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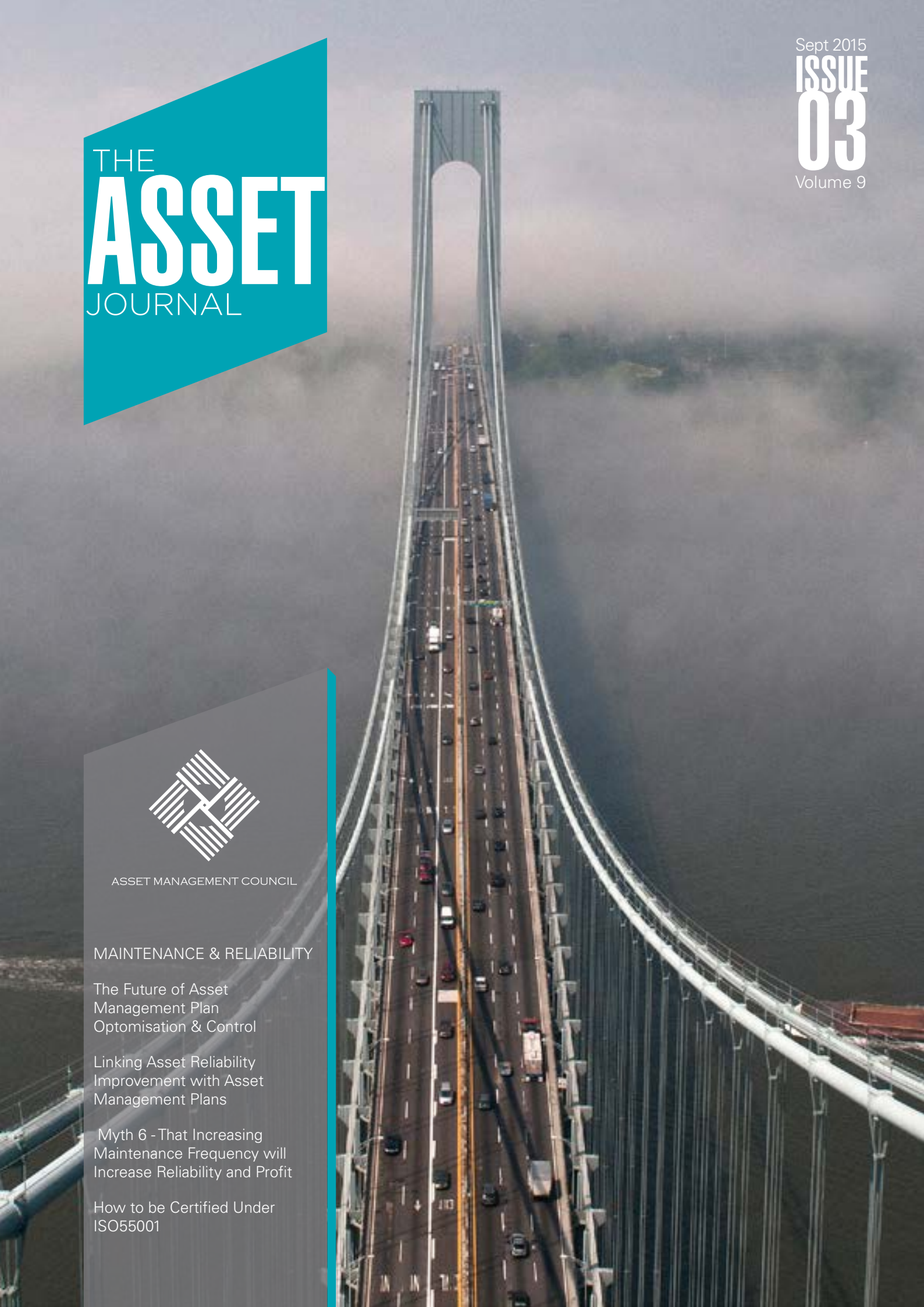

ASSET MANAGEMENT COUNCIL

MAINTENANCE & RELIABILITY

The Future of Asset Management Plan Optomisation & Control

Linking Asset Reliability Improvement with Asset Management Plans

Myth 6 - That Increasing Maintenance Frequency will Increase Reliability and Profit

How to be Certified Under ISO55001

BIG DATA. BIG DISCUSSION.

ASSET MANAGEMENT COUNCIL

TECHNICAL SYMPOSIUM
OCTOBER 23 - MELBOURNE
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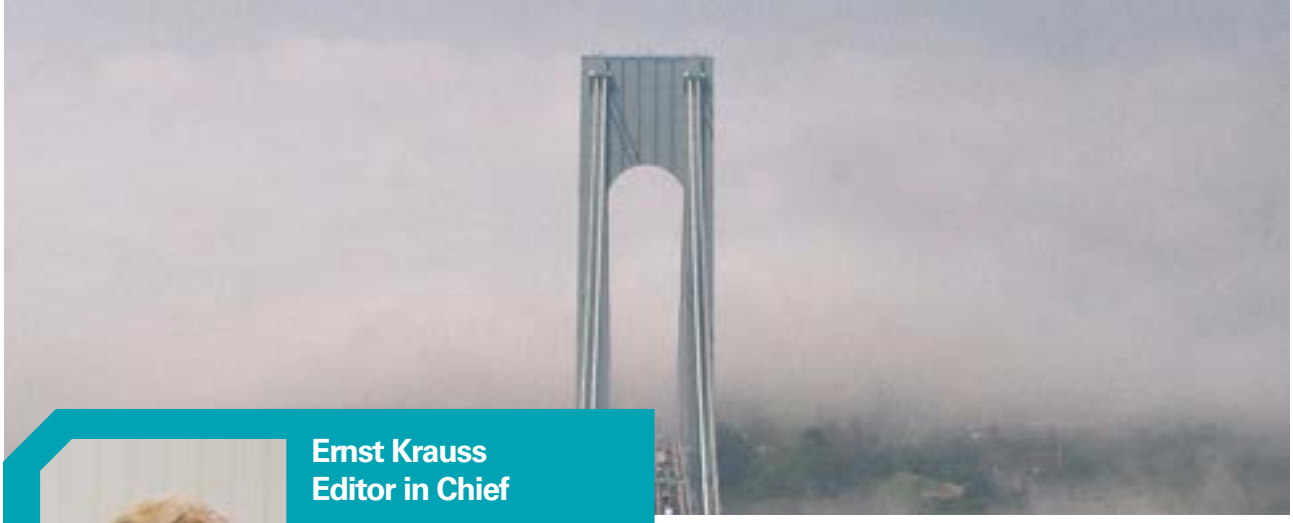

Ernst Krauss
Editor in Chief

In this issue of The Asset we focus on the Operational side of Asset Management, namely Reliability and Maintenance. We rightly rate the maintenance activities that sustain physical assets – or any other assets for that matter) at their capability as critical in their useful life period. Maintenance as a process is as important a process as any other process that sustains a business. The Royal Engineering Academy of the UK states that the ratio of operating and maintaining an Office Building is five times the cost of building it. This figure may be much higher in process or other asset intensive Industries. Of course the production or service value lost through ineffective maintenance can be many, many times higher. We find in this issue case studies of linking maintenance and reliability to business plans, thereby ensuring that the right activities re carried out to meet the business requirements. Planning o the key, both strategically and operational. Of course all activities and their optimisation are underpinned by data. Many organisations still appear to struggle with managing, creating and suing data to support their business and specifically maintenance. The case study presented aims to show that there are real gains to be made to 'getting it right'. Perhaps we need to pay make a stronger link in our Asset Management Systems between the Senior Management level, Operations and Maintenance personnel and assure that their valuable contribution is understood at the various levels. Inspiring the workforce through visibility of Leaders and their vision, appreciation and recognition is important and should be on the to do list of every executive. The Maintainer of the Future therefore will not only be very technology savvy, but also know of his/her confidence in the knowledge of their valuable contribution to the wellbeing of an organisation.

The editorial team trusts that you find this issue of The Asset interesting and informative. As always, we look forward to your feedback and comments on the Journal, the articles and your thoughts. Please send comments to publications@amcouncil.com.au., or contact me directly on Ernst.krauss@amcouncil.com.au. We are only too happy to hear from you and take on board your ideas and thoughts.

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SPECIAL FEATURES

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From the Chief Executive Officer

CEO,
ANNE GIBBS

One of the big changes to our industry in recent years is the approach to big data – a broad term used for data sets so large or complex that traditional data processing applications are inadequate. Challenges for asset managers include analysis, capture, sharing, storage, transfer, visualization and information privacy. "Big Data, Big Discussion" is the theme of the AM Council's Annual Symposium to be held in Melbourne on Friday 23rd October 2015 at The Oaks-on-Market. We are looking forward to a robust conversation around the issues of big data in October and invite you to join us for the event in Melbourne.

Changes in community and stakeholder expectations is another key change in our industry. Those organisations that embrace the principles of asset management into their business tend to be able to show efficiencies within their operations translating to value for stakeholders and the community. Many in the Government sector, in particular, are exploring how best to harness the value of asset management systems and processes. The AM Council has joined working groups in various states to assist government departments in their asset management journey. The AM Council provides an online forum from its website designed to connect those who have an interest in asset management practices in government sectors and encourage collaboration between government departments. A monthly online newsletter will also be sent to those who sign up to the Asset Management Community of Practice for the government sector online forum providing information on various government initiatives in the asset management space.

A third prominent change in the industry is the resources available to undertake our work with tightening of budgets in government and private sectors and a notable change in skill sets that have traditionally undertaken maintenance and asset management works. An exciting new Seminar has been developed by the AM Council's AMBoK team entitled, "How to Develop a Strategic Asset Management Plan" which is to be launched in late September. The AMBoK team is also running an updated version of the Asset Management Plans Seminar which will be of interest to many. Be sure to stay up to date and enrol in these informative seminars when they come to your state.
If you are looking for further ways to gain professional development or for technical information to help you in your work then you could join one of the AM Council's monthly webinars; join the ever increasingly popular Chapter meetings in your area as well as make full use of the search through the AM Council's online technical database. The 2016 AMPEAK Conference is to be held in Adelaide in April 2016 is also a great way to keep up-to-date with the asset management sector and to network with others, so plan to be there.

Has your organisation thought about becoming certified to ISO 55001?

If you are hoping to attain accredited ISO 55001 certification in Australia, the body certifying your organisation must be an accredited CAB (Certified Accreditation Body) as determined by JAS-ANZ (Joint Accreditation Services – Australia New Zealand). To identify whether your certifying body is an accredited CAB in Australia, please view this link for a list of CABs: http://www.jas-anz.com.au/accredited-bodies/all .

To further ensure your CAB is complaint with ISO 55001 and JAS-ANZ's standards, it is in your best interest to ask the following questions before starting or paying for certification:

1. Are you accredited by JAS-ANZ to certify for Asset Management Systems under ISO55001?
2. Will my certificate have the JAS-ANZ logo on it?

If the answer is "no" to either of these questions, then the certification body is not an accredited source for certification under ISO 55001 and your certification will not be recognized by governing bodies, nor will it conform to the international standards for ISO 55001 certification.

Finally with this edition of The Asset Journal we say goodbye to our Communications Officer, Mr Maxwell Junge and our Events Co-ordinator, Ms Juliette Bond. Both were on working holiday visas which have now sadly expired. A huge thank you for the terrific contribution each has made to the AMCouncil during the last six months

From my desk: Chairman's Letter

CHAIRMAN,
GLENN INGRAM

Over the last three months, the Asset Management Council has been actively pursuing strategies and approaches to make your membership benefits more comprehensive and satisfactory. Through the effort of our staff, volunteers, and partnering organisations, we are proud to announce that we have achieved one of our primary goals: founding and launching our government-sector Community of Practice.

The government-sector Community of Practice was created in order for asset management professionals in government bodies to convene, share, and grow their asset management skills and knowledge. It acts as a single meeting place for government professionals in asset management, bringing together and establishing connections that may have otherwise not been available.

The primary meeting point of the Community of Practice will be at the Asset Management Council's national forum. Hosted online, the national forum is available for members of the Community of Practice to read, interact with, and post on. In order to join the Community of Practice and post a topic on the forum, go to amcouncil.com.au/forum and you will be guided by a set of instructions. We welcome all asset management practitioners to post topics that are relevant to government and asset management.

In addition to the national forum, the Sydney, Tasmania, Melbourne, Brisbane, and Perth chapters will all hold various government Community of Practice events throughout the year. The goal of these events (and the broader goal of the Community of Practice) is to:

- Bring together a group of like-minded professionals in government asset management
- Share knowledge, experiences, and case studies in order to learn
- Create strategies for implementing and improving current challenges in asset management in government departments
- Help government bodies develop and enhance their asset management practice starting from the planning phase through to the retirement phase

We are proud of the accomplishment we have achieved in creating the government-sector Community of Practice and hope you take part in the opportunity presented.

As another benefit our members may experience, the Asset Management Council will be holding our annual symposium on October 23 in Melbourne, entitled, "Big Data, Big Discussion". The symposium will cover the latest asset management topics in data collection, data interpretation, and data storage.

Whether you are a senior manager or a beginning practitioner, the symposium is a must-attend event for information about big data. Speakers who are already confirmed for the event include Susan Harris, CEO of Intelligent Systems Transport, Michael Lawrie, Project Design Authority of Ground Transportation Systems for Thales Australia, and Dr John Brudenell, Chief Data Officer for Zetaris. The topics covered will have applicable, in-depth content that can be used in your organisation. For more information on the event, please visit amcouncil.com.au/bigdata.

Finally, if you are looking to advertise in The Asset Journal, we are now open to submissions for our December and February issues. The Asset Journal reaches an audience of over 5,000 asset management practitioners and professionals over a variety of industries and backgrounds per issue, and since The Asset Journal is now featured exclusively online, there are more advertising opportunities than before such as an ability to have "click-through" ads in which readers can link directly to your website and "video ads" in which you may stream multimedia content within the page.

For more information on advertising opportunities, please email publications@amcouncil.com.au

Maintainer of the Future

Professor Melinda Hodkiewicz

Tech
1

Professor Melinda Hodkiewicz

Professor Melinda Hodkiewicz is the recently BHP Billiton Research Fellow in Engineering for Remote Operations (ERO) at The University of Western Australia. Until mid-2015 she was the Chair of the Standards Australia Committee for ISO 55000 (AM Standard). At the UWA she teaches Risk Reliability and Safety and leads research projects aimed at improving Maintenance and Asset System Health.

Tech 1

Maintainer of the Future

In the last two decades the mining industry has seen significant changes in how assets are operated due to advances in process control, remote operations systems, and the development of autonomous assets. In contrast, the nature of maintainers' day-to-day work has changed very little. Engines still need lubricated, motors wired up, pipes welded and sensing systems repaired.

Are we now at a tipping point as pressure from business drivers and opportunity from technical developments combine to change the nature of maintenance work?

In 2012 a project sponsored by CRC Mining looked at developments that are likely to affect the role of maintainers and their day-to-day tasks. Three key drivers of change are identified:

- Changes to asset design, particularly for mobile assets,
- Developments in technical support equipment such as intelligent sensing, real-time remotely-supported diagnostics, and augmented reality, and
- Organisational strategies aimed at reducing safety exposure of maintainers and improving productivity.

In the mobile mining sector, which is dominated by a small number of Original Equipment Manufacturers (OEMs), OEMs are a key part of any change in the day-to-day work of maintainers. Their designs determine the maintainability of the system, their sensing systems influence which data are collected, and the interoperability of components and software influence training requirements. In some sectors (most notably commercial aviation) there has been significant progress in the use of modular design to improve maintainability. Changes towards modular designs would have knock-on effects for maintainers. The emphasis switches from one of repair to one of diagnosing which module to replace and then executing the replacement. This replacement activity may be done by maintainers with a different skill set than that required for the repair.

An ability to use computers and access equipment status information through digital interfaces is now a core requirement for most maintainers. The skills required to conduct basic troubleshooting and diagnostics using a range of tools are widely reported as being in need of further development across all maintainer trades.

The increased use of sensors and embedded systems is opening doors to proactively manage asset system health using big data techniques. Proactive maintenance requires a different culture and different skills in the maintainer workforce compared to one used to working in a reactive environment.

There have been a number of major initiatives in the last 10 years to move people off of remote sites. There are several obvious reasons for this, the first being health and safety. If the work can be done remotely using automation then there are potential benefits through reduced exposure. Maintainers represent a significant proportion of people who are involved in safety incidents and fatalities in the mining industry.

The second is cost. Transport and accommodation in remote areas is expensive, and wages also tend to be higher. The move of operators from remote locations and into centralised operations centres in major cities has implications for who is left on site, who has to travel to site and when, and the nature of their work. It is likely that these changes will encourage organisations to develop more multi-skilled or hybrid roles; for example operator-maintainer and cross-trade roles.

Because of the potential loss of some skills, there will be a rethink about what maintenance work can be done on site and if more complex repairs should be done off-site. Potentially, this will reduce the number of maintenance staff on-site needed for reactive work and chronic repairs. It could also increase the focus on technology-enabled maintenance support staff in central facilities such as the remote operations centres.

These developments taken together could significantly impact the nature of maintenance work. As the predictability of work improves through more knowledge of the health and performance of the asset, work becomes less reactive and there is more demand for proactive work. At present, a significant focus in maintenance training is on repairs rather than on the skills required to diagnose and respond to changes in asset performance prior to failure. These traditional "fail and fix " maintenance practices will be replaced by "predict and planned " e-maintenance approaches.

Collectively this research suggests that there needs to be a rethink of the role of the maintainer expected to do a wide range of tasks. We suggest that the "maintainer of the future" may include number of quite distinct and more specialist roles. The four roles, shown in Figure 1, are first-responders, equipment care technicians, diagnosticians, and specialists.

- First responders must be able to quickly identify issues and change-out parts to get units running again. They are likely to thrive in high pressure environments rather like a paramedic.
- Equipment care technicians will be responsible for inspections, equipment care and performing planned work. They are likely to appreciate working well in "predict and planned" environments rather like a nursing role in a hospital or the community.
- Diagnosticians will be responsible for analysing the operational and maintenance data coming from assets, and making decisions in conjunction with stakeholders. A medical analogy might be a GP doctor. They are likely to be based in remote operations centres and will come from a mix of technician, engineer and data analyst backgrounds.
- Specialists will be those working for an OEM or specialist contractor doing work that is beyond the technical capacity of the operating company such as a specialist engine rebuilder.

At present there is no national training program or focus on the maintainer of the future that supports this or similar developments for the mining sector.

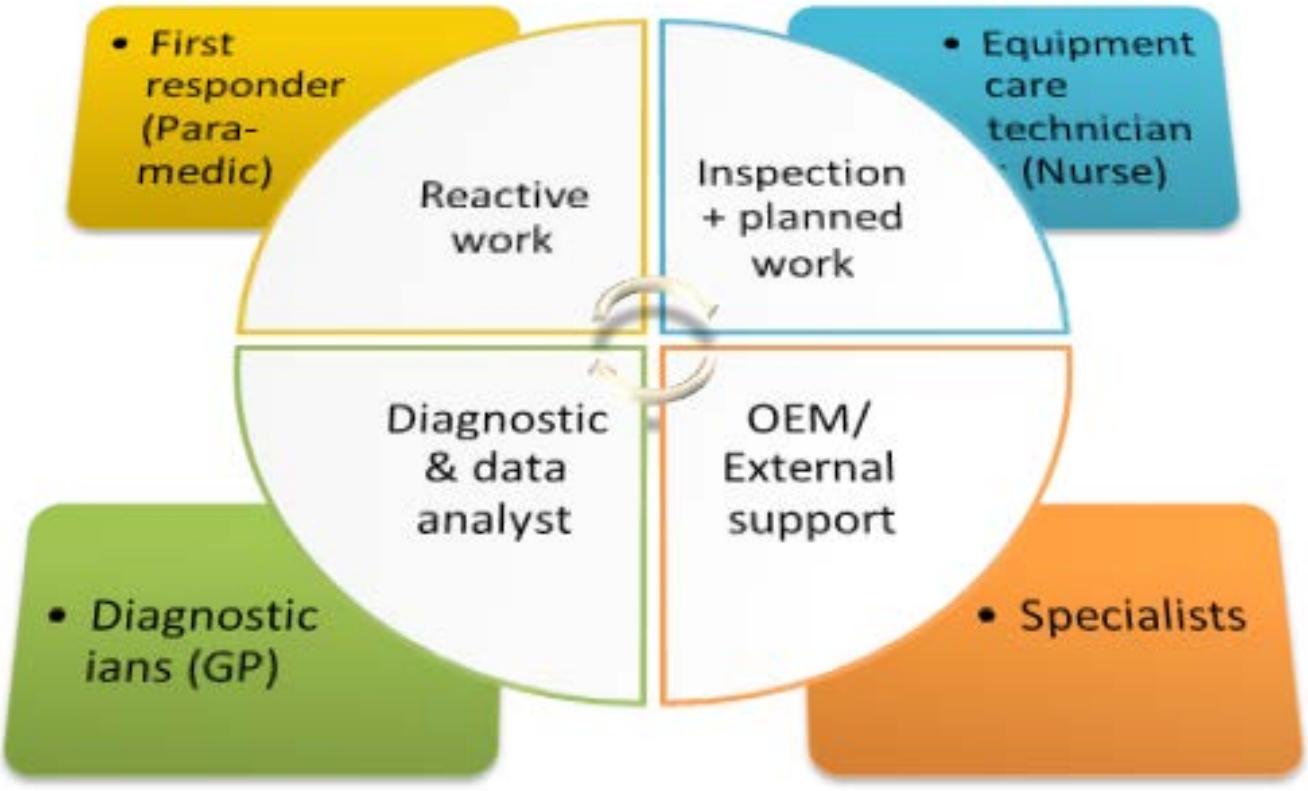


Figure 1: Maintainer of the Future

In an extension of this work Melinda and colleagues at the Centre for Safety at UWA have been looking at factors that influence compliance with maintenance and safety procedures by maintainers. Please see http://www.centreforsafety.com.au/research/new-model-safety-compliance

The author wishes to acknowledge her co-author of the original report, William Jacobs, and CRC Mining, its sponsors. The White Paper from which this article was abstracted is available at http://www.crcmining.com.au/wp-content/uploads/2013/02/CRCMining-Maintainer-of-the-Future-White-Paper.pdf

The Future of Asset Management Plan Optimisation and Control

Peter Nichols, Principal Consultant Asset Performance, LogiCamms

Tech 2

INTRODUCTION

A great deal of work has been published on the subject of maintenance strategy and plan optimisation. This work stresses the importance of alignment to business strategy and identifies opportunities for the feedback loop of continuous improvement. The reality however is that the most cost effective, efficient maintenance plan aligned to the organisational strategy is worth naught if it is not executed in the field. The activity performed by technicians in the field is the actual maintenance plan, regardless of what an asset management policy, strategy or documented plan may say.

Peter Nichols, Principal Consultant Asset Performance, LogiCamms

With over 20 years industry experience, Peter is a highly skilled practitioner and qualified engineer working across mining, oil & gas, manufacturing, waste water and power generation. Specific areas of focus include optimised work management and maintenance organisation, business optimised asset strategies and life cycle analysis.

The Future of Asset Management Plan Optimisation and Control

Invariably a gap exists between the approved maintenance plan and the maintenance activities actually conducted in the field. Equally concerning is the gap that commonly exists between the organisational objectives and the approved asset management plan. These disparities mean that rarely is plant maintained in a way that optimally contributes to the business objectives at any point in time, let alone as business objectives evolve. This disparity is costly.

In this paper, we focus on why organisations struggle to deliver an optimal, business-aligned result all the way from the business strategy to the shop floor. Further, we propose a solution to these challenges that ensures the approved asset management plan remains aligned to the business objectives and immediately affects the maintenance activity executed in the field.

This then poses three fundamental questions to asset managers.

1. How do I ensure that my maintenance plan remains continually optimised to my business strategy through managed but constant iterative improvement?
2. How do I ensure that the maintenance plan, approved by the business in direct support of the business plan, is issued to field technicians in a form that remains complete and up to date in light of its constant change?
3. How do I ensure that the technicians execute that plan as expected?

Backdrop

The fact that asset management plans should be inextricably linked to business strategy, informed by an understanding of criticality and the ways in which equipment fails to perform their function, is long established and well understood. This is undisputed. The translation of this fact into a living, breathing, continuously optimising set of activities to achieve that strategy though remains elusive.

The textbook understanding

The textbook approach to this process centres on three key activities iterated at intervals dependent on the type of activity.

1. Optimise strategy and plan utilising a process like Reliability Centred Maintenance (RCM) to determine activities effective at detecting, predicting or preventing failure modes and mitigating the consequences of unplanned failure.

   This links the 'why' an activity is performed (failure modes) to the activity itself providing justification but also a means for assessing remnant risk and predicting future maintenance spend.

   Business strategy and objectives, asset criticality, legislative compliance and other influencing factors are incorporated into the decision process.This typically involves the use of a tool to provide process, structure, efficiency and standardisation.
2. Consolidation of activities into packages, typically into documents or task line items in a Computerised Maintenance Management System (CMMS)

   Consolidation is typically by frequency, operational constraint and skill or competency required.
3. Create the schedule of packages in the CMMS for execution by maintainers.

The intention is that analysis of incoming data from the operation of plant and maintenance execution would inform changes to the plan and be reflected in future maintenance execution.

This ideal visualisation of the process however is all too often not what happens in practice.

Figure I: Simplified 'Plan Do Check Act' Asset Management Plan Cycle

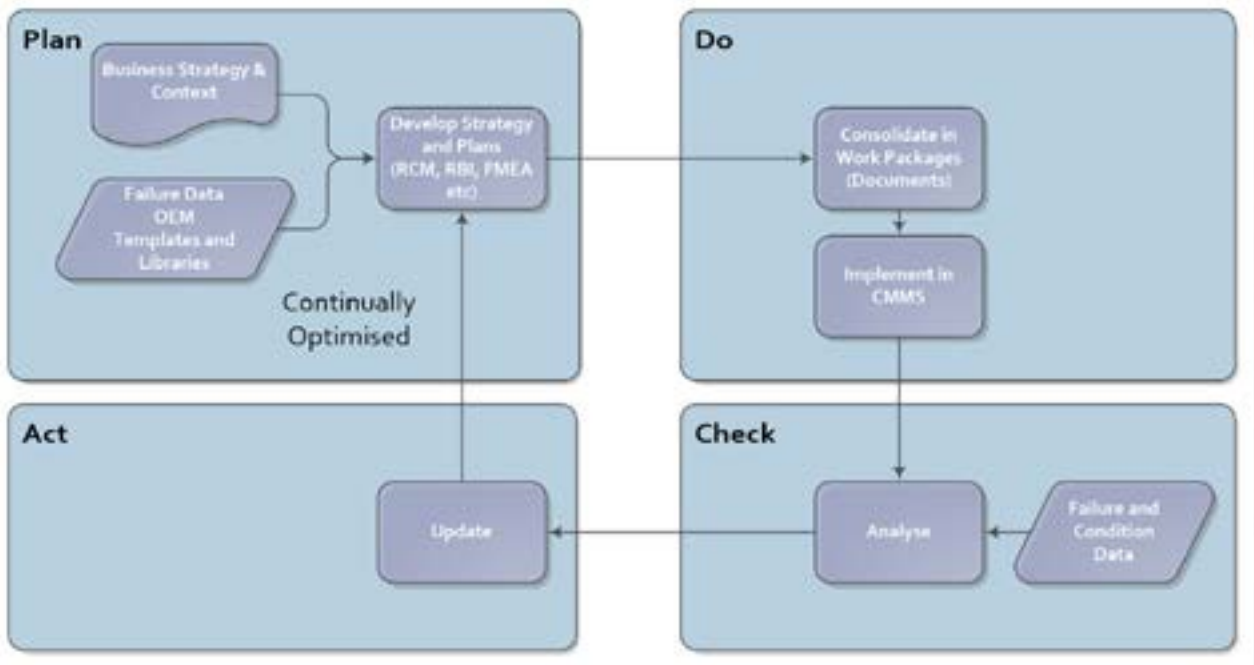
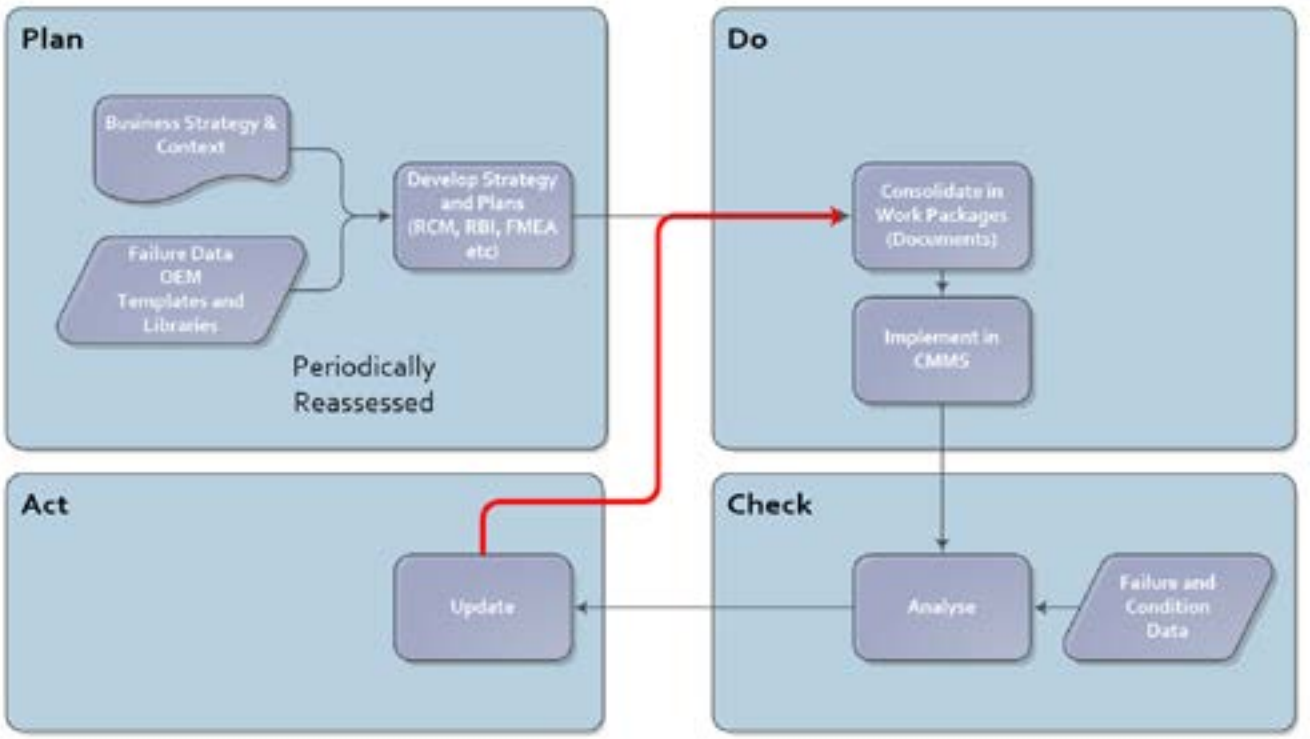


Figure II: Continuous Improvement Short Circuit



Where textbook meets reality

That textbook view of asset management plan optimisation in an operating environment fails in a number of ways.

1. Alignment of the asset management plans to the business strategy at optimisation doesn't happen.

   Performed by reliability or maintenance engineers, the focus is often on the optimisation process itself and not what it is being optimised to.

   The tendency is towards the pursuit of maximum reliability independent of business strategic alignment.

   The effect of failing to align with business strategy is that finite resources are wasted pursuing reliability that doesn't matter.

2. Any strategic alignment that is achieved diminishes over time. The optimisation, often performed in a tool, is disconnected from the actual activity performed in the field after consolidation and initial implementation in the CMMS.

   a. This disconnect creates diverging alignment to business strategy as the plan is adjusted in the CMMS without reference to that strategy.

   b. The diverging plans lose their effectiveness as task accuracy and alignment decreases.

   This disconnect is a consequence of the logistical difficulties of managing asset management strategy and plans at the failure mode level resulting in the CMMS becoming the actual record of strategy by default.

3. Frequently there is a limited link to operational budgets. The direct cost of the plan is taken into account but not the implication that plan has on availability, reliability or forecast corrective activity.

   a. Plan execution is underfunded, either directly or in terms of required availability resulting in immediate, operational pressures taking precedence over strategic aims.

   b. As the CMMS plan diverges from the approved plan so too do the costs. Not only direct costs (because the work being undertaken is changing) but corrective costs as the plan being executed is no longer aligned to the business strategy or even effective at mitigating the consequences of unplanned failure.

In practice, that same 'Plan Do Check Act' cycle becomes short circuited, with the executed plan iterating in the CMMS in isolation from the approved strategy and plan.

Figure II: Continuous Improvement Short Circuit

This is at best ineffective. At worst it presents a significant risk to a business by providing a false sense of security. What the business believes is being done is different from what is actually being done with consequences for compliance, risk and cost.

solution

We have known the solution for a long time. The two core principals we have found through direct interaction with dozens of organisations are:

1. Don't just optimise your asset management plans at the failure mode level, manage it at that level.

- 'Snapshot' optimisations don't work. In fact, they may do more harm than good.
- All maintenance activities must be able to answer the question 'why'. If an activity fails to effectively mitigate the consequence of failure it adds no value. Managing at the activity loses this fundamental connection.
- Managed at the right level, maintenance activity is auditable against the compliance and performance standards of the business. We know exactly what we're doing and why we're doing it.
- Link the plan to budget in real time to ensure the plan can be resourced and executed. Modelling 'on condition' restorative activities can make predictions on unplanned failure and give a realistic, achievable activity based budget.

2. Let the CMMS be what it's meant to be. The CMMS is a financial tool to capture maintenance transactions and history. Maintenance activity, while transacted in the CMMS, should be driven from the strategy in real time. One version of the truth.

   This is conceptually simple but logistically complex. A typical operation may have hundreds of thousands of tags, representing hundreds of thousands of failure modes contributing to thousands of lines in thousands of documents.

How do you keep it aligned in real time?

Continually optimised strategy

1. Link strategy to criticality dynamically through a reliability and risk model. This can generate a dynamically optimised result with transparent delta for validation and compliance.
2. Leverage similarities in assets through the management of templates, deployed to individual tags. This drastically reduces strategy management load and renders the transfer of strategy, to plan, to field execution within reach.
3. Template assets cautiously. Always validate. Don't let the lure of a template blind you to the nuances of the application. Always consider specific criticality and duty or application.
4. Allocate responsibilities for strategy management carefully and avoid conflicting motivators.

- Maintenance execution is about doing the work assigned safely, effectively and efficiently. If they drive the strategy and plan they will always push for maximum reliability independent of business strategy. It's just easier.
- An assigned asset strategy owner, independent of the maintenance execution function, determines what needs to be done.

Real time strategy driven CMMS

Push to the CMMS dynamically, either via data integration or through semi-autonomous document generation.

Manage on change and only what changes. Stop updating documents as entities but rather construct them as aggregated packages, polling for change. Consolidated efficiently, aggregated with all supporting information automatically version controlled and collated. The CMMS is the manager and holder of the transaction ($ spent and history) but fundamentally NOT the holder of the strategy.

Real time field update

The greatest advancement in recent times is that technology is finally able to deliver on the demands of real time field maintenance documentation and performance management. Leverage that technology.

1. Use advanced analytics to divine knowledge from the overabundant supply of information. Make the systems work for you.
2. Push job packs to technicians in the field on electronic devices. With semi-autonomous task aggregation the field technician will always have the up to date maintenance plan and documentation.
3. Capture quality inspection data in real time. Inspection outcomes, accurate timing, photos, video and audio, geographic information and real time fault recording.

Conclusion

Asset strategy management and plan optimisation has developed over the last 50 years into a dedicated and mature discipline, becoming recognised as a fundamental necessity in any operation. There remains however a gap between what should be done and the pragmatic application of that in field. We are on the verge of a new revolution in business-aligned asset strategy and plan management aided not just by technology but through the clever integration of that technology.

1. We can ensure that our maintenance plan remains aligned through managed real time iterative improvement.
2. We can ensure that the approved maintenance plan is issued to field technicians in a form that remains complete and up to date despite constant change.
3. We can ensure that technicians execute that plan.

Global News

Our Government-Sector CoP has Launched

What is a Community of Practice (CoP)?

A CoP is a body in which like-minded individuals gather to share information. Think of it as a "club" within the Asset Management Council.

How will the government CoP benefit me?

Within our government CoP, individuals may share knowledge, experiences and case studies in order to learn from peers. This collaboration can help AM practitioners overcome challenges, improve their AM practices, and facilitate connections.

What do I receive upon joining?

Upon joining, you will be subscribed to the monthly government CoP newsletter, which provides updates and information on asset management in the government sector, you will have access to our CoP events in Melbourne, Brisbane, Perth, Sydney, and Tasmania, and you will have access to an online, live forum in which AM professionals can communicate and collaborate.

Who should join?

If you work for government bodies, organisations that provide services for the government, PPP organisations, or are directly tied to the government in relation to asset management, then joining our CoP would benefit you.

What does it cost and how do it join?

The government-sector Community of Practice is free to join! Consider it a "thank you" and another service the Asset Management Council provides. To join, please go to amcouncil.com.au/member/forumgroup.aspx

ASSET MANAGEMENT
AMPEAK
PROMOTE EDUCATE ASSIST KNOWLEDGE

Call for AMPEAK 2016 papers!

AMPEAK 2016, which will be held in Adelaide, is a must for asset owners from all industries as well as asset management professionals and associated service providers. If you have a technical paper or case study that you would like to present at AMPEAK 2016, please email training@amcouncil.com.au

MAINTENANCE System Optimisation FOR ESTABLISHED PLANT

Seyed Safi Principal, Maintenance and Reliability Services, Covaris Pty Ltd
B.E. (Mechanical), M.Eng.Sc., Ph.D.

Tech 3

Safi has over 15 year experience in the Asset management industry. His area of expertise include; Asset management, Reliability engineering and Maintenance optimisation. He leads a team responsible for Asset management and Maintenance optimisation to variety of sites in power, facilities, health, mining and food industries.

Summary: This paper presents a methodology for the efficient upgrade of the maintenance strategies for all assets in existing facilities from initial asset confirmation to upload of the master data in the management system. The techniques are presented utilising a case study of a coal-fired power-station in Southeast Asia. The challenges which were addressed included an inaccurate plant configuration and inefficient preventive maintenance (PM) procedures resulting in a steady decline in the power-station reliability.

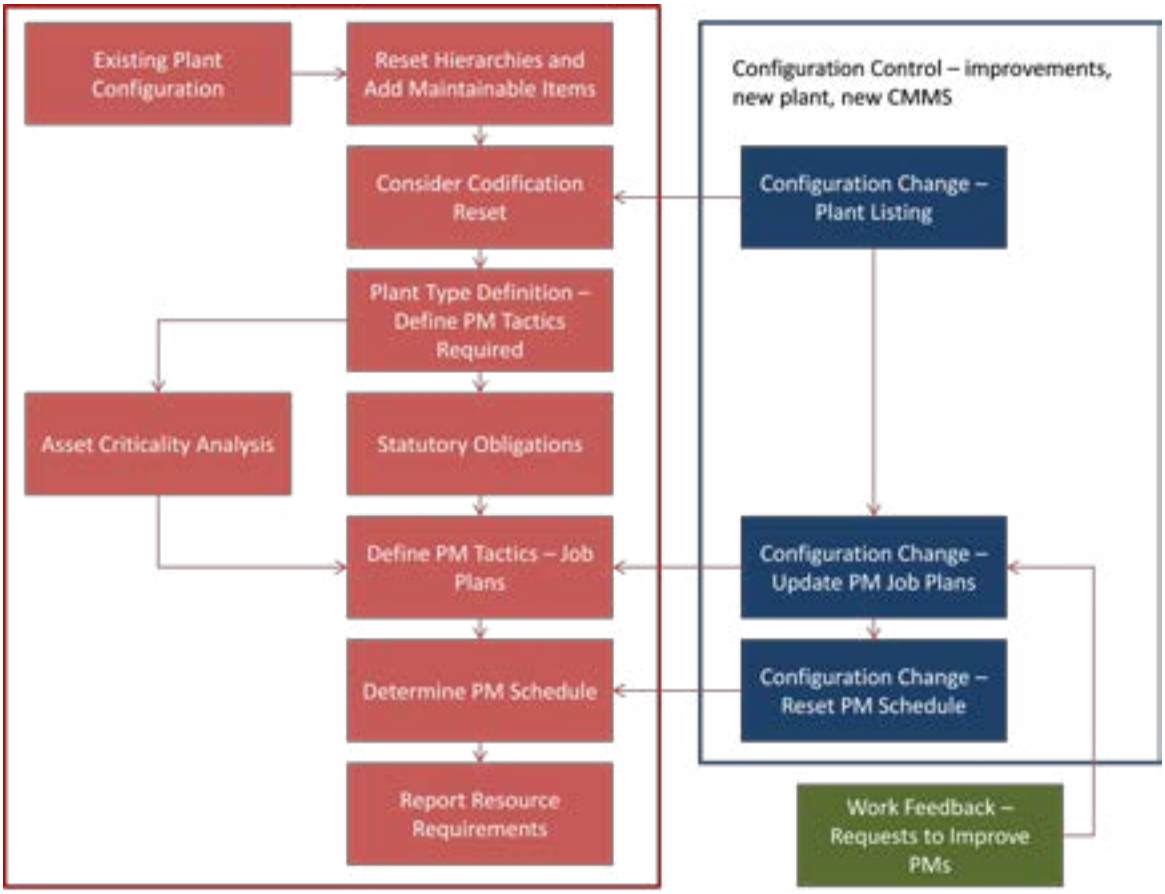
The approach commences by resetting the plant configuration by excising retired assets, adding assets which had not been registered and resetting all assets into an appropriate sense of hierarchy. This was followed by a systematic procedure for asset criticality ranking.

The limited PM procedures which were in place were reviewed and additional procedures developed to ensure an optimised maintenance strategy for all maintainable assets. This strategy was formally designed to be compliant with statutory obligations. A systematic procedure for Failure Modes and Effect Analysis (FMEA) was employed on an as-needed basis for complex assets with low reliability such as coal pulverisers. The main purpose of the FMEA in this case was to advise improvement to in-service asset care. The last phase of the work involved establishing a resource balanced PM schedule covering all maintainable assets.

INTRODUCTION

The subject coal-fired power-station in Southeast Asia consist of two 300 MW units with different configurations. It was built by the government in 1980s. In late 2009 the government sold the power-station to a private company. In 2013 the new owners initiated a reliability analysis and an asset management (AM) review process.

The AM review was based on the PAS 55:2008 specifications for an asset management system. The aim was developing an action plan to improve the asset management practices across the power-station. The study was completed in 2013 prior to the release of the international standard ISO 55000: 2014 Asset Management.



Reviewing the plant configuration and development of detailed PM procedures for assets in the configuration were among the proposed improvement actions. Another key recommendation was to confirm the compliant with the statutory obligations by reviewing all maintenance strategies.

In addition to this work the power-station management decided to upgrade the computerised maintenance management system (CMMS). The work associated with upgrading the maintenance strategies and handling a change in the CMMS is shown in Figure 1.

ASSET CONFIGURATION

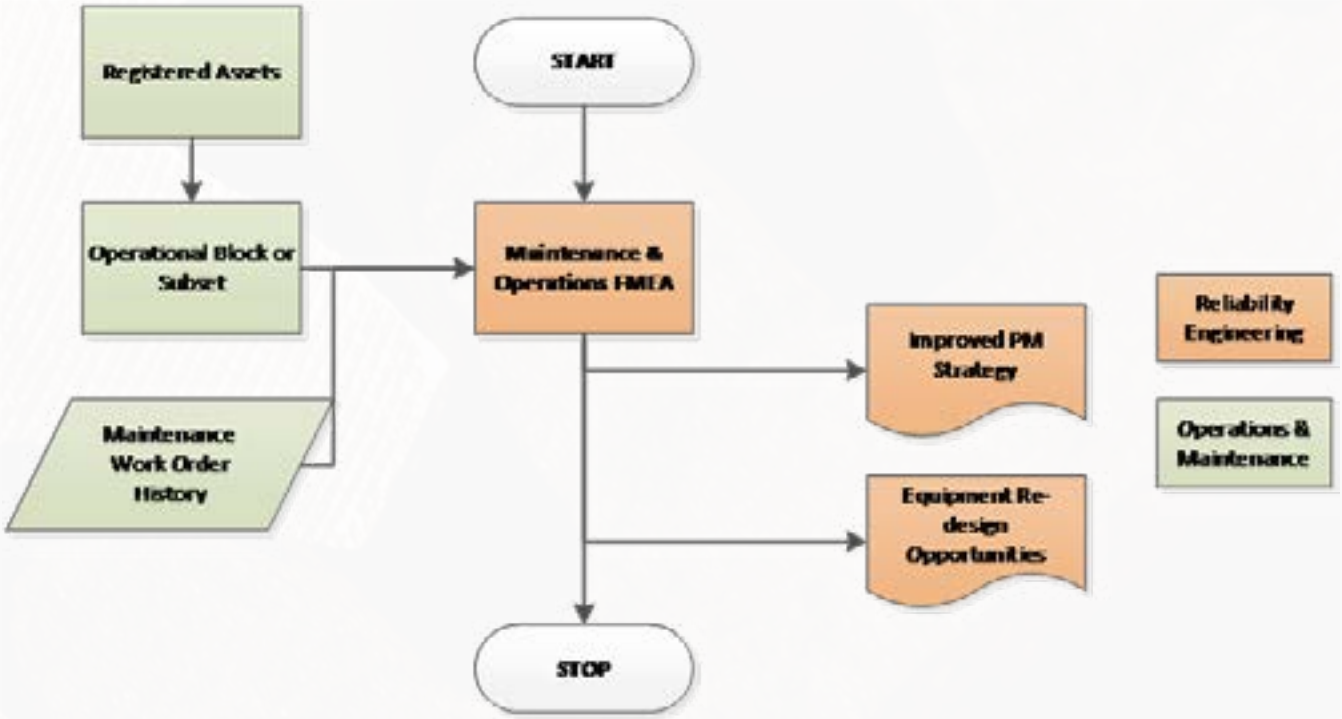
The establishment of an accurate asset hierarchy is the first step in the development of effective preventive maintenance which identifies what needs to be maintained.

The original plant configuration of the power-station did not have a strong sense of hierarchy. The parent children relationship between the assets were not established. The only grouping of the about 36000 listed assets were the unit and the system. For example 515 assets were identified to be part of the Fuel Coal System of Unit 1. The first objective of the project was to reset the configuration and introduce an appropriate sense of hierarchy such that:

- It is easy to locate equipment in the complex asset base
- Work results such as costs can be rolled up to parent levels for reporting purposes
- Work can be allocated to the maintainable item so that the life cycle costs of assets can be determined
- PMs will be set at the right level in the hierarchy to facilitate good schedule control which translates to efficient use of the labour resources

Resetting the original asset list removed about 6000 assets from the list. These assets were either retired or duplicate records which people added over years when they had problem finding a record in a flat hierarchy. About 1000 records were added to the asset list. The majority of these records were hierarchy assets to reset all and establish an appropriate sense of hierarchy. The remaining new records were for adding assets which had not been registered.

The next step is Asset Criticality Analysis (ACA). A consistent procedure for the performance of ACA was established for the power-station based on the AS/NZS-



ISO-31000:2009, Risk management – Principles and Guidelines, in conjunction with the power-station's risk matrix.

A number of outcomes are sought:

- A consistent ranking of the significance of the assets delivering and supporting the business objectives of the power-station.
- Rankings which allow prioritisation of subsequent analysis, for example FMEA.
- Banding of ranking scores to define minimum maintenance strategies and condition monitoring.
- Identification of "Classified" plant and reference for each asset.

MAINTENANCE STRATEGIES AND PROCEDURES

The next phase is the identification and specification of maintenance strategies. These are PM procedures that specify a range of tasks (job plan) for a specific type of maintainable item. The maintenance strategy set will be consequently allocated to many incidents of the same type of equipment across the site. PMs were derived from four sources:

1. Existing power-station PMs – respect the experience and what people have developed during the period of power-station operation;
2. Existing PMs developed over years for various maintainable items - a database of thousands of individual job plans which have been proven in multiple industries supported by a software designed for delivering quality PM strategies for bulk set of plants;
3. Vendor PMs – these are found in manuals provided by the supplier of equipment. Our experience is that while the frequencies are conservative and can be modified, the content of the procedures are not conservative; and
4. Field developed PMs which may require a formal FMEA process with the maintainers leading to the individual development of the PMs for complex systems.

The FMEA objective was to improve reliability of the physical equipment or systems in the context of the maintenance and operations as shown in Figure 2.

A consistent procedure for the performance of FMEA was established which was compliant with the International Standard IEC60812 for FMEA and BS5760: Part 5 for FMEA and FMECA.

The defined scope for the FMEA carried out during this project included the Fuel Coal System consisting of coal silos, feeders and pulverisers. The reasons for undertaking FMEA on this system was to improve the reliability.

38 Failure modes were analysed for the FC System and 170 Failure Causes were identified. The current maintenance strategies were reviewed for adequacy to eliminate the failure causes or raise advanced notification for each failure mode. The current maintenance strategies

addressed 6 out of 38 failure modes. 23 failure modes were partially addressed by the current strategies but reliability improvement can be realised from improved maintenance strategies. 9 failure modes were not addressed in the current maintenance strategies.

A major delivery of this project was to identify the governing regulations applicable to the maintenance of equipment at the power-station. All applicable standards were reviewed and the maintenance requirements for the applicable assets were identified. It was ensured the statutory obligations are met by the PM strategy. The individual procedures which contain the maintenance tasks required to satisfy the maintenance requirements of these regulations and Standards were identified and documented. The list of statutory assets which the identified statutory maintenance strategies shall be applied to was also documented.

All PM procedures were documented using the software for PM development which ensure a consistent format which complied with the power-station asset management team requirements. All PMs were validated in a controlled process with members of the power-station's maintenance team in a process called Acceptance into Service. Acceptance means that the maintenance team certifies:

- The procedures are well written and can be understood;
- The procedures are clear and can be implemented;
- The team believes the procedures are effective and necessary; and
- The team believes the nominated time and resources to do the work are valid.

PM Schedule and Resource Analysis

The PM schedule is the heart of the maintenance strategy. Within the CMMS it generates work orders which will direct specific resources to undertake specific PM Job Plans on specified equipment or using specified routes covering multiple equipment. All steps within this case study on the maintenance strategy were directed to ensuring that the PM Schedule:

- Covers all plant to be maintained using a PM strategy;
- The right PM tactic is deployed to address known failure modes on the target equipment;
- Equipment is made available for PM work either in a running state (eg for condition monitoring) or stopped state (ie isolated);
- A schedule is available to provide monthly warning in advance of the work to be done so that resources and parts can be made available; and
- The right resources will be working on the right job.

A key analysis of the PM schedule is the statement of labour hours required for different craft types per week, and how much work is on running and non-running equipment. The work ensured the PM schedule is balanced for resources and provided maximum possible operation of the plant with avoidance of unnecessary planned downtime.

Conclusion

This paper presented a methodology for the efficient upgrade of the maintenance strategies for existing facilities with the aim of improving asset management practices. A comprehensive process from the initial asset validation to upload of the master data into a new computerized maintenance management system was employed.

The success of such work is based on actual PM work orders being generated from the maintenance management system, and hence one of the deliverables of this work was upload files for all data to the system in formats which were consistent with the application employed.

The first work order based on the revised PM tasks and PM schedule was released in January 2015. It has been recommended to the management of the power-station to initiate a follow up reliability analysis a year after upgrading the maintenance management system. This analysis plus the trend in power generation will identify the extent of the power-station's reliability improvement from the proposed changes.

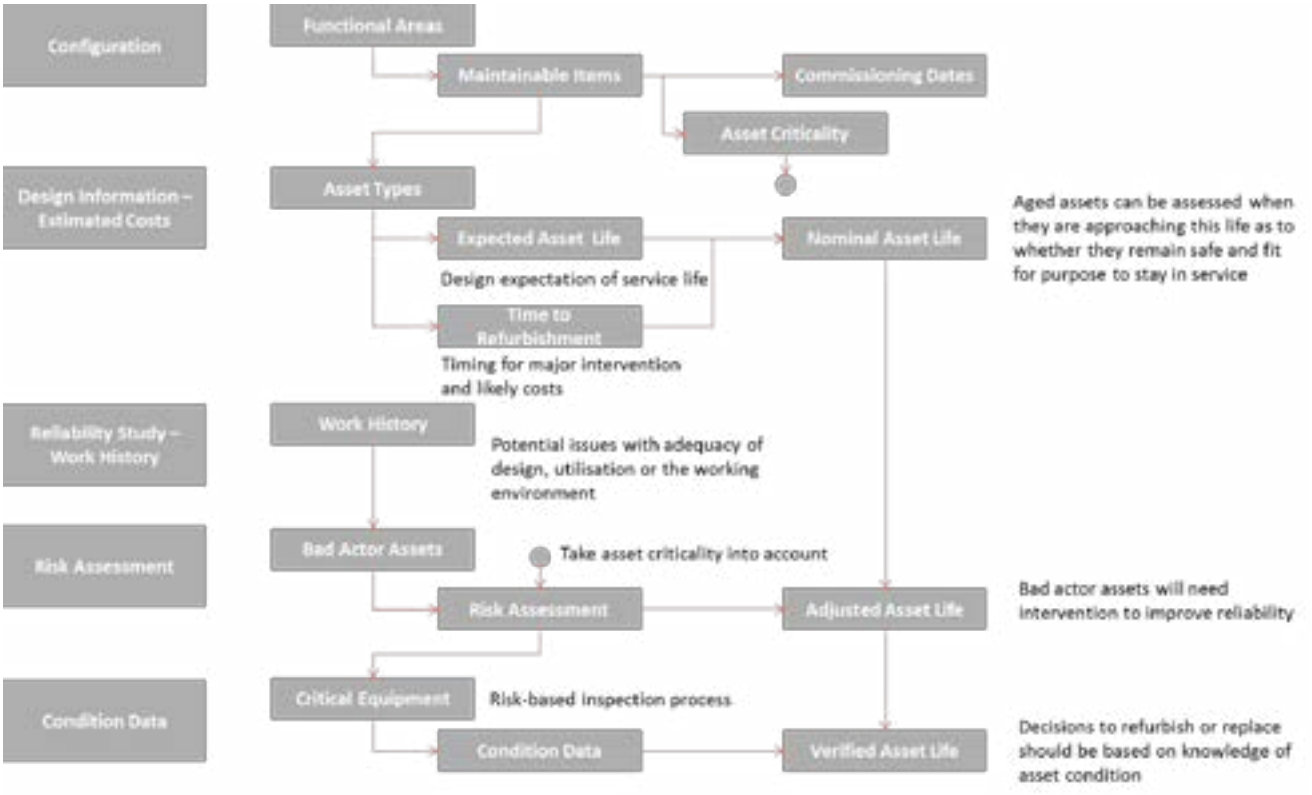
LINKING ASSET RELIABILITY IMPROVEMENT WITH ASSET MANAGEMENT PLANS

Dr Bob Platfoot, Principal Covaris

Tech 4

Bob Platfoot has been an active researcher in asset management for over 30 years, working across power, manufacturing, mining, Defence, facilities and utility industries. He believes effective research in asset management has to balance innovation and new thinking with the ability to prove value and deliver enhancement for asset owners. His work has been enabled by both the Covaris team and the many industrial sponsors who have sought better ways to manage their assets.

ISO 55001 (2014) requires an organisation to establish, document and maintain Asset Management Plans to achieve the asset management objectives. These objectives include commitments to safety, sustainable business and reliable operation, where the latter can mean ensuring profitable return to the business from the assets' operation or in the case of public infrastructure, continuity of services to the community. The ISO asset management standard is based on policy listing top level goals leading to a strategy by which the enabling objectives are specified, and then plans establish actions leading to investment in the assets.



The Asset Management Plan is important because it documents the risk in the assets, reports alternative options for significant investment, and communicates to senior executive how the organisation can sustain its future operations with the existing asset base. It takes into account the criticality of the assets, their expected design life and any impact due to utilisation or their working environment which may limit the service life. It is therefore likely that the asset management objectives within the Strategy Asset Management Plan (refer ISO 55001) will most likely reside in a written document. The Asset Management Plan would then be best implemented as a dynamic register of activities, each of which is individually justified, costed and scheduled at a top level, eg to the year. The justification of the activities can be tied back to one or more problems or issues found with the assets, each of which can be individually risk assessed.

The principles for an effective Asset Management Plan include:

- The organisation should establish a team whose role is to find and assess issues throughout its operations and who will then advise other teams who have the expertise to resolve these issues (eg design work, maintenance improvement, capital projects etc);
- The organisation must know the condition of its assets and hence must implement a continuous, cost effective strategy of surveillance and reporting;
- All assets need to be covered by the surveillance and have their issues plus proposed work registered in an enterprise-wide and accessible Asset Management Plan; and
- The effective use of the Asset Management Plan can be assessed by monitoring continuous improvement of operations and maintenance (eg preventive maintenance refinement) plus proposals for capital projects refurbishing existing systems and plant areas.

Condition Level	Results
A= Condition is equivalent to as-new	
B= Condition is functionally acceptable with expected in-service deterioration for the age of the equipment	203
C = Condition is functionally acceptable but refurbishment or replacement is required in the short term	15
D – Imminent failure expected – less than 1 year	
F = Equipment is little used compared to similar for the facility	1
G = Equipment usage is about average for the facility	216
H = Equipment is heavily used compared to similar for the facility	1
L – Equipment is in a favourable operating environment which is likely to extend the operating life	1
M = Operating environment is normal for the facility	202
N – Unfavourable environment which is likely to shorten considerably the life of the equipment	15

Asset Life

The Asset Management Plan documents activities which intervene before assets become unsafe, reach the point of functional failure or generally no longer meet the requirements of the business. A three level approach to determining asset life is set out below. It includes the following steps:

1. Define the assets and their asset type along with commissioning date;

2. Use design or information gained from working with comparable assets to forecast asset life;

3. Understand where it is likely the assets will fall short of expected life as they are unreliable, and from this conduct a risk assessment to identify assets which need early intervention; and

4. Undertake a detailed condition survey to confirm likely asset life and what is limiting this life (if anything).

Problems such as loss of reliability, poor asset condition, harsh working environment or over utilisation can be documented in the Asset Management Plan as reasons why the actual asset life is less than expected from original design and commissioning. Otherwise aged assets can be assessed, and if their condition warrants the investment, they can also be entered into the Asset Management Plan as candidates for refurbishment or replacement sometime in the future.

The Asset Management Plan has to reconcile with the known asset life, coping with deterioration of the assets through inadequate design, utilisation, the process or some other factor. All of the steps shown in the above diagram are concerned with identifying issues which have to be acted on starting with a trouble-free asset intended to achieve its nominal asset life as specified when it was first installed.

The organisation has to have teams whose various roles include:

- Track the expected asset life of its assets based on design and according to asset type and working environment;

- Undertake a risk assessment, utilising reliability information, to determine high risk assets which may be subject to early replacement and at least, need surveillance;

- Commit to routine inspection with the data analysed to determine the timing of possible intervention; and

- Link the approach with Asset Management Planning so that proposals for major investment are supported by the facts established in the earlier steps.

In this work investment equates to assets being refurbished or replaced, with the opportunity to replace equating to the chance to introduced improved capabilities or greater operational flexibility.

Facility Condition Assessments

The condition of assets and then determining which will need to be refurbished or replaced by certain dates has to be a consistent process within the organisation. The approach documented below has been found useful for large fleets of simple assets across large facilities. It

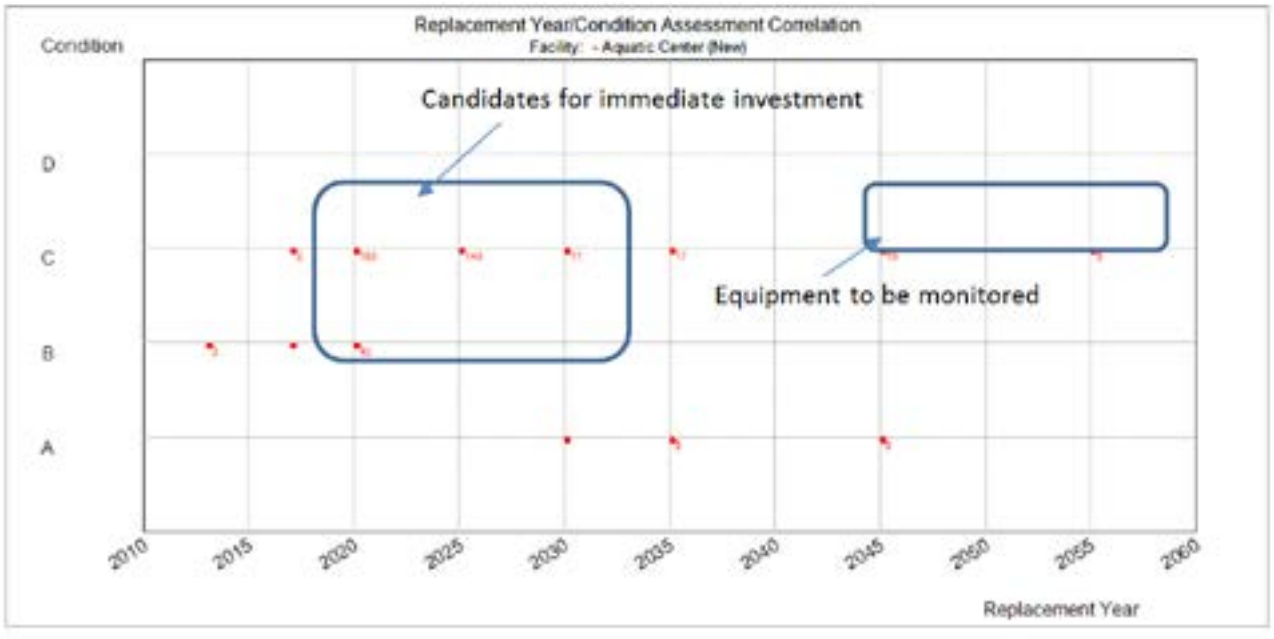
requires condition assessments using formal inspection sheets, and entry of issues and times for replacement into an Asset Management Plan. This is an important point: the nature and content of an Asset Management Plan may differ across different enterprises with different operating circumstances and complexities of assets. The underlying principles and what is sought to be achieved remains the same.

This example is less aligned with a reliability analysis and more focused on getting the right feedback from maintenance teams who go out and check the assets. It relates to an international sporting facility with multiple arenas, hospitals, office buildings and other venues. One particular venue was inspected with the following results:

a) Summary of condition checks – illustrates the criteria for the inspection

Asset	Repl Year	Type	Asset Crit	Crit(CM WOs)	MTBF (CM WOs) (Days)	Nom Life (Years)	Adj Life (Years)	Issues
ALL Emergency Lightings*	2015	EMERGENCY LIGHTING	HIGH	2	61	10	8	MODULE (1), TOILET (1)
All Exterior Lighting	2015	EXTERIOR LIGHTING	MEDIUM	1		10	10	AC UNIT (1)
All Interior Lighting	2010	INTERIOR LIGHT	LOW	11	45	5	4	Refer below
BALLAST (4), LAMP (4), LIGHTING (1), LIGHTING FIXTURE (1)								
BMS Computer-001	2017	COMPUTER	MEDIUM	18	30	12	9	AHU (7), BMS (1), EXHAUST FAN (4), FCU (3), PUMP (1)
DOCP-003 & Field Devices	2015	COMMUNICATIONS FIXTURES	MEDIUM	4	92	10	8	AHU (2), BMS (1), FAN (1)
DOCP-004 & Field Devices	2015	COMMUNICATIONS FIXTURES	MEDIUM	3	27	10	8	AHU (3)
DOCP-005 & Field Devices	2015	COMMUNICATIONS FIXTURES	MEDIUM	2	7	10	10	BMS (1), FAN (1)
Snell&Wilcox-001	2017	LAN	MEDIUM	1		12	12	POWER SUPPLY (1)

b) Correlation of condition with adjusted time for replacement



A number of assets were found to be in a condition where refurbishment may be needed in the short term. Considering the diagram above, some of the assets in a condition at level C level probably are candidates for immediate replacement. This list can be provided to the financial administration for early warning of the need for investment. Other assets in a C condition were known to have longer asset lives so the inspection results do not immediately justify their replacement. If they were in condition D as defined on the above table, then they would definitely have needed urgent replacement. These long life C condition assets do need to be monitored and a contingency for some being replaced may need to be set aside.

The inspection process must take into account where assets are heavily utilised or located in an adverse working environment. The Asset Management Plan can register this information as well so that as the assets are monitored there will be fewer surprises if future inspections indicate the need for replacement.

Information from this survey which was used in an Asset Management Plan specific for this facility is shown below.

The Asset Management Plan registers which assets are of concern and the timing (based on Adj Life (years) in the above table) along with expected replacement costs. In this way the investment portfolio represented by the Plan is built up from individual inspections with risk information such as the Asset Criticality (Asset Crit in the above table) and the utilisation/environmental factors also taken into account.

Key considerations in this approach include:

- All assets are specified in detail and consistent with how they are registered in the organisation's asset information system;
- Asset criticality along with reliability information can justify a proposed reduction in the expectation of the asset life as provided from its original design and commissioning; and
- Condition surveys are needed with detailed information per asset to justify likely times for early refurbishment or replacement, or simply to sign off that as assets approach their nominal asset life they should be replaced (or better, their life can be safely further extended).

Asset	Repl Year	Type	Asset Crit	Cnt(CM WOs)	MTBF (CM WOs) (Days)	Nom Life (Years)	Adj Life (Years)	Issues
ALL Emergency Lightings*	2015	EMERGENCY LIGHTING	HIGH	2	61	10	8	MODULE (1), TOILET (1)
All Exterior Lighting	2015	EXTERIOR LIGHTING	MEDIUM	1		10	10	AC UNIT (1)
All Interior Lighting	2010	INTERIOR LIGHT	LOW	11	45	5	4	Refer below
BALLAST (4), LAMP (4), LIGHTING (1), LIGHTING FIXTURE (1)								
BMS Computer-001	2017	COMPUTER	MEDIUM	18	30	12	9	AHU (7), BMS (1), EXHAUST FAN (4), FCU (3), PUMP (1)
DDCP-003 & Field Devices	2015	COMMUNICATIONS FIXTURES	MEDIUM	4	92	10	8	AHU (2), BMS (1), FAN (1)
DDCP-004 & Field Devices	2015	COMMUNICATIONS FIXTURES	MEDIUM	3	27	10	8	AHU (3)
DDCP-005 & Field Devices	2015	COMMUNICATIONS FIXTURES	MEDIUM	2	7	10	10	BMS (1), FAN (1)
Snell&Wilcox-001	2017	LAN	MEDIUM	1		12	12	POWER SUPPLY (1)

Conclusion

The Asset Management Plan is a key element of ISO 55001. The Plan is intended to be dynamic, to govern the forward budget for investing in assets, to act as a repository for consolidated information from surveys etc., and in general to be of immediate use to a wide group of stakeholders. It is not a document which is refreshed periodically; it is there to support active decision making.

The starting point for the Asset Management Plan is the single asset located somewhere in the facility. It has an expected service or asset life which may be foreshortened with poor reliability and being subject to high utilisation or a poor working environment. An organisation has to know the condition of this as well as all other assets and then use that information to develop both short term and long term forecasts of what assets need to be refurbished or replaced by when. This is possible with a consistent business process, the effective use of information and clear responsibilities where people are tasked to identify issues and then report to others who then act on that information.

What is a Valid Accredited Certification against ISO55001?

At the request of members, and as the peak body for Asset Management in Australia, the Asset Management Council and its peers in the Global Forum on Maintenance and Asset Management (http://gfmam.org/) have spent a considerable amount of effort working with members of the International Accreditation Forum (www.iaf.nu) to establish a credible and independent framework for assurance and accreditation of certifications against ISO55001 .

Many organisations are claiming certification against ISO55001 or are offering certification services to asset managing organisations that are not in conformance to the expectations of the Asset Management profession and industry. This is generating confusion in the marketplace.

What constitutes a valid Accredited Certification against ISO55001?

1. The Conformity Assessment Body/certifying organisation (CAB) must be accredited by an accreditation agency such as JAS-ANZ http://www.jas-anz.com.au/ (Australia or NZ) or UKAS http://www.ukas.com/ (in the UK). The accreditation agencies have online registers of accredited CAB's listed by what schemes the CAB is accredited for. Be aware, CAB's are accredited by schemes, ISO9001, ISO14001, ISO55001. Accreditation for ISO9001 does not mean Accreditation for ISO55001.

2. The accreditation agency needs to be a member of the IAF – you can check by going to the IAF website: www.iaf.nu.

3. The actual auditors used by the CAB need to be competent, ask the CAB for the auditor's CAMA certification or request the CAB prove their auditors have an equivalent technical knowledge and comprehension in Asset Management. You can independently check an auditor/ assessor's CAMA certification at http://www.wpiam.com/index.php/get-certified/certificants

An organization is claiming certification to ISO55001, how do I tell it is a valid Accredited Certification?

1. The certification must be done by a CAB Accredited to do ISO55001 Certifications:

   a. Check the Accreditation Agency is a member of the IAF.

   b. Check the Accreditation Agency's register – it will list the CAB and what it is Accredited to certify.

2. The certification certificate must have the Accreditation Agency's logo on it. If the certification doesn't have this logo it is not an Accredited Certification.

3. The certification must state the number and name of the standard to which it applies.

4. The certification must document the scope of the asset's to which the AMS is being applied. .

5. There must be a direct link between the value generated by the outputs/function of the asset, the management responsibility/decisions and the meeting of the organizational objectives.

6. All requirements of the Standard must be met, where the activities of the organization do not encompass all requirements, an organization cannot receive certification against the standard.

If you want to be assured your certifier is an accredited body, ask if your certification document will have this JAS-ANZ logo on it.

[1] This includes:
- Setting up the Certified Asset Management Assessor (CAMA) scheme http://www.wpiam.com/ to provide organisations with assurance of potential assessors/auditors credentials in asset management knowledge and comprehension.
- Working with JAS-ANZ (the Joint Accreditation Scheme for Australia and New Zealand) http://www.jas-anz.com.au/, developing an accreditation scheme for organisations who conduct certification assessments.

[2](Note: the standard requires that the AMS scope incorporate the scope of the assets, other requirements cannot be met without explicit and demonstrated application to the asset's within the scope.

How to be Certified Under ISO5500X

In early January 2014, the International Standards organisation (ISO) published the ISO5500X suite of standards for asset management. These standards contain the requirements by which an Asset Management System must comply in order to be certified under ISO 55000X.

ISO itself does not provide certification or conformity assessments, but instead, ISO acts as a framework for Conformity Assessment Bodies (CABs) to certify organisations. In order to understand if your organisation is being properly certified under ISO 5500X, it is crucial to understand the "chain of command" ISO has in place, which is described and illustrated below.

The first section of this "chain" is a committee created by ISO called the Committee of Conformity Assessment (CASCO). CASCO was formed in order to establish liaisons with international organisations involved in certification and conformity assessment. For the purposes of certification in Australia, CASCO has partnered with the International Accreditation Forum (IAF) – the next portion of the chain.

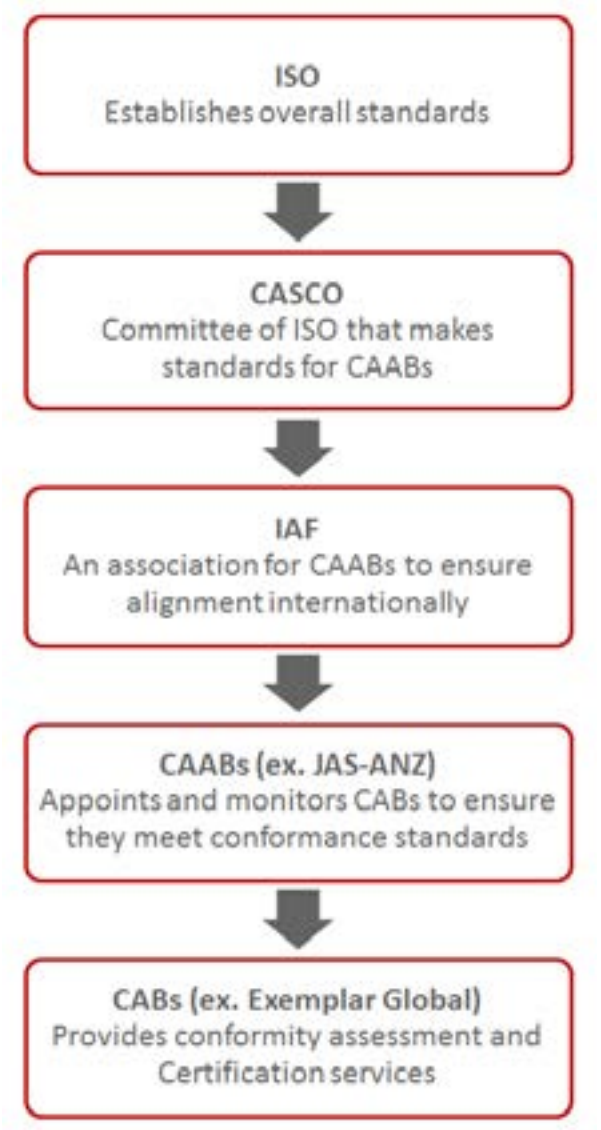
The IAF is the world association for Conformity Assessment Accreditation Bodies (CAABs). Its primary function is to develop a single worldwide program of conformity assessment. The IAF does not provide certification or conformity assessments itself, but instead acts as a monitoring organisation for bodies that directly monitor CABs. There are members of the IAF in various countries such as the UK – United Kingdom Accreditation Service (UKAS), the US – American National Standards Institute (ANSI), and more, but for the purposes of certification in Australia and New Zealand, the primary IAF member is the Joint Accreditation System of Australia and New Zealand (JAS-ANZ)

As a member of IAF, JAS-ANZ is a Conformity Assessment Accreditation Body (CAAB). JAS-ANZ itself does not perform certification, but instead certifies CABs as being competent to perform assessments and issue certificates of conformance against specific standards (such as ISO 5500X). To summarize, JAS-ANZ certifies the bodies that certify your organisation.

Therefore, in order for your organisation to be certified against ISO 5500X in Australia, a certifying body (or CAB) must be accredited by JAS-ANZ for assessing and certifying "Asset Management Systems." A list of CABs that JAS-ANZ authorizes may be found on their website, and at the time of this post (30 July 2015) there are no certification bodies that are accredited to certify for Asset Management Systems.

However, JAS-ANZ recently released their requirements for ISO Certification for CABs, for which a summary and original text can be found on the AM Council's website, so there are expected to be numerous bodies that qualify for Asset Management System certification within the upcoming months.

In order to have a clearer understanding of the chain of command for ISO certification, please refer to image on this page, and, if your corporation wishes to be certified under ISO5500X, please assure that the certifying body is an accredited CAB for ISO5500X certification. The easiest way to do this is to ask if your certificate will have a JAS-ANZ logo on it, such as the one found on this page.



New Members and Certificants

New AM Council Members

Hugh Stott - Overseas Chapter
Phillip Whitehouse - Sydney Chapter
Wendy Malcolm - Perth Chapter
Malcolm Yeoman - Sydney Chapter
Thorsten Freitag - Sydney Chapter
Simon Miller - Sydney Chapter
Paul Davis - Hobart Chapter
Robert Schultz - Brisbane Chapter
Bill Bignell - Perth Chapter
Mike Wundenberg - Adelaide Chapter
Trent Giles - Brisbane Chapter
Wayne Hatcher - Overseas Chapter
Tomas Keraitis - Brisbane Chapter
David Humphreys - Perth Chapter
Grant Phillips - Perth Chapter
Chris Cunningham - Brisbane Chapter
Praveen Pillai - Brisbane Chapter
Russell Vorpagel - Brisbane Chapter
Tony Brockhurst - Brisbane Chapter
Claire Jackison - Sydney Chapter
Grant von Horsten - Perth Chapter
Terrence Stamp - Sydney Chapter
Wenda Yu - Sydney ChapterMichael
Allen Bufton - Sydney Chapter
Arun Joshi - Sydney Chapter
Gary McGregor - Sydney Chapter
John Karaboulis - Sydney Chapter
Zain Westmacott - Brisbane Chapter
Paul Coady - Melbourne Chapter
Graham Bell - Melbourne Chapter
Jim Grimes - Overseas Chapter
Danny Shafar - Melbourne Chapter
Leigh Cox - Sydney Chapter
Trajce Tosevski - Melbourne Chapter
AGL - Corporate Membership
Neil Fitzclarence - Melbourne Chapter
Jack Balales - Adelaide Chapter
Ralph Villarosa - Melbourne Chapter
Andy Lai - Melbourne Chapter
Stuart Mann - Melbourne Chapter
Bruce Hansen - Melbourne Chapter
Glenn S. - Melbourne Chapter
Tri Tran - Melbourne Chapter
Harry Tsavlidis - Adelaide Chapter
Wim Belgraver - Melbourne Chapter
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Anthony Englund - Sydney Chapter
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Mark Jones - Sydney Chapter
Tim Barnes - Sydney Chapter
Heather Wagland - Sydney Chapter
Steve Stavropoulos - Sydney Chapter
Sean Beamish - Overseas Chapter
Paymon Aria - Sydney Chapter
Michael McCallum - Brisbane Chapter
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Matthew Webb - Sydney Chapter
Maselaganye Petrus Matji - Sydney Chapter

Become a Certified Asset Management Assesor

Advance Your Career

Certification in asset management allows AM professionals to have a step ahead of the competition. Whatever industry you are in, certification will add a definitive stamp to your resume or CV.

Prove Your Knowledge

For those who have worked in asset management for over five years, the CAMA certification allowes you to demonstrate your knowledge on a standardized, international scale.

Grow your opportunities

Being certified through the World Partners in Asset Management demonstrates that your knowledge is transferable across multiple industries, giving you opportunities in any field that practices asset management.

Understand Your Skills

After undertaking the CAMA exam, practitioners are more aware of the competencies they excel in, as well as areas that can be improved, facilitating certificants to a better uderstanding of their capabilities.

Join A Community

The majority of asset management practitioners who become certified are also members of the Asset Management Council, Abraman, iframi, PEMAC, or SMRP, connecting them to the premier bodies of asset management knowledge, networking and information across the world.

WPiAM
World Partners in Asset Management

About WPiAM

WPiAM is a worldwide partnership, established in late 2014, of national non-profit professional associations working together to enable individuals and organizations to develop, assess and recognize competence in Asset Management, for the benefit of their members and of the asset management community globally.

The three key objectives of the WPiAM are to

- Maintain a database of questions and answers suitable for certifying ISO55001 auditors and assessors in the minimum required knowledge and comprehension of asset management;
- Be a globally certifier of personnel in the market place; and
- Demonstrate the values of integrity, collaboration and duty to the public

WPiAM is a separate legal entity equally owned by the shareholders, who are currently the Asset Management Council

How to Start

To register for a CAMA exam, please visit wpiam.com

Tutorial 4

Key Concepts and Terms in asset management

There are several key concepts of an asset management organisation. Understanding them aids successful implementation of asset management. The key concepts are summarised here.

Cost, Risk and Performance

The notion that the outcome of the management of assets is a balance between the cost of providing the asset performance to an agreed level of risk is a key concept of asset management, and contained in ISO 55000. The phrase used in ISO 55000 is "Effective control and governance of assets by organisations is essential to realise value through managing risk and opportunity, in order to achieve the desired balance of cost, risk and performance."
As such, the Asset Management Council considers that for such a balance to be 'demonstrable' the following issues should be considered, namely that:

- *Risk is usually expressed as the agreed residual risk associated with the delivery of the agreed asset performance, based upon the organisational risk management approach and the stakeholder agreed decision making criteria, imbedded in the risk approach;*
- *Performance is usually expressed as quantitative measures such as Reliability, Availability, Maintainability and Supportability (RAMS) against an agreed time frame and an agreed performance functional specification (expressed in terms that relate to the business needs, such as an agreed speed/power curve and specific fuel consumption per unit power etc.), over which the relevant risks have been identified and mitigated; and*
- *Cost is usually expressed in dollar terms, but may include other measures, where appropriate. The cost associated with this balance is usually reflective of the aggregation of the risk mitigation measures (maintenance, spares, access, special tools etc.) and the direct enabling costs (such as fuel etc.). It may also include the opportunity costs associated with any asset down time. Each organisation will need to have its own agreed cost structure.*

Decision Making Criteria

The Asset Management Council recommends the use of rational decision making using quantitative criteria that are demonstrably linked to the objectives of the organisation via a defined and repeatable process. This is demonstrated in ISO 55001 by the requirement that an organisation (through its stakeholders) develop and apply agreed and approved decision making criteria. Organisations should therefore consider how such a balance might be able to be demonstrated.

Key Terms

The key terms presented below may aid the reader in better understanding general asset management concepts.

Acquisition The process by which an entity obtains/acquires an asset capability for its stated purposes.

Capabilities The inherent functions of an organisation or physical asset.

Configuration Management The management of the functional and physical attributes (data) of a system/asset and its part sub-systems and assemblies

Continuous Improvement A process to assess, identify and improve performance of a management system and/or asset, and often called PDCA.

Culture A set of learned beliefs, values and behaviours the way of life shared by the members of a society or organisation.

Demand Management The establishment of sound relationships with stakeholders who may be internal or external to the organisation.

Inputs Resources and constraints required to deliver outputs.

Leadership The process of influencing and directing the performance of group members towards the achievement of organisational goals.

Learning organisation An organisation that actively seeks change in environment or domain knowledge and adapts to improve its products or services.

Level of assurance *Quantifiable level of confidence in the delivery of a capability.*

Life cycle *Evolutionary phases of a system/asset, product, service, project or other human-made entity from conception through retirement.*

Operations & Maintenance *Combination of processes and tasks necessary to implement the required support, through which the requisite outputs and level of assurance should be delivered.*

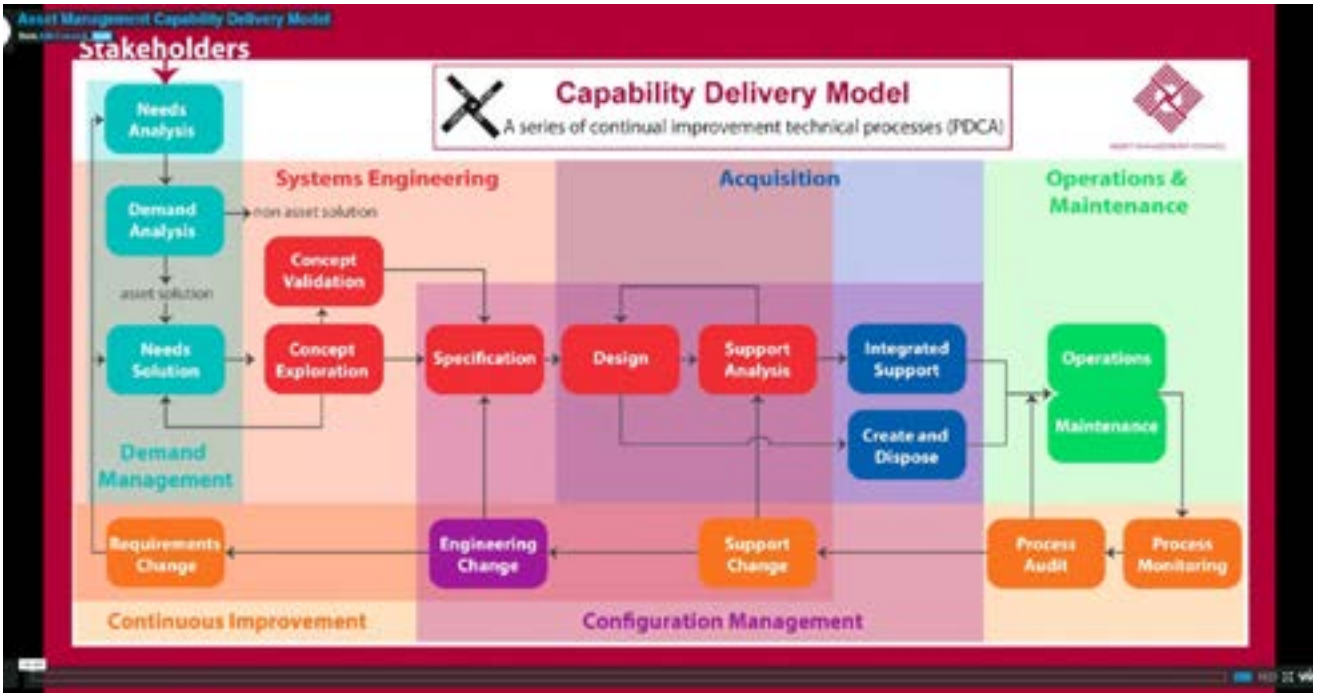
Outputs *The stated requirement for services or products required by the enterprise.*

Physical asset *A combination of interacting elements organised to achieve one or more stated functions.*

Systems Engineering *An interdisciplinary, collaborative approach to derive, evolve and verify a life-cycle balanced system solution which satisfies customer expectations and meets public acceptability.*

Capability Delivery Model

Want an in-depth explanation of the Capability Delivery Model? Click the picture below to watch the video.



Myths of Asset Management

Myth #6 - That there is no need for knowledge about statistics in the management of assets!

Introduction

The problem of under-maintaining assets is often addressed through loss elimination and continuous improvement programs, by comparison, the problem of over-maintaining assets receives little attention. Left unattended, over-maintaining assets can silently and continuously squander precious maintenance resources. The myth that increasing maintenance frequency will increase reliability and, ultimately, profit for the company is debunked in this essay.

WASTE

In order to understand the pitfalls of over-maintained assets, it is necessary to have a clear comprehension of waste. In "The War on Waste" by Buell and Smedly [1], waste is defined as "anything that adds no value to the manufacturing process" and is categorized into the following common sources:

- Overproduction – Producing product quantity in excess of requirement or demand.
- Inventory – Producing levels of end product or work in progress above the optimum.
- Waiting – Delays in the production process.
- Transportation – Transporting end product or work in progress unnecessarily.
- Motion – Unnecessary motion of workers, assets or materials associated with production.
- Processing – Redundant steps or activities in the production process.
- Defects – Producing defective products
- For monitoring assets, similar categories of waste have been developed by O'Hanlon [2] that detail the list further:
- Overproduction - Performing preventive and predictive maintenance activities at intervals more often than optimal
- Inventory – Overstocking maintenance spares with slow moving parts and secret inventories.
- Waiting - Waiting for tools, parts documentation, transportation, etc.
- Transportation – Time spent walking, running, driving, and flying associated with maintenance work
- Motion –PM performed that adds no value to the prevention of downtime.
- Processing– Opportunity to improve the quality of repairs in reactive or breakdown maintenance.
- Defects – Asset failure caused by under-maintaining assets or maintenance rework.

It is estimated that between 18% and 30% of every dollar spent on maintenance is wasted [Bever, 3], and furthermore, it is estimated that maintenance operations may be wasting up to 25% of available labour and that up to 60% of this waste results from activities that add no value to the performance of the plant [Folts, 4].
Evidently there is a problem of waste in maintenance that can be considered an issue derived from strategy, planning, control, and other areas of practice.

Preventative Maintenance

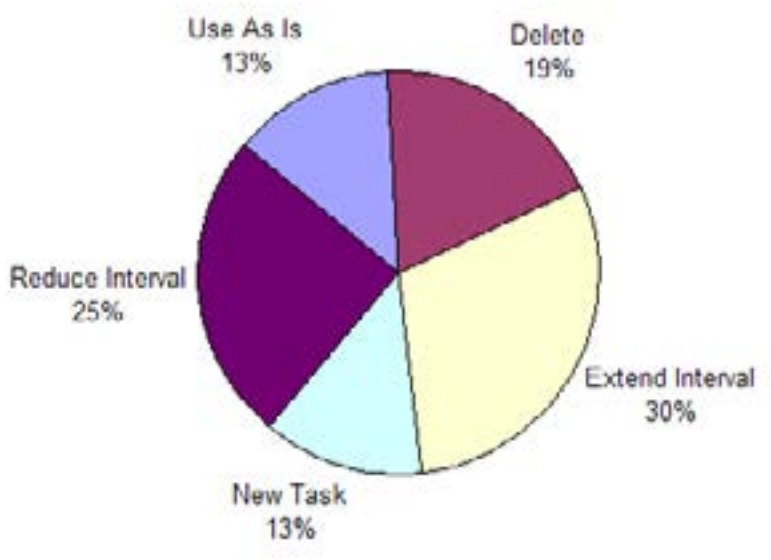
Preventative maintenance is the foundation to determine how often assets should be checked, repaired, and replaced. Yet in many businesses, preventive maintenance activities have been established over time with little technical discipline supporting the decision process. This has resulted in preventive maintenance activities that:

- Are ineffective in detecting the onset of failure
- Duplicate the effort of other preventive activities
- Are missing for critical failures

In his essay, "Optimisation Using PMO", Turner describes an approach for preventative maintenance that reviews activities in a nine-step process. The results of a typical PMO review are shown in Figure 1.

As illustrated by the graph, only 13% of existing preventive maintenance activities were considered worthwhile, 19% of preventive maintenance activities were considered a waste of time, and 30% of preventive maintenance activities were carried out too frequently. Of the 30% that maintained too frequently, their actions could be defined by:

- Performing preventive maintenance (PM) activities at more frequent intervals than necessary
- Performing PM activities that add no value to the output
  - » PM activities are ineffective at detecting failure and are a waste of time
  - » PM Activities are redundant (i.e. duplicate other effort)



Over-maintaining assets leaves a less obvious waste trail then under-maintaining assets, and since maintainers are inclined to believe that their preventive maintenance activities are effective if they are not constantly rectifying breakdowns, over-maintenance is often ignored.
Preventive maintenance frequencies can be varied according to deterioration and failure rates, operating strategy, (i.e. windows of opportunity), the cost of performing the activity and the penalty associated with asset failure. Collating decision models for timing of inspections, repairs and replacements based on asset failure data is often difficult, and the data for optimising frequencies for a wide range of assets is regarded as problematic. In the absence of data for such decision support, the setting of frequencies by "personal judgement" is widely recommended and practiced.
A straw survey of industry supported by published maintenance frequencies [5] shows a distinct preference for certain intervals when specifying Preventive Maintenance frequencies. These are:

- Monthly
- Quarterly (3 Monthly)
- Semi Annually (6 Monthly)
- Annually

This observation supports the contention that maintenance frequencies based on "personal judgement" are heavily influenced by monthly and annual calendar cycles. In essence, the majority of maintenance plans have no technical basis for their decision making. If each of these frequencies were extended by just one week most maintenance facilities could realise a 20% reduction in the direct cost of their Preventive Maintenance Program.

If preventive maintenance activities are allocated to the preferred frequency intervals above in a conservative manner it is easy to imagine a situation for many activities of over-maintaining by a factor of up to 200%.

Impact of Preventive Maintenance Frequency on Reliability
It is assumed that as Preventive Maintenance frequency increases (i.e. the interval between Preventive Maintenance activities is reduced) the cost of performing the preventive maintenance activity increases. It is also often assumed that the probability of failure reduces with increased Preventive Maintenance frequency. However, figure 2 shows below a different relationship between preventive maintenance frequency and the probability of failure prevention (assuming that the Preventive Maintenance activity is successful and the penalty costs are avoided).

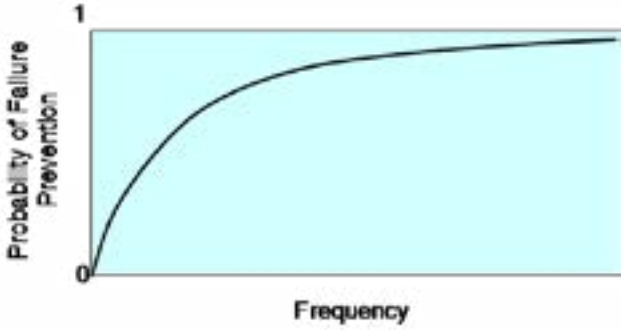
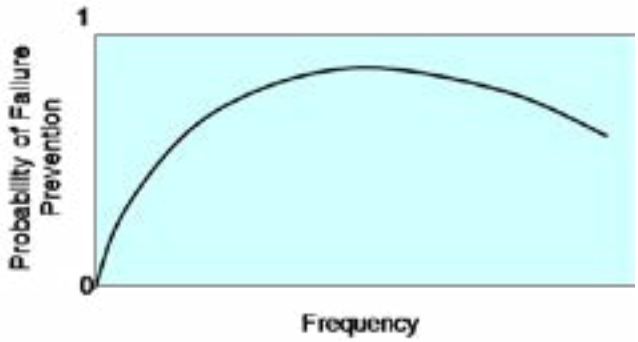
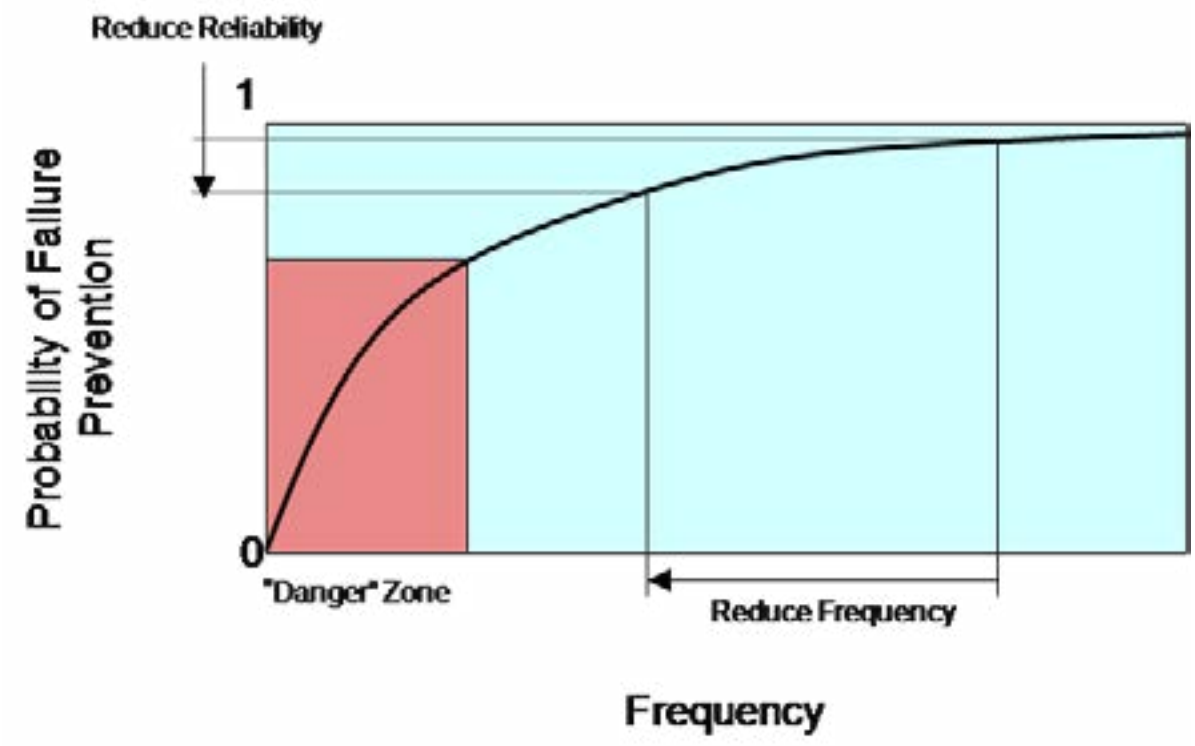


Figure 2 shows a diminishing return in relation to probability and frequency of preventive maintenance. If the correct inspection frequency for a bearing is 6 weeks then there is very little to be gained by carrying out the inspection 4 weekly or 2 weekly.

It cannot be assumed that the benefit of carrying out the preventive maintenance activity increase in all cases. In the case of intrusive preventive maintenance where assets is opened, adjusted, or otherwise handled, there is a chance that assets will be returned to service in a worse condition than when it was received. This means that as maintenance frequency increases the probability of a maintenance induced failure increases and the overall probability of success of the preventive maintenance activity is reduced as demonstrated in Figure 3 (below). Figures 2 and 3 provide the basis of an argument for avoiding high frequency preventive maintenance activities.



The graph of Figure 2 suggests that it is possible to reduce preventive maintenance frequency without significantly impacting on assets reliability. Figure 4 (below) shows that a significant decrease in maintenance frequency may only result in a minor reduction in the probability of failure detection (perhaps even an increase if the graph of Figure 3 is considered).



The challenge associated with frequency reduction is that without reasonable failure data or history, it is difficult to know where the current preventive maintenance frequency sits on the graph. Frequency reductions in the "Danger Zone" indicated in Figure 4, would result in proportional reductions in assets reliability. If the current maintenance frequency is low then significant reductions in reliability may not be apparent for some time. If the current maintenance frequency were high, then reductions in maintenance frequency within the "Danger Zone" would result in more immediate reductions in reliability.

Frequency reduction may only be a reasonable strategy where the consequences of failure are low and the current frequency is high, and therefore minor reductions in maintenance frequency with these characteristics can yield considerable returns.

CONCLUSION

Preventive Maintenance activities can have a significant impact on waste in maintenance and manufacturing as a result of both under-maintaining and over-maintaining. The problem of over-maintaining receives little attention by comparison with under-maintaining.

The choice of Preventive Maintenance frequency impacts the total cost of the Preventive Maintenance program. Conservative approaches to setting Preventive Maintenance frequencies increase maintenance waste while adding little or no value to the detection or prevention of asset failure. The review of Preventive Maintenance activities has been shown in the past to effectively reduce waste caused by over-maintaining. A review of Preventive Maintenance frequencies offers further opportunities to reduce Preventive Maintenance effort. The reduction of Preventive Maintenance frequencies for high frequency activities on low criticality assets provides a method for quickly and effectively reducing Preventive Maintenance costs and eliminating maintenance waste.

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5 Moubray J, Reliability Centred Maintenance, Butterworth-Heinemann, 2nd Edition

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