DECEMBER 2017
ISSUE
04
Volume 11

THE ASSET JOURNAL

ASSET MANAGEMENT COUNCIL

ANALYTICS FOR ASSEST MANAGEMENT

How to Use Analytics to Prevent the Deferral of Critical Maintenance

Improving Profits Using Data

Big Data Analytics for a Strategic Approach to Asset Management

ERNST KRAUSS

EDITOR IN CHIEF

The Industrial and Business world today is full of new phrases and acronyms that relate to things like 'Digital Enterprise', 'Industrie 4.0', 'Digital Asset Management', IIoT and more. These concepts and developments all go towards using Computers more and more to derive, develop and deliver on outcomes from our Businesses. All things digital require of course to be driven by data and must have engines that drive these data strings and learn about their environment and how the task on automated function has in connection to another. We all hear about the need for accurate data, and more and more and better analytics. We are presently still in many Organisations on the beginning if this journey, which often coincides with the transition to better Asset Management.

The digital world of the future will require extra supportive and better analytics without a doubt. This comes with the need to extend metrics and KPI's to encompass elements that we have not yet seen in more conventional enterprises The core metrics we focus on in Asset Management and Business in general, safety, cost, risk and performance, will need to be better defined and formalised to represent that status of our digital worlds. More data means more need for clarity what is important to Business. In this edition of 'The Asset', we explore some ideas and cases where analytics based on specific data collection create the environment promoting better decision making.

But perhaps before we venture into the future of computerised Asset Management, we should reflect on what needs to be measured to give the right perspective on the balance we require and achieve for safety, cost, risk and performance. Douglas W. Hubbard states in his "How to measure anything" that "measurement is the reduction of uncertainty". I believe that keeping this in our minds will make it easier to define what we need to know.

One thing is certain, that we will continue to deliver our Readers and the interested Asset Management more articles, case studies and ideas about Asset Management in the coming year and beyond. We thank you for your support and wish you a safe and happy Christmas period and a successful and prosperous New Year!

CONTENTS

Editors Column: The Asset Journal, December 2017	2
From my desk: Chairman's Letter	3
Article 1. How to Use Analytics to Prevent the Deferral of Critical Maintenance	4
Article 2. Improving Profits Using Data	10
Article 3. Big Data Analytics for a Strategic Approach to Asset Management	18
Tutorial 12 – Capability Model – Configuration Management	26
Myth of Asset Management	28
Discussion Starter – Asset Management, Open Systems and the Role of Governance	31
Chapter News	38
WiAM News	42
Inside Asset Management on The International Space Station	44
AMCouncil Member Profile	53
Upcoming Events	59
Membership Application	61
New Members	63
New Corporate Members	64
Corporate Members	66
Testimonials	67
Awards for Excellence Nomination Booklet	69

Publisher: The Asset Management Council
Chief Editor: Ernst Krauss
Publication Design: nonilou
ISSN: 1834-3864

For all enquires please contact:
publications@amcouncil.com.au
Asset Management Council
PO Box 2004 Oakleigh Vic 3166 Tel 03 9819 2515

FROM MY DESK: CHAIRMAN'S LETTER

CHAIRMAN, DAVE DAINES

A few more months pass and we are rapidly approaching the festive season, so I would take this opportunity to wish everyone well and thank all of our members that have contributed to the success of the AM Council over the past 12 months.

Recent activity has seen the refreshing of our relationships with our partner organisations and new representatives join our Board. It is timely to thank the contribution of Dr Achim Kruger (SAP) with 6 years of service to the Board and Danny Elia (IFM) with 5 years of service to the Board. We are delighted to welcome Peter Hannam as IFM representative to the Board. SAP has nominated Patrick Thomas Crampton from the UK as SAP point of reference for our Partnership.

Our Annual Symposium was held in conjunction with Leadership Exchange weekend in November started with a seminar on the Friday run by the Special Interest Group (SIG) for Digital Assets.

The session was well attended and we were treated with a number of quality presentations and discussion on the application of Digital Technology across a wide range of subject areas. Feed back from the audience particularly noted this variety of use for the digital technology and the speed of development.

The weekend saw the Board, CEO, Executive and office bearers come together to discuss the currency of our Strategy and the Objectives of the organisation. A fully interactive session, facilitated by John Hardwick, took the group through the Mission, Vision, Values and Organisational structure to deliver to our Stakeholders. There was much discussion around a number of operational areas and whilst the fundamentals of our Strategy and Objectives are solid, it was recognised that there was room for much operational improvement and this will be the focus of the Board over the next few months.

We have also taken the opportunity to meet with a number of key stakeholders and discuss strengthening our ongoing relationships and how we can better leverage our respective groups. This will be an ongoing activity as we continue to create a deeper understanding of asset management within our communities.

We are very excited to announce a partnership with Transport for Victoria which has already seen development and delivery of a customised asset management assessor program and formation of an Asset Transport SIG linking the government sectors across Australia with industry and asset management experts.

The coming year will certainly be an exciting one with a lot of activity in the pipeline. AMPEAK in Hobart will be our opportunity to demonstrate what we are doing and I urge you all to try and attend if you can .

ARTICLE 1 – HOW TO USE ANALYTICS TO PREVENT THE DEFERRAL OF CRITICAL MAINTENANCE

by Michael Carman

What can asset managers do to prevent the deferral of critical maintenance? And how can they use analytics to assist with this?

When budgets are tight, or there are competing priorities for funds, deferring maintenance is an easy target for decision-makers in Finance, or Executive Budget Committees.

Yet asset managers know this myopic approach can have serious impacts: cuts to critical maintenance expenditure can accelerate asset deterioration leading to worsened performance (more defects and downtime) and higher costs in the long-run.

Wouldn't it make for a compelling funding bid if an asset manager could have at their disposal an armoury of supporting analysis with which to front their Executive and say: "Deferring maintenance for 10 years along the lines proposed will lead to net cost increases of the order of $1.8 million, with the $750,000 in savings from the deferral being more than offset by higher reactive maintenance costs and asset replacement costs being incurred earlier."

The integrity of a planned asset maintenance regime has to be fought-for, and this article will outline how analytics can be used as one weapon in the fight for funds and management attention.

THE PROBLEM, DEFINED

The reason that maintenance is so susceptible to deferral is because its benefits are intangible (especially early in the life of an asset) and occur a long way into the future.

The task for asset managers then, is to make the benefits of maintenance both tangible, and immediately relevant. And then to translate them into terms that decision-makers understand and care about.

This is where analytics can play a big part. Analytics is defined here as the systematic effort to collect and interpret data and apply quantitative techniques to it, in order to improve performance. In a management context, analytics is associated with a move away from decisions made on opinion, hearsay or force of personality, in favour of evidence-based decision-making.

WHAT ARE THE EFFECTS OF DEFERRED MAINTENANCE?

How do we use analytics to create a firm and credible evidence base in support of a properly-funded maintenance regime?

We need to construct a model which takes into account the magnitude, timing and sequence of impacts. To put it another way, how do the detrimental impacts of maintenance deferral specifically manifest themselves?

Taking the approach used by Koo and Van Hoy (2000) we distinguish two key impacts of deferred maintenance:

1. Assets deteriorate at a faster rate than they would otherwise, leading to the costs of replacement or renewal being incurred earlier than if maintenance was undertaken, and
2. Repairs (reactive maintenance) occur more frequently than they would otherwise and are therefore higher over the expected life of the asset.

These two effects occur because planned and preventative maintenance (hereafter simply referred to as planned maintenance for ease of reference) either don't occur, or don't occur at the frequency they should.

Our model, therefore shows the sequence of effects set out in Figure 1.

Note that reactive maintenance will occur in any case, but will occur more frequently and be progressively more costly in the absence of a proper planned maintenance regime.

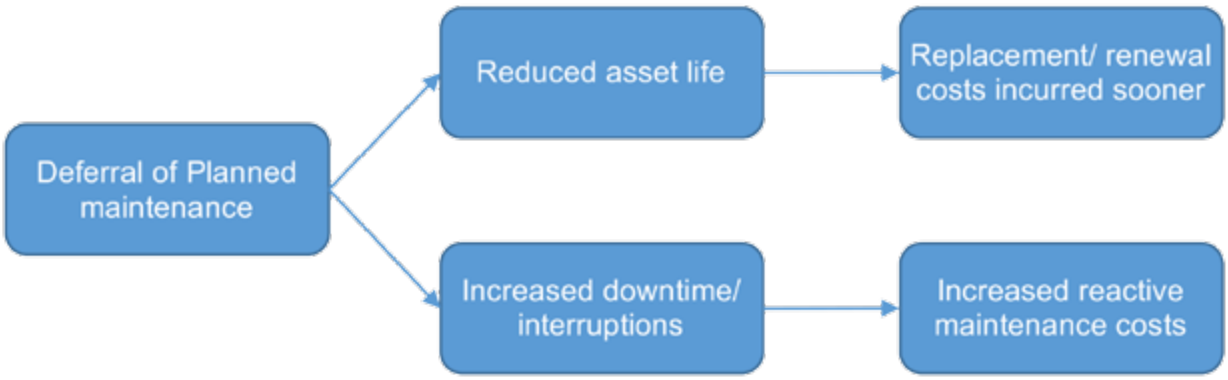


Figure 1: Effects of Deferring Planned Maintenance

QUANTIFYING THE PAIN OF DEFERRED MAINTENANCE

Asset managers typically draw on a number of tools in dealing with these issues. Asset lifecycle curves (also known as deterioration curves) plot the decline of an asset's performance with the effect of time. Less frequently used, but no less important, are cost curves which plot the increase in annual maintenance costs as an asset ages: in effect, the maintenance costs of an asset become more expensive as it slides down the steep slope of the deterioration curve. Planned maintenance has the effect of pushing the deterioration and cost curves outwards, effectively extending the life of the asset, maintaining performance levels for longer, and delaying the need to incur replacement costs. These are shown conceptually in Figure 2.

Conversely, deferring planned maintenance has the opposite effect: it pushes the deterioration and cost curve inwards from where they would otherwise have been.

While most asset managers are familiar with these curves as conceptual or explanatory tools, what's needed is a means of generating them with actual data, for real assets, and then deriving best estimates of the benefits of planned maintenance. This is where we put our analytics to work…

BUILDING THE MODEL

A customised model has to be built to reflect the specifics of a particular asset portfolio, and requires data on each of the following, by asset:

i. The expected useful life of the asset

ii. The replacement cost of the asset

iii. The annual cost of planned maintenance

iv. The annual cost of reactive maintenance (when planned maintenance occurs) for each phase of the asset's life

v. The annual cost of reactive maintenance in the absence of some or all of planned maintenance for each phase of the asset's life, and

vi. The amount by which the expected useful life of the asset decreases in the absence of a proper planned maintenance regime.

As with all analytics undertakings, the effort is data-intensive and requires the most effort the first time it is undertaken. Senior management commitment to the collection, cleansing and analysis of data is a necessity for any credible analytics effort. It's reassuring to note however that subsequent runs of the model and 'tweaks' require far less effort.

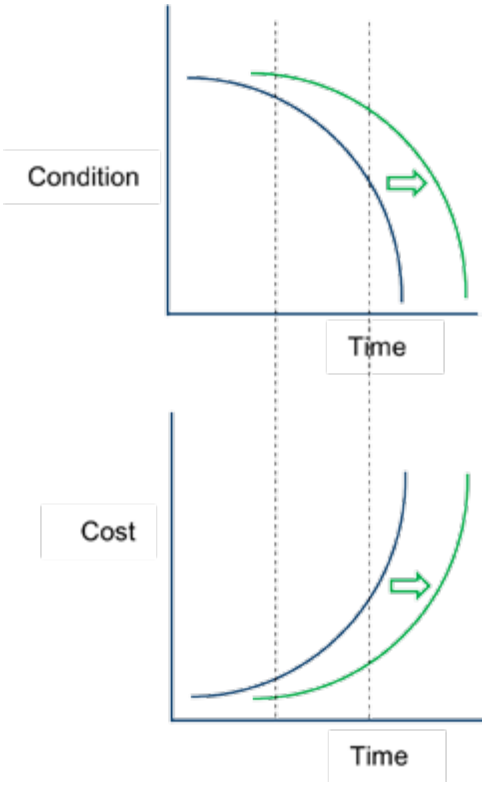


Figure 2: Deterioration Curve, Cost Curve and Effect of Planned Maintenance on Each

PUTTING THE MODEL TO WORK: A CASE STUDY

To see how the model works we will use an example with a single asset (a 500kW commercial steam boiler) so the concepts and calculations can be seen. The same principles apply with a whole asset portfolio, but simply on a larger scale.

The data used here are hypothetical but will serve to illustrate how the model works in practice. In our scenario, the boiler is 10 years into its expected life and has been properly maintained until now. Senior Finance staff are considering deferring maintenance on this asset for 10 years and reallocating the funds elsewhere.

The manager of this asset has collected and analysed data from within the portfolio, as well as gathering information from industry and trade publications and experts, and determined the following (financial figures are in inflation-adjusted terms):

i. The expected life of the asset when it is properly maintained is 30 years; thus 20 years remain if the asset receives proper planned maintenance

ii. The replacement cost of this asset is $85,000

iii. Planned maintenance costs $900 per annum

iv. Reactive maintenance costs when planned maintenance occurs are $500 per year for the first 10 years of the asset's life, $750 per annum for the next tranche of 10 years, and $1,100 per annum in the final 10 years of the boiler's expected useful life

v. Reactive maintenance costs when planned maintenance is deferred for 10 years are $1,000 per annum for the second tranche of 10 years, and rise to $2,300 per annum in the last 10-year period (owing to the need for extensive asset renewal)

vi. The expected useful remaining life of the asset with 10 years of deferred planned maintenance reduces from 20 years down to 17 years.

The data in items iii, iv and v above enable us to construct cost curves for this asset, as shown in Figure 3.

Figure 3: Annual Planned and Reactive Maintenance Costs

With this information in hand, we now construct two scenarios: one with a proper planned maintenance regime, that is with maintenance not deferred (which serves as a comparator) and the other with deferred maintenance. The impact of deferred maintenance is the difference between the two scenarios. We'll use a 20-year time horizon for the analysis.

Using the figures above, the cash flows for the remaining 20 years of the life of the boiler with planned maintenance are shown as per the graph in Figure 4.

The main thing to note is the increase in reactive maintenance in the final 10 years of the asset's life. The total maintenance expenditure over 20 years under this scenario is $36,500. Taking into account the effects of time (ie. discounting the cash flows at a rate of 7 percent) produces a net present cost of $18,730.

Figure 5 shows the graph of cash flows under the second scenario where maintenance is deferred.

The deferred maintenance scenario shows the steep increase in reactive maintenance costs at the beginning of the second 10-year period, but the standout item is the replacement cost incurred in year 17 (note that the $85,000 replacement cost is mapped against the right-hand axis). Reactive maintenance costs in the last three years reduce because the asset is a new asset.

Total maintenance expenditure over 20 years under the deferred maintenance scenario is $121,600 or a net present cost (at a discount rate of 7 percent) of $43,862.

The bottom line: deferring maintenance actually leads to costs which are $85,100 higher over the 20-year period ($121,600 minus $36,500), or $25,132 higher ($43,862 minus $18,730) once the effects of time are taken into account. Thus, the 'savings' from deferring maintenance are actually a false economy: the costs associated with increased reactive maintenance and earlier asset replacement outweigh the savings from deferring maintenance.

These then, are the figures the asset manager would be armed with to take to decision-makers in Finance or the Executive Budget Committee.

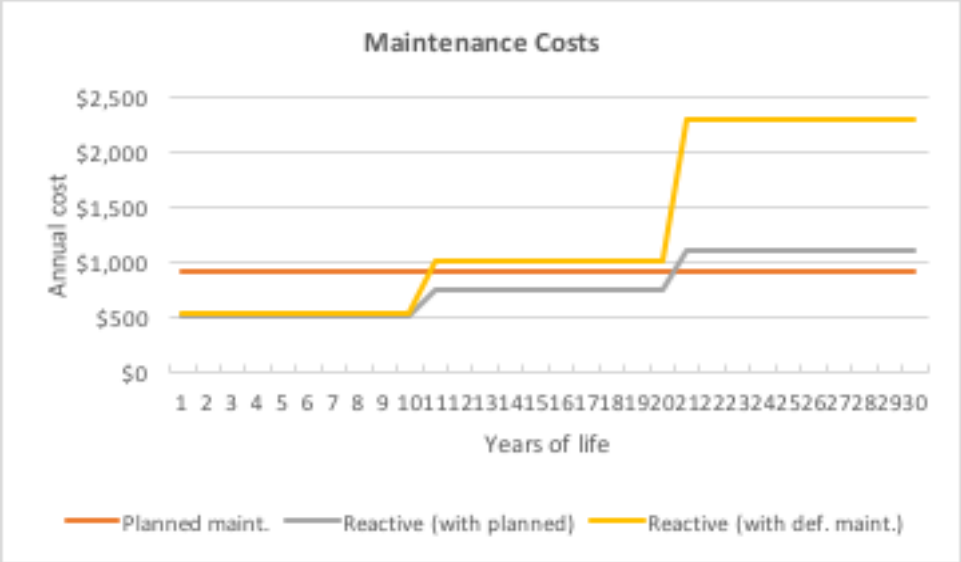


Figure 3: Annual Planned and Reactive Maintenance Costs

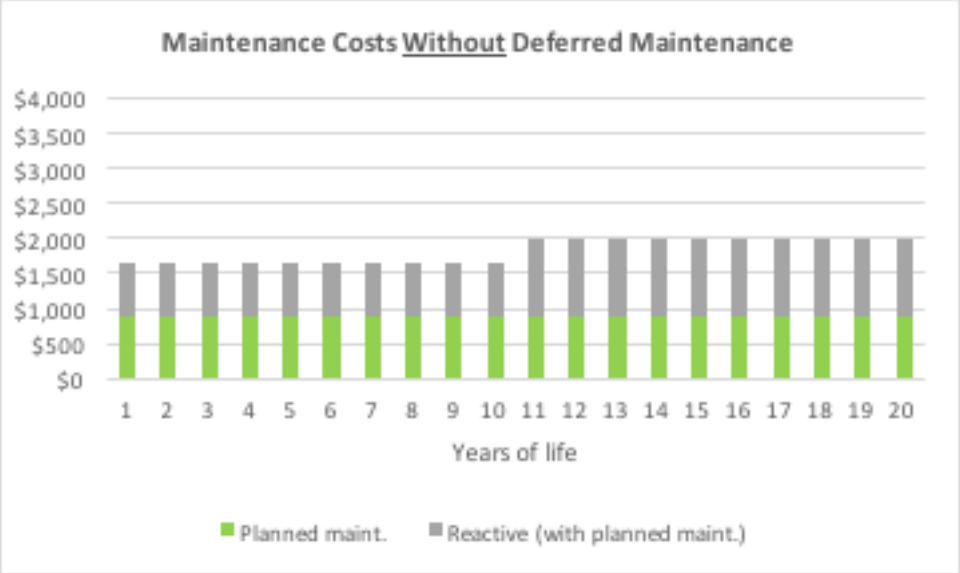


Figure 4: Maintenance Costs with Maintenance Not

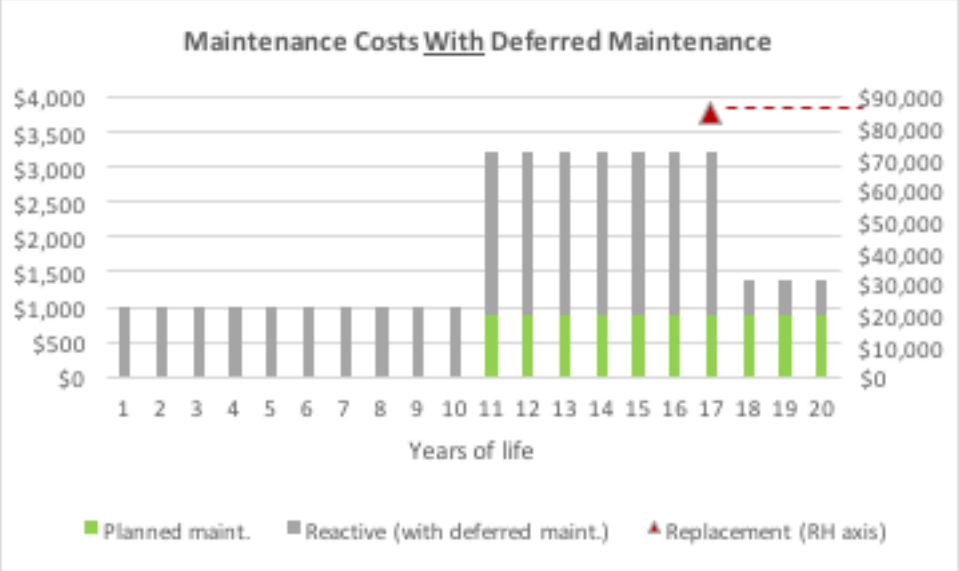


Figure 5: Maintenance Costs With Deferred Maintenance

WHERE DO THE NUMBERS COME FROM?

As we've seen, making the case to stop maintenance being deferred relies on putting together several key data items: where are the data for these items sourced from?

Expected useful life of an asset would be known from manufacturer's specifications or engineering experience. Replacement cost would be ascertained from market data or commercially available cost guides. Data on the cost of planned maintenance would be gathered from the organisation's historical financial data. Data on the relationship between reactive and planned maintenance costs, and on the degradation of expected useful asset life in the absence of planned maintenance, are critical to quantifying the impact of deferred maintenance. There are two main ways to derive these data items.

One way is to gather information from industry experts, trade associations or academic studies. These might be in the form of specific dollar values for reactive maintenance compared with planned maintenance, or a degradation factor which is applied to reactive maintenance costs and expected useful life.

The other way is to undertake (or commission) analysis and calculate these values from the organisation's own operating history. Plotting reactive maintenance costs against planned maintenance costs and using regression analysis to establish the relationship between them (refer Figure 6 below: again the data here is hypothetical for illustrative purposes only) is a powerful application of analytics and one that is at the heart of evidence-based asset management.

Of course, this line will also partially reflect the age of the asset: cross-referencing data on maintenance cost with that on asset age allows further regression analysis which 'unpacks' the cost impact of a certain amount of maintenance spend at a particular stage of asset life.

As we've noted, all this data collection and analysis requires commitment; it can seem like a major effort.

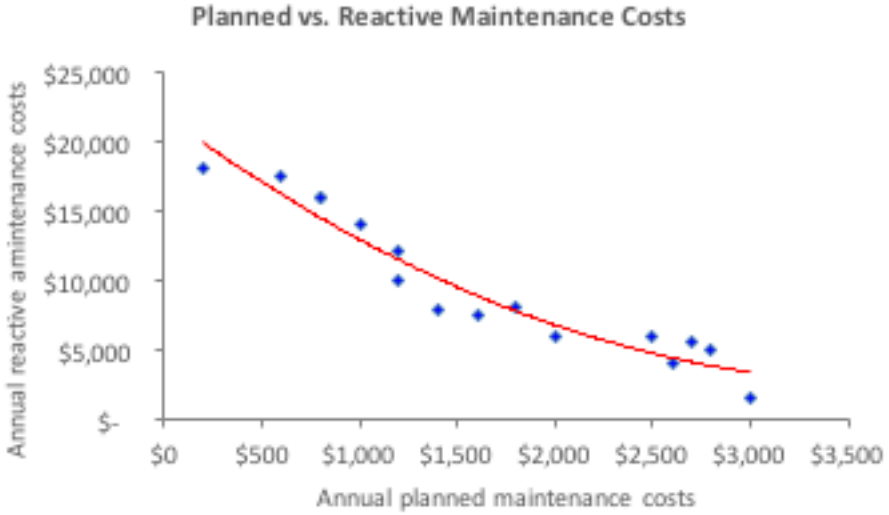
However, as with asset maintenance itself, the return is well worth the investment.

REFERENCES

Feunekes, Ugo et. al 'Taking the Politics Out of Paving: Achieving Transportation Asset Management Excellence Through OR' Interfaces January–February 2011 pp.51-65. Koo, Wei Lin, and Van Hoy, Tracy (2000) 'Determining the Economic Value of Preventive Maintenance' Jones Lang LaSalle Research Paper.

Rawlinson (2017) Australian Construction Cost Handbook Edition 35. Michael Carman is a consultant specialising in the application of analytics to improve business performance. Contact: info@mcarmanconsulting.com

Figure 6: Plotting Planned and Reactive Maintenance Costs Against



ARTICLE 2 – IMPROVING PROFITS USING DATA

Mustapha El Hayek, Meridium Ian Gordon, Meridium

Summary: Asset-intensive industries continually strive to improve profitability while at the same time reducing business risk and expenditure. Today's financial climate and market competition require organizations to improve productivity and asset performance with less resources and capital. A recent study indicated that around 47% of organizations associated the inability to achieve asset management goals with the 'lack of visibility into actual asset condition and performance'. Asset Performance Management (APM) encompasses the ability to connect assets, people, strategies, and information in order to obtain actionable insights and allows timely detection of problems and anomalies. This is enabled by the ability to intelligently combine big amounts of data residing in Enterprise Asset Management systems, real time and condition monitoring systems and inspection routes. This overwhelming amount of data, once put in the proper context for asset performance monitoring and evaluation, will provide an opportunity to understand trends and emerging business risks. By intelligently applying 'algorithms' to the data, organizations can free up resources from laborious data-gathering tasks, and divert attention to higher value pursuits such as RCAs and strategy reviews across a broader scale of assets. Not only will this translate into significant financial gains (higher availability and lower costs), but will also have a positive impact on the organizational OH&S performance.

Key Words Big Data, Asset Performance Management, Asset Health Management, Asset Condition Assessment, Prognostics

WHY BIG?

For many decades, asset intensive organizations have been collecting data to improve asset performance. Over the last few years, the term 'Big Date' has been referred to repeatedly by executives, practitioners, and vendors across industry forums, online blogs, and social media. Recently, the level of interest has shifted from understanding 'what Big Data is' more towards 'How can we use Big Data to improve asset performance and revenue".

According to an IDC Digital Universe Study, the amount of digital data is growing exponentially with a projected 16 billion interconnected devices by 2016 (compared to 1 billion in 2006). In fact the same source has estimated that the value of leveraging on Big Data in the Health Industry alone is in excess of $300 billion.

So, what is Big Data? And how can organizations use it advantageously? Big data refers to massive data sets whose size surpasses that of what standard tools can manage (Column Five media). The data comes at a velocity, variety, and volume that traditional solutions cannot process (LNS). According to a recent LNS study, operators and asset owners today do not suffer from tools required to handle this, but rather from the ability to convert data to intelligence and actionable insights. This is nothing but the skills required to create and retain asset knowledge.

So, the potential from asset-level data is the ability to process, analyze, apprehend, and make conclusions based on the information contained within our big data sets. Expending resources to manually accumulate that data from multiple data sources, make sense of all information, and derive proper decisions is, at best, debatable. This is particular in today's financial climate and market competition, where organizations are required to improve productivity and asset performance with less resources and capital.

BIG DATA IN APM

Asset Performance Management (APM) connects assets, strategies, people and information to create a holistic view of the plant operations. To improve asset performance, the ability to define asset risks is vital, but may not be enough. It is important that stakeholders have a broad and comprehensive view of the asset condition when making decisions which may affect the health of physical assets. Applying the "Plan, Do, Check, Act" cycle is one of the pillars of a successful APM program. This cycle leverages on existing data sources in a manufacturing plant.

Figure I presents a high level overview of how an integrated Asset Performance Management process can be designed.

Defining sound and well-articulated asset strategies which are based on criticality and failure risk is one of the foundational work processes in any reliability driven organization. Actions derived from asset strategies define how physical asset are to be managed for the defined function and operating context. As these actions are implemented and executed in the field, asset-level data is generated.

There are numerous systems where asset-level data is stored and processed. Process Historians are used to capture process variables like pressures, temperatures, RPMs, etc. EAMs and CMMS systems are used to house asset registers and manage daily work, capture costs, and cope with schedules and resource requirements. Condition Monitoring systems are used to store asset condition data such as vibration, infrared, lube oil analysis, etc. Inspection data captured through daily operator routes are kept in spreadsheets or Operator Rounds Systems. This is in addition to integrity asset systems that record data such as wall thicknesses, corrosion rates, remaining life, etc.

These massive data sets, when combined and put in the right context by applying smart 'algorithms' or and monitoring logic, can generate a wealth of timely information and intelligence on critical asset issues, and help asset owners with an actionable insight on overall asset health and current risks.

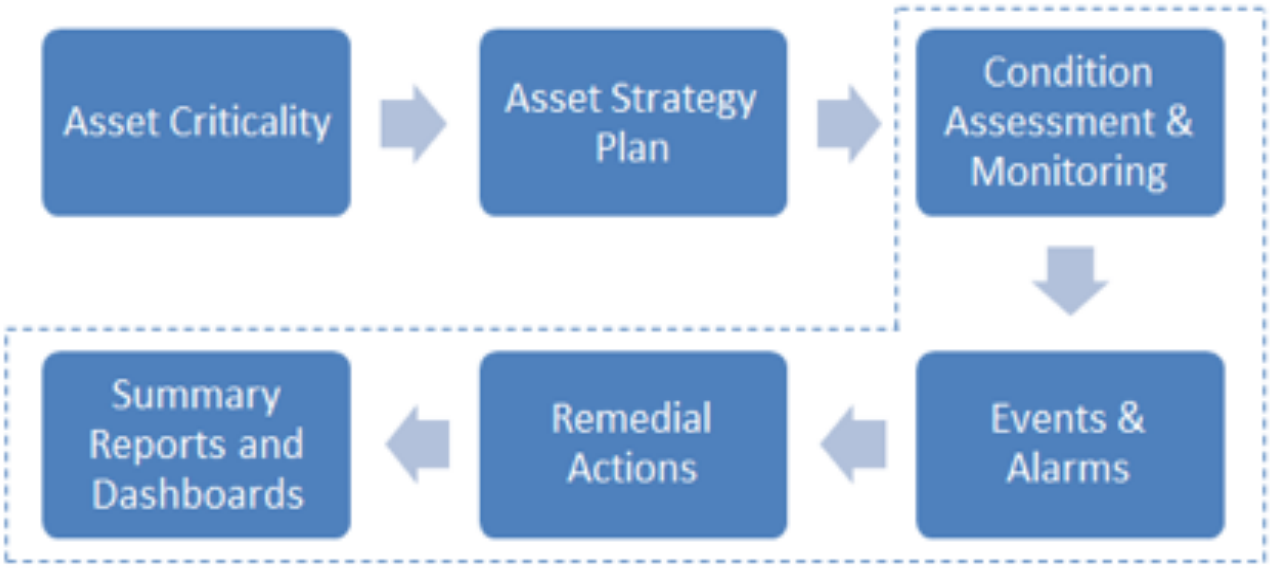


Figure I – Integrated Asset Management System

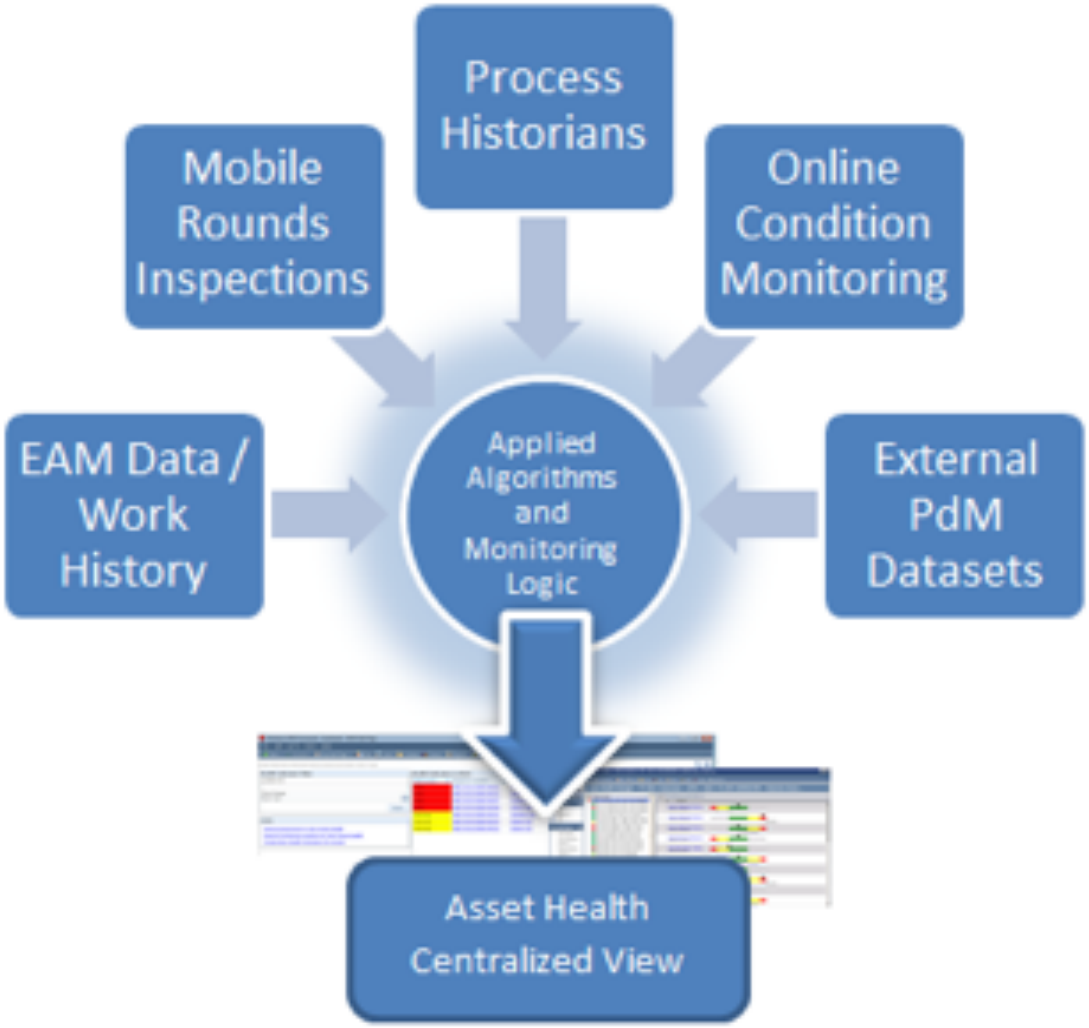


Figure II – Integrated Asset Health Management

ASSET MONITORING POLICIES

It has been mentioned that the ability to combine contextual information derived from multiple data sources will help asset owners evaluate asset performance and make good and timely decisions. The below diagram illustrates how advanced tools have been used to build algorithms or 'policies' to analyze asset level data as defined by the analyst, and trigger alerts and remedial actions when a combination of asset conditions have been met. Not only will this empower asset management practitioners by allowing them to build and take ownership of these policies and therefore become less dependent on IT resources, but will also divert their attention to higher value pursuits like reviewing asset strategies, facilitating RCAs, and analyzing asset Life-Cycle Costs.

The following section will present some working examples on how such policies can be used to evaluate asset risk and trigger alerts and remedial actions.

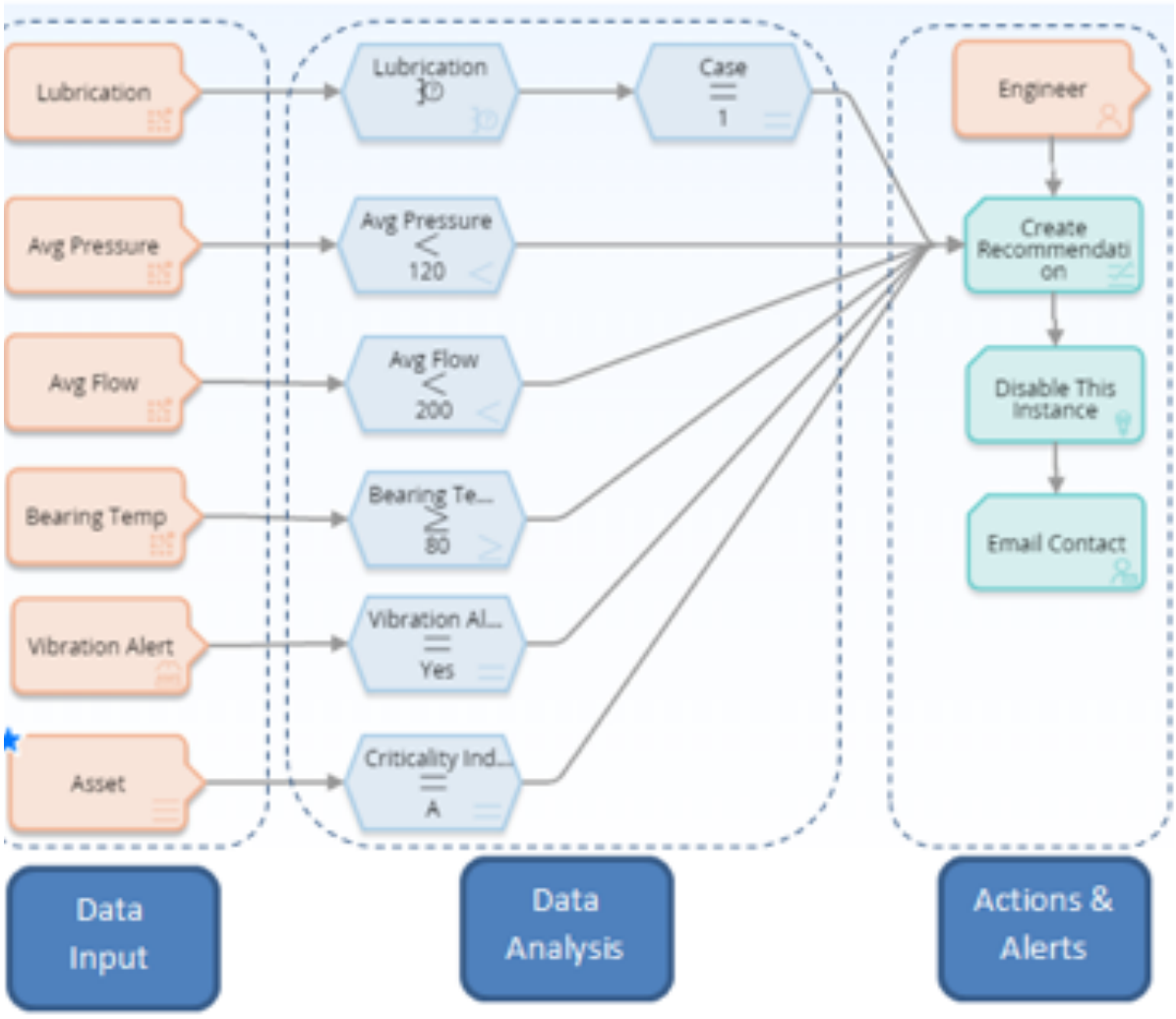


Figure III – Prolonging the P-F Inteval

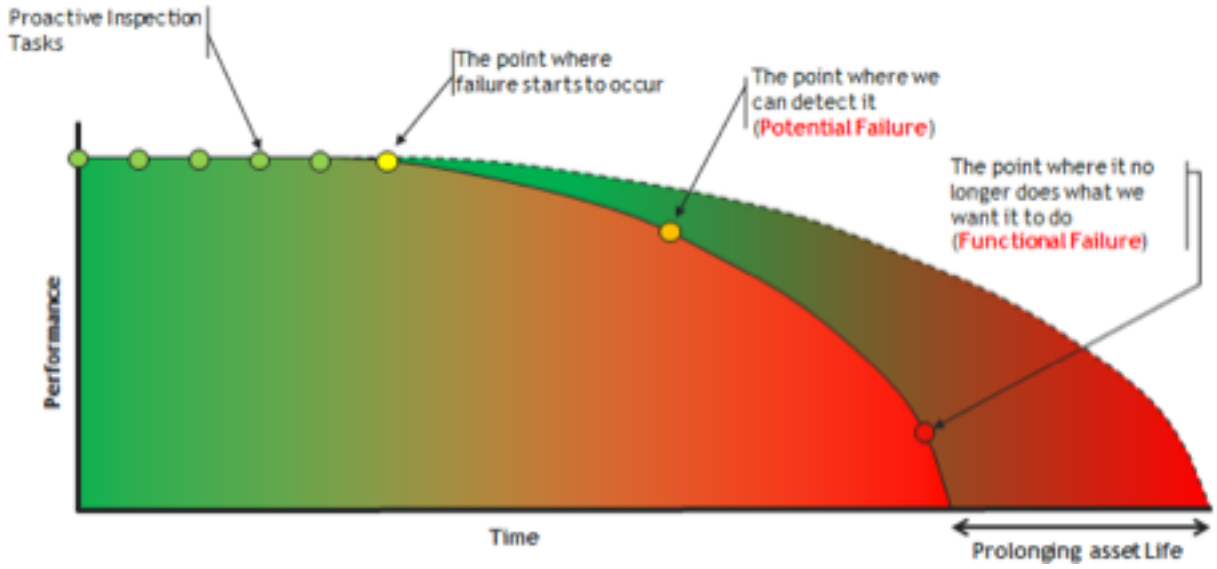


Figure III – Prolonging the P-F Inteval

PROLONGING THE P-F INTERVAL

Many times, failure occurs because we fail to pick up 'weak' signals from assets which when combined will suggest that immediate action needs to be taken to avoid slipping into the potential failure condition.

For example, a gradual increase in an intake manifold temperature may be perceived by the operator as normal, and most of the time will go undetected. However, once accompanied by a slight increase in torque is an indication that the asset is about to fail, thereby causing significant production downtime. Having a policy similar to the above that continuously monitors both variables for all similar asset types, and sends alert notifications once the combination has exceeded the predefined thresholds can help detect risks early; thereby 'prolonging' the asset's P-F interval and consequently reducing the number and/or magnitude of undesirable events.

INTEGRITY & SAFETY OPERATING WINDOWS

Section 6.4 of API 580 states that "It may be worthwhile to monitor key performance parameters to determine whether operations are maintained within boundaries". IAPI 510 Section 5.4.2 also states that understanding the operating conditions as well as other design variables is crucial in identifying potential defects and damage mechanisms.

In today's financial climate, and with organizations running thin on human resources more than ever, the expectation of having practitioners sitting in front of a monitor and continuously monitoring critical process variables seems, at best, unrealistic. Employing the right technologies where an automated alert is sent out or an excursion 'event' is created by the policy when the asset's Integrity Operating Windows are breached. Users can even use advanced policies to monitor the count and duration of these excursions; which in turn becomes an essential input to the evaluation of risk and the definition of inspection requirements.

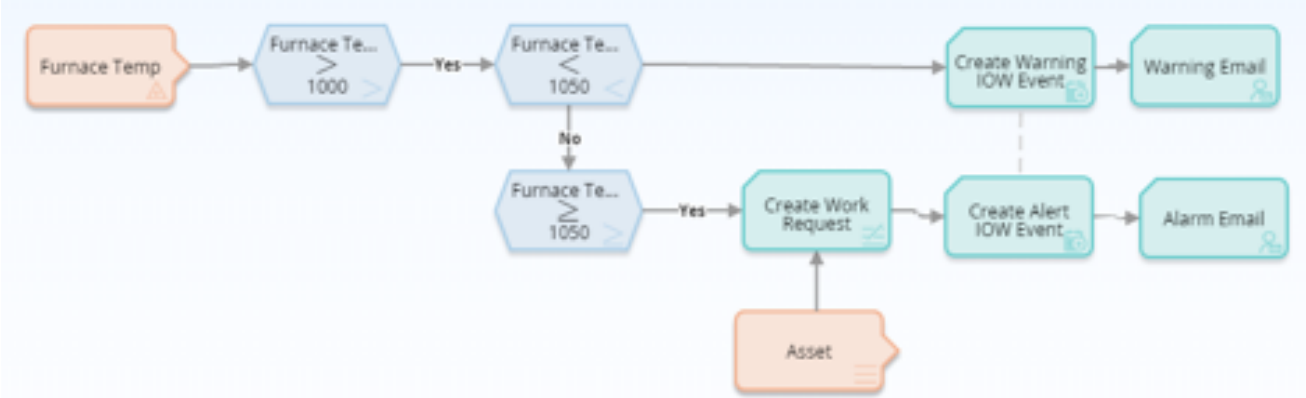


Figure IV – Managing IOWs using Policies

As shown in Figure IV, the very simplest examples of IOWs is the establishment of furnace tube temperature limits to avoid premature rupture or replacement of the tubes. At some pre-established limit, say for example 1000 °F, a furnace tube designed for 950 °F operation would have a shortened service life, so at every occurrence where the temperature limit is exceeded, an alert notification is sent and an IOW event created. At an even higher temperature, say 1050 °F, the integrity team lead might be directed to take more immediate actions or even shut down the furnace if necessary. As one can see, there may be multiple levels of IOW limits for the same process parameter (in this case furnace tube temperature), as well as multiple responses with different response times, depending upon the degree of exceedance of the process parameter limit.

TECH 2

DATA DRIVEN ASSET HEALTH INDEX

As part of a strategy to systemically measure, monitor, analyze, and evaluate the assets' health, policies can be used as a means to create calculated health indicators, such as the overall asset health index. This provides adequate visibility into the overall condition of the physical asset. An asset health index is calculated from multiple conditions and by leveraging the existing sources of data. Readings are factored, weighted, and a score is calculated using the formula defined by the analyst in the policy design. The health index score will also be viewed and managed via corporate asset health dashboards.

SUMMARY

Today's financial climate and market competition require organizations to improve productivity and asset performance with less resources and capital. There is a huge potential for asset-intensive organizations to employ prognostics in enterprise APM programs in order to become more competitive, profitable, and innovative. The potential lays in the ability to tap into the existing data sources, and putting them in the right context to define monitoring policies that will help identify emerging trends and mitigate the risk of failure. To do so, it is important that you ask the right questions and manage your data differently.

Figure V – Asset Health Dashboard

ARTICLE 3 – BIG DATA ANALYTICS FOR A STRATEGIC APPROACH TO ASSET MANAGEMENT

Inna Kolyshkina, Analytikk Consulting
Marcus Brownlow, Analytikk Consulting

Summary: Asset-owning organisations seek to optimise lifecycle planning, budgeting and strategic management.

This paper describes a case study that used Big Data Analytics to provide a large Australian utilities company with data-driven insights that help them to achieve these key objectives for their geographically-diverse high-value asset portfolio.

To deliver the required insights, we applied best-practice Data Science techniques to identify the key factors and their combinations that affect asset maintenance cost and reliability, and to quantify the extent of their influence. We combined rich asset attribute data with historical maintenance records and external geographical and environmental/socioeconomic data. The resulting large and rich data set formed the basis of the advanced machine learning analysis we undertook.

The solution delivered was easy to use and understand. It enabled the organisation to proactively identify problematic or costly assets prior to asset failure and to use predicted future costs to inform annual maintenance activity. Intelligent allocation of limited maintenance resources and the accurate forecasting of future asset costs were the key strategic benefits of this project.

This data-driven approach can be used by any organisation that manages assets and seeks to reduce asset failure rate and optimise maintenance cost and effort.

Keywords: Asset Management, Big Data, Predictive Analytics, Machine Learning, Data Analysis, Case Studies, Lifecycle Cost Forecasting, Evidence-Based Decisions

INTRODUCTION

Big Data methods have become increasingly popular and effective in the asset management field (see, for example, [1]– [5]). This paper discusses how asset-owning organisations can use Big Data analytics to optimise asset lifecycle planning, budgeting and strategic management.

The paper describes a case study where organisational data were successfully used to generate actionable insights that aided proactive, effective, evidence-based business decisions.

It discusses in detail analytical techniques used to build the required solution as well as data-related issues and how they were resolved.

The case study involves a large Australian utility provider with high-value assets dispersed over a wide geographical area with a variety of operational and environmental factors impacting the occurrence of failures and maintenance cost generation (to maintain confidentiality of the client some details have been adapted).

The scalability and more general applications of the approach are identified showing the potential of this approach for future value improvements in strategic asset management.

BACKGROUND AND BUSINESS OBJECTIVES

A large Australian utility provider owns large numbers of high-value assets spread over a wide geographical area. The assets generate considerable maintenance cost every year, sometimes the cost exceeds the available limited funding. It then becomes crucial to optimise maintenance spend ensuring that the issues are prioritised by the degree of high cost risk generation or serious failure, and then maintenance resources are allocated in the optimal way and issues are efficiently addressed.

Additionally, asset failures create reliability concerns and it was necessary to reduce their occurrence by improving maintenance process aiming to prevent failures where possible, and to optimise the time and effort required to resolve the failure and any consequences it generated.

The organisation sought a more strategic approach to optimising its maintenance and lifecycle spend with a limited budget while at the same time increasing the reliability of essential infrastructure services to the community. It was also important to identify the individual assets that were likely to incur the highest cost and failure occurrence in the future to enable the organisation to optimise strategies for future maintenance, remediation and/or replacement of these assets.

Another important driver was to demonstrate compliance with regulatory requirements.

The organisation wished to approach these key objectives in an innovative, efficient way by leveraging the wealth of the organisational data.

APPROACH OVERVIEW

Big Data analytical techniques were applied to large volumes of internal historical data combined with a variety of external variables impacting the outcomes of interest in order to build solutions that aided successful, evidence-based business decisions regarding maintenance optimisation. This included identifying individual assets at highest risk of generating large costs or failure, and design of successful interventions.

As a first step to build the data-driven solution that would deliver the required insights, the relevant factors that had potential to influence asset maintenance cost and failure occurrence were identified. This was done in close consultation with the organisation subject matter experts.

Next, rich asset attribute data was combined with historical maintenance records and external geographical, environmental and socioeconomic data. The resulting large and rich data set comprising hundreds of variables and millions of records formed the basis of the advanced analysis undertaken.

Finally, powerful Big Data analytic techniques were applied to the data aiming to identify the key factors (and their combinations) that affect asset maintenance cost and failure occurrences and to quantify the extent of influence of each factor.

The resulting solution was easy to read and understand as well as implement into organisational data.

DATA USED: DESCRIPTION AND ISSUES

Data Description

In consultation with the organisation subject matter experts, as many as possible internal and external factors that could potentially influence cost and failure, were identified and included for consideration.

The resulting data comprised millions of records and up to five hundred variables and included in-house asset records such as asset type; model; manufacturer; location; installation date; replacement and overhaul dates; operational performance statistics and maintenance records over about fifteen years. Management variables were also included such as different policies/strategies in different regions. Environmental data included temperature, rainfall, humidity, wind and seasonal variability. Additionally, for each asset component, information was included on asset technical characteristics such as voltage, size, capacity, etc. and information about the type, size and technical characteristics of the facility where the asset component is located. The relevant technical, environmental, geographical and socioeconomic factors describing the location of the facility (for example, distance from the city and proximity to the coast) were matched against asset performance history.

Data Quality Assessment and Preparation for Analysis

To ensure data quality and consistency, thorough data audits were conducted including detailed exploratory data analysis. Additionally, reality checks were devised in collaboration with organisational subject matter experts to identify any unusual data values or patterns. Where anomalies or inconsistencies were detected, these were reported to the relevant experts and remediated.

Data were then reorganised into a layout suitable for modelling. The layout followed what is variously termed in statistical and econometric literature as longitudinal data [6], Time Series Cross Sectional data [7], repeated measures data [8] or panel data [9], where the same units are observed repeatedly through time. For the purpose of this paper, the term longitudinal is used.

All maintenance cost figures were adjusted for inflation using CPI data from Reserve Bank of Australia [10].

Established Data Issues

In the process of data assessment, it was established that the analysis was potentially affected by several features of the data, specifically high level of random variation, sparseness and, for some types of assets, small number of failure records. Such data issues are fairly typical for asset data, and it makes sense to consider each issue in detail.

1. Random Variation

Conventional opinion suggests that the main driver of maintenance cost and failure is asset age. Cost analysts often describe Life Cycle Costs as following a bathtub cost vs age curve (Figure I), which is generally related to the more common reliability bathtub curve [11].

This is defined by a system experiencing early failures during the burn-in phase due to manufacturing and design defects that are gradually remedied. The next phase is a long period of operation with stable maintenance costs and after the system reaches a certain age, costs begin to rise during the wear-out or ageing phase. The bathtub curve [11] is often used to describe the generalised cost and failure trend over time [12]. It would therefore be reasonable to expect that a significant amount of variation in our data would be explained by a curve of this type.

However, exploratory data analysis identified a high level of random variation in both cost and failure data when related to asset age. See, for example Figures 2 and 3, that show graphs representing asset annual maintenance cost and annual failure count plotted against the asset age for specific asset types.

Review of these diagrams shows that the dots indicating number of failures per year (Figure II) and annual maintenance cost (Figure III) are not closely aligned along the curve of the best fit (in our example this curve is represented by polynomial regression, but similar results were obtained for curves fitted by three other curve-fitting methods). On the contrary, at any age point the variability of each outcome is quite high, varying from zero to the maximum of the range.

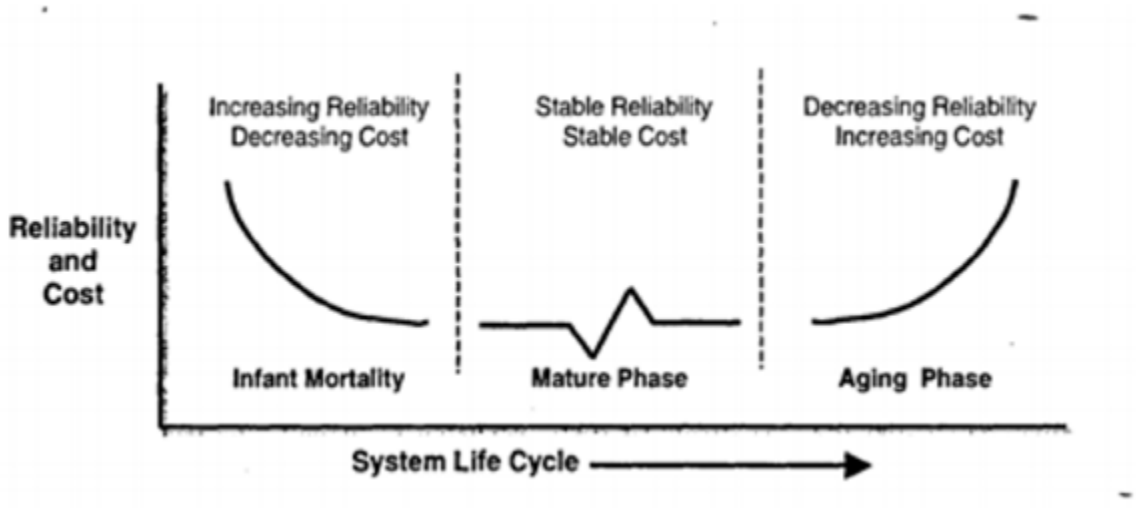
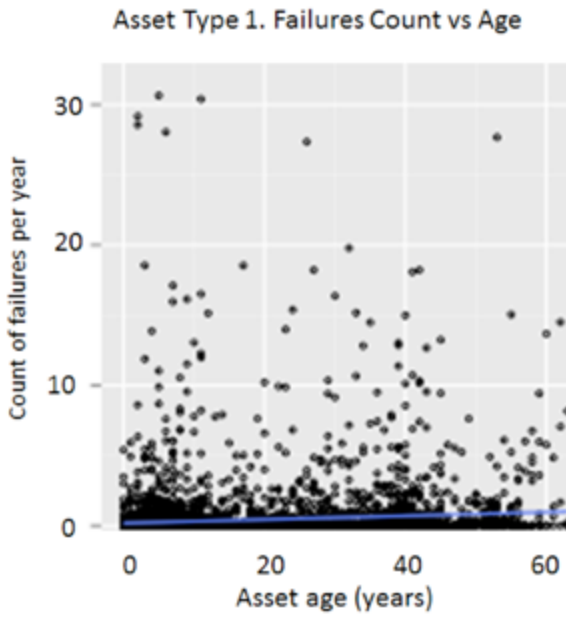


Figure I Bathtub Cost Vs Age Curve

This suggests that while asset age does play a significant role in explaining maintenance cost generation and failure occurrence, there are other important factors besides it that have a strong influence on the outcomes of interest.

Figure II



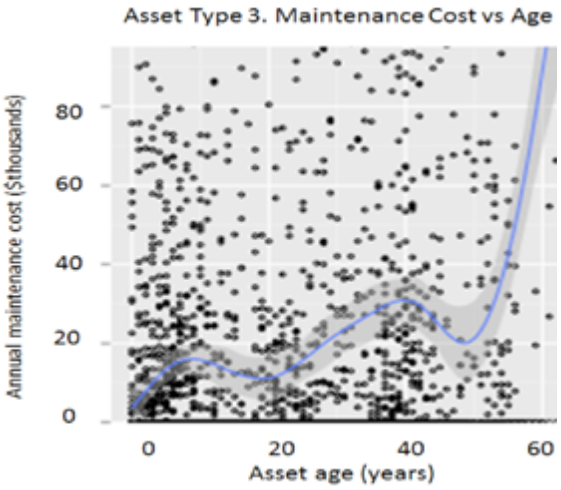


Figure III

Further analysis showed that a considerable amount of the outcome variability was explained by asset subtype, model and manufacturer; as well as climate, geographic and socioeconomic characteristics of the facility such as proximity to the coast and the degree of remoteness; operation and performance history of the individual asset, location and technical environment; and other factors.

2. Sparseness

To accurately estimate an analytical model, it is necessary to have enough data to estimate all parameters included in the model. If it is desired to include in the model all potential variable combinations to ensure that no influential factor is overlooked, then all parameters related to each category of every variable as well as all interactions of the categories if such categories and interactions are directly included in the model need to be estimated.

In the situation where the data contains many variables with a large number of categories, the number of such parameters can quickly exceed the number of available data records. For example, if the variable representing asset model had about 500 categories and the variable representing geographical region had about 200 categories, then the inclusion of an interaction of these variables would generate $500 \times 200 = 100{,}000$ parameters. To overlay these interactions with, say, the variable representing asset technical usage details which has fifteen categories, would generate 1,500,000 parameters, and the number would continue to increase multiplicatively as more interactions were considered with other variables such as age, distance from the nearest maintenance centre, fire danger index etc.

The model would then require the provision of much more data than were actually available.

3. Limited Number of Failure Records for Some Asset Types

For certain asset types failures occur very rarely and therefore only a very small number of non-zero failure data points was available for use in modelling which potentially complicated analysis and required special consideration for modelling such asset types.

Analytical Modelling Description

A modelling approach was devised that aimed to deliver superior predictive power by enhancing classical statistical methods with contemporary Big Data and Data Science techniques. These techniques derive maximum value out of data while effectively addressing various data limitations. They have been proven to be effective in cases of noisy, sparse and otherwise suboptimal data and are widely used in many industries with great success.

The techniques used included Random Forests [13],

Stochastic Gradient Boosting [14]– [16], LASSO regression [17], Multivariate adaptive regression splines (MARS) [18], [19] and various types of Regression Trees [20]– [25]. To counteract the effect of the limited number of failure records for certain asset types, Synthetic Minority Over-Sampling Technique (SMOTE) [26] and Random Over-Sampling (ROSE) [27] were also used.

The modelling was conducted as follows. First, all factors predictive of the outcomes were selected out of the vast amount of the available variables while the established data issues were suitably addressed. To achieve this, advanced feature selection approaches based on combination of Random Forests and Stochastic Gradient Boosting with correlation analysis (see, for example, [28]) were used.

Next, a number of suitable modelling approaches were identified and applied to the selected predictors, their performance was compared and the models that best fitted the data were chosen. The modelling methods compared included generalised linear mixed models (GLMM) [29], Zero-Inflated Regression models [30], [31], Hurdle models [32], [33], MARS, LASSO regression and Regression Trees as well as combinations of the above methods.

Finally, model fit was thoroughly assessed by relevant statistical criteria. The assessment showed that the selected cost and failure models exhibited good fit and strong alignment between observed and expected values across the range of responses.

RESULTS AND FINDINGS

Summary

The models allowed the key drivers of the maintenance cost and asset failures to be established and the extent of each effect, quantified.

The solution therefore identified what levers were available to strategically plan the Facility Management operations to minimise overall cost and maximise reliability. Additionally, the models enabled the individual assets at highest risk of cost generation or failure to be identified.

The findings were evaluated and validated by the organisation's subject matter experts.

The solution developed comprised a set of human- and machine-readable business rules that were easy to understand and deploy in the organisation's systems.

Examples of the detailed findings

Overall, for the majority of asset types the main factors driving cost and failure were asset age; number and pattern of historical failures; performance of the equipment directly connected with the asset; history of maintenance in previous years; asset model, manufacturer and type; asset operational characteristics (frequency, consistency, magnitude etc.); characteristics of the facility the asset was located at (e.g. facility type, size, distance from the city, region, average age of assets at the given facility etc.) and weather conditions at the asset location.

For some asset types, failures were to a lesser degree driven by asset age with asset model and manufacturer being more predictive of the outcome.

Additionally, for the asset types where failures were extremely rare, modelling sought to establish whether such failures occurred at random or whether they followed a detectable pattern. Where the modelling detected the presence of a pattern, the pattern was described in detail.

Identifying at-risk assets

One of the objectives of the project was to identify the assets that are likely to incur the highest cost and failure occurrence in the future and thus enable the organisation to develop strategies for remediation or replacement of these assets.

The models allowed us easy identification of such at-risk assets. This is illustrated by the gains chart [34], [35] in Figure IV.

The horizontal axis of the gains chart shows cases ranked by the model-predicted outcome such as cost amount or failure count from the highest to the lowest. The axis is divided into deciles (i.e., top 10%, next 10% etc.). The vertical axis shows the cumulative percentage of total actual outcome (cost, or failure count) captured by each decile. In this way, the assets responsible for the highest proportion of cost or failures are ranked at the left side of the plot and thus easily identified.

The overall shape of the gains chart reflects the proportion of assets responsible for known

proportions of total cost or failures: the steeper the curve, the better the model identifies at-risk assets.

Figure IV: Gains chart.

The chart in Figure IV shows that the model identified top 20 percent of assets that generated more than two-thirds of all the maintenance cost.

GENERAL APPLICATIONS FOR THE METHODS USED

The approach described is generally applicable for any organisation that owns infrastructure assets to facilitate making evidence-based, informed decisions regarding effective interventions and maintenance planning to reduce asset failure rates, optimise maintenance spend and effort and identify at-risk assets that require immediate attention.

The solution is easy to understand and deploy in organisational systems as it is representable as set of human- and machine-readable business rules. A simplified example of the business rules generated by the solution is provided below (as mentioned earlier, some details have been adapted to ensure client confidentiality).

- If the asset is of type 1 AND
- the asset age is greater than 35 years AND
- is located in a facility where distance from the maintenance centre is greater than two hundred kilometres AND
- the distance of the facility from the coast is less than one kilometre

then the annual cost forecast for such assets is $50,000 (which means that annual maintenance cost for this asset is up to ten times higher than for the average asset of this type).

Some Examples of Organisations Where Such a Solution Would Be of Benefit.

- Electrical generating and distribution infrastructure including generating plant, lines and poles, substations, circuit breakers, switching equipment, etc.
- Water treatment and distribution infrastructure with pipework, valves, pumps, water treatment plant,etc
- Road and rail tunnels with power supply systems, substations, lighting, ventilation and fire safety systems.

CONCLUSIONS

This paper describes how Big Data analytics techniques were used by a large Australian utility provider to enable evidence-based decisions related to optimising organisational asset maintenance and lifecycle spend with a limited budget, increasing the reliability of essential infrastructure services to the community, demonstrating compliance with regulatory requirements and identifying the individual assets that were likely to incur the highest cost and failure occurrence. To achieve the required objectives, a customised Big Data analytic-based approach was devised that aimed to deliver superior insight-generating power by applying to organisational data the contemporary Big Data and Data Science techniques that are widely and successfully used in many industries to derive business insight out of large and complex data.

The approach described is generally applicable for any organisation that owns infrastructure assets to facilitate making evidence-based, informed decisions regarding effective interventions and maintenance planning to reduce asset failure rates, optimise maintenance spend and effort as well as identify at-risk assets that require immediate attention. The solution generated business rules that are easy to understand and deploy in operations by the business managers as well as provide a strategic insight into the key drivers of maintenance costs and failures thus enabling optimal risk management and planning. Organisations where such a solution would be of benefit include: hospitals with a large number of plant

assets; commercial buildings with mechanical, electrical, hydraulic, transport and fire protection systems; electrical generating and distribution infrastructure; water treatment and distribution infrastructure; road and rail tunnels.

REFERENCES

[1] J. Bughin, M. Chui, and J. Manyika, Clouds, big data, and smart assets: Ten tech-enabled business trends to watch, McKinsey Q., vol. 56, no. 1, pp. 75–86, 2010.

[2] S. LaValle, E. Lesser, R. Shockley, M. Hopkins, and N. Kruschwitz, Big Data, Analytics and the Path from Insights to Value, MIT Sloan Manag. Rev., vol. 52, no. 2, 2011.

[3] M. Kezunovic, L. Xie, and G. Santiago, The role of big data in improving power system operation and protection., in Bulk Power System Dynamics and Control - IX Optimization, Security and Control of the Emerging Power Grid (IREP), 2013 IREP Symposium, 2013, pp. 1–9.

[4] P.-C. Chen, T. Dokic, and M. Kezunovic, The use of Big Data for outage management in distribution systems, in International Conference on Electricity Distribution (CIRED) Workshop, 2014.

[5] J. Feblowitz, Analytics in Oil and Gas: The Big Deal About Big Data, in SPE Digital Energy Conference, 2013.

[6] S. L. Zeger and K. Y. Liang, Longitudinal data analysis for discrete and continuous outcomes., Biometrics, vol. 42, no. 1, pp. 121–30, Mar. 1986.

[7] A. S. Banks and K. A. Wilson, Cross-National Time-Series Data Archive, Jerusalem, Israel, 2015.

[8] M. J. Lindstrom and D. M. Bates, Nonlinear mixed effects models for repeated measures data., Biometrics, vol. 46, no. 3, pp. 673–87, Sep. 1990.

[9] M. Arellano and S. Bond, Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations, Rev. Econ. Stud., vol. 58, pp. 277–297, 1991.

[10] Reserve Bank of Australia, RBA Statistics, {RBA} Statistics, 2015. [Online]. Available: http://www.rba.gov.au/statistics/. [Accessed: 06-Jun-2015].

[11] M. Xie and C. D. Lai, Reliability analysis using an additive Weibull model with bathtub-shaped failure rate function, Reliab. Eng. Syst. Saf., vol. 52, no. 1, pp. 87–93, Apr. 1996.

[12] Y. Li and J. R. English, Economic cost modeling of environmental-stress-screening and burn-in, IEEE Trans. Reliab., vol. 46, no. 2, pp. 275–282, Jun. 1997.

[13] A. Liaw and M. Wiener, Classification and Regression by randomForest, R News, vol. 2, no. 3, pp. 18–22, 2002.

[14] J. H. Friedman, Stochastic gradient boosting, Comput. Stat. Data Anal., vol. 38, no. 4, pp. 367–378, Feb. 2002.

[15] A. Lemmens and C. Croux, Bagging and Boosting Classification Trees to Predict Churn, J. Mark. Res., vol. 43, no. 2, pp. 276–286, May 2006.

[16] T. Zhang, Solving large scale linear prediction problems using stochastic gradient descent algorithms, in Twenty-first international conference on Machine learning - ICML '04, 2004, p. 116.

[17] R. Tibshirani, Regression shrinkage and selection via the lasso, J. R. Stat. Soc. Ser. B, vol. 58, no. 1, pp. 267–288, 1996.

[18] T.-S. Lee and I.-F. Chen, A two-stage hybrid credit scoring model using artificial neural networks and multivariate adaptive regression splines, Expert Syst. Appl., vol. 28, no. 4, pp. 743–752, May 2005.

[19] T.-S. Lee, C.-C. Chiu, Y.-C. Chou, and C.-J. Lu, Mining the customer credit using classification and regression tree and multivariate adaptive regression splines, Comput. Stat. Data Anal., vol. 50, no. 4, pp. 1113–1130, Feb. 2006.

[20] L. Breiman, J. Friedman, C. J. Stone, and R. A. Olshen, Classification and Regression Trees. New York: Chapman and Hall, 1984.

[21] C. Strobl, J. Malley, and G. Tutz, An introduction to recursive partitioning: rationale, application, and characteristics of classification and regression trees, bagging, and random forests., Psychol. Methods, vol. 14, no. 4, pp. 323–48, Dec. 2009.

[22] X. Wu, V. Kumar, J. Ross Quinlan, J. Ghosh, Q. Yang, H. Motoda, G. J. McLachlan, A. Ng, B. Liu, P. S. Yu, Z.-H. Zhou, M. Steinbach, D. J. Hand, and D. Steinberg, Top 10 algorithms in data mining, Knowl. Inf. Syst., vol. 14, no. 1, pp. 1–37, Dec. 2007.

[23] C. M. Bishop, Pattern Recognition and Machine Learning. New York: Springer-Verlag, 2006.

[24] T. Hothorn, K. Hornik, and A. Zeileis, Unbiased Recursive Partitioning: A Conditional Inference Framework, J. Comput. Graph. Stat., vol. 15, no. 3, pp. 651–674, 2006.

[25] C. Strobl, F. Wickelmaier, and A. Zeileis. Accounting for individual differences in Bradley-Terry models by means of recursive partitioning. Journal of Educational and Behavioral Statistics 36.2 (2011): 135-153.

[26] N. V. Chawla, K. W. Bowyer, L. O. Hall, and W. P. Kegelmeyer, SMOTE: Synthetic Minority Over-sampling Technique, J. Artif. Intell. Res., vol. 16, pp. 321–357, 2002.

[27] G. Menardi and N. Torelli, Training and assessing classification rules with imbalanced data, Data Min. Knowl. Discov., vol. 28, no. 1, pp. 92–122, Oct. 2014.

[28] J. Cohen, P. Cohen, S. G. West, and L. S. Aiken, Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences, Third. Routledge, 2002.

[29] C. E. McCulloch, S. R. Searle, and J. M. Neuhaus, Generalized, Linear, and Mixed Models, Second. Chichester: Wiley, 2008.

[30] D. B. Hall, Zero-inflated Poisson and binomial regression with random effects: a case study., Biometrics, vol. 56, no. 4, pp. 1030–9, Dec. 2000.

[31] D. Lambert, Zero-Inflated Poisson Regression, with an Application to Defects in Manufacturing on JSTOR, Technometrics, vol. 34, no. 1, pp. 1–14, 1992.

[32] J. S. Shonkwiler and W. D. Shaw, Hurdle Count-Data Models in Recreation Demand Analysis, J. Agric. Resour. Econ., vol. 21, no. 02, 1996.

[33] S. Gurmu, Generalized hurdle count data regression models, Econ. Lett., vol. 58, no. 3, pp. 263–268, Mar. 1998.

[34] C. A. Rolling, Package 'gains.' 2013. [Online]. Available: https://cran.r-project.org/web/packages/gains/index.html [Accessed: 06-Jun-2015].

[35] H. Hamilton, Cumulative Gains and Lift Charts, Computer Science 831: Knowledge Discovery in Databases, 2012. [Online]. Available: http://www2.cs.uregina.ca/~dbd/cs831/notes/lift_chart/lift_chart.html. [Accessed: 06-Jun-2015].

Tutorial 12

Capability Delivery Model – Configuration Management

Figure 1: Garfield Cartoon, 22 Jan 2011, www.garfield.com

CONFIGURATION MANAGEMENT COMPETENCY ELEMENTS

Configuration management is the management of the functional and physical attributes of a system, an asset and its part sub-systems and assemblies. It also includes the derived information representing the integrated support needs. Configuration management is a poorly understood and applied discipline in most organisations, including many regarded as good managers of assets. Certainly all have some fundamental knowledge of establishing asset registers and processes for change control and of drawing numbering and version control. However, these disconnected capabilities do not achieve the core intent of good configuration management practices. They do not formally manage the changing functional and physical configurations of their asset systems along with the derived information necessary to sustain the asset capability both short and long term.
Configuration management is the 'guardian' to the acquisition process. This role recognises that if the functional requirements for a system change, it is likely that the design and subsequently the support requirements will also change. Configuration management change control provides a formal test check that identifies the implications and answers the questions:

- Do I still want to make this change?
- Is it a worthwhile thing to do?

ENGINEERING CHANGE - CONFIGURATION MANAGEMENT COMPETENCY ELEMENTS

The aim of engineering change is to validate that the process monitoring, process audit and support change processes indicate a high level of compliance with the requirements of the asset management plans. Then, if necessary, validation that the assets and system collectively deliver the specified performance and as a result, identify and justify changes needed to the technical design of the affected assets and systems.Engineering change requires a structured process around the identification of why change is required, the impact of change on current business, and the outcome of the change. The level of approval of the Engineering change will depend upon the complexity of the change. For instance a simple like-for-like asset replacement will require a lower level approval than a complex system change associated with a major upgrade or investment. It is good practice to identify levels of change based on the risk associated with the change, the complexity of the change and the effort to implement it. Governance of change must address all elements of systems engineering to ensure the correct support functions are updated and assure the required level of support.

Figure 2: Configuration Management in the Capability Delivery Model

HOW CAN YOU MAKE MONEY ON SOMETHING IF YOU ALREADY SOLD IT?

IT'S SIMPLE.
THE ANSWER IS SAP HANA.

What if you could gain completely new insights from your assets, and correct problems before they even occur? Efficiently manage the entire asset lifecycle with world-class enterprise asset management software from SAP. With real-time visibility into asset performance and powerful analytics, it's easier to optimise asset usage, shrink costs, better manage capital expenditures, and ultimately maximise your return on assets (ROA) – including fixed property, plant, and equipment.

What if you could turn current products into future revenue? SAP HANA® monitors millions of parts in machines around the world. Helping manufacturers provide intuitive maintenance services for their customers, and new streams of revenue for themselves. Just think what you could do.
For more, go to **go.sap.com/australia/solution/lob/asset-management.html**

SAP®
Run Simple

Myth 12 – That maintenance programs are based

REFERENCES:

A. ISO 55000:2015 Asset Management System

B. Nowlan and Heap, Reliability Centered Maintenance, 1978

C. J.R.Kennedy, Asset Management for the Military – A Commercial Business Model, Euromaint Conference Helsinki 2014.

D. International Electrotechnical Vocabulary (IEV)

E. US MIL-STD-338B Electronic Reliability Design Handbook,

F. IEC 60300-3-11 Reliability centred maintenance, 2009

G. AM Council, Capability Delivery Model, http://www.amcouncil.com.au/knowledge/asset-management-body-of-knowledge-ambok/ambok-models.html

INTRODUCTION

Asset Management is intended to achieve an organisation's "desired balance of cost, risk and performance"[ISO 55000]. This intent can be worded in a more obvious and measurable manner as the characteristics of performance, cost and risk are measured differently and hence not readily balanced. This rewording would have the Asset Management effort of an organisation intended to achieve a desired balance of the asset performance agreed with stakeholders, the life cost of delivering that performance and the risks the come from the amount of money delivering that performance.

Change the money and the risk profile for the same performance shall change also.

This paper addresses the oft stated belief that the budget is in the hands of the CFO. That the allocation of financial resources has little to do with what the asset needs to achieve and the balance between performance and risk but more to do with the company's financial state. Higher profit in any year means more monies available to the maintenance function, lower profit means constrained maintenance spending.

Implications

The intent of a maintenance program is to achieve four primary objectives. These objectives are: [Nowlan and Heap 1978]

- Achieve inherent levels of reliability and safety designed into the equipment
- Restore those levels when unacceptable degradation has occurred
- Collect information (necessary to assess compliance, verify decisions and identify opportunities for change)
- Do above at lowest life cost.

Failure to address the maintenance commit inherent in a design solution comprising the asset, its integrated support system and its organisational enabling system, will inevitably lead to:

- Failure to be statutory compliant, resulting in injury to people or damage to the environment or the loss of some level of protection from these events;
- Commercial or other loss through non-delivery of product or service, where defective products or materials result or a service is not provided in either a timely manner or at all;
- Increased cost and down time due to secondary damage to the equipment itself and associated systems either functionally or geographically related;
- Increased cost of continued failure mode management actions that have not been eliminated by design;
- Increased logistics costs associated with failures that will likely occur at inconvenient times and caused increased unavailability due to the effort required to assemble resources and undertake the work often in unusual circumstances with what is available at the time.

However, there are often differing views between finance and maintenance departments as to what that financial commit might be if the maintenance solution is not clearly connected to the related asset and its required functional performance. Such lack of connectivity creates doubt as to the value of a maintenance task and hence the ability to understand what are the consequences of reducing financial resources.

Resolving those differing views requires a holistic approach that understands the root cause of asset failures and seeks the most cost effective solution from a variety of options applied across the life of that asset. Such interventions must of course be technically feasible and cost effective in managing

l on how much money is available from corporate!

the consequences of identified failure modes such as loss of function, secondary damage and inefficient unplanned emergency maintenance and operator actions.

As noted in Myth 11, possible responses to any identified failure mode are:

- Redesign (often very expensive);
- Operator response (manage adverse events);
- Maintainer response (apply a preventive or corrective task).

During the initial design effort, quite clearly the opportunities for eliminating a failure mode completely can be identified using the FMECA process. After all design change options have been exhausted during initial design, the remaining failure modes must now be managed with either an operator or maintainer action. The failure characteristics information is now applied within a process titled Reliability Centered Maintenance to determine the content of the Preventive Maintenance program.

Level of Repair Analysis and Task Analysis are then applied to determine the detail content of preventive or corrective tasks for all identified failure modes. The competencies required to identify the cost of the defined maintenance program now move beyond the normal design engineer into the realm of the integrated support analysis.

The resulting maintenance plan is underpinned by the inherent levels of reliability and maintainability created by the design solution. These values cannot be varied except by further expenditure on modifications to change the design. There is no free lunch here – if the resources necessary to sustain the required maintenance are not available then compromise is necessary such as:

- Extend task frequencies (but suffer more unplanned failures);
- Reduce staff costs by cutting people (but suffer more unplanned failures as staff task time reduced or tasks left undone);
- Reduce staff costs by reducing staff quality or competency development (but suffer more unplanned failures due human error);
- Reduce spares costs by cutting inventory (but suffer more down time of equipment due unavailability of spares);
- Reduce material costs by using alternate spares (but suffer reduced reliability due lesser quality or increased down time due interface and fit issues).

THE DEFENSIBLE BUDGET

In 2012 the concept of a defensible budget [J.R.Kennedy 2014] was developed to assist the understanding of the characteristics of a financial budgetary request that would be able to resist any proposed ad hoc reduction without an understanding of the consequences.

Defensibility though is more than just making a good expenditure case with one's peers. Defensibility requires the transparent connection of every financial unit (dollar) spent to achieve an agreed stakeholder requirement or outcome. In support of this tenet, the key objective of the Asset Management Plan and its defensible budgetary submission is to assure agreed and verifiable objectives of:

- •Safety and environmental risks managed;
- Required performance is achieved;
- All done at lowest whole of life cost (from an agreed reference point in the asset life).

In this context "defensible" means a budget that can be defended against any challenge from financial, technical or political sources. To achieve this intent the budgetary solution should represent an Asset Management Plan that is:

- Fact and risk based;
- Fully traceable to asset output requirements;
- Demonstrably good practice (applies international and national standards);
- Compliant with statutory and regulatory imperatives;
- Developed and implemented by competent (certified) staff;
- Supported by verified

Myth 12 – continued

technology (information and decision systems);

- Transparently and verifiably costed;
- Deliverable in the agreed time frame;
- Inclusive of the cost to develop the plan.

If all the above characteristics cannot be verified, then the asset management plan is probably not defensible. Core to the defensible budget is traceability of all expenditure to an agreed outcome or output. The process steps in the AM Council Capability Delivery Model, demonstrate how to achieve this traceability starting from Stakeholder Needs and progressing to an integrated operations and maintenance plan (Asset Management Plan) followed by implementation and verification of the plan (verification of delivery and achievement of intent).

SUMMARY

Arguably, the role of the CFO is to protect an organisation's financial assets. In this role hard questions must be asked of the maintenance planning staff as to why their budget should be approved. This question can only be answered if there is a "defensible" budget process that ensures every budget element is required to deliver agreed organizational objectives and each element is demonstrated as being efficiently delivered.

Asset fundamentals of reliability and maintainability are an outcome of the design of an asset. They are asset characteristics that do not change from year to year unless their context of use changes. Saying there is not enough money to achieve those inherent characteristics will not change the financial requirement, only a change of context will achieve a new balance where cost is reduced. Allocation of funding should be based on the concepts of the Defensible Budget to assure the assets are allocated the resources necessary to achieve organizational intent else change the intent,

If immediate savings are required by an organization to achieve survival over the short-term, then the longer-term implications must be known and acknowledged. If that future is not understood or accepted, then the venture is likely unsustainable and the organization should review its purpose and business options.

There is an old saying "you can pay me now or you can pay me later" which was a marketing campaign from Fram oil filters. Meaning you can pay a little for an oil change and new filter now or a lot for an engine rebuild later. All CFOs should be aware of this homily.

CONCLUSION

An oft stated belief that "the budget is in the hands of the CFO" has some element of truth from an organisational perspective. However, an arbitrary allocation of financial resources will have little to do with what the asset needs to achieve and the associated balance between performance and risk; and more to do with a perception of a company's current financial state.

The asset does not know the financial state of the organisation and will not change its inherent failure characteristics to suit an organisation's financial situation – the maintenance requirements are inherent in the characteristics of reliability, maintainability and supportability created by the asset and organisation designers. Arbitrary cutting of maintenance budgets only buys time, it does not change the need.

Hence the belief "The allocation of financial resources has little to do with what the asset needs to achieve and the balance between performance and risk, but more to do with the company's financial state." is confirmed as a part myth.

ASSET MANAGEMENT, OPEN SYSTEMS AND THE ROLE OF GOVERNANCE

James (Jim) Kennedy CPEng, CFAM, CAMA
Sensei, Asset Management Council

I.INTRODUCTION

Asset management has now been established as an international discipline and defined through the publication in 2014 of ISO 55000 and ISO 55001, which are the normative standards for Asset Management (AM). The linkage between asset management and systems engineering has been established through the publication of IEC 62775TS:2015 Technical and financial decision making in AM.

This paper will:

- describe the core intent and characteristics of ISO 55000/1,
- link those AM characteristics to Systems Engineering as described in ISO/IEC 15288 Systems lifecycle processes, and
- then link AM to open systems through discussion of continuous improvement, governance and change management

II. ASSET MANAGEMENT INTRODUCTION

ISO 55000 Asset management – Overview principles and terminology describes what asset management is. ISO 55001 Asset Management – Management System – Requirements describes what an asset management system should achieve being a set of 174 functional requirements for a system to manage assets. The intent of the asset management system is to achieve, for an organisation, a desired balance between the organisation asset management objectives of statutory, performance, cost and assurance (balance of performance, cost and risk).

The ISO 5500O principles are described by the Asset Management Council through its Capability Concept Model shown at Figure 1 and the capability delivery model shown at Figure 2. These two models are described briefly in the following sections but in greater detail in the extended version of this paper electronically available in the webpage of this workshop[6].

A. BALANCING PERFORMANCE, COST AND RISK

Balancing performance cost and risk (statutory and uncertainty) is described in the following model at Figure 2[2]. Balance does not mean equality. An organization may put greater emphasis on operations rather than budget or on safety rather than operations. When adverse external events occur, rebalancing may be required.

The role of the asset management system is to be able to put alternate options for rebalancing. For example, if there is a budget cut that creates an imbalance, the rebalancing solution would be selected from a set of options assembled by the asset management team. Some options might reduce required performance, others might change risk appetite (assurance) in regard to the achievement of that performance, or there may be a mix of options that also include alternate cost, performance and assurance outcomes.

B.CAPABILITY CONCEPT

The Asset Management Council's top-level model is titled the Asset Management Concept Model. The model derives from the Maintenance Engineering Society of Australia's original Capability Assurance Model from 1995 and is intended to assure the capability of assets acquired and sustained to deliver services to an owning and/or operating organisation. The assurance model seeks to address the role of asset management in a very fundamental way.

The model's intent is to change the sequential thinking that pervades most technical competencies associated with engineered systems and to emphasise that asset management is a holistic discipline. Holistic is from the Greek word meaning all, entire, total and is the idea that all the properties of a given system (physical, biological, chemical, social, economic, mental, linguistic, etc.) cannot be determined or explained by its component parts alone[6]. The Concept Model shown at Figure 2 provides a top-level model of Asset Management and consists of three parts: the stakeholders, a process, a set of underpinning principles and an organisational environment that supports the required culture and leadership.

Figure 1 Balancing Performance, Cost and Risk

C .A SET OF PRINCIPLES

The second part of this Capability Concept Model is the notion of Principles. At Figure 2 the principles, which underlie good asset management, are like the sails on a windmill driving the capability delivery PDCA process. These principles are described in more detail in the following paragraphs and comprise:

1. Organisations must have an output focus (Assets exist to provide value to the organization and its stakeholders)

2. Achieving that output requires capabilities (Asset management translates the organizational objectives into technical and financial decisions, plans and activities)
3. Capabilities must be associated with a level of assurance to their delivery (delivery system, support system and enabling system)
4. Sustaining alignment by continuously evolving requires the leadership and culture of a learning organization.

These principles are identical with those described in ISO55000 except that the ISO standard has tended to broaden diminishing the clarity and focus of those principles. The ISO standard avoids prescription and hence often greys out these principles and they lose much of their richness and elegance. For example, in the ISO standard:

1. Output focus becomes "value", a more difficult outcome to measure
2. Traceability of Capabilities become "alignment" between actions and objectives
3. Assurance is stated identically, and

Learning organization, which is quite a specific form of leadership and culture becomes just "culture and leadership" but provides no direction on what form.

D.CAPABILITY DELIVERY (THE PLAN DO CHECK ACT PROCESS)

The Capability Delivery process follows the classic Plan Do Check and Act (PDCA) process originally defined by Walter A. Shewart more than sixty years ago and often referred to as the Deming Cycle. This process is at the core of the Asset Management Concept Model and is described in detail in the Capability Delivery Model at in the extended version of this paper electronically available in the webpage of this workshop[6].

In summary, we plan and identify a suite of actions necessary to create and sustain a physical system to satisfy a defined need, we then do those actions in accordance with the plan, we then check; firstly, that we achieved the stated intent of our plan and secondly, that we did exactly what was required by the plan. Finally, we act on any threats and opportunities what we have discovered.

The Capability Delivery process at Figure 3 aligns well with the technical processes in ISO/IEC 15288:2015 Systems and Software engineering – System lifecycle processes; and is the foundation of a whole of life or life cycle approach to asset management. As shown, the systems engineering core in the model is subject to multiple sources of external change while day to day management of operations is subject to three sources of change.

Figure 2 Asset Management Concept Model

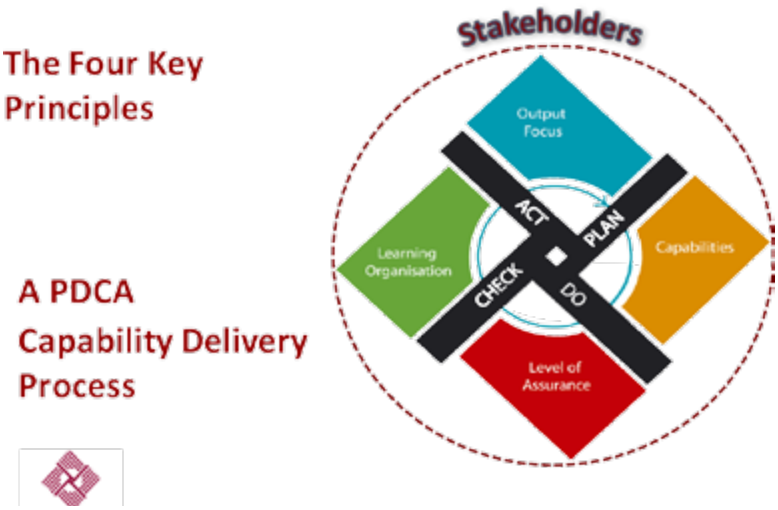
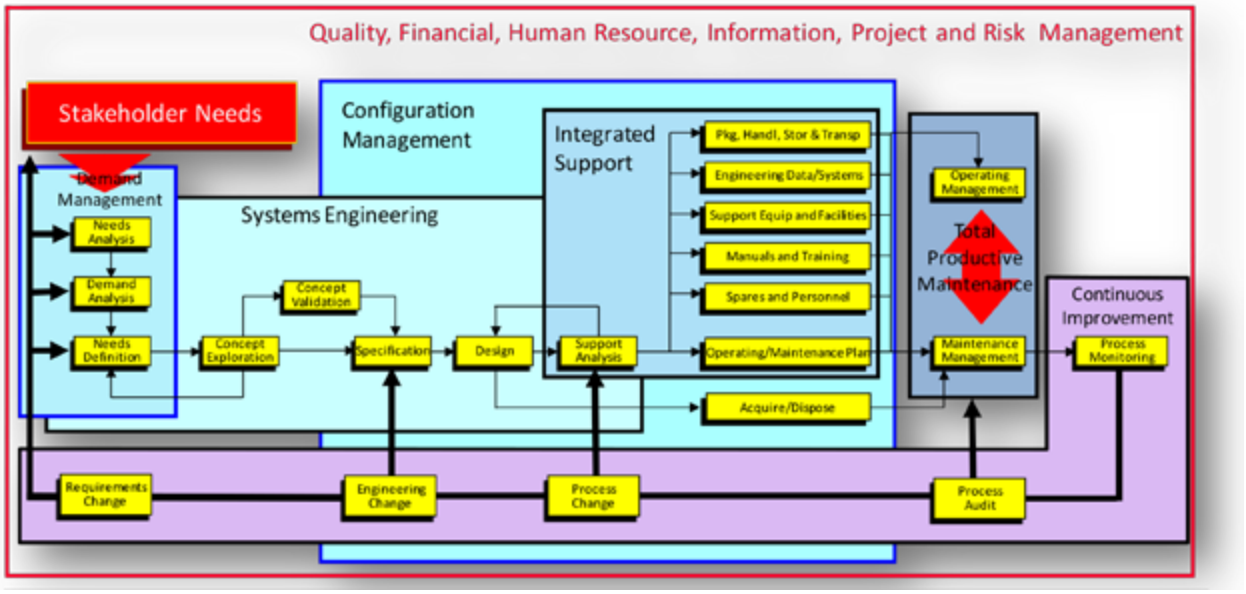


Figure 3 The Asset Management Capability Delivery Model



III. ASSET MANAGEMENT AND OPEN SYSTEMS[2]

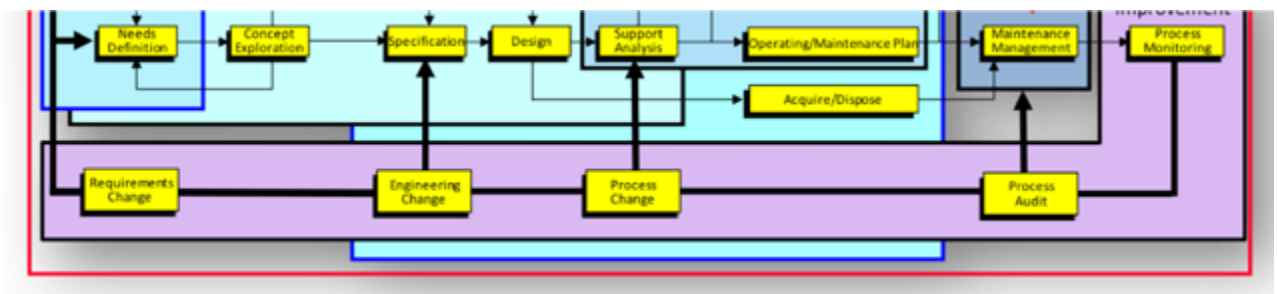
An open system is a system that regularly exchanges feedback with its external environment. Healthy open systems continuously exchange feedback with their environments, analyze that feedback, adjust internal systems as needed to achieve the system's goals, and then transmit necessary information back out to the environment. Critically important aspects of open systems include the boundaries, external environment and the concept of equifinality which means that the same or similar results can be achieved by using a variety of means. Asset management describes this in terms of "optioneering" meaning that the same results can be achieved by using different inputs or by using different processes with the same inputs.

Equifinality suggests that there is no one right way to accomplish important results in an organization.

In contrast, closed systems have one right way to do things. For example, in operationally based organizations, a person must follow the procedures and keep producing regardless of the end impact on the organization – the focus is on doing things right (produce), rather than doing the right things (manage change). Examples of this are the classic case studies of major disasters represented by Piper Alpha (North Sea Petrochemical Processing Platform) and Texas City in 2005 where production should have been stopped but was not in the hope that issue could be corrected by operators (it could not).

As shown at Figure 4, Asset Management recognises the need for continual alignment of the internal and external environment. External influence is assessed

Figure 4 Continuous Rebalancing through Feedback Loops



on a regular basis from the Process Monitoring point in the Figure 4 model by the use of such analysis tools as PESTLE (Political, Economic, Societal, Technical, Legal and Environmental) for external implications or stakeholder reviews to redefine needs and revise agreements. Many of these influences are not under the direct control of the effected entity, which can only respond by rebalancing – quickly.

A.ISO 55000 Asset Management Principal #3 states: "Culture and Leadership are the determinants of value realisation from assets"

A highly effective organization is regularly exchanging feedback with its external environment – it is an open system. Healthy organizations regularly try to understand their environments through use of environmental scanning, stakeholder research and evaluations. These organizations often try to influence their external environment, as well, for example, through use of public relations, advertising and promotions, lobbying and advocacy, and educating industry and local leaders. This pushback on stakeholders is shown at the front of the model in the Demand Management domain.

IV. ASSET MANAGEMENT AND GOVERNANCE

Governance is the system of principles, policies, procedures, and clearly defined responsibilities and accountabilities used by stakeholders to overcome the conflicts of interest inherent in any enterprise. Such conflict is most evident in the legal Corporate form of organisations in the public domain that exhibit many of the characteristics of such entities such the tension between owner (Shareholders), user (Customer) and resource manager (Executive Team).

Corporate governance affects the operational risk and, hence, sustainability of the organisation. The quality of that governance affects the risks and value of the organisation. Such governance is essential to the Corporate form where the owner does not know how to run the business.

A distillation of the words on governance drawn from Australian Commonwealth law, International Bodies (OECD) and Commercial Practice can be expressed as a set of core attributes for a Corporate Governance System:

- Clear delineation of the rights of the asset owner and other parties to the enterprise;
- Clearly defined executive manager and Board governance responsibilities;
- Identifiable, allocated and measurable responsibilities;
- Fairness and equitable treatment in dealings;
- Transparency and accuracy in disclosures.

Objectives of Enterprise Governance can be stated as:

- To eliminate or mitigate potential conflicts of interest between key system decision makers such as owner, operator and service provider;
- To assure that the asset related services or products are delivered efficiently and productively and in the best interests the agreed stakeholders;
- To assure a desired balance of performance, cost and risk is achieved in the delivery of assets and their outputs;
- To assure that continuous improvement is a focus of the Enterprise.

The Australian National Audit Office (ANAO) has a better practice guide for Governance. The guide identifies three interrelated areas for leaders to focus on in order to achieve good governance outcomes and shape an entity for success. These three areas are outlined below and shown diagrammatically at Figure 5.

- Performance Orientation: Efficient and effective program and service delivery are central to the performance of any entity. This requires a:
- Clear understanding of objectives
- Willingness to engage with risk to foster innovation
- Clear understanding of how outcomes and achievement will be measured and assessed
- Willingness to tailor governance arrangements to achieve better outcomes
- Openness Transparency and Integrity: Accountability is the process by which entities and the individuals within them are held responsible for their results, decisions and actions as confirmed by external audit noting that:
- Openness transparency and integrity are required to assure

stakeholders have confidence in the decision-making processes and subsequent actions.

- There must be meaningful consultation with stakeholders
- Consistent communication of reliable information is essential
- There are quality records keeping.
- Effective Collaboration: Collaboration is about engaging effectively with others to achieve mutual benefit and resilience;
- Allows exchange of information
- Makes best use of resources and consolidates knowledge to achieve more effective Governance
- Requires an appreciation of the responsibilities of others
- Benefits from clear purpose, defined outcomes, and the recognition of shared risks and accountabilities.

The key to effective Governance is the Culture and Leadership of a Learning Organization as defined by Senge (The 5th discipline). However, change will not happen without good leadership because Leadership is about the enabling of change. This theme is at the core of Peter Senge's book, which describes leadership as "the capacity of a human community to shape its future, and specifically to sustain the significant processes of change required to do so[5]". Thus, leadership is not a single charismatic person at the top of an organisation arbitrarily directing; leadership is about the whole organisation.

Good leadership means that everyone in that organisation is empowered to implement agreed strategies and plans, is a fully involved and valued participant in the decision making of the organisation, is clear as to the direction in which the organisation is going, and shares a common mental model of the means to achieve that direction.

Organisational Culture is the "beliefs and ideas about what kinds of goals members of an organisation should pursue and ideas about the appropriate kinds or standards of behavior organisational members should use to achieve these goals. From organisational values develop organizational norms, guidelines, or expectations that prescribe appropriate kinds of behavior by employees in particular situations and control the behavior of organizational members towards one another. [1]"

A learning organisation is one that fully supports its people in terms of their knowledge role and their continued learning; it encourages those people to participate in the decision-making process. It is a culture that is free to question, to grow and to learn together. Such a culture will exhibit characteristics of what is termed a "Just Culture" by James T Reason[2] and exhibits knowledge and information related behaviors distinct to his "generative culture" as against "pathological" or "bureaucratic" type cultures shown at Figure 6 below.

Figure 5 Good Governance Model

V. CONCLUSION

Open systems are a core requirement of a mature asset management system. ISO 55000/55001 with its principles that focus on alignment between what we do, our visible stakeholder agreements and associated organizational objectives along with a mature culture and leadership exhibited by learning organisation's enable the management of uncertainty in a manner that can achieve a "desired balance of performance, cost and risk".

REFERENCES

[1] Charles W. L. Hill, and Gareth R. Jones, (2001) Strategic Management. Houghton Mifflin.

[2] http://www.authenticityconsulting.com/

[3] J.R.Kennedy, ISO 55000 – A process model for balancing performance, cost and risk, AMPeak Conference, Sydney 2015.

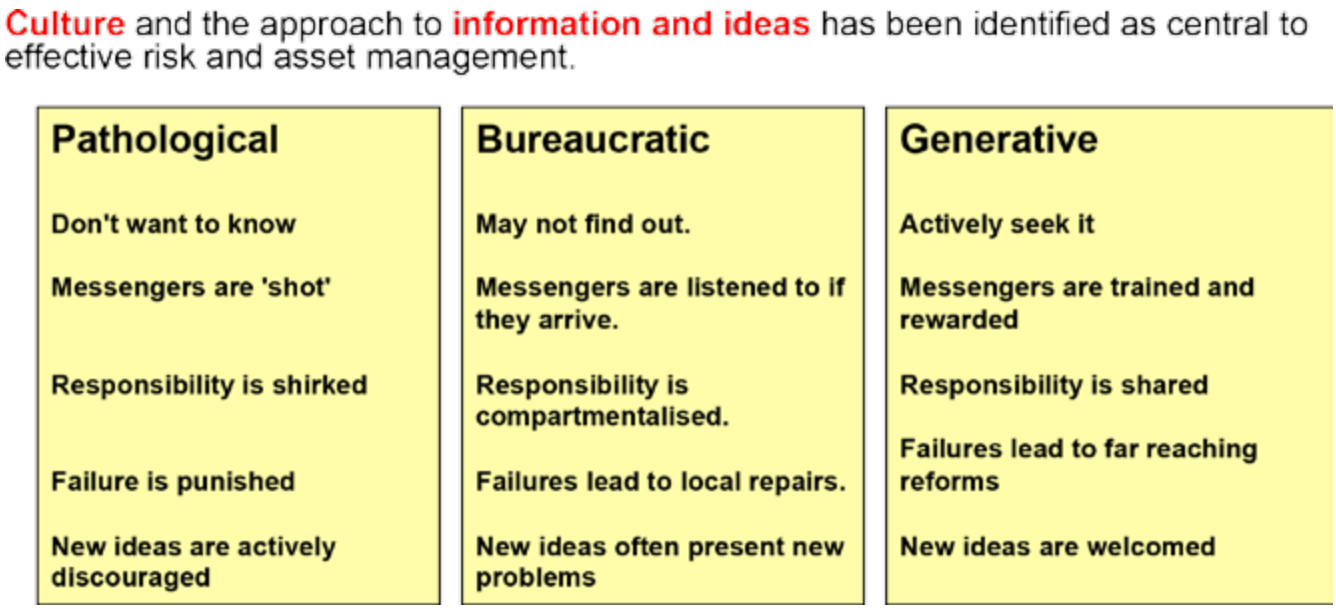
[4] James T Reason, Managing the Risk of Organisational Accidents, Ashgate, 1997, page 195.

[5] Peter Senge, The Dance of Change, 1999.

[6] The sixth Workshop on Open Systems Dependability, 2017, https://sites.google.com/a/progsci.info.kanagawa-u.ac.jp/wosd-2017/

[7] Wikipedia, The free Encyclopedia.

Figure 6 Cultural Responses to Organisational Knowledge and Change



HAVE YOUR SAY

What is your opinion on the role of Governance in Asset Management? We would like to hear your views.
Please send your comments addressed to The Editor, The Asset Journal via email **publications@amcouncil.com.au** for consideration in a future edition of The Asset Journal

CHAPTER **NEWS**

WHAT'S HAPPENING IN THE ADELAIDE CHAPTER?

The 14th September saw the Asset Management Council's very own Mark Mackenzie, a highly qualified and experienced engineer with over thirty years' experience in maintenance, reliability and asset management, present tips and tricks for reliability practitioners to a group in Adelaide.

Mark asked and answered thought-provoking questions such as: Why should we measure reliability and what are the benefits? How should reliability be demonstrated? How should we specify reliability requirements? And, how should we use reliability to focus effort?

With our growing South Australian member base look out for more events coming through Adelaide in 2018.

WHAT'S HAPPENING IN THE MELBOURNE CHAPTER?

The Melbourne chapter have continued to get together frequently and it was great to see old and new faces in a group of fifty people, interested in sharing experiences with the implementation of the Victorian State government's Asset Management Accountability Framework, back on 19th September

With guest speakers from the emergency services sector and additional commentary from attendees, the session was constructive and highly informative.

October was devoted to a re-development of the Certified Asset Management Assessor (CAMA) examination and a call to arms was put out, for chapter members to participate in the re-development of the exam questions.

The Melbourne chapter hosted a facilitated workshop with the World Partners in Asset Management (WPiAM) to develop the new questions.

The CAMA question set was developed nearly three years ago through a collaborative, global approach, largely led by the AMC and involving people from Australia, Brazil and the UK. Now, three years later, WPiAM wanted to see the question set expanded, updated and inclusive of the latest contemporary knowledge in asset management.

In a game show type environment, members had an interesting time brainstorming, contributing and influencing the CAMA question set and it will be great to see what comes out of this session in the near future.

Asset Management Value Proposition was next on the agenda. John Dyer, AusNet Services, and Tim Gowland, Energy Safe Victoria, explored more about the value being delivered in AusNet Services and the electricity industry more generally through asset management, on the 16th November 2017.

The general consensus was that, for Asset Management to add value, the benefits must be greater than the cost (from the view of the stakeholder).

As if things couldn't get busier enough, Melbourne was also the home of the AMCouncil's National Symposium – this year focusing on Digital Infrastructure.

Over sixty participants congregated for this one day symposium to cover this key topic.

The objective of the symposium was to improve the knowledge of digital infrastructure in asset management by delivering presentations involving national best practices on key challenges affect most industries using digital infrastructure.

With a stellar line-up of over ten speakers including Laurie Patton, CEO Australian Smart Communities, Veronica Scott, Minter Ellison, Dr Fang Chen, Data61 CSIRO, Jonathan Chang, Silverpond and many more, it was an event that did just that."

With a stellar line-up of over ten speakers including Laurie Patton, CEO Australian Smart Communities, Veronica Scott, Minter Ellison, Dr Fang Chen, Data61 CSIRO, Jonathan Chang, Silverpond and many more, it was an event that did just that.

CHAPTER **NEWS**

Steve Doran

Toby Horstead

John Hardwick Presenting

WHAT'S HAPPENING IN THE SYDNEY CHAPTER?

Sydney Chapter Chair Steve Doran and AM Council Director Toby Horstead recently participated in a round table discussion hosted by the Board of buildingSmart Australia that opened with 'what the challenges are for the adoption of building information modelling (BIM) within their industry'.

TAlso contributing to the discussions were representatives from the Facilities Management Association of Australia (FMA), the Tertiary Education Facilities Management Association (TEFMA), the Department of Defence and MasterSpec NZ.

The focus of discussions was on the poor transfer of BIM and Digital Engineering data from the construction cycle to the asset maintenance cycle. The intent of the discussions was to determine what needs to be done to improve the situation as well as identify the key players we need to influence to ensure that the Facilities Maintenance community get the building/ project data they need to effectively manage their assets.

Your AM Council representatives presented our interest in the BIM/digital engineering space and also explained that our view of the asset life cycle being from identification of need through to dispose, rather than asset management starting once construction is complete. The conversation that started with transfer of building information models progressed to digital information and by the end of the round table the focus of the group was ensuring that the right asset information was available for decision making.It is buildingSmart's intention is to arrange a follow up workshops with other key industry representation to look at how the issues discussed may be best addressed. Value through Asset Management – what words spring to mind? This question was put to the audience during the latest 20th September Sydney chapter event and you can see the what they came up with in the word-cloud attached to this post. This was just the start of an open discussion, full of tangible examples of and ideas for value improvement for stakeholders through asset management, which centred around core elements from the ISO 5500x global standards suite for Asset Management - leadership, planning, support and operation.

The introductory talk from Kevin Young, CEO of Sydney Water, proved very interesting as he spoke about what he has found in his look at overseas utilities and how that is shaping his views on the customer-centric approach to Asset Management at Sydney Water.

And we can't forget about the latest event, on 15th November, when John Hardwick generously made time to share his insights and experience in the vital area of the right leadership, behaviour and culture. Many of you know John as the past-National Chair of the Asset Management council and the Global Forum on Maintenance and Asset Management where he first highlighted the importance of Leadership in Asset Management.

John was the Group Executive, Network Strategy of Networks NSW. John has a background in the NSW Electrical Industry with 30 years' experience. He completed a Masters of Business Administration at the Australian Graduate School of Management. John was responsible for all maintenance and replacement programs and expenditure on Network assets in Ausgrid for 10 years.

WHAT'S HAPPENING IN THE BRISBANE CHAPTER

It was a full house on the 27th September for Brisbane to talk all things Asset Management System Implementation, this one particularly on determining key assets.

Asset Management depends upon the determination of key asset requirements in order to provide effective and efficient methods to avoid catastrophic failure or expensive rework to meet those requirements.

How do practitioners effectively manage assets which are very complex or where they may be reaching their economic life when an error has the potential to cause significant loss of life and/or negative publicity?

These were all discussed extensively during the course of the afternoon. The Brisbane Chapter teamed up with AMCouncil's very own sub-group Women in Asset Management (WiAM) on the 23rd November to bring together a dedicated all-woman strong line up to talk about all things challenging within the asset management world.

We heard from Dr Anne Gibbs, Wendy McPate and Sophie Burgess who all brought their insights to the table and much discussion was had over what up and coming asset manager's face in the future .

WHAT'S HAPPENING IN THE PERTH CHAPTER?

Some fresh faces on the Perth Chapter Committee and, along with it, some fresh events. Our Perth chapter is really putting themselves on the map now as they finished the technical sessions year with a fantastic evening attracting interest from 65 asset management practitioners with which the session exceeded all expectations - standing room only! A great show of interest and support for Asset Management in the West.

After a brief introduction, Sandy Dunn shared the difference between Asset Management capability, compliance and maturity. Next was Ernst Krauss sharing his research on understanding the value of asset management. Keen interest and discussions continued into the following networking opportunity, where most people stayed to catch up with old acquaintances and to make some new ones.

The Perth chapter has also, once again, partnered with organisers (Diversified Communications Australia) to organise a session at the AOG's Knowledge Forum on the topic of "Asset Management – Improving Asset Performance".

AOG 2018 will be held 14-16 March 2018 in Perth, WA, and AMC members have the advantage of special rates and conditions for the exhibition area and also the opportunity to contribute to the session.

The story of **WiAM**

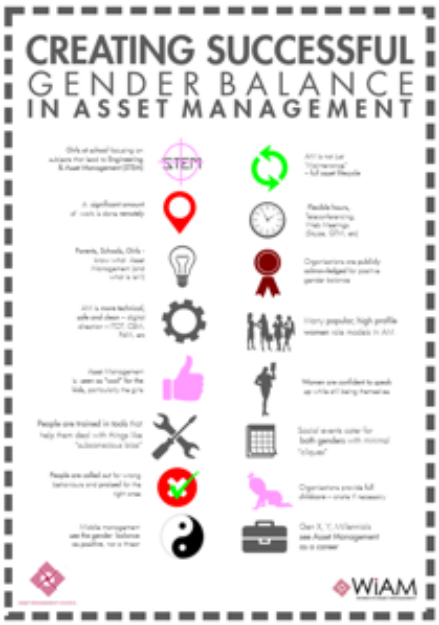
What do businesses need to do to balance their workplace gender gap? Diversity in the workplace – especially gender diversity - is a hot topic and something all organisations should be looking at, if they aren't already.

Felicia Tristanto is a passionate asset manager who wants to see a gender balance in organisations that manage assets. She is also keen to encourage STEM in the school system and breakdown any barriers that prevent girls taking up the STEM subjects. Based in Western Australia, Felicia manages to balance family and work as she travels all over the world with her career.

Earlier in July this year, Felicia was pondering the workplace gender gap issue and quickly rounded up Peter Dunford, President of Vesta Partners, and Belinda Vassillo, Senior Director with GE Digital, to create an AMCouncil webinar that discussed ideas and solutions to balance the workplace gender gap.

Out of that webinar, came this:

And so, Women in Asset Management (WiAM) was born!



A sub-group of the AMC, it is a community accessible for anyone with an interest in workplace diversity, who is keen to show the benefits of asset management in providing diversity in the workplace.

Felicia has partnered with like-minded asset managers across Australia and has rounded up a team of both men and women to promote awareness and education across this topic.

After this first successful event provoking discussions on the gender gap, WiAM is steadily making their way through each of the AMCouncil's chapters to bring you events that showcase strong, empowering women in asset management across all industries.

First up was the introduction of Andrea Boyd who amazed us all with her webinar on Asset Management in Space in September.

Andrea, stationed at the European Space Agency, shared insights into daily life on the International Space Stations, what astronaut training is like, future plans for space exploration and more. We even learned all about how a toothbrush was used to save space!

The Sydney chapter took on a WiAM flavour during October, where they had some silos to shatter while talking collaboration through asset management. Inspirational stories were shared by Lucie Mitchell, Sydney Trains, Tammy Falconer, Sydney Water, and Belinda Templeman, Department of Defence.

They spoke passionately about the role we play, how to improve knowledge and how to shape our organisations' thinking for increased success.

To cap off the year, in November, Brisbane was set with an all-women strong line-up during their WiAM charged event.

Dr Anne Gibbs, CEO AMCouncil, Wendy McPate, electrical engineer, and Sophie Burgess, a QUT Undergraduate, gave us their take on what challenges asset managers face today and how we can best upskill to meet tomorrow's challenges.

The area of diversity was high on Felicia's agenda during the November AMC Strategic Meeting. Taking the opportunity while all the AMC leadership team were together as one, she broached the topic and gained great buy in from the AMC chapter chairs to agree that the diversity issue shall be tackled as part of their strategy. Rather than creating events in isolations, WiAM will work with chapter chairs to get commitment from them during 2018.

WiAM will be tackling the issue from a partnership perspective, with the aim to create the norm in having the same number of women and men in all of the events. They will lead by example to ensure events encourage the same representation of men and women as speakers and participants.

With such a strong start to the WiAM community during the latter half of 2017, Felicia, the National Chair of Women in Asset Management and her team are looking forward to bringing you more diversity-inspired events and news during 2018.

If you would like to get involved or stay updated on the latest WiAM news and happenings, please sign up here: **http://www.amcouncil.com.au/mailing_list_sign_up.aspx**

INSIDE ASSET MANAGEMENT ON THE INTERNATIONAL SPACE STATION

Australian Andrea Boyd from the European Space Agency took us up to the International Space Station for a Women in Asset Management webinar. Her WiAM mission was to give attendees an idea of the management and maintenance processes involved in keeping the station operational at 400km above the Earth.

OVERVIEW OF THE INTERNATIONAL SPACE STATION

The International Space Station (ISS) is a modular, microgravity laboratory in which an international crew of six live and work while travelling at a speed of 29,000 km/h and orbiting Earth every 90 minutes.

The station consists of 15 modules added over time.

The first was launched in 1998 by the Russians. Modules include laboratories, cargo bays, airlocks, connecting nodes, docking ports and crew quarters.

The station's four sets of solar arrays can generate 84 to 120 kilowatts of electricity, enough to provide power to more than 40 homes. Batteries store energy to power the station when the solar arrays are in Earth's shadow.

The space station has been continuously occupied since November 2000. In that time, 222 people from 18 countries have visited.

Crew members spend about 35 hours each week conducting research in many disciplines to advance scientific knowledge in Earth, space, physical, and biological sciences.

ADELAIDE GIRL INSPIRED BY STAR TREK

Andrea Boyd is an International Space Station Flight Operations Engineer at the European Astronaut Centre in Cologne. Originally from Adelaide, she's the only Australian International Space Station controller in the world.

After studying engineering and mechatronics at the University of Adelaide, she worked as a fly in-fly out mining engineer at BHP Billiton's Olympic Dam in South Australia before pursuing her childhood dream of working with spacecraft.

Andrea's journey into the space program began early.

"I was always a big fan of Star Trek," she says. "I grew up watching the Chief Engineer making things work in space as a day job, like it's no big deal. As a 12-year-old, I was like, 'Yeah, I can do that!'"

After completing her studies, Andrea went into mining "by accident" but liked it so much she almost didn't leave.

"I find mining and space really similar," she explains. "You've got high-risk, low fault-tolerance with pretty intense control rooms, and a lot of expensive equipment.

"If something goes wrong, you're looking at loss of human life or the loss of very expensive equipment."

Andrea says she never found gender to be an issue when I was working in the mines or with the space station.

"You're there to do your job and you get treated as such. I think space attracts women – the gender count is 50-50. Sometimes in the control room the entire room will be women."

The space station is the result of a unique international collaboration, one that is drawing to a close as the ageing space station nears its use-by date.

"It's the closest thing to Star Trek's Starfleet," Andrea says. "There was a magic moment in time where Russia, the US and Europe, Canada and Japan were all building their own stations – and then decided to build one big one."

ROUTINE MAINTENANCE ON THE SPACE STATION

Andrea describes daily life on the ISS as "pretty chockers". There are 12-hour work days Monday to Friday doing experiments, then Saturday is for maintenance and cleaning.

"It's like a sharehouse – someone has to do the bathroom and the kitchen, and vacuuming and cleaning the filters."

[Slide:A typical ISS timeline: video 14:50]

Planning is done on a weekly basis, but also months and years ahead. Astronauts know what experiments they will be doing for a year ahead in detail. The crew are assigned two years in advance.

There are internal on-orbit tasks for scheduled preventative maintenance, and for contingency and unplanned maintenance due to failures.

The crew follow an anomaly report process that categorises four levels in a hierarchy:

- Crew safety
- Hardware protection
- Hardware loss
- Science loss

It is not easy to get parts to the space station when there is a failure. Essential spare parts are stored on board, but cost prohibits the storage of a back-up for every item. The enormous database and support systems are shared between all mission controls.

Any one can log into the integrated management system and see the status of every part on the station and where to find it in the inventory. "When you can't run down to Bunnings to get a spare part, you've got to plan for failures," Andrea says.

"Sure, we definitely fly spare parts. But we also train our people in mission control to handle the development of robust solutions at any time with short notice. Because launching cargo is difficult and high risk – rockets explode, there are weather delays and boats venture into the 'keep out' zone.

"So we try to have our essential spares on board, but for those that aren't going to be super-critical, we don't bear the cost of putting them up until we need them. Those are things that you can run safely for a few months that aren't going to affect your ECLSS."

Maintaining the ECLSS, the Environmental Control and Life Support System, is one of the biggest jobs on the ISS. There are three carbon-scrubbing mechanisms plus urine processing and recovery. This process is extremely efficient, recovering about 90% of water after purification.

"The astronauts have a saying," Andrea says. "Today's coffee is tomorrow's coffee."

REPLACEMENT SCHEDULES & FAILURE IMPACT WORKAROUND

The ISS is packed full of filters and pumps and other expendable items that need to be replaced on a prescribed remove and replace (R&R) schedule. But there are schedules, and then there are schedules.

[Slide: The Columbus module. Video 7:33 & 7:51]

"For the non-essential items we don't replace them on schedule," Andrea says.

"It's too expensive and we don't have the storage space for every single component of the space station. We fly non-critical components up when we need them and just run them until they fail."

Despite everyone's best efforts, Andrea says "space does happen" and there are unexpected equipment failures.

"We have a procedure for almost anything. But you also need to have the Apollo 13/The Martian ingenuity to put everything on the table, figure out what you've got and what the crew can build to solve the failure.

"We put together what we call a Purple Team whenever this happens and we tag team each other to run 24/7 solutions until we have the problem solved. Everyone in the team is trained and trusts everyone else implicitly."

The failure impact workaround (FIW) involves understanding what part of a system has actually failed. After receiving a failure signature, ground support has to find out what kind of failure it is, whether it's internal or an external power source failure.

"We have to determine the criticality of each of the issues. ISS has a non-negotiable hierarchy of obligations. The first is crew safety, the second is the safety of the vehicle.


Europe's Contribution: Columbus


Europe's Contribution: Columbus

"We didn't want to do that on the station, because if that broke we would lose the entire relay box and we did not have a spare for that."

The team unscrewed the troublesome bolt and tried reinserting it many times. Each time it went in less far, and it became clear something was clogging the thread, possibly metal filings. This needed to be removed, but there was no tool available. On a space walk, astronauts wear cumbersome gloves with no dexterity to hold a delicate tool.

"A space walk that was supposed to take two hours has now gone on for almost eight," Andrea continues.

"We called it a day – eight hours is a long EVA. We brought the crew inside and called out the Purple Team to figure out what we wanted to do. We had no tool available to do what we wanted.

"We had a look around at what we'd got. We needed a wire brush, essentially. But we had no such thing we could use on the outside of the space station. Then we thought, what about an old toothbrush? But it was too small for an astronaut to use with those big gloves. So we looked around and we found a T-bar, which is a standard EVA tool. We found a socket to fit on to that, and a toothbrush, if you cut it in half, popped almost exactly inside that socket."

They attached the improvised tool to a drill, creating a rotating brush suitable for use in space.

However, the original bolt was now useless because the thread was worn.

"So we needed a new bolt as well," Andrea says.

"We found an identical one in our inventory management system that was being used to secure one of the computers inside the station. We pulled it out and did an analysis because it hadn't been checked for use outside the station with the radiation.

"We found it was fine and we were able to use it. The relay came online and we were able to get back to full power again. So we saved the space station with a toothbrush."

An Antares rocket blows up at launch

We would lose the space station before we lost a crew life," Andrea says.

"We look at how long it's going to take to repair an item. With the critical items we have spares and we replace them. We don't look into what went wrong, we don't have that luxury in space as much as we would on earth. We do a straight R&R."

The ISS has been in space since 1998, so internal components do require repairs. There are regularly scheduled inspections and real-time verbal descriptions from the crew.

If they see anything amiss, they call mission control, where Andrea at EUROCOM or her counterpart at CAPCOM or PAYCOM will talk to them about the situation.

"The crew also leaves us helpful notes in the timeline that they keep. That's a good open source of communication. We have really good digital cameras on board and the crew take a lot of images for us."

APPLYING ISO 55000 PRINCIPLES IN SPACE

The space station is an asset, jointly held. In fact, it's a collection of assets literally joined together. One problem-solving incident shared by

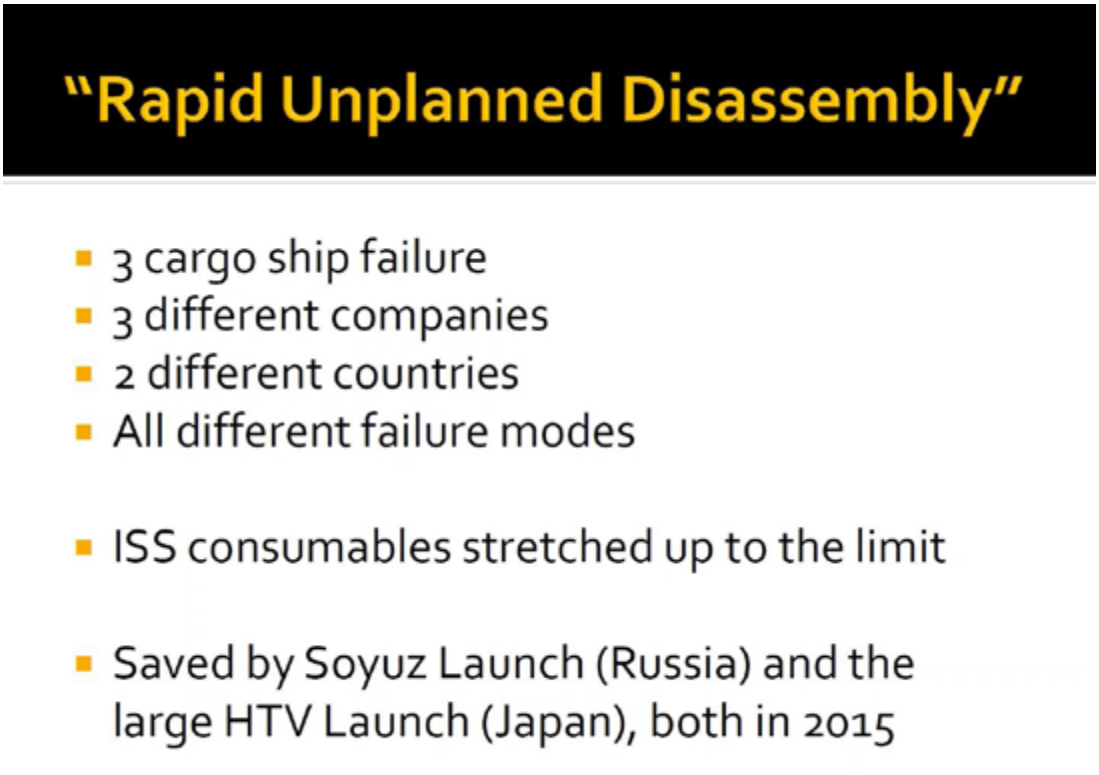
Andrea highlights a point about an asset's value:

"Asset management does not focus on the asset itself, but on the value that the asset can provide to the organisation." (ISO 55000:2014 - 2.4.2)

"We were out on a spacewalk, an EVA," Andrea says. "It was going great; we were ahead of time. We thought we'd be done in two hours and we were almost done."

The task was to bolt one of the relays back on the outside of the space station. Two bolts were needed to secure it, but the second would not go in properly; the bolt head was about a centimetre from being flush with the surface of the space station.

"So we're like, okay what do we do if the thread's not going all the way in? You torque it a little bit more. We did that – didn't work. All right… So if you were at home maybe you'd get a bigger lever and torque it even more.



List of spacecraft failures

WHEN THINGS GO REALLY WRONG…

Andrea believes the methods used for spacecraft could be applied to almost any industry. Team members are empowered and trusted implicitly to find solutions and keep operations running. The Flight Director has overall control, but trusts the team. There's a large amount of mutual respect.

Prior to taking over the console at a mission control, controllers have over 100 hours in a simulator.

They are tested to the limit with worst case scenarios, and every simulation ends with one of three emergencies: fire, depressurisation or an ammonia leak.

Andrea has even had her own Gravity moment.

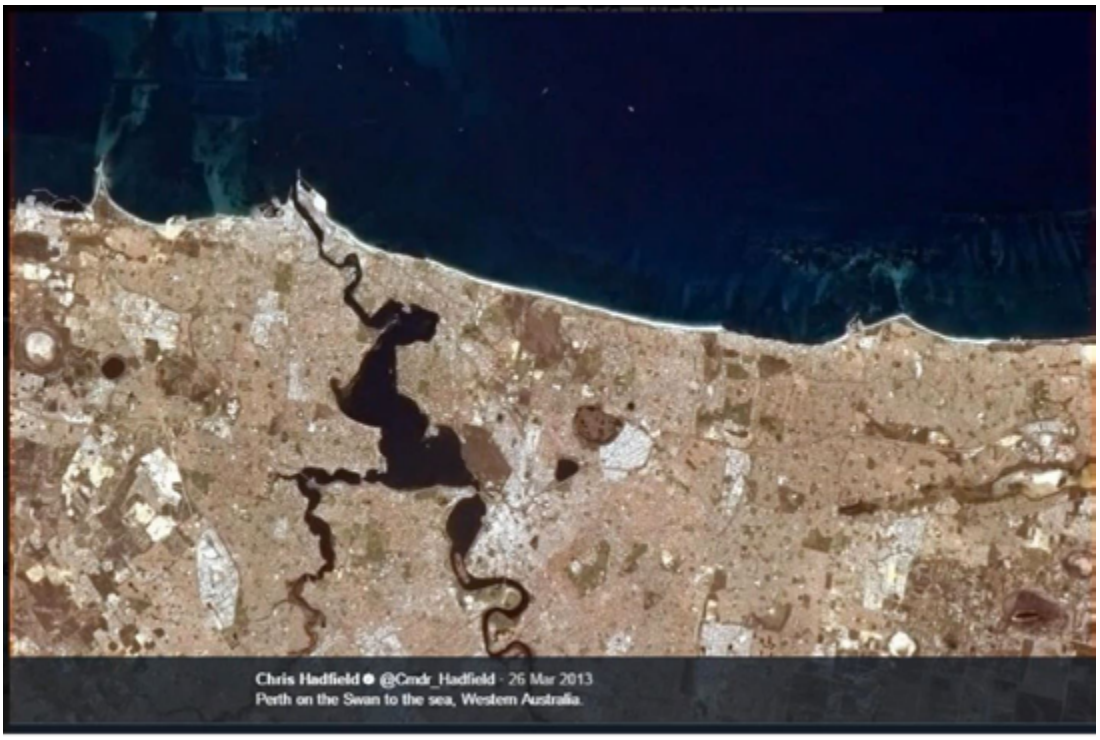
"We had space junk that almost hit the crew. They had to go take refuge in the Soyuz [space capsule] after closing all the hatches. Luckily, it missed the station," she says.

"We also had telemetry one day with the alarms going off for an ammonia leak. We did the procedure and dealt with it and five hours later we were able to ascertain there was a faulty combination of signals that resulted in the telemetry. We were grateful in the end that it wasn't the real thing."

There are four different companies that bring up cargo on spacecraft attached to rockets. Usually nothing goes wrong, but in 2014, space happened. An Antares rocket carrying a Cygnus spacecraft blew up above the launch pad in Virginia.

"Not long after that, the Progress, which was our amazing workhorse vehicle, had a problem in its third stage in space where it started spinning," Andrea remembers. "We were unable to stabilise it and it kept spinning and spinning, then slowly and spectacularly burnt up with all the cargo in it on re-entry a few weeks later.

"Then in June 2015, the SpaceX spacecraft launched, but had a rapid unplanned disassembly in mid-air. So that was three separate spacecraft failures."



Perth from the ISS

The crew found that ISS consumables were being stretched to the limit.

"Luckily, Russia launched another Progress and we were saved. Then we had a large HTV launch from the Japanese and that got us back on track. My team managed to get precious equipment up on a Soyuz launch, in an example of excellent international collaboration."

ASSET LIFE AND THE SPACESHIPS' GRAVEYARD

Originally, the space station was to be decommissioned in 2020. However, further analysis found the structures were usable until 2024. The theoretical maximum of the US segment of the space station is 2028.

The international partners agreed to keep the station operating until 2024.
After that, 2028 is the theoretical maximum.

"If you read any fantasy articles about moving the space station to the moon, that's rubbish," Andrea says. "It's an old station. It's got all of your regular mechanical stresses, especially to the truss structures."

When its time comes, the space station will be de-orbited after the Russian side is split off. Analysis shows that the Russian components have a few more decades in them. Russia will then have its own space station. China is now building its own station, due for completion in 2021. Russia and China will own the only space stations in orbit.

As for the ISS, Andrea says its final resting place has already been chosen.

"When we de-orbit big spacecraft, like the Mir space station or large satellites, there's a spot in the Pacific Ocean, east of New Zealand, where we de-orbit things safely. It's affectionately known as the Spaceships' Graveyard."

The WiAM webinar was hosted by Felicia Tristano, National Chair of WiAM, and moderated by Dave Daines, National Chair of the Asset Management Council.

AMCouncil Member Profile: Mark Mackenzie, CFAM

Certified Fellow in Asset Management (CFAM)

Name: Mark Mackenzie

Role: Strategic Consulting Manager

Location: K2 Techno, Perth, WA

Mark Mackenzie's career in asset management has taken him from the Australian Army to some of Australia's leading resource companies. Discover more about Mark's journey to becoming a leading reliability engineer and learn from his insights into how you can really progress your career.

WHY ASSET MANAGEMENT?

It seemed to fit with some of my natural passions of trying to make things work better, trying to make things optimal. It also enabled me to put some of the skill sets I had learnt over the years into practice. The more I became involved in it, the more I learnt, understood and desired to become successful in it.

The other thing is, I think that the subject of Asset Management quite broad ranging. I didn't need to stay in one area. Asset management has such a broad scope of activities and disciplines that you can always be touching on other areas which keeps it exciting. The interrelationship between elements of asset management continues to reinforce the need for a holistic approach.

HOW LONG HAVE YOU BEEN WORKING IN THE ASSET MANAGEMENT SECTOR?

More than twenty-five years.

WHAT IS YOUR SPECIALITY?

My speciality is reliability engineering, so all our aspects of reliability engineering - that's the discipline that I have done a lot of work in and the subject that I lecture in at the university.

WHAT DREW YOU TO EXPLORE MORE ABOUT RELIABILITY ENGINEERING?

I got into reliability engineering almost by accident when I was in the military. I was offered a Master's Degree in Reliability Engineering, which I thought would be a good skill set to have. After the degree the more I got into it, the more I enjoyed it, the more I learnt and became comfortable and confident with it. It seemed to me, that reliability engineering was an area where lots of people had an interest and concerns and queries that I was able to provide them answers for. I naturally grew in this discipline and did lots of work in different reliability projects and learnt little bits and made mistakes and just got a good experience in that area.

AMCouncil Member Profile: Mark Mackenzie, CFAM

WHAT'S THE BEST CAREER ADVICE YOU'VE EVER RECEIVED AND WHO GAVE IT TO YOU?

I can't remember if someone specifically gave it to me but it's the advice I would give and that is get involved with lots of different things. Always stick your hand up and volunteer to do whatever jobs there are, whether you think they're good or bad, because it gives you a broad knowledge base. Everything actually fits together at some stage and you never know when you're going to be called on to use that experience again. So, just put your hand up and volunteer and take every opportunity that's presented to better yourself and gain knowledge.

WHAT MAKES A GREAT ASSET MANAGER?

I think someone that's adaptable and flexible. There are very few people that know who are gurus in every aspect of asset management.

So, I think having a good understanding of all the different aspects and maybe specialising in one or two.

Reliability engineering is my specialty but I do need to know about spares, I do need to know about cataloguing, I do need to know about maintenance.

So, the more the other areas that you're conversant with and confident with, the better and more rounded you are as an asset manager.

So, I think picking up extra skills and learning those things that maybe aren't your core business - but picking up those extra skills just to know where they fit and complement what you are doing. Asset management is a group of inter-related activities and everyone needs to come together and do the right thing in their area because, if one of those areas isn't done well, then asset management as a whole fails. The best maintenance plans will fail if there are no spares, or the wrong maintenance competency is identified, or the support equipment is unavailable.

WHAT IS THE MOST EXCITING TREND THAT YOU'VE NOTICED IN ASSET MANAGEMENT TODAY?

I think people are understanding that asset management is a holistic approach, so with more relevant data, new software and all the other technologies now available companies can see the interrelationships like never before. I also think that industries are getting more aware that asset management is an actual discipline and there is value to the business in getting it right.

In the past it was often considered a burden to do maintenance and hold spares and manage warehousing and all the other support activities. It was a burden and companies didn't see it as a way of really helping their bottom line. So by getting more recognition and more understanding of what asset management truly is and the value it can bring to companies if done right vindicates what I and other have been promoting for several years.

WHAT IS THE BIGGEST CHALLENGE FACING UP-AND-COMING ASSET MANAGERS TODAY?/ WHAT ADVICE WOULD YOU GIVE TO AN UP-AND-COMING ASSET MANAGER TODAY?

The biggest challenge is being able to quantify and sell the value of asset management. Most people that are playing in asset management know or feel that what they're doing is valuable but sometimes it's hard to convince other people that control funds or control projects that asset management provides tangible benefits. Sometimes it is difficult to build a business case to really have others understand why asset management is so important and how important it is to get it right at the right time of the life-cycle.

The advice I would give is that, if you're going to do your work, obviously do it well. But justify your existence; prove that what you're doing in the asset management space is going to bring value to the business. If it's going to bring value to the business, you've got to be able to demonstrate it, quantify it and really argue your case.

WHAT IS THE BIGGEST CHALLENGE FACING THE ASSET MANAGEMENT SECTOR TODAY/YOUR PARTICULAR FIELD OF ASSET MANAGEMENT TODAY?

Obtaining high level specific training in the disciples of asset management. There are several training courses around Australia delivering basic training, but most of the top-level high-quality specific disciple training is done overseas.eg post graduate reliability training . The people that I know in the industry that have got a really good grasp of reliability have done their post-graduate reliability studies overseas.

WHAT IS YOUR PROUDEST CAREER ACHIEVEMENT?

It's hard to say. I had a whole career in the military and had some unique experiences. I have received a number of awards in and out of the military but I just like being able to help people. I enjoy giving people good solutions to problems they have encountered and getting good feedback from them saying, "The work that you've done has been valuable to us."

I also like teaching, so when people come back after a training course and they say, "I really appreciate that. I learned a lot from that course, it's really turned the light on." Being able to mentor people and see them progress, I think is probably what I enjoy the most.

I consider my most rewarding job the two years I had doing an aid project in Vanuatu, where I was responsible for installing water supplies in remote villages. The work was difficult and challenging but it delivered a tangible benefit to the people in those villages and they were so happy that work was done. I just felt that the work that I had done was really contributing to the community and they appreciated it.

WHAT'S NEXT FOR YOU?

What's next for me is that I want to gradually retire and do aid work in places that actually benefit from my skills, helping people that actually need it.

WHEN YOU'RE NOT BUSY AT WORK, WHAT DO YOU ENJOYING DOING TO UNWIND/RELAX/EXPLORE?

I do maintenance and engineering projects at home, on my property. I've got a six-acre property so I'm always tinkering, building things or doing maintenance of some type. I have lots of tools and toys so I like to make different things.

In an ever-changing and competitive work environment, it can be difficult to distinguish yourself. Consider your potential and become certified in asset management today.
http://www.amcouncil.com.au/certification/

AMCouncil Member Profile: Raymond Tan, CSAM

Certified Senior Practitioner in Asset Management (CSAM)

Name: Raymond Tan

Role: Head of Asset Management Intelligence Support

Location: Auckland Council, New Zealand

Originally from Singapore and now having lived in New Zealand for close to twenty-six years, Raymond Tan juggles a busy career in asset management and life with three teenage boys. Discover more about Raymond's asset management journey so far and learn from his insights into how you can really progress your career.

WHY ASSET MANAGEMENT?

Asset management was my preferred choice. It was the most appropriate discipline for my various professional development.

It provided the opportunity to integrate my formal education and working experiences in facilities, financial, strategic and operational management, mainly focused on physical assets.

To me, it's essentially not a new discipline, but an amalgamation of a multiple of disciplines that focus on whole of life value of an asset in relation to its benefits, costs, and risk and service performance.

HOW LONG HAVE YOU BEEN WORKING IN THE ASSET MANAGEMENT SECTOR?

If you consider the broader definition of 'managing physical assets', I have worked in the defence, hotel, education, health, banking, corporate property, central local government organisations during the last thirty years.

WHAT IS YOUR SPECIALITY?

Operationalisation of core asset management disciplines in organisations which includes asset information systems development, designing operational models, implementation of asset management strategies and enhancing staff capabilities.

Over the last ten years, I've mainly focused on the integrated asset management discipline. So, I'm able to do a strategic asset of a need or an asset or a group of assets or a portfolio - look at what's required when we actually decide to build it or acquire it and, towards the end, when we decide to dispose of it or perhaps change its function or reconfigure it's use.

WHAT DREW YOU TO EXPLORE MORE ABOUT THE INTEGRATED ASSET MANAGEMENT DISCIPLINE?

After I left the asset management consulting industry in 2010 where I assisted organisations with developing asset information systems, developing asset management plans. I got offers to join many of the organisations I worked with, to help optimise the value of both the systems and the strategies that I put together with them. I chose Auckland Council which has just undergone a major transformation after the amalgamation of eight legacy councils. I have been involved in many asset management projects over the years which had led me to realise that change management methodologies involving human factors, the culture, the behaviour and capabilities, was just as important than just building a system on its own. This led me to my current position, where I have the chance of both being able to quickly change the environment so, for me, financially for pleasures as well as being able to cope with technical advances, to build up more effective and efficient asset management organisation.

WHAT CAREER ADVICE WOULD YOU GIVE TO UP AND COMING ASSET MANAGERS?

Be very good in one or more disciplines related to asset management before making a decision, or whether you prefer to take either a technical specialist role or a people leader career path.

Never stop learning the things you have the most passion for even if, in your career, the opportunities are unfortunately not immediately available.

A great asset manager is one that meets the demands of service expectations a few years ahead of time.

WHAT IS THE MOST EXCITING TREND THAT YOU'VE NOTICED IN ASSET MANAGEMENT TODAY?

It's probably the rate of technology advancement - mobile technology and also big data analytics. There's so much choice around and I think perhaps the challenging thing is to go back to grass roots and answer the fundamental questions - why do we need the asset? Or why do we need a service that's going to be delivered from the assets?

Because sometimes we can get carried away with just trying to understand every bit of information and digest every bit

of data, and miss the point of actually why we have that in the first place.

WHAT IS THE BIGGEST CHALLENGE FACING UP-AND-COMING ASSET MANAGER'S TODAY?

I think technology will eventually take over some of the disciplines asset managers try very hard to obtain over a long period of time - so computers and drones and everything else you can think of - will be able to do some of the tasks that we've now all been trained to do, using our hands. But one thing that will not be replaced by technology is communication and relationship's fields.

I've come across many times, when I've put an asset management plan together or I've put an asset management system together, is sometimes we struggle to make it work well and I think one of the most common short-comings is how we communicate and tell a very good story.

AMCouncil Member Profile: Raymond Tan, CSAM

And after we do tell a good story - a compelling story - as to why we need to introduce change, building the relationship is just as important. People need to understand and have empathy from the user's perspective, how they can actually make them do their work better. That's the biggest challenge - we need more communications.

WHAT IS YOUR PORUDEST CAREER ACHIEVEMENT?

I've just got my staff engagements score of over sixty percent, compared to my organisation which has an average of fifty percent. I'm really proud of that.

I've just got a small team of forty people and they've worked very hard over the last twelve months or so. For the last seven years, everyone kept saying it was impossible but, over time, we can definitely get things done.

WHAT'S NEXT FOR YOU?

Contribute further to the asset management profession and promote the discipline to other organisations outside Auckland Council and outside New Zealand. I'm currently involved with PacificTA to develop an Asset Plan for the Samoan government

WHEN YOU'RE NOT BUSY AT WORK, WHAT DO YOU ENJOY DOING TO UNWIND?

I like to go fishing on a boat. I've got a kayak as well but I haven't had a chance to take it on the water yet, I've been too busy. But that's one of my things - just looking out at the ocean - whether I catch a fish or not, I feel very relaxed.

In an ever-changing and competitive work environment, it can be difficult to distinguish yourself. Consider your potential and become certified in asset management today.
http://www.amcouncil.com.au/certification/

UP COMING **EVENTS**

EVENT	DATE	LOCATION	REGISTRATION VIA WEBSITE FOR ALL EVENTS
December 2017			
AM in Action #7 – Arup and Jacobs by Josh Symonds	5/11/2017	Webinar	**CLICK HERE**
Sydney – Join us to review the year and network!	6/11/2017	Sydney	**CLICK HERE**
Gippsland – Asset Management Workshop	6/12/2017	Gippsland	**CLICK HERE**
Perth - End of Year Celebration	7/12/2017	Perth	**CLICK HERE**
Melbourne – The Year that was in Asset Management	14/12/2017	Melbourne	**CLICK HERE**
AM in Action #8 – K2Techno by Mark Mackenzie	19/12/2017	Webinar	**CLICK HERE**
CAMA EXAM (WPIAM) - Register Through www.wpiam.com			
Australia (CAMA)	8/12/2017	Melbourne	

MERRY **CHRISTMAS**

from the Asset Management Council

AMCouncil National Office will be closed from close of business
Friday 22 December 2017 reopening **Monday 15th January 2018.**

BROADSPECTRUM

Infinite Solutions

OPTIMISING SUSTAINABLE ASSET VALUE

We will work closely with you to provide financial, compliance and technical solutions utilising the levers of degree of in-service support, acquisition and disposal of physical assets.

We understand that managing your assets is about pursuing optimum sustainable performance in support of the development of shareholder value, whilst complying with requirements for health, safety and the environment. To achieve this we adopt a whole-of-life approach, ensure legislative compliance, pursue best asset management practices, make sure the people used in the management of your resources are appropriately selected, developed and trained, and apply continuous improvement at every step.

Membership Application

ASSET MANAGEMENT COUNCIL

ASSET MANAGEMENT COUNCIL LTD

A Technical Society of Engineers Australia

ABN: 15 141 532 747 www.amcouncil.com.au
Phone: +613 9819 2515 Email: accounts@amcouncil.com.au

Thank you for joining the Asset Management Council. Please complete all sections. Phone or email with any queries.

PERSONAL DETAILS (Please print in BLOCK CAPITALS)

Title (Please circle) Dr Mr Mrs Ms Miss Other (Please specify) Sex (Please circle) F M

Family Name Given Names (in full)

Date of Birth Engineers Australia Membership No

CONTACT DETAILS (Please print in BLOCK CAPITALS)

Preferred Address: ☐ Private Address or ☐ Business Address

Position

Organisation

Postal Address

City State

Country Postcode

Phone Fax

Mobile

E-mail

AREAS OF INTEREST (Please tick)

Technical Topics

- ☐ Reliability
- ☐ Availability
- ☐ Maintainability
- ☐ Performance
- ☐ Spares Planning
- ☐ Maintenance Planning and Scheduling
- ☐ Maintenance Plan development and implementation
- ☐ Maintenance Policy/Strategy development
- ☐ Logistics
- ☐ Shutdown planning and the maintenance interface
- ☐ Asset Management
- ☐ Other:

Issues

- ☐ Skills development
- ☐ Training
- ☐ Other:

Industries

- ☐ Facility Management
- ☐ Consulting
- ☐ Power
- ☐ Transport
- ☐ Defence
- ☐ Oil and Gas
- ☐ Mining and Industry
- ☐ Water and Utilities
- ☐ Infrastructure
- ☐ Other:

Return completed Membership Application with payment to:
Asset Management Council
PO Box 2004, Oakleigh Vic 3166

GROUP AFFILIATION

☐ Young Asset Management Practitioners (18-35 year olds)

CHAPTER AFFILIATION (Please tick one)

☐ Newcastle ☐ Canberra ☐ Sydney ☐ Illawarra ☐ Mackay
☐ Melbourne ☐ Adelaide ☐ Brisbane ☐ Hobart
☐ Darwin ☐ Overseas ☐ Gippsland ☐ Perth

MEMBERSHIP FEES Effective Jan 2015 (Please tick one membership type only)

Individual Annual Fee (including GST)

☐ Member $154.00
☐ Student $33.00

Corporate Annual Fee (including GST)

☐ Platinum $9,570.00 ☐ Gold $3,608.00
☐ Silver $1,804.00 ☐ Bronze $957.00

GST (10%) does not apply to overseas memberships.

CORPORATE MEMBER NOMINEES

Platinum – 30 nominees, Gold – 10 nominees, Silver – 10 nominees, Bronze – 5 nominees

	Name	Email	Date of Birth (Mandatory)	AM Council Chapter
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Contact Asset Management Council to provide more corporate nominee details.

PAYMENT

Method of Payment (please tick one and enclose payment)

☐ Cash

☐ Money Order or Cheque drawn in AUD from an Australian bank) payable to **Asset Management Council Ltd**

☐ International Money Order

☐ Credit Card
(Australian or New Zealand Bankcard only acceptable)

Credit Card Details Please charge my card (tick one card type)

☐ Visa ☐ Bankcard ☐ Mastercard
☐ Diners ☐ American Express

Card no _____

Expiry _____ Amount $ _____

Name on card _____

Signature _____ Date _____

New Members

Koray	Faiz
Mike	Cush
Chris	Hatch
Christakis	Street
Slava	Miller
Ramesh	Liyanagedera
Brett	Maher
Tim	McQualter
Neil	Lawson
Barry	Murray
Jo	So
Manuel	Martinez
Jay	Hong
Andrei	Ezergailis
Hongtao	Cao
Robert	Alcaro
Adam	Hoare
Edward	Luk
Sam	Murali
Paul	Bamforth
Peter	Schurmann
Michael	Meraklis
Peter	Livingston
Kirsty	Kalantzis
Kevin	Gray
Luke	Vaughan
Julie-Anne	Latham
Tim	Barclay
Michael	Colville
Craig	Robert
Sarah	Hannah
Louise	Carcanis
Peter	Hannam
James	Mann
Trajce	Tosevski
Hugh	Brown
Barry	Smith
Johan	Van Dyk
Bruce	Wilson
Melanie	Anderson
Sean	Fogarty
Nik	Aloustani
Rocky	Wolters
Travis	Parker
Ian	McGivney
Phillip	Mansfield
Ray	Hezkial

Pierre	Cassian
Kristian	Sorbello
Anthony	Cordina
Marieke	Van de ley
Jonathon	Spencer
James	Calaitzopolous
Mario	Abdelmeseh
Matthew	Fahey
Paul	Ryan
Peter	Engelen
Carsten	Varming
Orlando	Tonholi
Shannen	Masia
Wendy	West
Peter	Coventry
Scott	Robertson
Alex	Payne-Billard
Anthony	Fagan
Samar	Patel
Daan	van Riel
Tim	Mortensen
Tony	Bosch
David	Morgan
John	De Bono
Abraham	Kazzaz
Walter	Makoni
Kristyl	Horton
Siva	Thiru
Alan	Samuel
Devaraj	Balaraman
Shaun	Begley
Jose	Rodriguez
Ernest	Senior
Dave	Franzel
Janarthan	Sri Kantha
Wayne	Spencer
Janet	Purcell
Vahid	Pourghadiri
Janet	Wilson
Paul	Bruzzone
Ivy	Huynh
James	Porter
Omeremeth	Concha
Oliver	Morrissey
Daniel	Brauer
Aravindhan	Rajaratnam
Anthony	Comegna

Filip	Buyse
Paul	Parolo
Samantha	Tulloch
Rob	Pradera
Prosper	Odeta
Charles	Davis
Graham	Piggott
Nicola	Belcher
Claire	Whinney
Vaishali	Ghosh
Varan	Karunakaran
Melanie	Vincitorio
Peter	Teakle
Simon	Rooney
Desiree	Nortje
James	Carroll
Christopher	Gaspard
Prem	Panicker
Dean	Larsen
Joshua	Lowndes
Sam	Isaacs
Nathan	Peime
Michael	Grainger
Amy	Lezala
Wayne	Threlfall
Peter	Gall
Kate	Babic
Meredith	Blais
Helen	Kennedy
Claire	Fazakerley
Russell	Pascoe
Zoran	Ribicic
Alex	Pavlickovski
Adrian	Connor
Lejan	Palackathrappil
Vickram	Chundhoo
Ashraf	Zaghwan
Fengrui	Hu
Aayush	Chaurasia
Medina	Huzejrovic
Ali Reza	Hashimi
Ling	Guo
Pola	Ghaly
Janardhan	Yembalam
Jaber	Hassani

New Corporate Members

NSW Ports
Energy Queensland
Boeing Defence Australia - Wedgetail In Service Support
Pindan Asset Management
Penrith City Council
Wood Plc (Australia)
Australian Rail Track Corporation Ltd (ARTC)

empowering sustainable change

2018 AMPEAK

ASSET MANAGEMENT COUNCIL INTERNATIONAL CONFERENCE

"The AMPEAK conference is the key meeting place for thought leaders in asset management across all industries"

SUNDAY 15 APRIL- WEDNESDAY 18 APRIL 18

Wrest Point, Hobart Australia

www.ampeak.com.au

AMPEAK 18 HOBART CALL FOR PAPERS

We would like to invite professionals, students and organisations from asset intensive industries and academia to apply to present their asset management technical and research developments at AMPEAK18 Asset Management Conference 2018

ABSTRACT SUBMISSIONS CLOSE 30TH NOVEMBER 2017

AMPEAK18 THEME IS "ASSET MANAGEMENT – EMPOWERING SUSTAINABLE CHANGE"

AMPEAK18 will consider common asset management challenges and share solutions that may be from academia, from a maintenance practitioners experiences an asset management journey or from a specific industry sector. Eight sub themes have been identified under the conference theme of empowering sustainable change as follows:

Leadership and Culture – how do you embed an AM culture?

Technology & Innovation – how to use to drive empowerment

Sustainable Asset Management Planning

Measuring Sustainable Impact – what data do you need?

Shared value – value of AM to community, organsiations,

Equipping yourself and your workforce for a sustainable future

Legal aspects of asset management

ISO55000x & AM Frameworks, Standards, Certification

KEY DATES:

Abstract submission closes
Thursday 30th November 2017

Final paper submitted **Friday 9th March 2018**

For details and to submit your abstract go to **http://www.ampeak.com.au**

Partners, Corporate Members & Contacts

Partnering Organisations

Broadspectrum
www.broadspectrum.com

IFM Investors
www.ifminvestors.com

SAP Australia
www.sap.com

PLATINUM

Asset Standards Authority, Transport for New South Wales
Ausgrid
BAE Systems
Broadspectrum
Downer Engineering, Construction & Maintenance
Industry Funds Management (IFM)
SAP
Ventia Pty Limited

GOLD

Airservices Australia
Atos Australia Pty Ltd
Austal Ships Pty Ltd
Bentley Systems International Limited
Bombardier
Capability Partners
Cardno (QLD) Pty Ltd
City of Ballarat
Department of Defence - Capability Acquisition and Sustainment Group - Programme Management Branch
Department of Defence CASG
GHD Pty Ltd
Hardcat Pty Ltd
Jacobs
K2 Technology Pty Ltd
Lendlease Services Pty Ltd
Naval Ship Management (Australia)
Power and Water Corporation
Riva Modeling Systems
Stanwell Corporation Limited
Sydney Water Corporation
Thales Australia Limited
TransGrid
Transurban Ltd
Utopia Global Inc.
Vesta Partners
Warship Asset Management Agreement
Wave International Pty Ltd
Western Power

SILVER

ActewAGL Distribution
AECOM
AGL
AMCL
ASC Pty Ltd
Australian Rail Track Corporation Ltd (ARTC)
Broadcast Australia
Capability Acquisition and Sustainment Group - Land Engineering Agency
Cardno (QLD) Pty Ltd
City of Perth
I @ CONSULTING (PTY) LTD
Jemena Asset Management
Kellogg Brown & Root Pty Ltd (KBR)
Lake Maintenance Pty Ltd
Logsys Power Services
Lycopodium Infrastructure Pty Ltd
Metro Trains Melbourne (MTM)
Nova Systems
NSW Office of Environment and Heritage, National Parks and Wildlife Service
Programmed Facility Management
Public Transport Authority
QinetiQ Australia
Refining NZ
SKF Australia Pty Ltd
SNC-Lavalin Rail and Transit
Sodexo Australia Pty
Sydney Trains
Unitywater
VicRoads
VicTrack
WSP Parsons Brinckerhoff

BRONZE

ABB Enterprise Software
Activa Pty Limited
Advisian Pty Ltd
Akzo Nobel Pty Limited
ANSTO
Aquenta Consulting Pty Ltd
ARMS Reliability Engineers
Asset Management Council
Assetic Pty Ltd
Assetivity Pty Ltd
Aurecon Australia Pty Ltd
Australia Pacific Airports (Melbourne)
Babcock Pty Ltd
Bluefield
Boeing Defence Australia - Wedgetail In Service Support
Brisbane Motorway Services
Bureau Veritas
Campeyn Group
Certus Solutions
Comdain Infrastructure
Country Fire Authority (CFA)
Country Fire Authority (CFA)
Covaris Pty Ltd
Cushman & Wakefield
Cyient
Delta Facilities Management Pty Ltd
Department of Environment, land, Water and Planning
Egis Road Operations Pty Ltd
Electrix Pty Ltd
Energex Limited
Energy Queensland
Frazer-Nash Consultancy Limited
Fremantle Ports
GDF Suez Australia Energy
Gladstone Area Water Board
Goulburn Valley Water
Griffith University
HDR Inc
Hexagon PPM
Hobsons Bay City Council
Hunter Water Corporation
Icon Water Limited
Indec Consulting
Innovative Thinking IT
Institute of Quality Asset Management
KPMG
LogiCamms
Macutex
Maintenance & Project Engineering Pty Ltd
Maintenance Systems Solutions Pty Ltd
Melbourne Water
Meridian Energy
Nexus Global Australia
North East Water
NRG Gladstone Operating Services
NSW Ports
Opus International Consultants
Pacific Hydro
Paradoxian Pty Ltd
Penrith City Council
PHC Projects
Pindan Asset Management
Port of Newcastle
PricewaterhouseCoopers
QENOS
Redeye Apps
Relken Engineering
SA Power Networks
SEQWATER
Shoalhaven Water
St George Community Housing
State Automation
Structural Integrity Engineering Pty Ltd
Sutherland Shire Council
Tasrail
TasWater
Terotek (NZ) Limited
The Asset Management College
Townsville City Council
Transport For Victoria
United Energy
Water Corporation
WaterNSW
Wood Plc (Australia)

Testimonials

Mark Mackenzie: *" It's the peak body, not only in Australia, but for asset management around the world. We've got representation on a number of international forums and organisations. Australia, surprisingly, is leading the world in asset management. A lot of countries are adopting what we're doing and so being part of that is, I guess, being part of best practice with asset management in Australia."*

Greg Williams: *" I think it's not associated with any particular industry. We're not water, we're not electricity, we're not gas. We're about sharing knowledge, we're about providing forums for people to express points of view, we're about connecting together. Those are the three key reasons that I'm involved and I think those reasons are probably the same that most people get involved in the AMC."*

Melinda Hodkiewicz: *"They have done a tremendous amount to promote the professionalism of asset management and I really applaud the work that they have done to assist asset managers - not only to professionally develop, but to also provide events like the AMPEAK that bring a whole bunch of people together who wouldn't otherwise have any way to connect."*

Dave Daines: *"I think now asset management is really starting to draw people in the ability to use the standard to save money and improve performance, so that's really the key now to what the standard was developed for. I think now, when people are talking about it, they come together and there's that vibrant feel to get some activity generated from that."*

Tom Birdseye: *" It's really given me a leg-up in terms of my ability to be able to network and my ability to be able to communicate with the other professionals in the asset management industry. As a young asset manager, I guess you would call me, I would never really have exposure to any of the types of people or the contacts that I have been able to be exposed to as the Adelaide Chapter Chair."*

Martin Kerr: *"We're always looking for a new set of eyes, new ideas and of course experiences, and I think it's the richness of those things that actually contribute and make the AmBOK team as powerful as they are. All the models that we actually create, we actually use to create other models, so it actually demonstrates that we're actually testing ourselves for everything we do."*

Peter Kohler: *"Not just learn from the approach the AMCouncil might take to doing things in terms of its advice as to how you might manage your assets better, but also to be able to talk to people. There's a lot of huge amount of experience - good and bad - in the room and you should get a hold of that, listen to that, and take what you think would be useful and relevant out of that."*

ASSET MANAGEMENT COUNCIL

THE ASSET JOURNAL

Asset Management Council

PO Box 2004
Oakleigh Vic 3166

Tel 03 9819 2515

www.amcouncil.com.au


ASSET MANAGEMENT COUNCIL
AMCouncil
Asset Management
Awards Program 2018

The Asset Management Council Awards provides an outstanding opportunity to recognise excellence in the management of physical assets through their life cycle from concept creation to disposal and showcase use of best practice Asset Management systems and processes.

It is a chance to show what your organisation can do in asset management and celebrates the successes of individuals or teams. Applications are sought from organisations across a broad range of industries involved in Asset Management, including private companies, contractors, consultants, service authorities, and Government bodies

The Awards are divided into three parts

PART A – The Excellence Awards

PART B – The people Awards – For details of the people awards refer to the AMCouncil website

PART C – The Organisational Maturity Assessment Awards – for details of the Organisational Maturity Assessment Awards refer to the AMCouncil website

PART A.
The Asset Management Excellence Awards

Categories

The following categories are available in the Asset Management Excellence Awards;

1. Asset Management Innovation Award

Projects, products or frameworks that demonstrate new techniques or innovative approaches to asset management best practice at any or all of its life cycle stages.

2. Asset Management Information Management Award

Projects demonstrating best practice techniques and originality in the use and management of asset management data in one or more of the areas of acquiring data, storage of data, representation/interpretation of data and using data for decision making. Software programs will not be considered.

3. Asset Management CRP Award – Cost/Risk/Performance

Projects demonstrating the balance between the elements of cost, risk and performance to obtain a valuable solution for an asset.

4. Asset Management Environmental and Social Value Award

Projects which demonstrate a solution to an identified community need which was solved through the use of asset management principles. Consideration of the impact on the people involved, environmental factors and profit or value derived to the community service or organisation.

5. Safety in Asset Management Award

Demonstrates the use of asset management principles to manage safety better.

6. The Asset Management Diversity Award

Sponsored by Western Power, Asset Management Business Unit

The Diversity category recognises and promotes the positive contribution made by organisations that demonstrate a holistic and long-term commitment to diversity within the Asset Management community. Some key characteristics of workforce diversity may include race, ethnicity, gender, age, religion, ability, and sexual orientation.

Note: More than one award in each of the above (6) categories may be awarded if the Judging Panel judge more than one of the nominees are worthy of that recognition. Judges decision is final.

Assessment

Assessment of Categories 1 to 5 – the Asset Management Excellence Awards will include the following attributes:-

- Use of best practice asset management principles – 40%
- Degree of originality and ingenuity of solution – 20%
- Program and project management – 20%
- Benefit of the project or service to the community or organization – 15%
- Presentation of the award submission itself – 5%

Assessment of Category 6 – the Asset Management Excellence Awards – Diversity Award will include the following attributes:-

- Leadership – 40%
  How does your leadership team invest and build talent to create an inclusive workplace and diverse team? Outline how you are leading the way and attracting and growing a diverse talent pool. Include methods of measurement and targets in your submission
- Innovation – 30%
  Explain how innovative approaches have been used in achieving diversity. Highlight bold ideas, achievements, challenges and lessons learnt. Or demonstrate how innovation has been achieved through leveraging individual backgrounds, perspectives, experiences and strengths
- Diversity benefits – 25%
  Explain how your diverse team has positively impacted the organisation, stakeholders and contribution to the community
- Presentation of the award submission – 5%

Eligibility

Eligibility for Awards Part A –
Asset Management Council Excellence Awards

- The nominee must be a member or from a member organisation of Asset Management Council
- Permission to submit the Award should be obtained from the organisation's Executive Management
- The project must have been completed in the 12 month period immediately preceding the closing date.
- The service must be sustainable and operational at the time of nomination.
- No project or service is too large or too small, with consideration being given to the size and resources of the organisation and its staff.

Applications for Asset Management Excellence Awards

Applications should be submitted electronically in both MSWord format and pdf format and can be

- emailed to **training@amcouncil.com.au**
  Larger files can be submitted through dropbox (request details) or
- via mailing on a usb,to AMCouncil,
  PO Box 2004 Oakleigh Victoria 3166

Submissions should be suitable for publishing in the AMCouncil newsletters, The Asset Journal or for publicity purposes.

Submissions should be limited to 2000 words and include an executive summary of 100 words (Microsoft Word format) with two high resolution JPEG photographs for possible use at the presentation ceremony. Information to be provided is detailed on the application form found on the back page.

All applications will be acknowledged.

Closing Date

Closing Date for submissions for the Asset Management Excellence Awards is Close of Business **Friday 9th March 2018.**

Privacy and Confidentiality

By lodging your entry for the Asset Management Council Excellence Awards with the AMCouncil, you agree to the use of the documents and information you provide to AMCouncil (your Awards entry) as follows.

- In assessing and judging entries for the Awards, AMCouncil will provide your Awards entry on a confidential basis to AMCouncil staff who manage the Awards and external industry experts who have been appointed by AMCouncil to judge the Awards
- If you are selected as a finalist or as the winner of an Award, AMCouncil may reproduce or publish your Awards entry or any part of it including images and video recordings for the purposes and promotion of the Awards.
- AMCouncil endeavours to deal with any personal information it receives strictly in accordance with *AMCouncil's Privacy Policy.*

If your Awards entry contains confidential information or trade secrets you must notify AMCouncil that the information is confidential by marking the relevant part of your Awards entry "Confidential – not for publication". AMCouncil will not publish or reproduce information marked in this way without your consent

A GALA DINNER IS TO BE HELD ON **TUESDAY 17TH APRIL 2018** AT GLENALBYN ESTATE, HOBART, WHERE THE WINNERS OF THE ASSET MANAGEMENT AWARDS WILL BE ANNOUNCED.

Invitation
To Nominate

ASSET MANAGEMENT COUNCIL

APPLICATION FORM PART A – EXCELLENCE AWARDS

Title of Submission/Project:

Name of Organisation/Team/Person Nominated for Award:

Contact Name :

Contact Email address:

Contact Phone:

Nominators: **No 1**

No 2

Excellence Award Category (tick the box)

☐ **1.** Innovation ☐ **2.** Information Management ☐ **3.** Cost/Risk/Performance

☐ **4.** Environment and Social Value ☐ **5.** Safety ☐ **6.** Diversity

Information to be provided

Categories 1 - 5

1. Summary of the project, product, framework (maximum 100 words)
A short paragraph or dot-point summary of the key aspects of the project or framework

2. Description of project or framework addressing the assessment criteria (maximum 1000 words)

- Use of Best Practice Asset Management Principles
- Degree of originality and ingenuity of solution
- Program and project management
- Benefit/Value of the project or service to the community or organisation
- Submission

3. Opinion as to specific contribution made by the nominated individual/team /organisation (maximum 500 words)

4. General comments you may wish to add (maximum 500 words)
Attach photos, plans, reports etc that demonstrate particular features of the project or framework

Category 6

1. Summary of your asset management team (max 100 words)

2. Demonstration of Organisational Leadership in creating and maintaining

- your asset management team
- How does your leadership team invest and build talent to create an inclusive
- workplace and diverse asset management team
- How do you attract and retain asset management talent

3. Demonstration of Innovation in your asset management team

- How innovative approaches have been used in achieving diversity

4. Diversity benefits

- How has the diverse team had a positive impact on the organisation,
- stakeholders and its contribution to the community

5. General Comments you may wish to add

PART B.
The Asset Management People Awards

Categories

1. MESA Medal

The MESA Medal is the most prestigious asset management award, highly regarded within the asset management community, and given only to individuals who have demonstrated a significant contribution to asset management. A separate application form for those wishing to nominate for the MESA Medal is available from website or from training@amcouncil.com.au

2. AMPEAK Best Paper Award

Awarded annually to the best paper in the Annual Conference Proceedings of **AMPEAK 2018**. If it is determined that no papers are of the required standard then the award will not be made. All authors are eligible, including non AM Council members and residents of other countries

PART C.
The Asset Management Organisational Maturity Awards

The Asset Management Organisational Maturity Assessment Awards program offers a number of awards annually, to organisations and individuals for outstanding work within the discipline of asset management and maintenance engineering. It is designed to be a tool which evaluates asset management and maintenance practices to an industry benchmark. Asset Management Organisational Maturity Assessment Award Reviews are conducted both nationally and internationally. A separate application form for those wishing to participate in the Asset Management Organisational Maturity Assessment Awards is available for download from the website or by requesting from **training@amcouncil.com.au.**