used by some of Australia's largest companies.

MainPlan is written in various Microsoft Visual Studio tools using one of the fastest PC database products available. It is a fully visual (GUI) application and is fully integrated with the MS Office suite. MainPlan has been thoroughly tested on Windows Terminal Server and Citrix Metaframe and this is the recommended installation for Wide Area Network (WAN) use. A Wide Area Network reporter allows concise reports across widely distributed data.

MainPlan Standard is aimed at the first time CMMS user. MainPlan Gold is a fully featured product that incorporates advanced purchasing and stock control modules.



# MainPlan

## Maintenance Management System

**Features include:**

- Windows 98/NT/2000/XP Compliant
- Easy to install and use
- Powerful graphical report writer
- LAN and WAN compatible
- Citrix Metaframe certified
- Training and Support throughout Australia by Dbase Developments

**From only \$1,100 inc. GST**

For a FREE evaluation copy of MainPlan please contact Dbase Developments on 0500 59 59 55, fax this coupon to 03 9502 0250, send an email to sales@mainplan.com or visit us at www.mainplan.com

Name: \_\_\_\_\_ Company: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Phone: \_\_\_\_\_ Fax: \_\_\_\_\_ Email: \_\_\_\_\_



## Computerised Maintenance Management And Enterprise Management Systems

JobRequest is an integrated module that facilitates work request entry and tracking.

### CMMS Details - Functionality

MainPlan is a mature Windows-based asset and maintenance management system for manufacturing, engineering, facilities maintenance, equipment service and similar operations.

MainPlan Standard is aimed at the first-time CMMS user and organisations with modest requirements. It provides standard CMMS functionality including automated scheduling of preventative maintenance by fixed calendar intervals and plant condition, asset register, labour register, suppliers register, work and safety procedures registers and full access to all maintenance history. Fixed and user defined reports are available. A graphical report writer is included so there is nothing more to pay once the system has been purchased.

MainPlan Gold provides all the features of Standard plus spare parts purchasing, receipt and inventory control. Barcodes are available for spares tracking and work order closeout. Faults and Remedies registers are included together with additional databases for Motors, Drawings and Rotables.

Reports - A powerful graphical report writing and editing facility is included with MainPlan and a specialised Crystal Reports management reporting tool is also available.

Job Request (for both Standard and Gold) makes the requesting of work a completely paperless function. Job Request can also be used as a Help Desk front end for logging of work requests and tracking repair progress.

Control Panel is an add-on component that provides an asset based front end to MainPlan. All maintenance information such as routines, backlog, history and spares can be displayed for each item in the Plant/Asset register.

### Maintelligence

Address: Design Maintenance Systems Inc. USA  
 Name: Steve Reilly Phone: 604-984-3674 Fax: 604-984-4108  
 Email: sales@desmaint.com Web: www.desmaint.com

**Countries Supported:** Canada, US, Korea, Norway, UK, South Africa, Australia, New Zealand, Taiwan, India, Egypt, Holland, Mexico, Iran

### CMMS Designed For:

Specifically designed for industries focused on Inspections and/or Condition Monitoring.

**Typical Cost:** Small site: k\$3 Med: k\$40 Large Site: k\$75 (US\$)

**IS THIS CMMS available as a stand-alone system: yes**

**IS THIS CMMS part of larger management/corporate system: no**

### CMMS Details - Technical

Windows based system built modular to allow additions later, one shared database, scalable from workstation to client/server, extensive data access capabilities as it links to ERP, MRP, DCS, PLC's, extensive drivers to interface with other software and data collection hardware, advanced condition monitoring software module.

### CMMS Details - Functionality

The CMMS section of MAINTelligence has all standard capabilities. Where it differs from other CMMS's is that MAINTelligence is specifically designed from a maintenance perspective. It has the capacity to automatically generate work orders based on PM data that is derived from its advanced Condition Monitoring module that handles vibration, lubrication, infrared and ultrasound. It is expandable to include handheld Windows CE units for mobile inspections and work orders. MAINTelligence functions to finally enable maintenance people to gain full benefits from their regular data collection efforts.

### Maintenance Connection Onsite or Online

Address: Maintenance Connection, Inc. USA  
 Name: Brad Squires Ph: (888) 567-3434 x89 Fax: (888) 567-3434  
 Email: sales@maintenanceconnection.com :www.maintenanceconnection.com

**Countries Supported:** USA, Singapore, Australia, Middle East, Latin America

**Cost:** Small site: \$5-25K Med: \$25-75K Large: \$75K - 250K (US\$)

**IS THIS CMMS available as a stand-alone system: Yes (and web-based)**

**IS THIS CMMS part of larger management/corporate system: No, but can be integrated via API**

### CMMS Details - Technical

The Maintenance Connection solution encompasses the entire maintenance spectrum helping maintenance and facility managers across the globe increase asset life, predict

and prevent asset failures, improve labor productivity, reduce costly downtimes, minimize investments in inventory, and lower the total cost of maintenance. The Maintenance Connection open dialog is displayed below showing all the modules and how they interact with each other.

### CMMS Details - Functionality

Maintenance Connection provides Facility Maintenance and Asset Management Software for organizations worldwide. Our unique blend of technology and personalized service is a critical component of our client satisfaction. Our attention to service is evident in the people we hire, the systems we develop and the way we interact with our clients.

Headquartered in the greater Sacramento Valley in California, Maintenance Connection was founded by individuals who knew both maintenance and technology. We have developed a team that is dedicated to delivering the most advanced, easy to use software to the maintenance industry.

Using Maintenance Connection's simple, easy-to-use web-based application can help your organization increase asset life, track maintenance costs, prevent and predict equipment failures, improve labor productivity, reduce costly equipment downtimes, minimize investments in inventory, and lower the total cost of maintenance.

### MaintSmart 3.2, MaintSmart 3.2 Enterprise

Address: MaintSmart Software, Inc.  
 216 S. Fairmont Ave., Lodi, CA 95240 USA  
 Name: Daniel Cook Phone: 888-398-0450 Fax: 209-369-9396  
 Email: sales@maintsmart.com Web: http://www.maintsmart.com

**Countries Supported:** U.S.A., Australia, Egypt, Bahrain, Malaysia, Philippines, South Africa, Taiwan

**Typical Cost:** Small site: \$1295 Med: \$3995 Large: \$9695+ (US\$)

**IS THIS CMMS available as a stand-alone system: Yes**

**IS THIS CMMS part of larger management/corporate system: No**

### CMMS Details - Technical

SQL Server or Access database back-end, web-enabled work requestor, PDA. Automatic monitoring of OPC data sources and work order generation/distribution. User configurable automatic print/email scheduler for work orders, PMs and any analysis report. Schedule reports by day of week/time, calendar day or link equipment data (OPC) to MaintSmart and let equipment generate work orders as needed. Hot sheet provides a fully functional user configurable tree view display of important daily items. Email, FAX, save or print any report from MaintSmart.

### CMMS Details - Functionality

Automate your maintenance program with MaintSmart's exclusive print/email scheduler and automatic work generation features. Schedule printing or any data during any date range to the printer or printers of your choice. Have a weekly equipment expense report waiting on your printer Monday morning. Disperse work orders and PMs while on vacation.

User configurable equipment hierarchy displayed in a multi-view, functional equipment tree. Extensive analysis of equipment data by one of MaintSmart's primary sections (work orders, PMs, inventory, failures). Consolidate all expenses into one useful and informative report. Charting and statistics included in most filterable reports. Exports to Excel automatically.

### Mantra

Address: BMS Technology, Bournemouth BH9 3QP England  
 Web: www.bmstech.com/mantra/

**Countries Supported:** Worldwide (via Internet)

**Typical Cost:** FREE

**IS THIS CMMS available as a stand-alone system: yes**

**IS THIS CMMS part of larger management/corporate system: no**

### CMMS Details - Technical

Runs on standard PC hardware - for all versions of Windows - single-user system is free and may be upgraded to low-cost multi-user network version simply via web site without re-entering your existing data.

### CMMS Details - Functionality

Asset register; job control; flexible planned maintenance scheduling; job tracking; job history; breakdowns; job statistics; issue jobs sorted by resource, location, item; stock control.

## MEX

Address: Maintenance Experts,  
320 - 326 Ipswich Rd, Annerley, QLD, 4102. Australia  
Name: Matthew Ward Phone: +61 7 3392 4777 Fax: + 61 7 3392 4888  
Email: sales@mex.com.au Web: www.mex.com.au

**Supported:** Australia; New Zealand; USA; Malaysia; China; Indonesia;

**Typical Cost:** Small site: \$3000 Med: k\$10 Large: k\$30 (Aus\$)

**IS THIS CMMS available as a stand-alone system: YES**

**IS THIS CMMS part of larger management/corporate system: NO**

### CMMS Details - Technical

Recommendation for MEX is Pentium III Processor, 128 MB RAM, 200 Mb Hard Disk, 1024 x 768, 256 colours.

Operating Systems: Windows? 98, 2000, XP, NT4 - SP3.

Databases supported: MS Access? 2000; MS SQL Server 2000?.

MEX is available in SQL Server? and MS Access? Versions. Applications: MS Access? 2000 is not a prerequisite for Access Version (Except for customizing reports). SQL Server? is a prerequisite for SQL Version.

#### Web Components

MEX has web-based request application - enabling requests and responses to be completed over the Web. Internet Information Server (IIS) V 4.0 or above or Personnel Web Server (PWS).

#### PDA Components

MEX has developed maintenance specific PDA applications where data is exchanged between MEX and palm devices for efficient collection of information. Palm Operating System 3, 4, & 5 and Pocket PC.

- MEX Inspections - Paperless inspection routines
- HandiWork - Work Order completion
- HandiMEX - Includes four efficiency modules - Ad Hoc Work Orders; Store Issues / Returns; stocktake; Equipment Readings

Interface Components - MEX Links enables automated integration between MEX and external applications.

### CMMS Details - Functionality

MEX is an easy to use CMMS with extensive functionality and intuitive to maintenance environments. Designed for companies looking to optimize equipment performance and improve the efficiency and effectiveness of their maintenance operation.

Flexible functionality ensures that MEX delivers benefits to any size company, from stand alone installations through to multi-site regionalized organizations, MEX delivers functionality, simplicity and the ability to save time and money, and meet reporting requirements.

Core Functionality - Asset/Equipment Register; Work Orders; Maintenance Policies; Regions (SQL only); History; Inspections; Work Permits; ; Reporting; Invoicing; Readings; To Do List; Security; Downtime; Key; Register; Drawing Register; KPI's

The modular configuration of MEX enables companies to implement additional functionality as required. These modules provide an extra level of system integration including web requests, mobile palm applications and stores.

Stores Functionality - Catalogue; Purchasing; Suppliers; Reporting

#### MEX Ops

MEX Ops is a Web enabled job requesting system. It allows requests to be made anywhere at anytime and maintenance staff can easily prioritise and schedule work. It also allows the requestee to track their job.

#### Hand-held Device Applications

Specialised applications that eliminate time spent on data entry with automatic uploading of information into MEX.

#### EasyTime

A time cards module that efficiently records hours worked on multiple work orders, providing accuracy of costings and history records.

With MEX you control your maintenance with knowledge. Whether you require detailed information on every aspect of your operation or simply an overview of department efficiency or work scheduled and completed, MEX delivers.

**Countries Supported:** Many countries Worldwide

**Typical Cost:** Small site: k\$100 Med: k\$120 Large: k\$280 (Aus\$)**IS THIS CMMS available as a stand-alone system: yes**

**IS THIS CMMS part of larger management/corporate system: yes**

### CMMS Details - Technical

Mincom Ellipse is a system that has been architected to be independent of hardware, operating system or database. As such it is currently available on operating systems from IBM (AIX and O/S 390), HP (HPUX and Tru 64) Microsoft and Sun, and databases from IBM, Oracle and Microsoft.

The system can be deployed in a Windows or Web environment and is readily interfaced to corporate systems. Interfaces to GIS, Data Collection and Condition Monitoring systems are also available.

### CMMS Details - Functionality

Mincom Ellipse Asset & Works Management delivers optimum asset performance through the use of improved management tools, and by streamlining communication across the entire organization. Integrating with other Mincom Ellipse systems, Asset & Works Management provides details about service performance against schedules, vendor performance, stock number/part number performance, value-based procurement decisions, real-time grant expenditures, employee utilization and training needs, recruiting needs, as well as many other functions.

Mincom's flexible solution can be tailored to suit an organizations maintenance strategy. Mincom provides analysis of strategic maintenance requirements within each industry and establishes the drivers and the parameters for an effective asset lifecycle management.

## MPRO 2000

Name: BDR Systems, Inc. USA  
Phone: 610-873-8570 Fax: 610-873-9570  
Email: plant@bdrsystems.com Web: www.bdrsystems.com

**Countries Supported:** USA

**Typical Cost:** Small site: \$1695 Med: \$1895 Large: \$1895 (USA\$)

**IS THIS CMMS available as a stand-alone system: Yes**

**IS THIS CMMS part of larger management/corporate system: No**

### CMMS Details - Technical

BDR Systems, Inc. designs and distributes the MPRO 2000 and MPRO 2000 PLUS ISO Professional Maintenance systems as well as Calibration, Fleet Maintenance, Property Maintenance, and Purchasing/Vendor Management programs. All programs utilize the SoftVelocity relational database and are written in a language similar to C++. They will run on Windows 95, 98, ME, XP, or 2000 and also are network ready for Windows NT or Novell. . Unlimited technical support by phone, fax or e-mail is provided at no cost. There are no yearly maintenance fees.

### CMMS Details - Functionality

The MPRO 2000 PLUS program is a preventive maintenance system with maintenance intervals specified in units of mileage, meter readings as well as days, and an unlimited number of maintenance items for each piece of equipment. Standard features include an exclusive maintenance due notification, work orders, on line maintenance procedures, drop down entry selection tables, nameplate specifications, materials and labor cost tracking, and an extensive report selection. In addition the program includes an Inventory Management and Purchasing section. A data backup and restore feature is also provided. Options include Import/Export Data, Purge Excess Data, Downtime Graphical Analysis feature, Palm/PDA Data Interface, and an Ad Hoc Report Writer.

## NetFacilities Online

Address: NetFacilities, Incorporated  
3001 Redhill Ave Bldg. 4 Suite 120, Costa Mesa, CA. 92626 USA  
Name: Greg Christensen Phone:562 856 3344 Fax: 714 444 4349  
Email: gchristensen@netfacilities.com Web: www.netfacilities.com

**Countries Supported:** USA

**CMMS Designed For:** Property, Facility, and Maintenance Management  
**Typical Annual Cost:** Small site: \$708+ Med: \$708+ Large: \$708+ (US\$)

**IS THIS CMMS part of larger management/corporate system:** NetFacilities is 100 % web-based and part of a "global" system. ASP model allows user interface via Internet (IE 5.5 or higher) 24/7. We maintain all hardware,etc

## Mincom Ellipse

Address: Mincom Limited, 198 Turbot St, Brisbane, Australia  
Name: Rebecca Hall Phone:07 33033034 Fax: 07 33033048  
Email: Rebecca.hall@mincom.com Web: www.mincom.com

## Computerised Maintenance Management And Enterprise Management Systems

### CMMS Details - Technical

GPS, GIS future release (2006). Web-based application built on .NET framework (SQL DB). Data collection on a per client basis (separate quote). All clients may download their data anytime. Completely rules based with total visibility for past, present, and future schedules, etc.

### CMMS Details - Functionality

NetFacilities is a powerful web-based work order system for total maintenance management that links together all of the people, places, and things in your maintenance process (buildings, managers, employees, maintenance staff, tenants, vendors and suppliers into one system). NetFacilities deploys immediately, unlimited users, no need for software installation, on-going support for site administrators, and is accessible 24/7 wherever you have an Internet connection.

Total solution (all features included for licensed clients)

MobileFacilities PPC is separate license charge.

NetFacilities links together all of your sites, employees, vendors, tenants, contractors for Work Orders (impulsive and recurring), Assets, Preventive Maintenance, Inventory, Imbedded discussions, Vendor collaboration, labor by work order tracking, performance tracking, and much more. NetFacilities is client driven and has a separate vendor interface (charges differ from client side solution). We continually develop and release feature enhancements and new functionality. NetFacilities is a continually evolving solution.

### OEE Manager

Address: PRIME Engineering Services, 13 Swinhoe Gardens, Wideopen, Newcastle Upon Tyne NE13 6AF UK

Name: Frank Chambers Phone: 0191 2364150 Fax: 0191 2364150

Email: prime00@onetel.com Web: www.zerofailures.co.uk

Countries Supported: UK

Typical Cost: Free to clients of PRIME. Available to non-clients at initial cost of £600. Consultancy rates and software cost charged in £Sterling

IS THIS CMMS available as a stand-alone system: Yes

IS THIS CMMS part of larger management/corporate system: Supports multiple-site operations, but not part of an EIS

### CMMS Details - Technical

Will run on any computer/server using Windows 98 or later operating system, and loaded with Microsoft Office Professional 2000 or later (Software is based on Microsoft Access 2000, although a limited version is available in Access 97). Incorporates multiple site option, and separate, linked Production and Maintenance data entry systems. Fully password-protected within the software, in addition to normal server-level security.

### CMMS Details - Functionality

Has been specifically written for, and incorporates, all the necessary functions for implementing an integrated continuous improvement strategy in Maintenance, including: \* OEE data collection, reports and graphs. \* Full downtime reporting, inc MTBF/Engineering Uptime reporting, including graphs. \* Maintenance work order system, including work order planning and work control. \* Full maintenance history and fault analysis reporting, inc craftsman performance and shift reports. \* FMECA sub-module, linked to maintenance history. \* PPM system design and execution, inc runhour scheduling. \* Stores management. \* Tooling Management. \* Root Cause Analysis sub-module. \* Small projects management.

### OPRA (Order Processing & Requisition Accelerator)

Address: Package Products & Services, Inc.  
520 Washington Blvd., Suite 105, Marina del Rey, CA 90292 USA

Name: Warren Wagner Phone: 310-822-5988 / 800-545-4888

Email: sales@opras.net Web: opras.com

Countries Supported: US, Australia

Typical Cost: Med Site: \$350 per month Large: \$1,000 per month (US\$)

IS THIS CMMS available as a stand-alone system: No, however OPRA is Internet based and can run on our servers or yours.

IS THIS CMMS part of larger management/corporate system: Yes - Several modules available, including: Online Warehouse Ordering & Inventory, Fixed Assets, Enterprise Calendar, Purchase Requisition and others.

### CMMS Details - Technical

As a web based product, OPRA may be accessed from any web enabled device. System may reside on OPRA servers or clients own LINUX or Windows based server. SQL, MySql 4.1 and MS Access versions available. Work Order system may interface to

web enable GIS or GPS system. Alarms and alerts may page or email specific persons. No per seat or per user fees. Can be up and running within an hour of order.

### CMMS Details - Functionality

In 1996 OPRA was the first 100% browser based system ever. Online access for work requests, fixed assets, complete preventative maintenance, scheduling calendar, enterprise calendar, warehouse ordering/inventory, purchase requisitions and more. OPRA features graphic reports, pager and email notifications, robust approval routing and logging as well as GPS or GIS interface to your web enabled system. The OPRA "eDispatch" system is a web based CRM which interfaces with the Work Order system and allows for non registered users to enter request that once reviewed may be converted to a work request or otherwise handled.

### PCMAINT

Address: Dbase Developments

1 Neptune Street, Sandringham Vic 3191 Australia

Name: Tracey Francis Phone: 03 9502 0250 Fax: 03 9502 0250

Email: tracey@pcmstore.com Web: www.pcmstore.com

Countries Supported: Australia

Cost: Small site: k\$1-k \$3 Med: k\$2.5-k\$6 Large: \$10,000+ (Aus\$)

IS THIS CMMS available as a stand-alone system: Yes

IS THIS CMMS part of larger management/corporate system: No

### CMMS Details - Technical

PCMAINT allows small to medium operations to achieve higher yields and better reliability of equipment through better asset management. PCMAINT provides formalised maintenance management in a low-cost, easy to implement system. PCMAINT has been thoroughly tested on all Windows platforms including Windows Terminal Server and Citrix Metaframe and this is the recommended installation for Wide Area Network (WAN) use.

PCMAINT Standard is specifically aimed at companies that might be "getting by" with no maintenance system or rudimentary hours-based preventative maintenance. It is easy to learn, easy to operate and low in cost.

PCMAINT Gold is a fully featured product that will benefit industries which until now have had to spend many tens of thousands of dollars purchasing large systems to obtain the advanced purchasing and stock control systems offered by this system.

JobRequest is an integrated module (for both Standard and Gold) that facilitates paperless work request entry and tracking.

### CMMS Details - Functionality

PCMAINT is a Windows-based, asset and maintenance management system for plant maintenance, facilities maintenance, equipment service and similar operations.

PCMAINT Standard provides all the CMMS functionality required by an organisation implementing its first system including automated scheduling of routine preventative maintenance by both fixed calendar intervals and plant condition, asset register, labour register, suppliers register, work procedures and safety procedures registers and full access to all maintenance history. Fixed and user defined reports are available.

PCMAINT Gold provides all the features required in a CMMS and is suitable for all but the very largest organisations. Includes all Standard features plus spares purchasing, receive and inventory management. Faults/remedies, drawings and rotables registers are also available.

Job Request is a front end to enable users to enter work requests into PCMAINT without actually running the full PCMAINT system

Reports

A powerful graphical report writing and editing facility is included and a specialised Crystal Reports management reporting tool is also available.

Control Panel provides an asset based front end to PCMAINT. All maintenance information such as routines, backlog, history and spares can be displayed for each item in the Plant/Asset register. The majority of standard reports provided with PCMAINT are used to operate the CMMS. Control Panel incorporates a reporter which provides the information required by management to make decisions on plant replacement, capital works programs and to justify changes to the maintenance department budget.

### Pervidi

Address: Techs4Biz Australia Pty Ltd

Name: Naaman Shibi Phone: +61-3-9809-0887 Fax: +61-3-9809-4808

Email: Australia@techs4biz.com Web: www.pervidi.com.au

**Countries Supported:** USA, Canada, Australia, New Zealand

**Typical Cost:** Small site: \$1995+ Med: \$10,000+ Large Site: k\$100+ (Aus\$)

**IS THIS CMMS available as a stand-alone system: Yes (Stand alone or integrated with downstream applications)**

**IS THIS CMMS part of larger management/corporate system: Can interface with downstream applications and ERPs**

#### CMMS Details - Technical

1. Client-Server software that resides on LAN/WAN or accessed via the Internet (Citrix or Terminal services)
2. Handheld software for Palm-OS, PocketPC, or BlackBerry
3. Web Portal enabling authorized users to record work requests, view the status of requests, enter exceptions, etc.
4. Automated trigger mechanisms that send email reports and alerts based on dynamic customisable criteria.
5. Applications (developed in C++) are table driven including dynamic field aliases and ODBC connectivity to SQL Server, MS/Access, etc.

#### CMMS Details - Functionality

- Dynamic Work-Orders
- Detailed analysis of resources, materials, and cost.
  - Comprehensive info - schedules, costs, labour, KPIs, materials, equipment.
  - PM schedules, templates are defined, based on elapsed time and/or cycle counts.
- Asset Management
- Identify, track assets throughout their lifecycle.
  - Model relationships between pieces of equipment, locations and systems with which they are associated.
  - Track and populate components used in each asset.
- Analysis, Reporting
- Comprehensive set of pre-defined reports, ad hoc reporting via report wizard using filters and triggers.
- Handheld
- Designed to address all aspects of work management.
  - Utilize barcodes and wireless handhelds.

### PM Professional WEB

Address: CanaTech Consulting Int'l

Name: DeWayne Chiasson Ph: (604) 523-1744 Fax: on request

Email: dchiasson@promaintainer.com Web: www.promaintainer.com

**Countries Supported:** Canada and the USA

**Typical Cost:** Small Site: US\$4,100 Med/Large Site: US\$4100

**IS THIS CMMS available as a stand-alone system: Yes**

**IS THIS CMMS part of larger management/corporate system: No**

#### CMMS Details - Technical

It runs under Windows 98/ME/2000/NT or XP with hardware specs appropriate to the Windows operating system version chosen. With the edition of WEB- server software from Alpha5, PM Pro WEB will run on the Internet.

#### CMMS Details - Functionality

PM Professional WEB is designed for small to medium-sized maintenance crews in industry, a facility or a service group. It combines ease of use with features at a good up-front cost. It comes LAN-ready, WEB-ready with NO optional modules to purchase or after-sale surprises.

Designed by Plant Engineers who understand maintenance & the need not to have a computer degree to run it.

It handles the functions of a typical maintenance crew: automatic PM work order printing; PMs by date or meter; tracking of costs: labour, parts, contractor. Modules: Equipment; PM Tasks; Work Orders; Parts; Purchase Orders; Projects; Vendors; Employees.

### PMSoftware

Name: Phill Hellewell

Phone: +44 (0)1857 677709 Fax: +44 (0)1857 677709

Email: enquiries@pmssoftware.co.uk Web Page: www.pmssoftware.co.uk

**Countries Supported:** United Kingdom

**Typical Cost:** Small site: 300 Med: 1000 Large: 1000 (GB Pounds)

**IS THIS CMMS available as a stand-alone system: Yes**

**IS THIS CMMS part of larger management/corporate system: No**

#### CMMS DETAILS - Technical

Currently in use on Windows 95, 98, NT, ME, 2000 and XP, Min 10MbHD, Min Screen Resolution 800x600. Can collect data from a Seaward PAT1000 appliance tester.

#### CMMS DETAILS - Functionality

Master routines, once written provide a consistent approach maintenance. All routines and corrective work recorded in real time (along with causation, resolution and down time data) Worklist brings all work together in one place, can be filtered in a variety of ways. Staffing shows, who is on what shift, booked holidays, etc. Stores, issue spares against assets or jobs for cost analysis. SIPs provide a consistent approach to safe machinery isolation. Record issue of remote area, hot work and Red Tag, permits. Safety audits help with management of safety. Various reports provided. Download Fully functional evaluation copy from our website.

### PMSYSTEM

Address: 1101 Seafarer Circle Suite 305, Jupiter, FL 33477, USA

Name: Frank Murray Phone: 561-627-7945

Email: pmsystem@att.net Web: http://pmsystem.home.att.net

**Countries Supported:** USA

**Typical Cost:** Small site: \$395 US Medium Site: \$395 US Large Site: \$395 US

**IS THIS CMMS available as a stand-alone system: Yes**

**IS THIS CMMS part of larger management/corporate system: Yes**

#### CMMS Details - Technical

PMSystem is a computerized maintenance system (CMMS) that will manage the maintenance and repairs of your buildings, equipment, facilities, property, yacht, manufacturing plant and almost anything else. Plan maintenance by calendar based and/or by counter (i.e. runtime) scheduling. Unscheduled repairs can be reported. Numbered work orders for one time repairs can be generated and tracked. PMSystem maintenance management software is available for Windows Standalone or Network use.

#### CMMS Details - Functionality

Planned maintenance is essential to the efficient and reliable operation of any operation. This program is designed to be user friendly and is easy to use.

### POWER 10

Address: Bino Levi Ltd.

100 Hadas Street Carmiel 21661 Israel

Name: Moshe Sameach Phone: 972-4-9983783 Fax: 972-4-9983782

Email: info@power10.co.il Web: http://www.power10.co.il

**Countries Supported:** Israel, Turkey, Holland, Hungary, Nigeria

**Typical Cost:** Small site: 2,900 Med: 5,900 Large: 9,900 (Euro)

**IS THIS CMMS available as a stand-alone system: Yes**

**IS THIS CMMS part of larger management/corporate system: No.**

#### CMMS Details - Technical

Supports any PC network and with web capabilities (optional). Base language: English, Supports multi language, Software tool - MS .Net. MS-SQL database. System upgrades 4 times a year. Flexible screens, reports, forms. Built in OLAP. Export/import to/from Excel. Sophisticated data display. Filters any table by any field combination. Displays any picture format. Built-in OLAP: On-Line Analytical Processing. Handles mass data with remarkable response time. Interface to any system. Fifteen years of accumulative experience.

#### CMMS Details - Functionality

A general purpose CMMS for equipment, building, fleet help desk and for service companies. Covers most CMMS aspects: Help Desk, Work Orders, Corrective and Preventive Maintenance, Equipment Control, Inventory Control & Purchasing, Meter Readings, Employee Management, Budgeting, Costing, Database Administration and System Tables. Supports multi-sites company. Unlimited built in reports, Matrix reports, End-user Report/Form/Screen Designer, Adaptability to any organization size and needs, Remarkable response time, Intuitive system, Built-in compatible Outlook. Two levels of security: user and menu, Availability of frequently operated functions with just one mouse click. Easy to learn and use, yet adaptable to any user level.

## ProTeus IV Expert

Address: Eagle Technology, Inc.  
10500 North Port Washington Road, Mequon, WI 53092 USA  
Name: Heidi Schlinsog Ph: 262-241-3845 Fax: 262-241-5248  
Email: sales@eaglecmms.com Web: www.eaglecmms.com

**Countries Supported:** Worldwide Except Cuba, Iran, Libya, North Korea, Sudan and Syria per US Gov. not able to export to these countries.

**IS THIS CMMS available as a stand-alone system:** Client/Server Based  
**IS THIS CMMS part of larger management/corporate system:** NO

### CMMS Details - Technical

Eagle Technology, Inc. provides superior SQL database technology. With bandwidth utilization and security becoming an ever-important concern, ProTeus utilizes its in house developed CS2 technology to achieve this optimization.

By using the latest Oracle and Microsoft SQL Server designs, CS2 technology capitalizes on their improvements with better utilization of stored procedures, triggers and instruction within the database to lower access time and increase refresh times. This all adds up to a fully optimized database design that is unequalled in performance.

### CMMS Details - Functionality

ProTeus IV is an advanced maintenance management software solution that helps facilities manage their maintenance resources and physical assets effectively and efficiently throughout their entire lifecycle. With the tools that ProTeus IV CMMS offers, customers can save money and increase asset longevity.

At the heart of ProTeus IV are the ProTeus Alarm Interface (PAI) and the Multi-Cycle Scheduler. PAI offers seamless integration to most Building Automation Systems (BAS) around the world. Also, the Multi-Cycle Scheduling is a key feature in which a single master plan can be created for each individual asset to include associated tasks, employees, parts or tools at all desired intervals.

## RAMCO EAM

Address: Ramco Systems Ltd. 64, Sardar Patel Road, Taramani Chennai,  
Tamil Nadu, 600 113, India  
Name: Parameswaran E K Phone: 91-4422354510 Fax: 91-4422352884  
Email: paramek@rsi.ramco.com Web: www.ramco.com

**Countries Supported:** USA, Switzerland, United Kingdom, Germany, Malaysia, Singapore, India, UAE and South Africa.

**Typical Cost:** Available on Request

**IS THIS CMMS available as a stand-alone system?**

**Components can be picked to provide any combination to fit the requirement.**

**IS THIS CMMS part of larger management/corporate system? It is a part of Ramco Enterprise Series and has the ability to provide business components from Aviation, Banking and Financials, Health Care, HRMS and Logistics.**

### CMMS Details - Technical

Innovative Model based, Platform independent Web enabled architecture providing powerful solution for managing an agile and innovative business.

Solution uses five-layer technical architecture [UI, transport, Application Gateway, Rules, Data] and supports Non-proprietary off-the shelf technologies for every layer.

Salient Features:

1. Work Flow with Approvals & permissions
2. Asset Life cycle tracking and analysis
3. Equipment & location relationships
4. Document Management
5. Condition monitoring
6. Mobile computing
7. Corporate performance monitoring
8. Query & reporting based on drilldowns

### CMMS Details - Functionality

The core Asset management enables complete asset life cycle by defining, classifying and grouping elements like Equipments, Locations, Tasks and Procedures, Trouble Shooting Guides based on problem codes, Employees, Spare Parts, Tools, Working and Planning Groups, Equipment Tree, Rotors and Placeholders, Location Hierarchy, and Other resources.

Other components like Asset Induction and Work Management, Predictive Maintenance and Reliability Maintenance, Outage Management, Preventive Maintenance, Safety and Clearance Permits, Calibration, Costs & Budgeting, Reports & Drilldowns and Contracts Management have equally strong features.

Components like Procurement, Financials, HRMS, Inventory, Real Time Integrator, Mobile computing and Decision Works are comprehensive and completely integrated.

## Sabre32

Address: Rushton International & Associates  
4535 S. Commerce Dr, Ste B Murray, UT 84107 USA  
Name: Amber Gotberg Phone: 801-281-4466 Fax: 801-685-0664  
Email: admin@rushtonintl.com Web: www.rushtonintl.com

**Countries Supported:** All agents are located in the United States, but Sabre32 is installed internationally.

**CMMS Designed For:** Sabre32 is typically marketed to the mining industry, as it was written by mining experts. However, Sabre32 is suitable for ANY industry/company with plant or fleet maintenance needs.

**Typical Cost:** Sabre32 pricing depends on the number of modules licensed and the number of users licensed. Typical licensing price range is \$15,000 to \$45,000, with annual user fees ranging from \$3500 to \$10,000. (US\$)

**IS THIS CMMS available as a stand-alone system:** yes

**IS THIS CMMS part of larger management/corporate system:** No. **Sabre32 IS a 3-piece management package: maintenance, inventory, purchasing. Modules can be purchased and used individually, or as a package.**

### CMMS Details - Technical

- Sabre32 is a multi-user program that can be used on a stand alone station or on a network and Sabre32 can be run on Windows 2000 SP4 or above.
- The Sybase SQL Anywhere Studio9 Database Server runs on Server 2000 or above & Novell. -Sabre32 has a 2-tier architecture and is scalable.

### CMMS Details - Functionality

Sabre32 is a complete maintenance, inventory, and purchasing package. It can be used stand-alone, or added to another program to improve maintenance capabilities. It is fully customizable and easy to use. Sabre32 manages work orders, work requests, purchase orders, quote requests, inventory, preventive maintenance, scheduling, warranties, tires, components, wear materials, fuel/lubes, equipment, performance, reporting and employees.

Special features:

- \*advanced security
- \*over 200 custom reports
- \*employee badge creation (with photo/barcode)
- \*quick translation into any language
- \*custom interfacing to any outside accounting, payroll or software dispatch package
- \* mobile interfacing (coming soon)

## Spear 3i

Address: Spear Technologies  
436 14th Street, Suite 200, Oakland, CA 94612-2730, USA  
Name: Ken Voss Ph: +1 (1) 510 267-3333 Fax: +1 (1) 510 267-3344  
Email: marketing@speartechnologies.com Web: www.speartechnologies.com

**Countries Supported:** US, UK, and distributors worldwide.

**CMMS Designed For:** Yes, transportation industry.

**IS THIS CMMS available as a stand-alone system:** Yes.

**IS THIS CMMS part of larger management/corporate system:** Spear 3i can be interfaced with enterprise systems.

### CMMS Details - Technical

Spear 3i is designed with an open architecture, enabling integration with other enterprise finance, HR, or resource planning systems. Spear 3i Web Services architecture enables users to access their data from any location and provides a common technology platform for interacting with business objects through wireless, handheld computers; browser-based web applications; touch screen kiosks; or traditional PC workstations. Spear 3i provides portals for integration with transportation industry-specific systems for fuel management, onboard event recorders, GPS, GIS, etc.

### CMMS Details - Functionality

The Spear 3i suite of Enterprise Asset Management software solutions is designed for the transportation industry. Spear 3i software helps you maintain moving, fixed, and linear assets with industry best practices. Spear 3i has applications for work, materials, rebuild, infrastructure, and electronic parts catalogs management. Spear 3i Mobile Workforce applications and hardware enable workers to perform materials handling and inspection functions from anywhere in a facility. TouchPoint applications and hardware provide touch screen access to Spear 3i with the same ease as an automated teller machine. Spear 3i will help improve the service, safety, and economic performance of transportation operators.

**SPL EAM** SPL Enterprise Asset & Work Management

Address: SPL WorldGroup, Inc., 525 Market Street, 33rd Floor,  
San Francisco, CA 94105 USA

Name: Cathy McCause Ph: (925) 658-1000 Fax: (925) 935-9748  
Email: cathy.mccause@splwg.com Web: www.splwg.com

**Countries Supported:** SPL has offices/support in the Americas, EMEA and APAC

**CMMS Designed For:** Electric, gas & water utilities; manufacturing

**IS THIS CMMS available as a stand-alone system:** Yes

**IS THIS CMMS part of larger management/corporate system:** SPL EAM can be purchased as a stand alone product or as part of a best-of-breed suite of products that SPL WorldGroup offers.

**CMMS Details - Technical**

SPL EAM is a web based java/Oracle application the delivers thin client UI to workstations. It is an open architecture that allows integration to external applications such as SCADA, Mobile Work Force, etc.

The EAM application is easily scalable by deploying the components to application server tiers as needs expand and grow over time. A strong differentiator of SPL products is the very low total cost of ownership, represented by the ease of applying software upgrade, the low number of problem reports and the rate of high availability.

**CMMS Details - Functionality**

SPL WorldGroup supplies the only pure web-architected Enterprise Asset Management software solution for collaborative work management across the enterprise. SPL Enterprise Asset and Work Management addresses all aspects of MRO including: collaborative work management, asset reliability and maintenance; materials management; inventory control; purchasing, and contract management; operational accounting; reporting and analysis; project tracking; safety and regulatory compliance; and document control of capital-intensive industries. Supported by the latest in Internet technology, users need only a standard Web browser to rapidly install, deploy and access the SPL EAM solution across the enterprise.

**TAMES** Total Asset Management Enterprise System

Address: Buildfolio Inc  
1895 El Camino Real, Palo Alto, CA 94306 USA

Name: Alex Lau Phone: (650) 321 9005 Fax: (650) 321 5664  
Email: alau@buildfolio.com Web: www.buildfolio.com

**Countries Supported:** USA, Singapore, Australia, Malaysia, Hong Kong SAR

**Typical Cost:** Medium Site: USD 30,000 Large Site: USD 150,000

**IS THIS CMMS available as a stand-alone system:** Yes

**IS THIS CMMS part of larger management/corporate system:** Yes

**CMMS Details - Technical**

TAMES is a RDBMS-driven web-based solution powered by the Microsoft .NET framework. It schedules recurring preventive or corrective work and dispatches them wirelessly to a PDA or Tablet. Notifications and escalations can automatically be dispatched via SMS, Fax or e-mail. Work details can be downloaded onto and updated on a mobile device, and synchronized back with the server. TAMES integrates with major DCS/SCADA systems, with work generation triggered by condition-breaches and digital run-time limits.

**CMMS Details - Functionality**

TAMES is an enterprise-grade asset management solution that provides best-of-breed functionality in asset, maintenance and audit management, with comprehensive wireless and mobile capabilities to support distributed workforce and assets. TAMES enables organizations to maximize their asset productive life cycles and minimize asset total cost of ownership. The solution allows organizations to track their plant and asset base, life-cycles, maintenance processes, associated MRO inventory, parts, labor, contracts, budgets and service levels with customers and vendors. Using TAMES, organizations can monitor the health of their assets and operating environment in real-time to make superior asset-related decisions and comply with EHS/OHS regulations.

**Tero Consulting Ltd.**

Address: 200 - 2441 United Blvd. Coquitlam BC, V3K 6A8 Canada  
Name: Rob Saare Phone: 1-866-818-8376 Fax: 604-468-1408  
Email: rsaare@tero.ca Web: www.tero.ca

**Countries Supported:** US, Canada, UK, India, Malaysia, Singapore, Hong Kong, India,

**Typical Cost:** Small site: \$6000 Med \$15000 Large: k\$30-\$200 (US\$)

**IS THIS CMMS available as a stand-alone system:** Yes

**IS THIS CMMS part of larger management/corporate system:** No, but it easily interfaces with ERP and other legacy systems within the corporate environment

**CMMS Details - Technical**

Web Work runs on any NT server loaded with Microsoft Internet Information Service 4.0 or higher. All that is required on the desktop is Internet Explorer 4.01 or higher. Optional Interface module allows you to create interface templates to other legacy data or corporate systems such as accounting, fuel systems, GIS, GPS and Condition Monitoring Control Systems. You may also interface using XML through the built in report writer. Minimum Hardware requirements - Server PII or greater running 256 MG Ram with 80Gig hard drive. Desktop can be as simple as an E-Machine running a PII processor, 64 MG Ram and 20 Gig Hard Drive.

MS Access, SQL or Oracle DB,

**CMMS Details - Functionality**

100% Web Based, 9 Years of development history, 30 Integrated Modules, Includes Work Orders, PM's, Task Library, Fleet, Meter Readings, Inventory, Unlimited Storerooms, Built in Report Writer, Request Management, Vendor Management, Purchasing, Receiving, Item Requests, Interface Module, Scheduling, PDA Capabilities, unlimited Equipment and labor specifications, All Fields are Customizable, open Source Code, XML Capabilities, "Query-By-Example" allows you to query unlimited fields in every module, Link documents, web sites, Spatial data easily from any module. Unlimited account codes, track and maintain a complete history of all assets including depreciation. Unique "duplicate and modify" feature reduces repetitive data entry in key modules such as Procedures (tasks), PM's, Inventory and much more. Try it on-line now at www.tero.ca, nothing to download.

**Workmate**

Address: EPS Ltd - PO Box 47602, Ponsonby, Auckland, New Zealand  
Name: Andrew Willis Ph: +64 (0) 9 913 4000 Fax: +64 (0) 9 912 1212  
Email: info@ep-solutions.co.nz Web: www.workmate.co.nz

**Countries Supported:** New Zealand

**CMMS Designed For:** All manufacturing, processing and service industries with special modules for designed for the Power Generation/Transmission industry

**Typical Cost:** Small site:k\$3-k\$9 Med: k\$15-k\$30 Large: k\$100+

**IS THIS CMMS available as a stand-alone system:** Yes

**IS THIS CMMS part of larger management/corporate system:** No

**CMMS Details - Technical**

Workmate provides full maintenance system functionality including, Work Order & Planned Maintenance Management, Inspections, Work Permits, Purchase Orders, and full stock control functions, Invoicing and integration with Financial systems. Full Web and Internet capabilities are also available with clients requiring internal and secure contractor access to the system outside the company network.

Comprehensive implementation services are provided to maximize the effectiveness of your system with EPS supporting the software internationally.

**CMMS Details - Functionality**

Workmate's key advantages are its ease of use, practical functionality, straight forward implementation and full suite of asset management functions..

Workmate is managing many billions of dollars of assets internationally and has created savings of hundreds of thousands of dollars for many clients. All users benefit with Workmate from tradespeople to senior managers having access to information that is both valuable and relevant.

The web solution provides secure and centralized access to regional, national or international information. Workmate Web provides opportunities to reorganize management structures not possible with conventional systems with the resultant savings going directly to the bottom line.

# Improved Machine Condition Monitoring

*Adam Van Dyck, Guy Cotterill*

CCI Pope Pty Ltd (ICOMS 2004 Conference)

**SUMMARY:** Machines such as draglines and shovels are subject to a high degree of impactive loading under conditions of variable speed, load and direction of rotation. Consequently, failure of components such as shafts and bearings are common. Our aim is to detect the onset of a failure condition and optimise the safe working life of the component. For this class of machine there are limitations of conventional equipment and test methods that reduce the effectiveness of a condition monitoring program. With the aim of improving the quality and reliability of our testing service we have custom developed a number of measurement systems. The function and process of these systems is based on a testing methodology that takes into consideration the root cause of these limitations. Ultimately, our goal has been to build upon, rather than replace, standard techniques in order to enhance the quality and usability of raw data collected, and enable an operator to better utilise that data to analyse machine condition. This paper highlights this methodology with a focus on two specific condition monitoring applications: ultrasonic inspection of shafts and vibration analysis in variable speed machinery.

Keywords: Condition Monitoring, preventative maintenance, shafts, defects, spline cracking, ultrasonic testing, vibration monitoring

## 1. INTRODUCTION

Ultrasonic and vibration analysis methods employed to evaluate and monitor defects in industrial machinery are well developed and based on sound physical principles; however, in many practical situations reliable and / or timely evaluation is difficult to achieve. Test difficulties such as a lack of prior or recent machine condition history can lead to misinterpretation of the severity of defect indications; and access limitations, both physical and time based, can affect the validity or quality of data collected. Complexities inherent in test data due to physical artefacts and ambiguities often require follow up tests to resolve and detailed on-site analysis of results is difficult with traditional data collection equipment or not feasible due to time constraints.

In recent years, we have focused on improving two test scenarios which are particularly prone to the above downfalls and limitations. These include ultrasonic testing of shafts and vibration analysis of slow, variable speed equipment such as draglines and shovels. In both cases our approach has been to develop (i) data collection processes that provide a complete, permanently stored, record of raw data, available for detailed post collection analysis, while displaying results and alarms in real time to assist on-site analysis; (ii) data visualization tools, both graphical and audible, to enhance an operators ability to rapidly and reliably detect defect information within the data; and (iii) artificial intelligence tools to assist an operator in the analysis of results. This paper describes these developments and our results to date in more detail.

## 2. DATA COLLECTION

Largely for historical reasons, i.e. technical limitations of the day, vibration or ultrasonic flaw detectors collect, display and store only a subset of all of the available data or information available, which is considerable. For example, high resolution vibration data is converted to a frequency spectrum in real time based on pre-set parameters but only a relatively low-resolution time domain or frequency spectrum signal is permanently stored for later analysis. In the case of ultrasonic flaw detectors an often highly complex signal is analysed by the operator in-situ and a permanent record of raw data might consist only of individual A-scans and hand drawn sketches. The resulting assessment, which is prone to subjective interpretation, does not lend itself to further analysis or an accurate comparison between measurements to monitor defect growth.

**The first step of our approach is to permanently store all raw data.**

### Vibration test data

At times, the stored vibration data available to the analyst may not be enough to completely diagnose the health of the machine. Valuable information may have been discarded during data collection due to limited storage capacity of the data collection device.

Advances in robust portable computer technology now allow us to collect and permanently store high-resolution vibration data on board the data collection device. The vibration analyst is no longer required to decide a priori which processed subsets of the raw vibration data should be collected and stored for further analysis. By storing the high resolution, unprocessed vibration data, the analyst can conduct a detailed post-collection analysis at the point of data collection or at any time thereafter.

Additionally, it is now relatively easy to make full vibration analysis capabilities available to the vibration analyst at the point of data collection. By combining the data collection and data analysis capabilities along with a database of historical data into a single unit

this allows for immediate analysis of the data if a quick diagnosis of machine condition is required.

With some data collection devices, it can be difficult to determine the integrity of the data during data collection. This is particularly true of digital tape recorders, where the integrity of the collected data is not known until the vibration analyst returns to the office to extract the data from the collection device into the analysis tool. If for some reason, the collected data was faulty on one or more channels then the analyst would need to either repeat the vibration survey or conduct the analysis, diagnosis and prognosis with an incomplete set of vibration data.

With this in mind, it is important to give as much information as possible to the analyst regarding the integrity of the data at the time of data collection. By displaying a thumbnail view of all data (in our case: 10 independent channels at 50 kHz + speed) immediately after collection, the analyst can see at a glance if any channels are collecting faulty data.

Additionally, a sensor health indicator identifies any vibration sensor faults. The indicator will be green if the sensor appears to be working correctly; grey if the sensor is not connected or if the sensor cable is faulty due to an open circuit, perhaps caused by a broken cable; or red if the cable or sensor is faulty due to a short circuit.

Analysts using these extra data tools have reported a significant increase in productivity and integrity of the collected data.

### Ultrasonic test data

The ultrasonic signal seen lengthwise from the end of a shaft is often quite complex; including not only simple reflections from geometrical features of the shaft but a variety of multiple reflections, transmissions and artefacts from mode conversions. These signals vary at different locations on the end of the shaft hence the addition of a defect signal can easily be overlooked or misinterpreted.

Our approach is to permanently store lengthwise A-scan data at overlapping points covering the entire end face of the shaft, at the same time that the shaft is being tested and assessed in the traditional manner. The process is shown schematically in figure 1.

The resulting data set (V-scan) represents a three-dimensional ultrasonic signature of the accessible volume of the shaft which allows us to present this information in a more physically meaningful format on viewing individual A-scan traces.

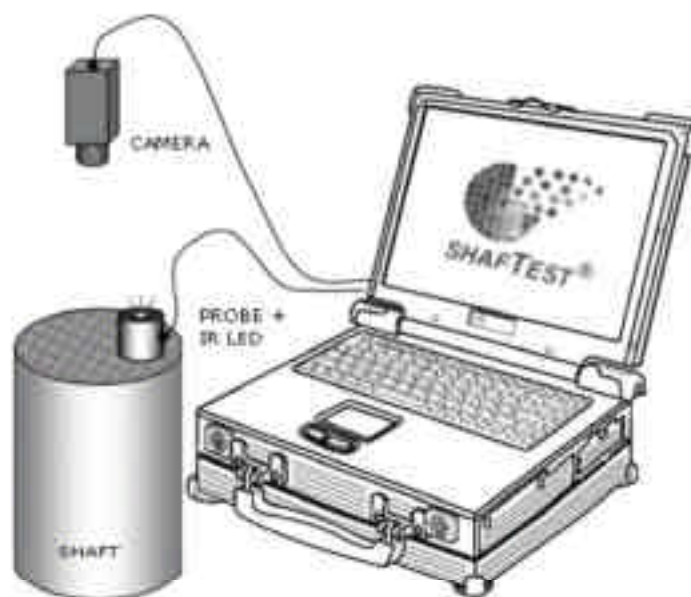


Figure 1. With the aid of a camera and tracking software A-scan data is automatically collected whenever the UT probe enters an untested grid location.

## 3. DATA VISUALIZATION

In most aspects of condition monitoring, analysts are required to determine the condition of a machine by analysing various data sets from one or more testing devices. By combining data sets into a holistic representation of that data, an analyst will be able to identify trends or correlation between related data elements more easily than by viewing single elements of data individually.

Typically, it is left to the analyst to combine these data sets into a holistic picture of machine condition.

**The second step of our approach is to combine all of the available individual data elements into a more valuable, holistic representation of the data.**

### Improved Visualization of Ultrasonic Data

The V-scan, or volume map, of the shaft is initially presented graphically in the form of a V-scan “profile” that summarises all of the A-scan data collected and visually highlights anywhere in terms of depth in the shaft that generates a reflection. Lined up with this information is a scale representation of the geometry of the shaft in order to quickly correlate reflections with shaft geometry. Additionally, a cross-sectional ultrasonic view is displayed at the same time for any selected depth.

The cross-sectional view provides a visual indication of the size and location of defects. It also brings together in a single image the information contained in many A-scan signals, enabling the operator a “big picture” perspective. For example, the cross-sectional image of reflections from a geometrical feature such as a step down in the diameter of the shaft will be seen as a symmetrical ring around the cross-section at that depth. In contrast, it would be rare that a crack might form in such a symmetrical fashion.

More in-depth analysis is available at this stage by replacing the V-scan “profile” summary view with the raw A-scan signals by selecting locations on the end of the shaft. In this way the shaft can also be tested (reviewed) by a “virtual technician” by viewing data as would be available if physically testing the shaft.

Two sets of data can also be displayed at the same time allowing historical data to be directly compared and overlaid. Because of the reproducible nature of the data collection process, changes in the condition of the shaft over time can be accurately assessed.



Finally, V-scan data can be plotted within a 3D model of the shaft providing a further appreciation of the relationship between ultrasonic reflections and shaft geometry as shown in figures 2a and 2b.



Figure 2a. 3D Visualization of a shaft with crack.

The shadow (loss of backwall signal) provides additional confirmation of the nature of the reflection.



Figure 2b. Another 3D Visualization of a shaft.

### Improved Visualization of Vibration Data

Typical vibration surveys contain very large data sets. Consequently, in most cases, it is not feasible (or necessary) to conduct a detailed analysis on all of the data collected during a vibration survey. Only those points that are suspicious, i.e. possibly indicating a defect, need to be analysed in detail. The first step then, in the analysis phase of the vibration survey, is to identify these 'suspicious' data elements and to focus the analysis on these points.

It is important to give the analyst as much information as possible during this data-culling process so that the most informed decision is made. When monitoring variable speed machinery we have found four important groups of information that should be analysed: (i) raw vibration data and processed data sets, (ii) historical data, (iii) machine speed and (iv) audio information.

#### Raw vibration data and processed data sets

From a single raw vibration trace (time domain), processed data sets such as velocity, frequency spectra, trend values and enveloped data can be generated. By displaying these data sets on a single screen, the analyst has the information at hand to make a well informed decision in the shortest possible time as to whether the data requires further analysis.

#### Historical data

Historical data is easily accessible during this phase of the analysis. By allowing the analyst to quickly step back through historical data, changes in machine condition over time can be identified.

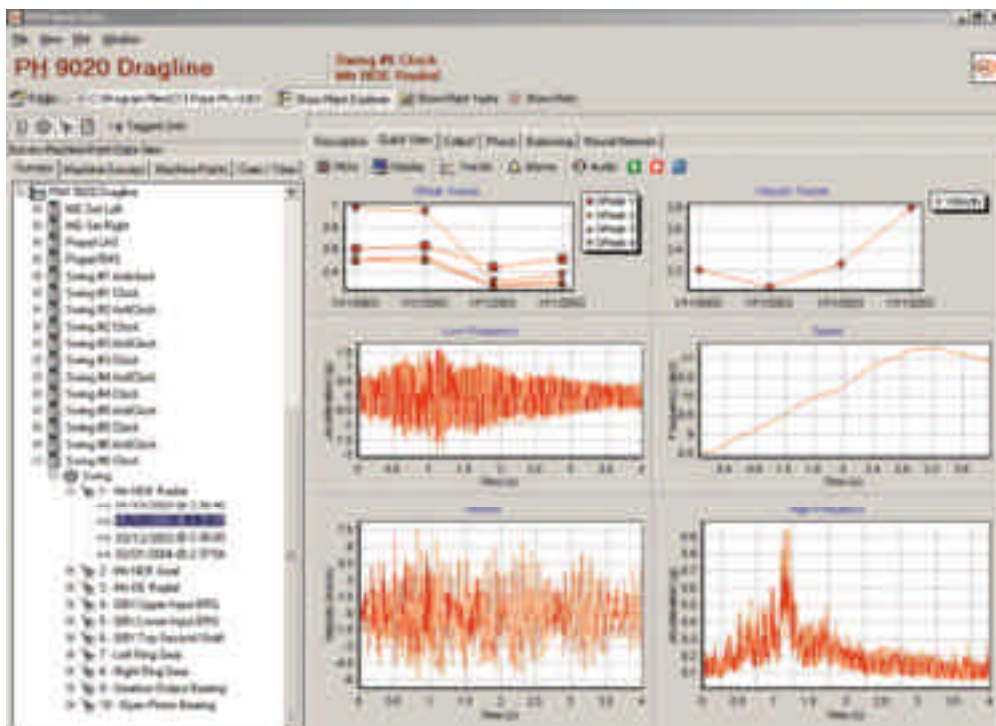


Figure 3. By bringing together the raw vibration data along with processed data sets and the audible vibration signal, the analyst has all of the important information on hand to make a quick decision as to whether this particular test point should be tagged for further analysis.

### Machine rotational speed

By including a plot of machine speed, the technician can immediately see the run speed of the machine and determine whether it was ramping up or ramping down during the survey. This information is essential when determining the condition of variable speed machinery as meaningful spectral analysis requires that data be normalised relative to machine speed.

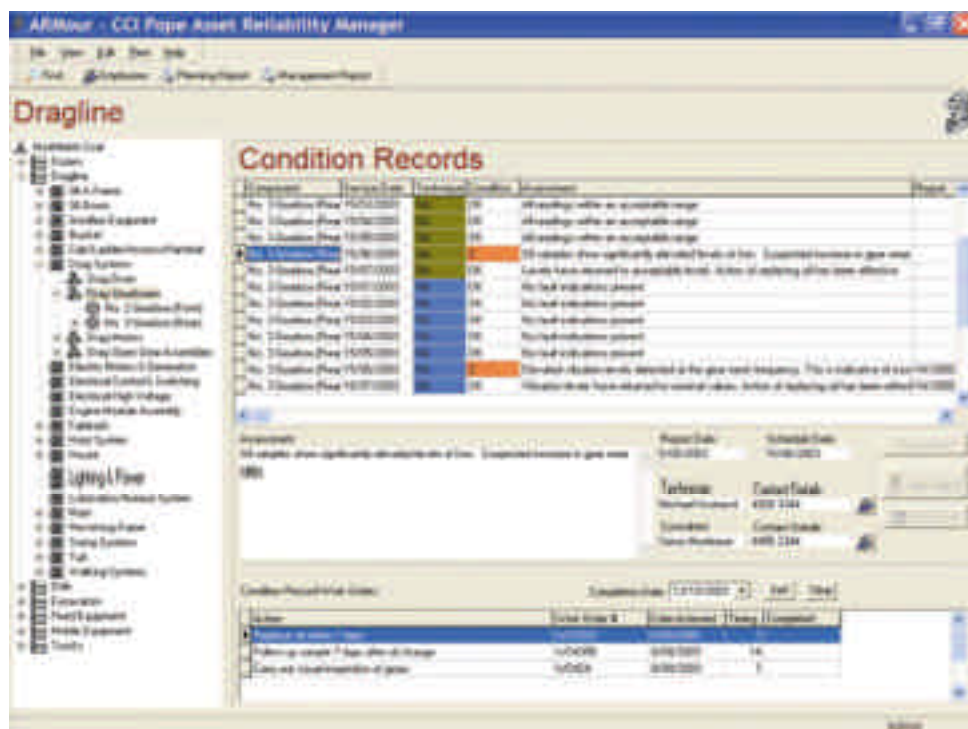


Figure 4. By selecting a particular machine component on the left, a holistic collection of all relevant condition monitoring data is displayed on the right. This brings together all condition monitoring techniques such as Vibration, Thermography, Oil Analysis, etc, so that the end user can look for any correlation or contradiction between data from various techniques and can also look for trends evident in historical data.

## Audio information

Because we both collect all raw data and by virtue of the fact that the frequency spectrum of machine vibrations coincides well with the bandwidth of human hearing we are able to routinely “listen” to the condition of a machine to provide a supplementary way of “visualising” the data.

Audio analysis is an often underrated aspect of vibration analysis. By “listening” to the vibration data through a set of standard PC speakers or headphones, intermittent and regular impacting, unique bearing noises, gear noises, rubbing and looseness of components can be distinguished by the experienced analyst to enhance the diagnosis of problems within machines.

## Combined condition monitoring data

It is common for a number of different condition monitoring techniques to be employed on an asset or component to provide overlapping or complimentary information. For example, routine vibration monitoring, oil analysis, ultrasonic testing and thermography might be utilized to ensure maximum reliability for a dragline or shovel. However, often the condition monitoring data from these various techniques is delivered to the asset owner in the form of a number of disconnected reports. It is then up to the asset owner to collate the information and decide on which corrective or preventative actions to take.

When diagnosing machine condition it is important to consider all available relevant data, even if that data is supplied by different sources. For example, if routine vibration monitoring results show an increased level of run speed vibration, recent thermography and oil analysis results should be reviewed to determine if there is any correlation with the vibration data and vice versa. Additionally, it is important to consult historical information as well as the current data. If condition monitoring is showing unexpected results or potential fault conditions, the historical data should be consulted to determine if this is a steady trend or if this is a sudden change in machine condition. Importantly, easy access to historical information relating to component failures provides a mechanism to learn from and improve the overall asset reliability management process.

Collecting this information into a central repository and making it easily accessible to the condition monitoring suppliers and asset owners allows all relevant information to be easily reviewed before a judgement is made on machine condition and the preventative or corrective actions necessary to maintain the productive machine state.

## 4. ARTIFICIAL INTELLIGENCE TOOLS

A common theme driving our approach described above is that both ultrasonic and vibration data can be complex and difficult to visualize in a physically meaningful way. In fact, hidden within raw data is a huge amount of information which is too subtle to detect or understand with the naked eye or even, in many cases, after processing the data to extract key defect indicators.

Commercially available artificial intelligence processes in the form of Expert Systems are common for assisting in the interpretation of vibration signals. While Expert systems are used routinely with success it can be argued that their reliability requires a high level of expertise to setup and properly understand their output. We are unaware of any such systems for the interpretation of ultrasonic shaft defect information.

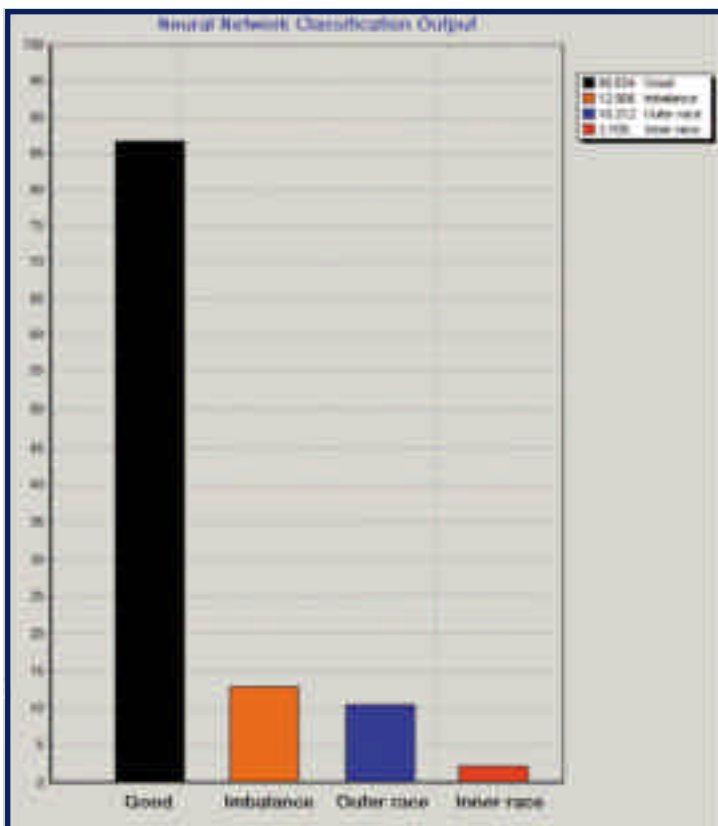


Figure 5. Neural Network classifier output showing high confidence that a machine is in “good” condition.

The type of raw unprocessed data that we collect lends itself to other forms of AI processing using techniques including Pattern Recognition<sup>1</sup>, Neural Networks<sup>2,3</sup> and Support Vector Machines<sup>4</sup>.

The third step of our approach is to implement machine intelligence tools to assist an analyst in correctly diagnosing machine condition.

### AI Processing of Ultrasonic Shaft Data

As described above, a major difficulty in interpreting ultrasonic signals is achieving the correct classification of echo signals which could be due to a reflection from a crack or machined surface, a transmission outside the shaft or a misleading artefact due to a mode conversion. Discrimination of these signals is often extremely difficult. Our experiments to date have employed artificial neural networks (ANN) trained on spectral information extracted as a classifier using the Fast Fourier Transform<sup>2</sup> and more recently the reliability of our ANN has been improved using the Wavelet transform<sup>3</sup>.

The result of these experiments, achieving better than 90% confidence level, is extremely promising, however, we are continuing to investigate improved methods, for example using Support Vector Machines<sup>4</sup> which do not suffer the problem of ANN's of possible convergence to a non-ideal result.

## AI Processing of Vibration Data

During laboratory trials, a neural network was capable of accurately discriminating between four different conditions in rolling element bearings. The neural network outputs were (i) good condition, (ii) machine imbalance, (iii) inner raceway defect, (iv) outer raceway defect. The neural network used in this laboratory trial was a 3 layer, feed-forward network, trained by back propagation with momentum. A sample output from this network is shown in figure 5.

As more data is collected, it is hoped that further neural networks can be trained to discriminate common faults in fixed and variable speed machinery. This research is ongoing.

## 5. CONCLUSIONS

The approach that we have developed for data collection and analysis is one born of a need to overcome practical, real life difficulties under commercial, field testing conditions.

From improvements in the reliability of our test results we believe this approach is validated.

The artificial intelligence tools described in this paper are still at an experimental stage. While it is not expected within the near future that a data collector could make a complete and accurate diagnosis of machine condition in all cases, it is anticipated that the machine can give a valuable "opinion" of the possible fault conditions detected.

## ACKNOWLEDGEMENTS

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# RCM Analysis Information And Decision Sheets

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## Abstract

This paper suggests the inclusion of possible additional questions on the RCM information and decision sheets and presents a decision sheet that incorporates the task type selection diagram. The objectives are to extract more useful information during RCM analyses and greatly reduce the time to analyse an asset class to less than one day on average.

## The RCM Information Sheet

### Defining the Asset's Function

A function must be specified as complete as possible, because a functional failure is defined in RCM as 'the inability to provide the function at the required performance level'. If we don't pay enough attention to comprehensively describe the function and associated performance levels, we will overlook possible functional failures that we should have considered in the development of the maintenance plan. This implies that we should cover operation policies, such as 'only operate during low electricity tariff periods', control of the asset, either locally or remotely and safety.

Note that the function description must cover the current application of each asset, not what it was originally designed for, as the two could be quite different.

### Recording Six Functional Failures for Every Function.

From experience it seems that for every function there are six possible functional failures that should be assessed in each case. These are:

1. not providing the function at all;
2. providing the function at less than the required performance level;
3. providing the function in excess of the required performance level;
4. providing the function intermittently (when continuity is required);
5. providing the function in an unsafe manner; and
6. not being able to control the function, locally or remotely.

### From Failure Mode to Failure Cause

There are many web-sites and publications containing a definition of failure mode, such as 'the failure mode represents the ways in which the component is expected to fail'<sup>1,2</sup>. The second reference adds 'in the progression of time a failure mode comes in between a cause and an effect'. Others define failure mode as 'the manner by which a failure is observed. Generally describes the way the failure occurs and its impact on equipment'<sup>3,4</sup>. The latter definition is an excerpt from 'The Reliability Engineering Handbook' by Bryan Dobson and Dennis Nolan.

Failure mode examples in literature include 'exhaust collapses', 'part of component falls off', 'wheel bearings seize' (the cause of the seized bearings was indicated to be lack of oil). There is also an instruction that a failure mode description must contain a noun and a verb<sup>5</sup>, for example 'valve closes shut'.

What these definitions and examples of failure modes have in common is that they definitely don't describe failure causes. Compared to a cause, the failure mode appears to be more the manifestation or symptom<sup>5</sup> of the failure.

The intention of RCM is to minimise unacceptable consequences of failures due to various failure root causes. We can find a statement that we 'must identify the cause so we don't waste effort treating symptoms. Shouldn't we, then,<sup>5</sup> record root causes in the RCM information sheet instead of failure modes, let alone a mix, such as 'Failure Mode (Cause of Failure<sup>5</sup>)'?

### Recording Failure Modes

\* RCM literature instructs that we should only list failure modes that might reasonably be expected to occur<sup>5</sup>. This means that when we are considering 'failure modes' (read 'root causes'), we have to simultaneously ask the question 'how likely is this'?

*\* What about the unlikely fault of something as unimportant as a small o-ring in the US Space Shuttle Challenger? What chance would that have to fail? Surely we would not have to consider that?*

*\* Some 25 years ago, an independent consultant discovered that there was a clear danger of catastrophic engine fault and fire from an 'explosive' break up of a Concorde wheel, following a blown tyre, with parts of the wheel piercing the aircraft's skin and fuel tank(s). Reports indicate that British Airways at the time acknowledged the report but said that the 'odds of that actually happening were improbable'. An estimate was 'once in twenty-five years! And they were right! Concorde flight 4590 from Air France that crashed with one or two port engines on fire in August 2000 was just about 25 years old. On the fourth day into the investigation of this accident, it was reported that a Concorde had previously been found by an inspector in New York to have holes in its fuselage and was dripping fluid, which turned out to be fuel! A tyre had blown on landing, the wheel had broken up, piercing the aircraft skin and punctured a fuel tank, leaking fuel onto the runway. No action was taken to modify the planes after this finding because...its occurrence was very unlikely! (In the mean time all Concorde's have been retired).*

The main danger of this instruction is that an unlikely fault can have disastrous effects. Risk should be assessed as a combination of severity and likelihood, as per various Standards. In our approach we therefore assess severity and likelihood of the consequences for each failure cause, after we have established causes and effects. This in recognition of the fact that we can not afford to simply record 'likely failure modes' but must record all 'modes'. Even if a failure is relatively unlikely, we should assess the need to perform maintenance if the consequence of the failure could be catastrophic. Comprehensive coverage also reduces the chance of overlooking maintenance needs.

Another instruction found in RCM literature is to identify failure modes at a level that results in appropriate failure management policies. At this early point in an RCM analysis, how could we even guess what an 'appropriate' failure management policy could be? After all, the determination of this is a final step in the RCM analysis and, surely, the analysis is not meant to fit a pre-determined outcome, perhaps the one that we already do?

The conclusion is that we should record as many failure causes as possible and, while we do so, disregard any considerations that belong further down in the analysis.

### The Importance of Detecting the Onset of a Fault

This question provides a link back to the design of the process or asset. If there is no way of detecting asset or asset output deterioration and we can't accept this deterioration, we might want to modify the design to include some sensors or indicators.

## The RCM Decision Sheet

### Consequences of Evident or Hidden Faults

RCM generally recognises four consequence categories, ranked in order of importance: hidden, safety & environmental, operational and non-operational consequences<sup>5</sup>.

The first question of decision diagrams determines whether the failure is hidden or evident. Failures that give some warning are evident and hidden failures go unnoticed until another failure occurs. Examples of hidden failures are safety devices or a parallel asset where only one of two is required. In practice a failure is deemed evident when 'in the passing of time' it will become evident to the operating crew under normal circumstances. We can find examples, such as 'total loss of vehicle brake fluid' and 'an underground tank leak'. Would you bother whether a task is evident or hidden when you find yourself going down a ramp in a dump truck into an underground mine and, when you press the brake pedal, the brakes don't work or that, in the passing of time, your process stops because the highly toxic chemical leaked out of your underground tank? Whether hidden or evident you would want to periodically check your assets.

Apart from this, the definition of evident and hidden failures refers to operators. How does this definition cover remote assets, especially those that are not linked to any remote monitoring system? Remember that we are not yet sending anybody out on a failure finding mission, as the decision diagram wants us to first establish whether the failure is hidden or evident!

Thirdly, the use of the term 'in the passing of time' in determining whether a failure is evident seems at odds with the definition in RCM of a failure as 'any deterioration from the required functional performance expectation'. Do you really only want to decide on regular fault finding tasks for hidden failures only, and not bother about brake fluid or tank leaks because they are defined as 'evident'? In line with the definition of a fault we should act as soon as possible.

So how important is the classification of hidden or evident? Indeed, a well-known decision diagram shows exactly the same questions under hidden failures and evident failures with safety, environmental and operational consequences. The only difference is for non-operational consequences where it is possible not to have any scheduled maintenance. Therefore, we developed a decision diagram where the first question does not consider evident or hidden failure but asks whether there is a significant safety, environment or operational consequence of a failure. This, to quickly identify all failure causes that allow 'repair on failure' or, in other words, 'no planned task'.

Part of an example of the RCM Information Sheet is shown below.

Reliability Centred Maintenance Information Worksheet				
Size Unit Component	Water Supply System Water Treatment Plant	Date Recorded By Audited By	Sheet No 1 of Team 1	
Function	Functional Failure (loss of functions)	Failure Root Cause	Failure Effort (What Happend When It Fails)	How do we Detect the Failure
1. To supply adequate and uninterrupted drinking water to a defined quality and standard. Adequate defined as the ability to deliver the current capacity required at all times with a maximum 5% loss	A. Water quality outside standards	1. Too little 'chemical' added 2. Too much 'chemical' added 3. Excessive solids in water due to blown filter 4. Contamination - sabotage 5. Contamination - oil & lubricants 6. Excessive solids due to skimmer failure	Public health consequences (sickness/death) Public health consequences (sickness) Excessive chemical corrodes assets Discolouration & minor sickness Severe public health issues - multiple fatalities Environmental issues Discolouration & minor sickness	Monitoring - chemical & physical analysis Monitoring - chemical & physical analysis Monitoring - chemical & physical analysis Monitoring - physical analysis Monitoring - chemical & physical
	B. No Water Supply	1. Catastrophic failure of dam wall results in no supply 2. Blocked filter halts supply	No supply, potential damage to township downstream Flow halted	Monitoring - low level in resevoir & low flow Monitor flowrate
	C. Intermittent supply	1. Short circuits on powerboard	intemittent operation, asset damage	power surges, monitoring of operations
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RCM Decision Sheet 1

**Risk Assessment**

After describing the effect, which is a qualitative assessment of risk, we can now try and quantify the risk. For this purpose we provide three columns for the assessment of severity, likelihood and detectability of the effects of a fault based on every root cause. We multiply the three values to arrive at a figure of risk.

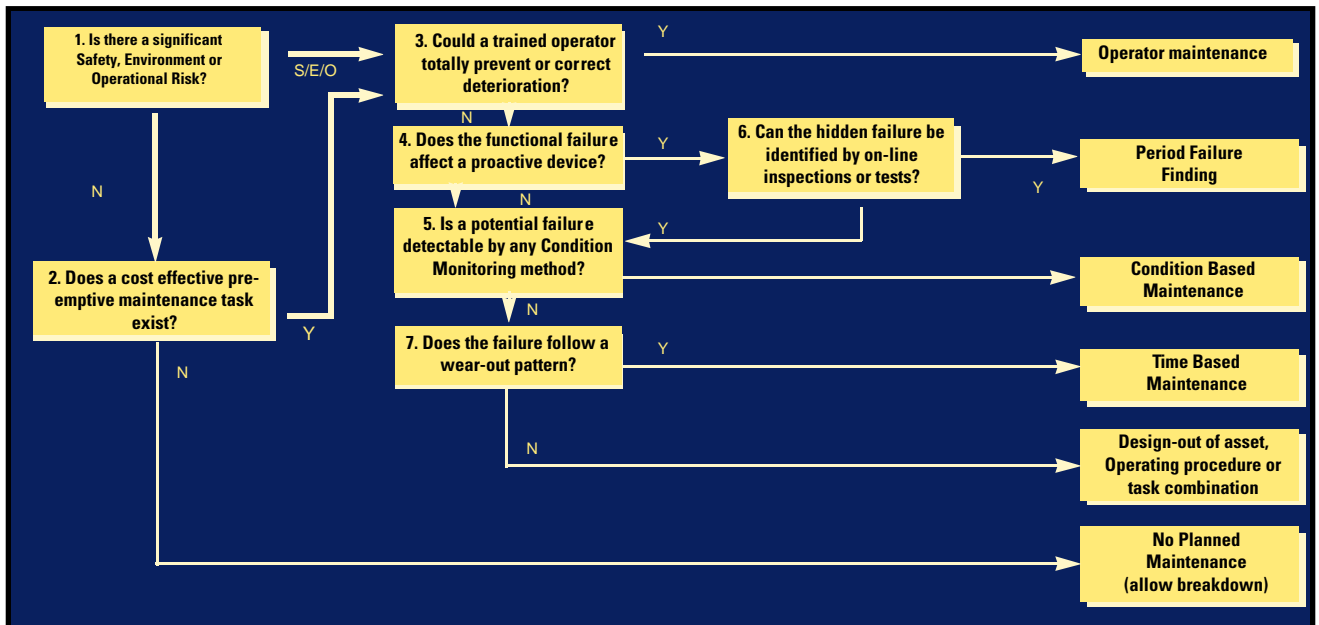
This part of the analysis has two functions:

- to be able to rank the fault consequences of each fault root cause, if we want to establish the order of implementing maintenance plan updates; and
- as a preparation for the task type selection analysis.

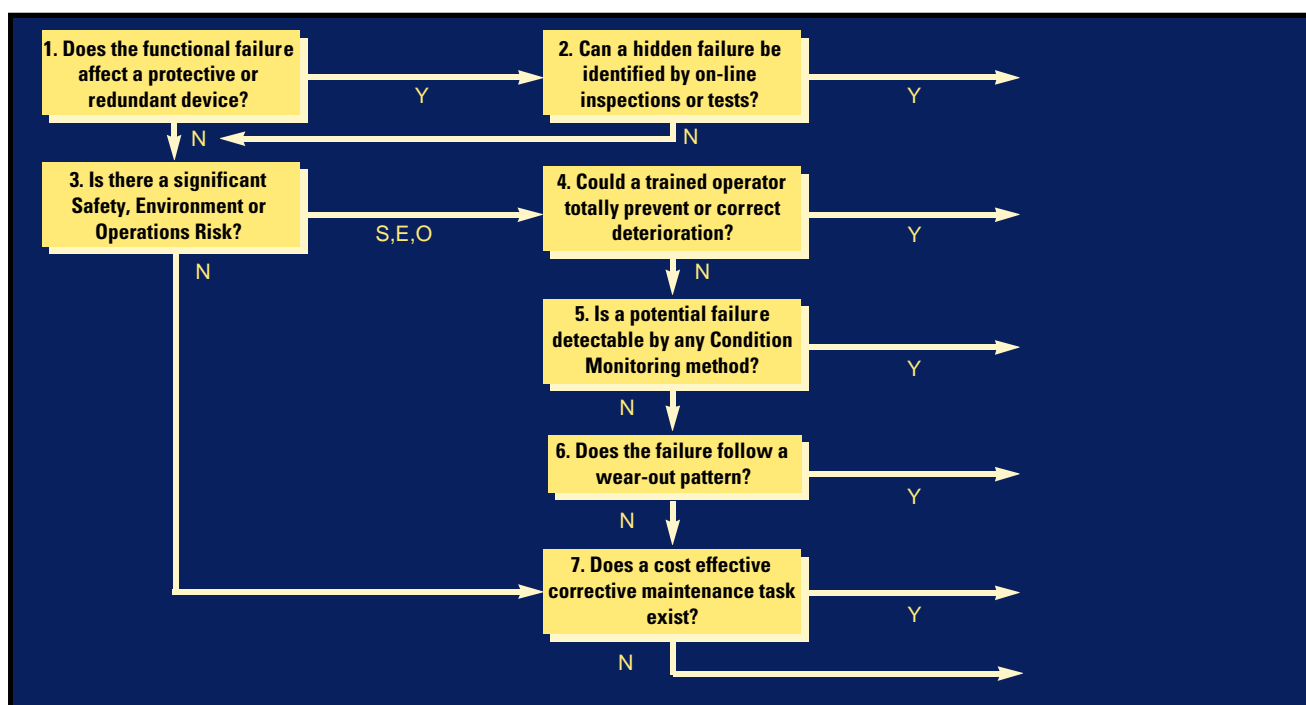
Note that this multiplication of numerical values only indicates a comparative rank. We warn against attaching too much value to the actual rank figure. What this means is that the risk as a result of selecting severity 5 and likelihood 1, or risk = 5 \* 1=5, is not necessarily the same as severity 1 and likelihood 5. This would only be the case if each class in severity, likelihood and detectability had exactly the same weighting, which is rarely the case.

**Task Type Selection Diagram on RCM Decision Sheet**

There are several conventional decision diagrams that do not normally appear on the RCM analysis worksheets and have to be consulted separately. Often, this means that they are not consulted at all. From informal surveys of groups of up to forty-five persons



Flow Chart - Version 1



Flow Chart - Version 2

who performed RCM analyses we repeatedly find that only about two claim to have cast an eye on the diagrams and these two may only try and save face. When analysts do not follow any decision flow diagram, how do they know what task to record? In most cases they revert back to 'what we already do'.

We include seven or eight columns to collect the answers to corresponding questions that appear in the bottom margin of the sheet. Each question offers the possible answers in bold. A small flow chart at the top of the sheet indicates what the next question should be, depending on the answers. The outcome of following questions and flow chart is the suggested maintenance regime, to be entered in abbreviated form in the task column.

We developed and tested three main versions; the first one existed in sub-versions for industries with or without operators (see operator-maintenance section below), the second version incorporated hidden failures and the third version has a totally different approach, going back to the very basics of the RCM philosophy. Below follow the first and second version.

Note that the word pre-emptive in the second question is a combination of preventive, predictive and pro-active.

The answer to one question directs to the next question. For example, 'no' to question 1 leads to question 2, but selecting that there is a significant consequence for safety or environment or operations would lead to question 3.

There are several advantages of including the decision diagram and questions on the worksheet:

- it removes the risk of reverting to only selecting 'what we already do';
- analysing teams are guided to the type of maintenance; and
- this feature results in comprehensive analyses of asset classes within greatly reduced times.

After the selection of the maintenance type with the flowchart, we have to define the actual task. Note that tasks can be of two types: • diagnostic tasks; and • maintenance tasks.

Whenever there is a need for a diagnostic task, we need to also record possible secondary (maintenance) tasks that are triggered by the diagnostic tasks.

### Operator Maintenance

Total Productive Maintenance includes the principle of operators performing asset cleaning, greasing, adjustments and minor maintenance, to keep the assets from deteriorating and maintaining proper operating conditions.

It seems logical to incorporate operator-maintainer principles into RCM for the selection of the appropriate maintenance task. This has the additional advantage of freeing skilled maintenance personnel for major maintenance and maintainability improvement activities.

We, therefore, include a question regarding the possibility of operator-maintenance and the readiness of the operator to perform the task, with or without additional training.

### Default Tasks?

For hidden failures, we are initially not supposed to consider failure finding missions, nor a re-design of the system, as these are 'default tasks', only to be considered 'if a preventive task can not be found which is both technically feasible and worth doing, then suitable default action must be taken'<sup>5</sup>.



Preventive maintenance, which is time or count-based, aims at preventing a failure, is only successful if there is a failure characteristic that is time or count-related. If such a task is not available, then the default task of fault finding becomes acceptable. Why can't this task be selected straight away? Furthermore, how is a regular (read time-based) failure finding task different from a preventive task?

### Questioning the Task Acceptance Criteria

In a general RCM approach, a task will be included in the maintenance plan if it passes the following two criteria:

- applicability; the task must reduce the impact or occurrence of failure due to the identified cause and the task must be technically feasible; and
- worth doing; the task must be cost-effective, compared to the avoided consequences and other tasks.

We feel that a task that is applicable and worth doing is not necessarily the best task. The next question should be whether this task is the most cost-effective task available. If it is, then the task 'will' be included, if there is a more cost-effective task, that task should be included instead.

This question must be asked but does not necessarily have to appear on the decision sheet. If the initial answer should be 'no', we then have to select another task that is applicable and more cost-effective. After that the answer in the column would change to 'yes'. Eventually the column should only contain 'yes'. Only if we wanted to record all steps in the analysis, for future audit purposes, would we record both the initial and final tasks and insert the column on the decision sheet.

### Obtaining Additional Information

After specifying the task, an RCM analysis determines the frequency for recurring tasks.

However, we feel that we should prompt for more information that we need for the development of the work schedule, such as the average duration of the tasks and the required resources. The resources can cover personnel, tools, equipment, spares and information.

Decision Sheet 2 Shows the corresponding part of the RCM Decision Sheet, containing the second decision diagram, albeit with an earlier version of the first question.

Reliability Centred Maintenance Decision Worksheet														
Site Unit Component		Installation Unit/Item No Item/Comp No		<div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>1 <input type="checkbox"/> Y <input type="checkbox"/> N</span> <span>2 <input type="checkbox"/> Y <input type="checkbox"/> N</span> <span>FF</span> </div> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>3 <input type="checkbox"/> S,E,O</span> <span>4 <input type="checkbox"/> Y <input type="checkbox"/> N</span> <span>OM</span> </div> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>5 <input type="checkbox"/> Y <input type="checkbox"/> N</span> <span>CB</span> </div> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>6 <input type="checkbox"/> Y <input type="checkbox"/> N</span> <span>TB</span> </div> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>7 <input type="checkbox"/> Y <input type="checkbox"/> N</span> <span>BM</span> </div> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>DO</span> </div> </div>							Date Recorded By Audited By		Sheet No	
Information Sheet Reference	Severity Likelihood Detectability	Criticality	RCM Decision Logic							Is this the most cost-effective task possible?	On or Off-line?	Frequency On or Off-line?	Manhours	Resources Needed
			1	2	3	4	5	6	7					
F	FF	FC												
F Function FF Funct. Failure FC Failure (root) Cause			7. Does a cost effective cor rective maintenance task exist? (Y,N) 6. Does the failure follow a wear-out pattern? (Y,N) 5. Is a potential failure detectable by any Condition Monitoring method? (Y,N) 4. Could a trained operator totally prevent or correct deterioration? (Y,N) 3. Is there a significant Safety, Environment or Operations risk? (Y,N) 2. Can a hidden failure be identified by on-line inspections or tests? (Y,N) 1. Does the functional failure affect a protective or redundant device? (Y,N)											

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RCM Decision Sheet 2

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# Are Women Welcome?

*Lisa Greenberg*

Managing Editor - Plant Services Magazine  
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**K**aren (not her real name) arrived at her client's maintenance facility early one morning, ready to work on a preventive maintenance program, when an older gentleman we'll call Ken greeted her at the door.

She introduced herself in her customarily cordial manner, but once he realized that she was the one who was going to be working with him to remove some maintenance-related obstacles, he promptly objected.

"He immediately refused to tell anybody anything," Karen recalls. "He demanded that we bring in a man to work with him and his staff." Karen, having experienced this workplace-related bias before, assured Ken that she was qualified to perform her duties, but still, he resisted.

"Then I started batting my eyelashes and flipping my hair and acting like a dumb woman," she says. "Some guys don't like to see women in a position of authority. So once I started acting helpless, he took me under his wing. His attitude was, 'That poor little thing - I can help her.'"

Once she gained entry to the maintenance department, she spent the rest of the week interviewing staff members. "They were 30 rough and rude maintenance men, but I got each one to talk to me about his situation," she says. "I did my job."

That Friday, after observing Karen in action, Ken apologized for his initial reluctance to work with her. But Karen knew what to expect. "Sometimes it's just a case of a man thinking a female can't do this job," she says of working in the maintenance field. She knew if she worked hard enough, he would realize that she is just as competent, if not more so, than a man in the same position. "A female has to go above and beyond," she says.

That was 15 years ago, and Robby Aumen, director of professional services for DPSI in Greensboro, N.C., experienced this true story. She works with customers to implement maintenance-related software, but got her start in the maintenance field while she was in the Army.

"It's still difficult to break into that good ol' boy network," she says. "In the past 10 years, more women have come into the industry, but they typically have been clerks," she says. "With more women coming out of the military, they are just as qualified as the guys."

She says she still encounters the occasional snub because she is a woman in the maintenance field, but she's used to it by now. "I'm too old now," she says. "I just blow it off." But other women who are looking for good-paying, stable jobs in the industry also have to deal with this "cultural" barrier.

In this era of declining interest by young people about getting into maintenance, companies should be flinging open their doors and welcoming women who are smart enough and strong enough to enter a nontraditional field. Women can help avert the impending maintenance crisis, and it would be a huge blunder on the part of maintenance managers to alienate half of the workforce because of misperception.

Mpact Learning Center, Greensboro, N.C., has hosted a tribute to women in the maintenance field. The maintenance training facility is working in conjunction with Greensboro's Women's Resource Center to train 25 employable women by December 2005. The goal was to raise awareness about the ability and presence of women in the industry.

Mpact is going to help with outplacement services, but it really comes down to industry's willingness to help these women secure jobs. "We're already getting companies that wouldn't normally have considered hiring a woman to think about it and change their hiring practices," says Joel Leonard, an instructor for Mpact. "Women are underrepresented. We are working with some women who will do whatever they can to help these companies." For employers who have begun to hire more women, they say it is refreshing to discover workers who will go the extra mile for them.

Leonard says women are better suited to perform some maintenance activities than men are. "Women are more detail oriented. Men have a hero complex: We let something go until it is burning down and then we want praise for putting the fire out. Women are good at preventing these situations and performing more of the preventive maintenance."

Women also get a lot out of the job besides a regular paycheck. "When you get in front of these guys and prove yourself, that feels good," Aumen says. "The men realize that you are just like any other co-worker on the job."

\* Download the song "Find Me A Maintenance Woman" from: [www.mpactlearning.com/maintenance\\_resources\\_links.asp](http://www.mpactlearning.com/maintenance_resources_links.asp)

# maintenance news

## Australian Maintenance Excellence Awards

SIRF Roundtables seeks to provide a high quality recognition process for Australian Industry through the annual Australian Maintenance Excellence Awards.

The objectives of the awards are to:

- Recognise maintenance excellence based on evaluation of performance, practices, people issues and business impact;
- Provide peer assessment of maintenance management systems against award criteria;
- Provide a learning experience and encourage progress along the path towards maintenance excellence;
- Promote, amongst business leadership, an understanding of the impact of maintenance upon the sustained profitability of individual operations and upon the health of Australian industry, and
- Provide a maintenance excellence recognition process of high integrity and of international quality.

The awards criteria encourage excellence in maintenance practices and performance and are similar to those being used internationally. Whilst extensive guidelines, self assessment and resource material are provided, the awards are not prescriptive about

approaches or models used by organisations who are seeking high asset reliability and capability.

Rather, organisations are free to choose their own improvement path and priorities, relevant to their individual business needs, and to use the awards to support their individual path and to acknowledge the results that are being achieved.

There are three levels in the Australian Maintenance Excellence Awards:

- Achiever - for recognition of achievement in the pursuit of maintenance excellence.
- Finalist - for recognition of achievement as a finalist in the Australian Maintenance Excellence Awards.
- And the prestigious Premier Award. This award acknowledges outstanding achievement in the field of maintenance excellence and its contribution to sustained improvement in business performance.

An enterprise recognised with an Australian Maintenance Excellence Award can expect to receive national and corporate recognition and to benefit from enhanced teamwork, pride, motivation and confidence.

Three organisations received awards in 2004

- Bonlac at Cororooke,
- Iluka, both the Mid West and South West operations, and



*Bryan Quinn of Powercor and the chairman of the AMEA panel presents an AMEA award to Alan Wilson and Leigh Smith of Esso Long Island Point*

- Esso at Long Island Point.

By applying for the Australian Maintenance Excellence Awards participants receive an external assessment from an experienced team of evaluators drawn from industry. The companies that have participated in the awards find the process of assessment by a panel of peers perhaps the most rewarding of the benefits gained through the review process.

Bonlac at Cororooke submitted for the awards in both 2001 and 2004. They were assessed at the Achiever level in 2001 and Finalist level in 2004. Randall Ferguson, Regional Maintenance Manager of Bonlac commented;

“The AMEA's process has been great for the development of the maintenance process at the Cororooke plant.

Maintenance generally gets audited for Environmental compliance, Quality (Food Safety) compliance but we have never been audited for how well maintenance is going.

Going through the AMEA's process the first time in 2001 really gave us the opportunity to have a look at maintenance from the inside out. Some really good feedback was given back to the site and this was incorporated into the next year's maintenance plan and goals and objectives.

In 2001 it also gave the maintenance staff recognition for the major change that they had assisted in the previous 3-4 years,

Going into the awards in 2004 was a different experience as the process was driven by the maintenance staff, you could see that from the trades staff up there was a sense of pride for what the maintenance staff do to maintain an old plant at a high level of reliability.

When maintenance staff walk up and say “look we did it”, or “we are the best”, you know that there is a sense of pride developing.

During the last couple of years going along the maintenance improvement journey the relationship between maintenance & production has become closer and closer to now where they share the same goals and purposes. The site is really aligned.”

The awards process has provided us all the opportunity to work on the pillars of maintenance and to understand these.

Most important it has provided the maintenance staff recognition from our maintenance peers that they are doing a really good job.”

Iluka Resources' Mid West and South West operations in Western Australia both achieved the coveted Finalist Award.

Joe Keane, Group Manager for Maintenance and Engineering at Iluka comments on the independent nature of the assessment process and peer review. “Iluka shop floor personnel were interviewed and the review process also focused on how Iluka communicates it's goals throughout the organization. and it was very

**AMEA**

**SIRF Rt**

**SIRF Roundtables develops and facilitates shared learning networks across Australia for operational excellence in industry. It provides a high quality recognition process for Australian Industry through The Australian Maintenance Excellence Awards**

**The awards:**

- \* Recognise maintenance excellence
- \* Encourage excellence in maintenance practices and performance
- \* Promote an understanding of the impact of maintenance
- \* Provide peer assessment

Contact SIRF Rt [www.sirfrt.com.au](http://www.sirfrt.com.au) +61 3 9248 1360 to participate in 2005

pleasing to our shop floor personnel play such a vital role”.

“Iluka maintenance personnel are very proud to win these awards and the teams from the South West and Mid West Operations should be congratulated”, said Joe Keane. “It has confirmed in everyone’s minds that our systematic approach is the way to go and has resulted in significant plant availability improvements.”

Iluka Resources was found to have demonstrated best practice with its cycle of review and improvement, consistent with maturity and sustainability in systems and processes. As part of a continuous improvement program, Iluka intends nominating for the Premier Award in 2007 which, if successful, will see the company secure a place in the top 10% in the world in this field, having satisfied the highest standards in the Assessment Matrix.

Alan Wilson The Maintenance Team at ESSO, Long Island Point saw the way the Awards process was used at Mobil Altona Refinery over a three year period to encourage improvement and was therefore happy to apply it at Long Island Point. Maintenance Superintendent Alan Wilson said “we have a good mix of experience and youth at Long Island Point and we are very proud of their achievements to date. At the same time we recognise that we have opportunities for more improvement. The Excellence Awards encourage us to look at ourselves in a way that recognises the good things that we have done but also the opportunities for improvement. We are pleased with the standard we achieved however we are determined to improve further and get a better result in the future.”

(See the Advertisement opposite for details of the AMEA awards for 2005)

## New Allen-Bradley Entek XM modules for fault-finding

Two new modules from industrial automation leader, Rockwell Automation, extend the Allen-Bradley Entek XM series of distributed protection and monitoring tools. This enables manufacturers to achieve and maintain optimum performance of their automation equipment. The devices--suited for specialised applications with large rotating equipment--leverage an application’s existing control network to gather and distribute data across the enterprise as part of a strategic predictive maintenance program.

Information gathered by the modules allows maintenance personnel to identify development faults and correct problems before downtime events occur, thus preventing impacts to production and safety. Because the XM series leverages the plant’s existing control architecture, users are able to reduce wiring by as much as 80 per cent.

The XM-220 dual speed module monitors machine speed and related parameters such as direction of rotation and acceleration. It is suited for rotary equipment such as centrifuges and turbines since it measures rotor acceleration and peak speed. In addition, it detects zero speed, locked rotor and reverse rotation.

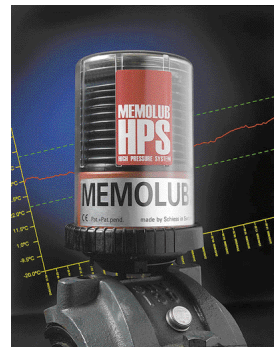
The XM-123 aeroderivative module meets the monitoring requirements of the majority of engines on the market, including gas turbine designs. These have

typically required specialised solutions to address the inherent noise these machines generate. The wide compatibility of XM- 123 allows customers to purchase and support just one monitor for all their aeroderivative machine monitoring applications.

## Cutting the cost of lubrication

The use of low cost, self contained automatic lube systems for oil or grease that cover from 1 - 8 lube points are becoming increasingly popular with Australian manufacturing- mining- and process industries.

MEMOLUB HPS electro/mechanical dosing pumps from Switzerland come in 3 sizes designed to take 120/240 or 480cc lube cartridges. Not affected by ambient temperature variations the pumps deliver a measured amount of lubricant at 25 bar (350 psi) output pressure. Pumps can be mounted directly to the lube point or placed for safety reasons as far as away as 8 m from it.



Combined with optional progressive distributor block kits for 2/4/6 and 8 lube points which are supplied with all necessary fittings and tubeings - motors, fans, pumps and any other plant items can be quickly and permanently fitted with their own “mini” central lube system.

A wide range of oil and grease cartridges are available off the shelf filled with major oil companies products. For special requirements a custom fill service is available. Changing out an empty lube cartridge together with its 4.5V power pack takes only seconds. The cost for the consumables replacement set (lube cartridge & power pack) is typically less than halve compared to “throw away” gas type lubricators.

Bearing temperature can also be automatically recorded with optional stand alone temperature loggers and the data is downloaded, analysed and filed on the PC with the ThermoChron® Manager Software.

Total Plant Control - Australia PH 1800 182 223

## Reducing Maintenance Cost Through Effective Prediction Analysis And Process Integration

Research and development work on the integration of Mainpac’s maintenance and asset management software with condition monitoring systems through the use of emerging technologies began recently at Queensland University of Technology (QUT).

The project which results from the AusIndustry grant secured by Mainpac last year will make predictive maintenance more efficient, thereby reducing maintenance costs.

The outcomes of the project being conducted at QUT’s Cooperative Research Centre for Integrated Engineering Asset Management, will ultimately be

included in a production version of Mainpac software. Integrating computerised maintenance management and condition monitoring systems will make preventive maintenance more efficient and therefore reduce maintenance costs. Mainpac's Sales and marketing manager, Mr Bates, explains:

"Broadly speaking, the entry of data is still a very manual process and although some software vendors provide integrated solutions, these typically have proprietary interfaces which restrict organisations to that single vendor.

"Our project is using open standards to develop a bridge between the CMMS which manages maintenance by budgeting work orders and scheduling resources and condition monitoring systems which monitor the state of an asset through sensors. We are also developing our own condition monitoring system which will allow us to test our unique health prediction models that we have developed for predictive maintenance," Mr Bates said.

The project uses MIMOSA EAI (Machinery Information Management Open Systems Architecture for Enterprise Application Integration) as the communication protocol between the two systems. The condition monitoring system is based on the OSA-CBM (Open Systems Architecture for Condition Based Monitoring) standard.

"To facilitate the communication between the two components we will use a Web Services platform which combines very well with the OSA-EAI and OSA-CBM as all rely on XML-based technology," Mr Bates said.

OSA-CBM is a distributed communications framework for machinery monitoring and diagnostic systems. It considers a condition based maintenance philosophy that is based on six layers - data acquisition, data manipulation, condition monitoring, health assessment, prognostics, and decision making. Only the first five components are implemented in the specification, and among other middleware technologies, XML over HTTP is supported - This is the same approach used by web services.

OSA-EAI provides open data exchange standards in several asset management areas - asset register management, work management, diagnostic and prognostic assessment, scalar data, vibration and sound data, sample based data, thermographic data and reliability information.

"The main development work of our project is going into constructing and refining these two processes, and the connections from and to them," Mr Bates said.

Through an analysis of the sensor data, the health of an asset can be determined by looking at the signal deviation from a healthy baseline. By comparing health to historical trends and passing the information to reliability models, a judgement is made on when maintenance should be undertaken. Combining this information with a company's maintenance strategy allows the system to optimise the maintenance plan. The final step involves the CMMS passing certain financial information to the ERP system for reporting purposes.

Mr Bates says Mainpac has identified several key attributes of a system that implements this chain. The system must be:

- timely, such that changes in asset condition result

in appropriate maintenance orders

- event driven such that each process is triggered automatically and user intervention is minimised
- flexible so the CMMS can adjust various parameters and settings of the condition monitoring system
- secure so that processes accept data from authenticated sources

"We have identified three outcomes to ensure that the developed system meets its stated objectives," Mr Bates said.

First, the system should result in reduced maintenance costs. By integrating both the CMMS and condition monitoring systems, immediate cost savings come from more timely health notification and less manual data entry.

Second, there should be a reduction in resources consumed by unplanned maintenance. As health prediction models schedule maintenance more efficiently it follows that unplanned maintenance should occur less often.

Finally, as down time through unplanned maintenance is reduced, the potential productivity of the asset should increase.

[www.mainpac.com.au](http://www.mainpac.com.au)

## ..... Revolution in hand

Asset maintenance specialists EPM Solutions have discovered that the utilisation of new technology in the supply and implementation of computerised maintenance management software (CMMS) solutions can bring all kinds of benefits for the client. One such development can be found in the use of remote handheld devices that are capable of communicating directly with a client's maintenance and stock control systems.

Handheld technology is a significant step forward for anyone involved in maintenance and asset management. By providing a paperless solution the technology is revolutionising the industry as the need for printed work dockets and form filling becomes a thing of the past. EPM is currently introducing a handheld system to one of the UK's largest newspaper groups to assist in the improved management and control of maintenance at their printing facilities in Scotland. The results speak for themselves with EPM's early adopting clients gaining greater control, improved efficiency, higher quality and increased profitability.

CMMS supplier Shire Systems recently showcased their latest handheld technology at the "Frontline on the Move" Road Shows held across the UK. Gary Kerr, Managing Director of EPM Solutions who attended the Glasgow event at Hampden Park commented, "This new development offers a wide array of features designed to provide greater speed, control and flexibility to help the industry re-think the way it currently works." At the "FrontLine on the Move" Road Show the handheld applications could be seen in action. A wide range of features were presented including signature capture, meter readings, send or raise all planned and reactive jobs, post results and stock issues.

The benefits of handheld devices in asset maintenance and stock control include:

- Seamless integration with existing software packages
- Improved data accuracy
- Scaleable and expandable to suit all organisations
- Huge savings in administration costs
- Low cost of ownership
- Quick data entry validation via barcodes.
- Supports quality as well as health & safety compliance

Most of the handheld devices that are available for asset maintenance and stock control make use of well-known mini and handheld computers. Procedurally both quality and health and safety goals are fully supported with significant improvements in traceability including who did what, where, when and why?

For more information on handheld technology please contact EPM Solutions on 0141 848 6609 or visit [www.epmsolutions.co.uk](http://www.epmsolutions.co.uk)

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## The challenge of change - Configuration Code Change Management

As industrial automation systems expand in scale and complexity, maintenance managers are fast recognising that configuration code management and maintenance is an important and emerging area of modern plant maintenance.

Managing and regulating automation device configuration code change--whether it be for a programmable logic controller (PLC), a human-machine interface (HMI) or even a configurable valve--poses an ever-increasing challenge for industrial automation engineers. As the sheer number of configurable devices on an operating site increases, and site automation systems become more interlinked and network access points more ubiquitous, so too does the risk of unmanaged code change.

To-date, managing code change has most often been addressed (if at all) by keeping manual records of the current code version, plus the code edit details and their authors for every change at each configurable device. Such systems are completely "open loop" and highly reliant on site personnel good practice. On a busy operating site, with many hundreds of configurable devices and the pressure and cost-implications of plant downtime, retaining such records accurately is difficult, to say the least. The practical reality is that such manual systems offer only a rudimentary safety net--access to controller code remains largely unpoliced and software changes are generally not recorded in a form that can be audited.

For many plant maintenance engineers, automation code configuration is regarded as being in a separate world to the science of asset and maintenance management--the tools, techniques and strategies used to minimize maintenance, repair and operation (MRO) costs, and maximize plant uptime. Conventional asset and maintenance management strategies tend to focus

on physical plant: it's all about large rotating equipment, production lines, utilities and so on--rather than software and code, right?

Not quite, says Jeff Sladeczek, Rockwell Automation's business manager for Rockwell Software - Asia Pacific. Sladeczek believes that this definition is too narrow, and that configuration code is an essential and often undervalued part of the plant asset big picture. "Companies don't often assign a dollar value to their PLC, HMI or drive code until it becomes a problem," he says. "The problem occurs when uncontrolled changes in the code cause the machine, line or even entire plant production to shutdown. It's then that they learn the true value of code; and that code--like any piece of physical plant--is an asset that should be factored into any asset management and maintenance strategy."

It is for this reason that code change management is one of the four operational elements of Rockwell Automation's powerful Rockwell Software Maintenance Automation Centre (RSMACC) collaborative asset management and maintenance tool.

In structure, RSMACC mirrors the ubiquitous plant-wide nature of contemporary industrial automation topologies, and leverages the power of three core building blocks: Microsoft SQL Server 2000, Rockwell Software FactoryTalk and Rockwell Automation's Integrated Architecture. The end result is RSMACC--a plant-wide collaborative asset management and maintenance tool that supports everything from OEE optimization to disaster recovery.

Once in place, RSMACC Change Management provide a fully integrated code change management tool that is completely scalable to the site's needs, now and in the future. Importantly, once the RSMACC foundation is in place, the important value benefits offered by the package's three additional operational areas--RSMACC Network Health, RSMACC Enterprise OnLine Condition Monitor RSMACC Automated Asset Manager--are easily accessed. "RSMACC really offers the complete site collaboration environment," Sladeczek concludes. "Change Management is most often the start point, but is rarely the end for most customers!"

### Change Management on five fronts

**Access control and Authentication** allows the user to control each individual's access to devices on the plant floor, the location from which they access the device, and the actions they can perform on that device. The entire system is 'rules-based', with the operator afforded tremendous flexibility to 'get the rules mix right'. Access rules may be tailored according to the role of the individual, the work station location from which he is working, and the area of plant on which he intends to work.

**Audit** tracks each and every change made to the facility's device configurations, showing when the change occurred, what application he or she used, which workstation the change was made from, who made the change and what the change was. Importantly, as all Rockwell Software editors have built-in audit functionality, RSMACC creates the audit trail via the editor software carrying out the change. This ensures that RSMACC provides a true 'bit level' audit--including such actions as a temporary force on an output.

**Archiving** takes control of record file usage across the enterprise. It protects intellectual property and manages validated programs by requiring users to formally check

files in and out. Archive also maintains version histories by tracking changes made to any file, from PLC programs and graphics, to system documentation reports. All data is stored in a secure Microsoft SQL Server database--the well-accepted IT format that 'bolts' easily into existing enterprise IT structures. Archive also logs the 'who, what, when and where' of all code change activity, and stores these for future audit analysis.

**Reporting** provides formatted views of the data stored in the RSMACC Change Management repositories, tailored to each site's unique reporting requirements.

**Backup, Recovery and Verification** allows the user to develop an automatic verification, back-up and recovery 'scheduling engine', which is customized at the device level. It also validates that the device configurations running in the facility have not been tampered with, by comparing these to the archived masters. Importantly, RSMACC Change Management uses highly efficient device library modules to perform these backup, recovery and verification tasks, rather than relying on code editing tools. These modules are 'multi-threaded', which means several copies can be used concurrently on the same computer, allowing for simultaneous uploads and downloads from several devices at the one time.

Rockwell Automation

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## New Machine Reliability and Inspection (MARLIN) system for Operator Driven Reliability (ODR)

Did you know?

1. Operators can contribute significantly to improve your plant reliability and bottom line
2. Your return on investment (ROI) from Operator Driven Reliability program is faster compared to any standard Predictive Maintenance programs
3. Operator Driven Reliability program complements your Maintenance Strategy Review (RCM, SRCM, RBM, TPM etc.) implementation process

### Built on Knowledge

Having introduced the first inspection tool for operators in 1992, SKF has gained a wealth of knowledge and experience with thousands of system implementation in the world. The new SKF MARLIN I PRO incorporates SKF's extensive knowledge and experience in Operator Driven Reliability (ODR), and offers advanced technology and ergonomic design that enhances effectiveness while easing the process of routine inspection for the operator.

SKF also offers a vast array of implementation services and support to ensure the essential cultural, process and technology adjustments are made to facilitate the success of your Operator Driven Reliability program

The New MARLIN I PRO is a rugged, high performance data collector, that enables plant operations personnel to quickly and easily collect, store, and analyse overall machine vibration, process and inspection data. The unit enables trending, comparison of previous readings, alarm alerts and more. A "user notes" allows operators to immediately record detailed observations of troublesome machine conditions or questionable measurements

The unit's graphical-user interface facilitates proficiency, enabling users to getup and running in no time - with minimum training required. Collected data by is uploaded to the powerful SKF Machine Analyst, Asset Efficiency Optimisation™ software for further review, analysis and follow-up action.

The MARLIN I PRO is loaded with following new features:

1. **Derived Points:** Utilizes a user definable mathematical formula to calculate a derived data value from data collected for multiple points.  
Benefit: This enables users with to react immediately to process variations.
2. **Structured Routes:** Will be asking the operator formally if they would like to "End Route collection" or "Suspend Route Collection". The route duration, Start/Stop - Date /Time and Route "User" shall be stored in SKF Machine Analyst/Inspector software. Benefit: Allows corporate standards for data-collection and permits management to determine data-collection efficiencies
3. **Alarm messages and Document links:** Document links from Machine, Point or measurement review form that provide further guidance
  - a. To aide in collection of a measurement
  - b. After a measurement has been collected, or
  - c. For follow-up-on actions if a measurement is in alarm

Benefits: Enables standardization of processes, communication of complex (or simple) instructions and facilitates and accurate and consistent approach to addressing changes to machine condition.

4. **MARLIN Conditional points:** Points in a route will only be collected if another point in the route meets a specified condition. Benefit: This features facilitates pro-active approach to monitoring by enabling a route to be continually modified to address changing machine conditions, reduces operators spend collecting unnecessary data

The SKF Machine Analyst/Inspector works seamlessly in multiple-client environment, integrates with Lube data, online surveillance, protection systems, E-maintenance and @ptitude - Industrial decision support system, allowing you to automatically generate works notification into your CMMS. Benefits are improved time utilization of maintenance & reliability resources and machine efficiencies, increasing production and profitability.

For further details email [info.reliabilitysystems@skf.com](mailto:info.reliabilitysystems@skf.com) or contact 03 92690773

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## MicroVibe P: Pocket PC-Based Vibration Analyzer

SKF Reliability Systems is proud to announce the second generation of Personal Data Assistant (PDA) based Vibration Analyzer and Data-collector. The New SKF MicroVibe P is a portable Vibration meter that fits into your various modern Pocket PCs and features user-friendly Windows mobile operating system.

The lightweight SKF MicroVibe P Analyzer provides features for a quick assessment of machine condition



and some features similar to heavy weight data Analyzer. It is therefore the most simplest, most economical approach to machinery analysis including root cause analysis that fits your pocket

The SKF MicroVibe P features the one-press-of-a-button quick check on Acceleration, Velocity, Displacement and Enveloped Acceleration overall readings. Now it also includes a route based data collection. In addition to the automated Velocity severity evaluation, the new MicroVibe P features early bearing degradation judgement call based on SKF's proven enveloped acceleration technique.

The SKF MicroVibe P kit (CMVL3850) includes all the necessary items for starting a predictive maintenance program or for perfectly complementing existing programs.

Benefits of SKF MicroVibe P includes:

1. Quick evaluation of overall vibration
2. Collects data in Metric and imperial units
3. Evaluation of vibration results with onboard expertise on machine health
4. Quick and reliable judgment calls on machine bearing condition
5. Detailed analysis of vibration data, displayed in FFT spectrum plots and time waveform
6. Upload overall scalar and spectral data to PC for trending, analysis and reporting
7. Route based data-collection
8. On-board vibration dictionary
9. Audio analysis
10. Internal signal generator to perform field calibrations

SKF Reliability System's new MicroVibe P truly brings you a vibration monitoring and analysis power without complexity. Its tomorrow's big solution for vibration analysis in a small, smart package - and is available today.

SKF Reliability Systems is a part of the worldwide SKF Service organization. The organizations condition monitoring and service businesses extend machine service life, reduce overall maintenance costs and improve plant efficiency by creating integrated solutions for end-users who need to improve plant operation and reliability maintenance management with minimal investment.

For further details email [info.reliabilitysystems@skf.com](mailto:info.reliabilitysystems@skf.com) or contact 03 92690773

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## Introducing the new CMVA65 Microlog - A Must for your Predictive Maintenance Program

In a continued endeavour to add Power, Advanced Capability and Expertise to your reliability efforts, SKF has added many new products, softwares and solutions for 2005. CMVA65 is the newest addition to the Microlog family of Portable Data-collectors and analyzers. CMVA65 continues the SKF tradition of offering real world instrumentation for hands-on vibration professional by building on foundation of versatile and feature rich Microlog.

CMVA65 Microlog detects mechanical, electrical and

process related problems with an expert diagnostic module. Also includes a colored alarm condition display (ISO 10816), two customisable user profiles for display settings and complete Bearing Library (20,000 bearings) embedded in the firmware.

Furthermore, the new CMVA65 introduces an SKF patented algorithm Harmonic Activity Locator (HAL) wizard as a standard feature.

HAL mimics the way a human would detect a harmonic series in the FFT spectrum.

That is, it acknowledges a series of peaks related to rotational speed when a FFT spectrum is displayed.

Therefore with the addition of HAL wizard to proven Enveloping technology, users can now easily and accurately identify bearing fault frequencies.

The CMVA65 continues with the "all in one" package so you do not have to purchase additional features, memory or applications.

Other embedded Wizards in CMVA65 include:

- Basic & advanced balancing (multi plane, also auto calculates correction weight and angle)
- Motor current analysis (on spot assessment of Rotor bar conditions in Electric motor)
- Tracking filter (for isolating amplitude and phase of 1x and 2x speed components)
- Cyclic analysis (time based analysis of reciprocating machines)
- Bump test (for analysing structural modal response of a machine or structure)
- Run-up/ Coast down (identifies structural resonances frequencies when shaft passed critical speeds)
- Multi-Point Automation (MPA) allows faster data-collection
- Configuration wizard: Allows to store 6 pre-defined machinery settings for analysis

The CMVA65 Microlog together with the powerful SKF Machine Analyst, Asset Efficiency Optimisation™ software packages provides the users with the most advanced software solution for managing, manipulating, and analysing machinery condition monitoring data.

The SKF Machine Analyst works seamlessly in multiple-client environment, integrates with Lube data, online surveillance, protection systems, E-maintenance and @ptitude, Industrial decision support system, allowing you to automatically generate works notification into your Computerized Maintenance Management System (CMMS).

Generating initial benefits through improved time utilization of maintenance & reliability resources and machine efficiencies. Hence increasing production and profitability.

For further details email [info.reliabilitysystems@skf.com](mailto:info.reliabilitysystems@skf.com) or contact 03 92690773

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## CSI 4500 ONLINE VIBRATION SYSTEM



### Visualization of Plant Asset Health

- Immediate notification of machine problems, Trend developing faults, Plant-wide access via Ethernet Intelligent Information Management
- Report on exception, Low LAN traffic, Input/output relays trigger appropriate action, Interface tools for information sharing

### Advanced Diagnostic Tools

- Monitoring adapts rapidly to machine state, PeakVue for early bearing fault detection, Dual channel with orbit displays

### Complete Monitoring Solution

- Program design and implementation, System training and optimization, Remote monitoring and analysis

## CSI 2130 PORTABLE VIBRATION ANALYSER



- new COLOR screen that is four times larger than most other screens
- can improve data collection time by 20-50% compared to opposition analysers
- 32 times more internal memory than other analysers
- ability to plug in standard off-the-shelf Flash RAM cards using card expansion slots
- onboard Analysis Expert for performing diagnostic tests in-field
- low noise floor and high dynamic range
- added on-board intelligence
- greater data collection speed and analysis power

### Thickness Gauges

MSC have a wide range of ultrasonic thickness gauges designed for determining metal thickness. Our gauges provide quick, easy and repeatable results and are great value for money.

from under **AUD \$3,000**



### Grease Monitoring

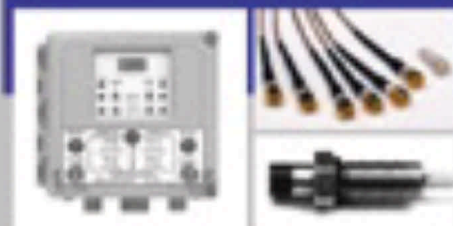
The UVUM UltraLube grease monitoring device allows the user to listen to the supply of one, two, three or greases required as well as revealing existing lubrication problems.

for **AUD \$2,250**



### Vibration Protection

Metric provide a comprehensive range of vibration protection monitors, switches and sensors. Proximity probes which are fully interchangeable with Berly Nevada probes, cables and drivers.



**vb3000 — The complete vibration analysis package**

- Bearing demodulation
- Keypad data entry
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- Bump test
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- Coast down & run up tests
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- Laser tachometer
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**vbONLINE — Creating the standard for affordable 24/7 surveillance monitoring of your machines**

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**Ascent software — The most powerful tool in proactive maintenance**

- The Proven Method
- Statistical alarms
- Bearing database
- Partial waveform analysis
- True network capability
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- Software and firmware service packs — free for the life of your vb instrument
- Trade up policy

supplied with Ascent software



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# AFFORDABLE VIBRATION ANALYSIS – keep the wheels turning

PRODUCT GUIDE



supplied with Ascent software



# AFFORDABLE VIBRATION ANALYSIS – keep the wheels turning

## Your productivity and financial success depend upon proactive maintenance of your plant and machinery.

Diagnostic specialists Commtest Instruments have listened to industry needs and responded by establishing the **vbSERIES** of affordable quality vibration analysis solutions that monitor the health of your assets and save time and money.

### Portable or permanently wired

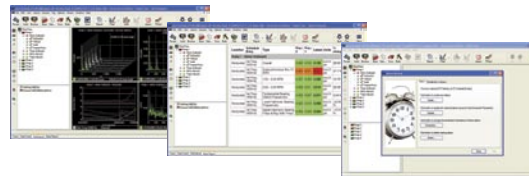
The **vbSERIES** is powered by intuitive and user friendly Ascent software as both a portable, durable monitoring system, and now as **vbONLINE** – a permanently wired remote monitoring system operable from anywhere in the factory or off site, 24/7.

Both effectively reduce downtime, optimise labour resources and increase profitability.

With Commtest's commitment to delivering high quality cost-effective solutions and the powerful suite of tools made available by Ascent software they have been recognised as one of New Zealand's leading exporters with over 30% growth in 2004 and over 500 systems shipped around the globe in the past two years.

### Software features:

- Ascent Level 3 – true network software via LAN/WAN
- Smart statistical alarm creation – fast efficient set-up
- The Proven Method by Technical Associates – automated alarm and database creation
- Commtest bearing database
- New graph capabilities – orbits, bode plots plus much more
- Data pump – easy export functions of a machine or complete data bases from remote sites



### vbSERIES portables:

- NEW** Quick set-ups – customise and save your preferred profile for special tests on the fly
- NEW** Signal processing module – providing:
  - faster data collection speeds
  - even longer battery life
  - increased processing power and performance



supplied with **Ascent** software

**ascent**



**vbOnline**™

### vbONLINE

- 16 or 32-ch multiplexer modules – compact and robust
- Remote networking – WAN and WiFi compatible
- Low cost per point – small or large systems benefit from cost effective installation options and low cost hardware and software

### EASY CONVERSION AND NO COSTLY UPGRADES

Converting from an alternative brand of vibration hardware or software is simply a matter of importing your CSI, Entek or SKF database including historical data in our powerful Ascent software.

### Comprehensive Warranty Policy

You will no longer have to pay annual user and support fees that are of little or no benefit. Commtest are the first specialised diagnostic provider with a comprehensive warranty policy on hardware and software updates.

Portable instruments warranty – 5 years

Online warranty – 3 years

If you run a large programme consisting of a few data collectors and software licences then you may wish to consider our extended warranty program. This program is designed to ensure that you are never faced with system redundancy.

**commtest**

Please fax completed enrolment form to (03) 9269 0701 or mail to PO Box 301, Oakleigh VIC 3166.  
All enquiries to Alan Ryan (03) 9269 0860 or email [info.reliabilitysystems@skf.com](mailto:info.reliabilitysystems@skf.com)

LOCATION	VENUE	DATE
<b>Mackay</b>	The Windmill Motel	29 June – 2 July
<b>Gladstone</b>	Country Plaza Motel	6 July – 9 July
<b>Brisbane</b>	SKF Training Centre, Archerfield	13 July – 16 July
<b>Sydney</b>	Century City Novotel	17 August – 20 August
<b>Melbourne</b>	SKF Training Centre, Oakleigh	24 August – 27 August
<b>Adelaide</b>	SKF Training Centre, Wingfield	31 August – 3 September
<b>Mt. Gambier</b>	The Lakes Resort	9 November – 12 November
<b>Morwell</b>	Powerworks	16 November – 19 November
<b>Launceston</b>	Tamar Yacht Club	22 November – 26 November

**Course fee:** **\$1,750.00** + GST per participant  
(Includes lunch, refreshments and course manual)

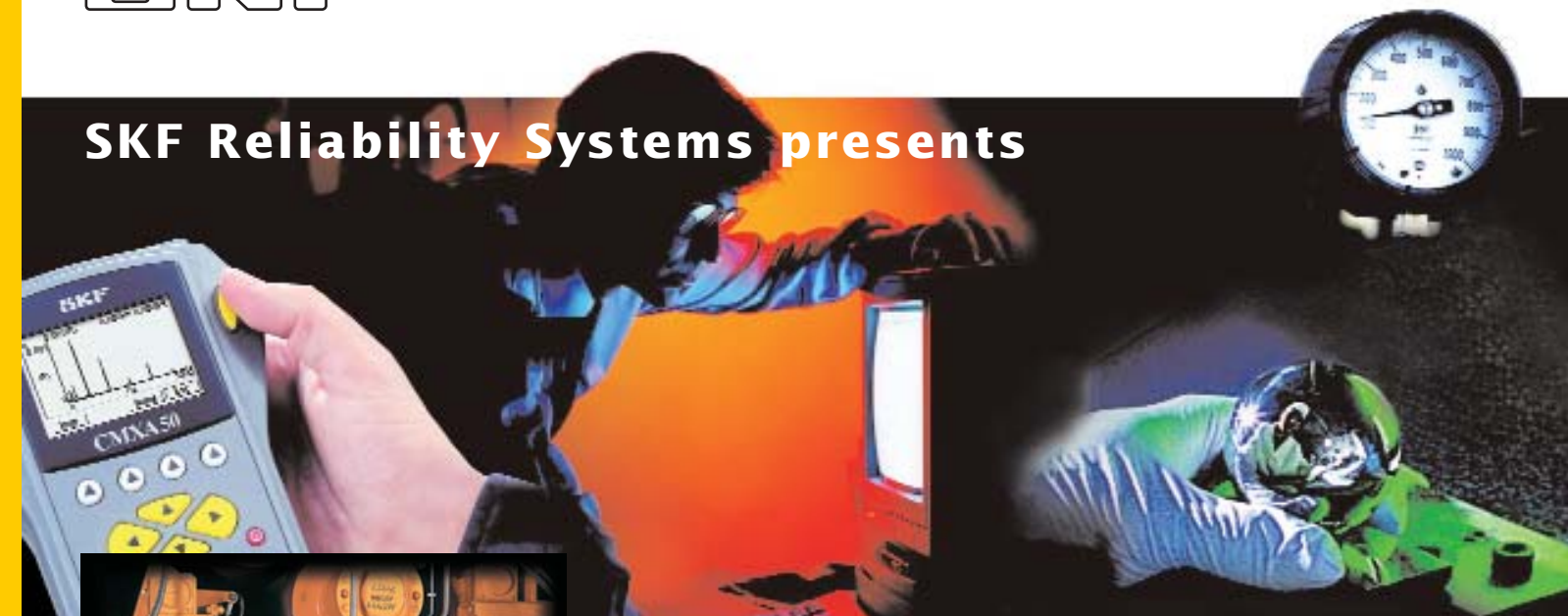
**Group discount:** send 3 or more delegates from the same organisation and save 10% off the registration fees for each delegate.

Location		Date
Company Name		
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Contact Name	Phone	Fax
Email		
<b>Delegate's Details</b> (Please print)		
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Name	Job Title	
Name	Job Title	
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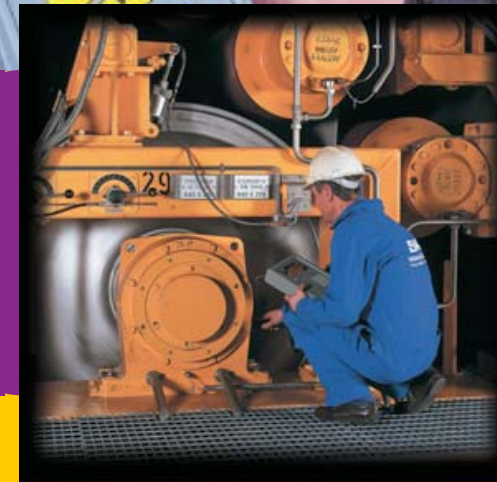
**NOTES**

To ensure enrolment, payment or official company purchase order must be lodged immediately.  
Cheques should be made payable to SKF Australia Pty Ltd and mailed to PO Box 301, Oakleigh VIC 3166.  
Please note that a 50% refund will be made for cancellations of 10 or more working days before commencement of the seminar. If less than 10 working days, no refund can be given. However, a replacement person may attend or the booking can be transferred to a future course.

[www.skf.com.au](http://www.skf.com.au)



SKF Reliability Systems presents



## ASNT Entry Level Vibration Analysis Training

Your chance to to become qualified to an internationally recognised standard in Vibration Analysis.

### LOCATIONS

**New training courses starting from June 2004**

**Mackay**  
29 June – 2 July

**Gladstone**  
6 July – 9 July

**Brisbane**  
13 July – 16 July

**Sydney**  
17 August – 20 August

**Melbourne**  
24 August – 27 August

**Adelaide**  
31 August – 3 September

**Mt. Gambier**  
9 November – 12 November

**Morwell**  
16 November – 19 November

**Launceston**  
22 November – 26 November

### Basic Vibration Analysis training includes:

- Predictive Maintenance practices
- Steps in setting up a successful Predictive Maintenance Program
- Setting up databases and machine identification protocol
- Where to take readings
- Data analysis terminology
- Machine Vibration theory
- Transducer selection
- Data collection set-ups
- Diagnosing common problems
- Vibration fundamentals

### Who should attend?

- Condition Monitoring Technicians
- Vibration Analysis Consultants
- Predictive Maintenance Engineers
- Maintenance Engineers
- Reliability Engineers



SKF Reliability Systems

## Course description

In today's plant maintenance, condition monitoring plays a vital role in ensuring the availability of critical plant machinery.

With the proper skills and equipment, engineers and technicians not only detect problems before they result in a major machine malfunction or breakdown, but they also perform root cause failure analysis to prevent problems from recurring.

Condition monitoring engineers and technicians can have a significant impact on a plant's bottom line profitability. This training focuses on providing comprehensive skills to assist engineers and technicians in utilising the right technology, obtaining the greatest benefit from condition monitoring tools, and effectively communicating program results to plant management.

## About ASNT

The American Society for Non-destructive Testing, Inc. (ASNT) is the world's largest technical society for non-destructive testing (NDT) professionals.

ASNT Predictive maintenance certification was developed in response to industry requests for a third-party certification that focused on Predictive Maintenance knowledge and test methods instead of the traditional NDT methods used. In response to ASNT requirements Technical Associates of Charlotte has developed a body of knowledge, training courses and vibration analysis examinations.

SKF Reliability Systems is proud to bring the ASNT courses to Australia with a teacher qualified by Technical Associates.

A four hour closed book written examination will be included with the course. Successful completion of the written examination result in Entry Level Vibration Analysis Certification.

Passing this course enables participants to progress to ASNT Levels I, II and III that will be available in Australia in the future.



## Continuing Professional Development

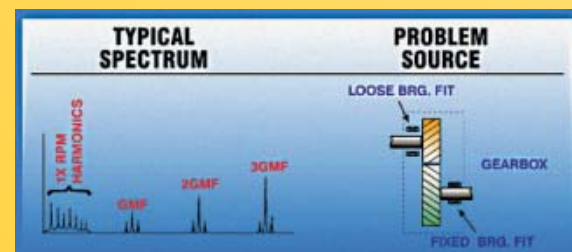
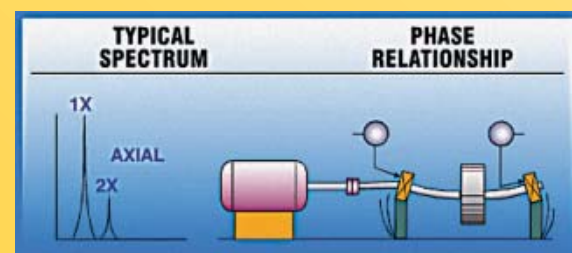
For Professional Engineers attending, this course meets the Continuing Professional Development (CPD) requirements of Engineers Australia.

## About the Instructor – Mark Jones

Mark has 18 years experience in vibration analysis (detailed, general, program set-up, management, training and procedure development).

He is officially certified under ASNT (SNT-TC-1A) by Technical Associates of Charlotte to Level III VA and authorised instructor to deliver the ASNT training courses Entry Level, Level I and Level II.

The ASNT courses are not specific to any manufacturers' brand and is suitable for users of SKF, CSI, Diagnostic Instruments, Entek, DLI, B&K, Bently Nevada, Commtest, Pruftechnik and other vibration analysers.



## 1. PREDICTIVE MAINTENANCE AND MACHINE VIBRATION

### 1.1 Introduction to Maintenance Systems:

- Types of Maintenance Systems
- Reactive Maintenance – Run-To-Failure
- Proactive Maintenance – Preventive
- Proactive Maintenance – Condition Monitoring
- Proactive Maintenance – Predictive
- Proactive Maintenance – A Broad-Based System
- Reliability Centered Maintenance
- Total Productive Maintenance
- Computerized Maintenance Management System (CMMS)

### 1.2 Predictive Maintenance Program (PMP):

- Vibration Analysis
- Goals of a PMP
- Continuous Monitoring System
- Periodic Monitoring System
- Setup of a Predictive Maintenance Program (PMP)

### 1.3 Steps in a Condition Monitoring Program for a Successful PMP:

- Detection
- Analysis
- Correction
- Verification
- Root Cause Analysis

## 2 DATA COLLECTION

### 2.1 Setting Up a Database:

- Machine Identification
- Measurement Points
- Measurement Routes (Lists)

### 2.2 Downloading a Route

### 2.3 Selecting Necessary Equipment

### 2.4 Safety Precautions

### 2.5 Collecting Data:

- Horizontal, Vertical, and Axial measurements
- Using Accelerometer
- Storing Data
- Connecting to the Computer
- Uploading the Data
- Storing the Data
- Disconnecting From the Computer

### 2.6 Uploading the Route:

- 'Last Measurement Report'
- 'Exception or Overall Alarm Report'
- 'Inspection Code Report'
- 'Spectral Band Alarm Report'

### 2.7 Report Printouts:

- Trend Plots
- Narrowband Alarm
- Spectral Plot
- Spectrum Map Plot

## 3 DATA ANALYSIS

### 3.1 Definitions of Terminology:

- Synchronous versus Subharmonic
- Synchronous versus Harmonic
- Nonsynchronous Modulation
- Spectral 'Pattern' Recognition

## 4 MACHINE VIBRATION – BASIC THEORY, PART 1

### 4.1 Basic of Vibration:

- Spring-Mass Systems
- Characteristics of Vibration
- Natural Frequency

### 4.2 Displaying Vibratory Motion:

- In the Time Domain
- In the Frequency Domain

## 5 MACHINE VIBRATION – BASIC THEORY, PART 2

### 5.1 Amplitude – The Magnitude of the motion, Displacement, Velocity, Acceleration

### 5.2 Root Mean Square, Peak, Peak-To-Peak Conversions

### 5.3 The Period of Vibration

### 5.4 Analysing Frequency Peaks & Amplitude Levels

### 5.5 Phase Relationships:

- From Oscilloscope
- From Strobe Light
- From Photocell or Tach. Pulse

## 6 PREPARING FOR DATA COLLECTION

### 6.1 Transducers – Choosing a Transducer:

- Types of Vibration Transducers

### 6.2 Transducers – Mounting Locations and Techniques

### 6.3 Selection Criteria:

- Amplitude of Vibration
- Frequency
- Environmental Limitations

### 6.4 FFT Data Collectors

### 6.5 Real-Time Spectrum Analysers

## 7 THE DATA PROCESSING SYSTEM

### 7.1 Data Collectors – Analysers:

- Collection Mode
- Analyser Mode

### 7.2 Setting Up the Analyser:

- Frequency Resolution
- Frequency Range
- Auto Range
- Averaging
- Dynamic Range
- Frequency Definition

### 7.3 Diagnosing Vibration Problems:

- Mass Unbalance
- Misalignment
- Bent Shaft
- Soft Foot
- Mechanical Looseness
- Gearbox Analysis
- Gear Frequencies
- Motors
- Pump & Fan Problems
- Rolling Element Bearings

# Maintenance 2005 Seminars

## Course One

### Planned Maintenance & Maintenance People

*The What, When & Who of Maintenance*

(For Maintenance & Non Maintenance Personnel)

## Course Two

### Maintenance Planning

*Advances in Maintenance Planning,*

*Maintenance Control & Feedback*

## Course Three

### Maintenance Management

*An Introduction To Maintenance*

*Management Activities & Techniques*

(For Maintenance & Non Maintenance Personnel)

**Attend just one, two or all  
three of these one-day courses.**

#### Venues

##### Perth

4-6 May 2005

##### Melbourne

18-20 May 2005

##### Townsville

18-20 July 2005

##### Sydney

5-7 Sept 2005

- Major Revisions & Updates for the 2005 Maintenance Seminars
- Detailed Seminar Slides in Hard Copy
- Plus a CD of Hundreds of Pages of Case Studies, Maintenance Related Facts, and Seminar Notes (500mb of Information)
- Each seminar provides opportunities to discuss with other practitioners improved ways of managing and performing maintenance activities

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**Len Bradshaw**  
ORGANISED BY  
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AND  
THE MAINTENANCE JOURNAL

**THE MOST SUCCESSFUL AND MOST  
RECOGNISED MAINTENANCE RELATED SEMINARS**

★ As well as Maintenance Personnel, why not also send your "Operations Personnel" ★

In-house presentation of these seminars will only be considered for organisations outside of Australia



## 1. Maintenance Activities

- The different activities performed in maintenance - emergency, corrective, preventive, predictive, condition based, proactive, and designing for maintenance.
- The pre-planning process in maintenance
- Shutdown Maintenance - does it work?

## 2. Consequences of Good or Bad Maintenance

- The direct and indirect costs of Maintenance.
- What do you cost and what are you worth.
- Effect of too little or too much planned maintenance.
- Providing and proving due care of your assets.
- Are “competent” people planning and doing the maintenance work.

**Discussion 1:** Has your organisation the correct mix of maintenance activities..  
Do you identify real maintenance costs and respond to those costs.

## 3. Inspections & Condition Based Maintenance

- What inspection and preventive/predictive techniques are now available in maintenance.
- How often should you perform inspections and condition based maintenance activities.
- Increasing the effectiveness of inspection and condition based maintenance activities.

**Discussion 2:** What techniques for inspections & Condition Monitoring are used in your plant.  
Are they successful.If not why not.

## 4. Maintenance Planning and Control

- The different processes and techniques involved with maintenance planning and control.
- The functions performed by a computerised maintenance management system.

## 5. The People and Structures In Maintenance

- People - The most important assets in maintenance or are they?
- The different organisational structures used for maintenance activities.
- Restructured maintenance;flexibility and team based structures.
- What motivates people to work with the company rather than against it.
- Are teams achievable in your organization? How far can you go.
- Utilising non maintenance resources.
- TPM - Total Productive Maintenance.
- Administrative responsibilities for teams.
- Recruitment and Reward methods.
- Maintenance Outsourcing/Contracting.

**Discussions 3:** Are your organisations using the right people and structures in maintenance.  
Successes and failures with people issues.

### Who should attend?

Planners, Team Leaders, Team Members, Supervisors, Tradesmen, Operations Personnel, Technicians, Engineers, Systems Managers,  
and others interested in maintenance of plant and assets.

**Each course costs AUS \$660.00 per delegate per day (inclusive of GST)**

### 1. Maintenance Planning in Different Structures

- From chasing breakdowns to total productive and proactive maintenance.
- How does the Maintenance organisational structure affect the roles of planner and supervisor.
- Maintenance Planning in team structures, or for outsourced maintenance.
- Who should be the Planner: Recruitment and Responsibilities/duties of the Planner. Who should not be the Planner: Full time or part time planners.
- Planner to Maintenance Personnel ratio.
- Value of effective planning and planners.

### 2. Maintenance Planning: Example Of The Best

- Examples of how the best plan and schedule their Maintenance Activities. Moving from Reactive Planning to Pro-active Maintenance Planning.
- Improving Communication in the Planning process.

**Discussion 1:** How is maintenance work Planned and Scheduled in your organisations.  
Planning strengths and weaknesses

### 3. Developing Maintenance Plans

- Developing maintenance plans. Introducing the various methods currently used.
- Sources of information and expertise. Who should be involved. Using a generic approach. Resources needs.

**Discussion 2:** The Plan Development Methods in your organizations. Who does it & is it successful

### 4. Computerised Maintenance Management Systems

- CMMS currently available and a demonstration of some of the improved features of modern CMMS.
- The maintenance planning and control process and how computer systems help improve that process.
- Automating the issue of work and reporting to history. Improving communication and quality of data.
- The move towards Asset Management Systems and beyond the traditional CMMS.
- Linkage to other management systems, control systems, GIS, GPS, Internet, etc.
- Benefits & Problems associated with the use/implementation of a CMMS.
- What makes for successful Maintenance Planning and a successful CMMS. What motivates people to work with the system rather than against it.
- What factors need to be in place if we are to have a functioning system. What factors are required for the BEST functioning systems.

**Discussion 3:** How well have your organisations selected, implemented and used your Planning Systems and CMMS.

### 5. Maintenance Stores

- Who owns the store? Stores objectives.
- Introduction to stock control methods for standard, expensive or consumable stock items.
- Improving service levels from your store.
- Maintenance of parts in the stores.

#### Who should attend?

Planners, Team Leaders, Team Members, Supervisors, Tradesmen, Operations Personnel, Technicians, Engineers, Systems Managers, Stores Personnel, and others interested in maintenance of plant and assets.

**Each course costs AUS \$660.00 per delegate per day (inclusive of GST)**

# Course Three

## Maintenance Management

3

*Whether you are a Maintenance Manager, Tradesman, Supervisor; or from Production, Stores or Finance; it is vital that you understand the importance of maintenance to the well being of your organisation.*

*This seminar introduces the wide range of Maintenance Management activities/techniques that may be applied within your organisation. Even if you are not directly involved in the use of these techniques it is still necessary that you have an understanding of what is being done and why.*

### 1. Business & Organisational Success Via Better Maintenance

- The key role that maintenance plays in achieving business success. Maintenance as a profit creator.
- Justifying maintenance resources. Proving your worth.
- Maintenance Impact on Safety and Legal Costs.
- Maintenance contributing to long-term competitive advantage.

### 2. Achieving Better Maintenance

- Common features of the best maintenance organizations in the world.

#### 2.1 People:

- Leadership, recruitment, training, flexibility, motivation, teams, TPM, performance, rewards, core skills and outsourcing

#### 2.2 Parts:

- Stores management, stores objectives, alliances, internet spares, parts optimisation, improved parts specifications, automated stores, stores personnel.

**Discussion 1:** How well are you moving towards good management of people and parts.

#### 2.3 Practices:

- Better Corrective, Preventive, Predictive, and Proactive maintenance.
- Moving through Preventive / Predictive to Proactive Maintenance.

**Discussion 2:** Discussions on Maintenance Practices

### 3. Maintenance Strategies For The Future

- Setting Strategies: From Policy Statements, Audits, Benchmarking, Gap Analysis and Objectives through to Maintenance Performance Measures.
- Examples of Maintenance Objectives and Performance Measures.

**Discussion 3:** Strategy development, setting of objectives & performance measures.

### 4. Analytical Methods In Maintenance

- Maintenance Plan Development and Optimisation Software.
- Example of how to collect, use, and understand maintenance data.
- Fine tuning PM activities.

### 5. Asset Life Issues

- Introduction to Plant Design considerations that improve reliability, availability and maintainability.
- Introduction to life cycle costing of assets.
- Plant replacement strategies; software tools.
- Better maintenance specifications of machines.

#### Who should attend?

Maintenance Team Members, Technicians, Planners, Engineers, Supervisors and Managers; plus Production Supervisors/Managers & Accounts/Financial Managers, and others interested in maintenance of plant and assets.

**Each course costs AUS \$660.00 per delegate per day (inclusive of GST)**

## The seminar is presented by Len Bradshaw

Len Bradshaw is a specialist in maintenance management and maintenance planning control and an international consultant in this field. Len has conducted over 280 courses for in excess of 8,400 maintenance personnel, both in Australia and overseas. He is managing editor of the Maintenance Journal. He has a Masters Degree in Terotechnology (Maintenance Management) and has held several positions as Maintenance Engineer in the UK and other overseas nations. He is the author of four texts on maintenance management. Len has conducted maintenance management courses for all levels of maintenance staff from trades personnel to executive management.

### Seminar Fees **AUS \$660 per person per day (Inclusive of GST)**

The course fees given above also include Seminar notes as well as lunch and refreshments. Course fee does not include accommodation, which if required is the delegates own responsibility.

### Confirmation

A confirmation letter will be sent to each person on receipt of their registration form.

### Times

The seminars start at 8:00am and end at 3:30pm, each day. Registration and coffee is from 7:45am each day.

### For Further Information

Phone EIT (03) 5975 0083 or Fax Australia (03) 5975 5735, or email to: [mail@maintenancejournal.com](mailto:mail@maintenancejournal.com)

[www.maintenancejournal.com](http://www.maintenancejournal.com)

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#### ● Perth: 04 - 06 May 2005

Course One: 4 May 2005  
Course Two: 5 May 2005  
Course Three: 6 May 2005  
Grand Chancellor Perth  
707 Wellington Street, Perth

#### ● Melbourne: 18 - 20 May 2005

Course One: 18 May 2005  
Course Two: 19 May 2005  
Course Three: 20 May 2005  
Rydges Carlton Hotel  
701 Swanston St, Melbourne  
Web: [www.rydges.com](http://www.rydges.com)

#### ● Townsville: 18 - 20 July 2005

Course One: 18 July 2005  
Course Two: 19 July 2005  
Course Three: 20 July 2005  
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#### ● Sydney: 5-7 September 2005

Course One: 5 September 2005  
Course Two: 6 September 2005  
Course Three: 7 September 2005  
Swiss-Grand Hotel, Bondi Beach  
Beach Road, Bondi Beach NSW  
Web: [www.swissgrand.com.au](http://www.swissgrand.com.au)

EVENTS

## REGISTRATION FORM

■ **Course One:** Aus\$660 (Inclusive of GST)

**Planned Maintenance and Maintenance People**

■ **Course Two:** Aus\$660 (Inclusive of GST)

**Maintenance Planning**

■ **Course Three:** Aus\$660 (Inclusive of GST)

**Maintenance Management**

Name of delegate \_\_\_\_\_ Position \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

\_\_\_\_\_ Email \_\_\_\_\_

Telephone \_\_\_\_\_ Fax \_\_\_\_\_

Name of approving officer \_\_\_\_\_

Position \_\_\_\_\_

**Method of payment** Fee payable \$ \_\_\_\_\_

★ **Cheque** enclosed made payable to Engineering Information Transfer Pty Ltd

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**Cancellations:** Should you (after having registered) be unable to attend, a substitute delegate is always welcome. Alternatively, a full refund will be made for cancellations received in writing 14 days before the seminar starts. Cancellations 7 to 14 days prior to the seminar dates will be refunded 40% of the registration fee, in addition to a set of seminar notes. There will be no refund for cancellations within 7 days of the seminar dates. This registration form may be photocopied.

### Course

Please Tick Course

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Please Tick Venue

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Melbourne

Townsville

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### How Do I Register?



1. Fax the completed registration and provide credit card payment details.

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2. Mail the completed registration form together with your cheque made payable to:

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P.O. Box 703, Mornington  
VIC 3931, Australia**



3. Email Indicate courses/ dates/ venue required and provide details of method of payment to

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