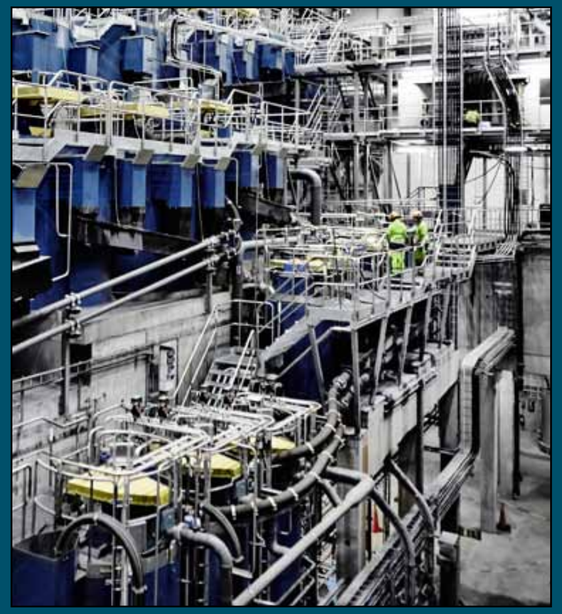
AMMJ

April 2016 Issue

Asset Management And Maintenance Journal



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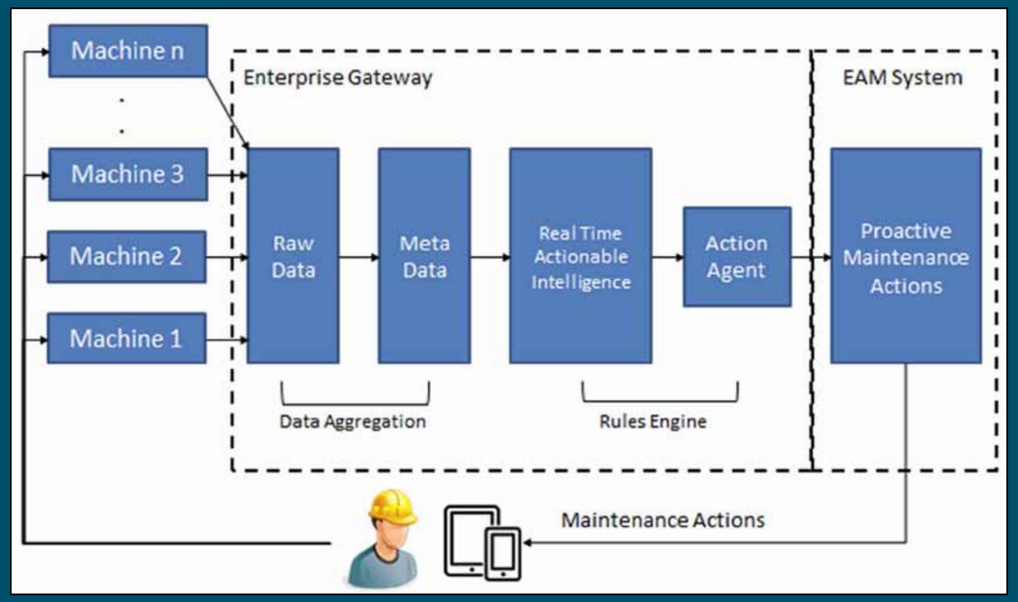

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Please Note:

The next issue will be published 24 June 2016 and will be last issue of the AMMJ. We started publishing in 1987 and are finally closing down.

Condition Monitoring Is Not Enough

Jason Tranter Mobius Institute Australia

ABSTRACT

Condition monitoring is a powerful technique used to detect incipient failures in rotating machinery and other plant assets. By accurately diagnosing fault conditions at an early stage, the risk of failure can be reduced, and the cost of corrective action can be minimized. However, in the majority of cases, condition monitoring techniques are used to detect fault conditions that should not exist – that have arisen due to poor procurement, storage, work management, installation, maintenance, and operating practices. This paper explores the idea that, while condition monitoring is vitally important, more must be done in order to maximize plant utilization through an active defect elimination programme.

INTRODUCTION

For many years, techniques such as vibration analysis, infrared thermography, ultrasound, oil analysis etc. have been used to monitor rotating machinery (and other plant assets) in order to detect incipient fault conditions, diagnose the nature and severity of the fault condition, and provide a report that informs the maintenance department about the assets that require repair or replacement. While these techniques are not perfect, and they do require training in order to attain a sufficient level of competence, condition monitoring has been used to reduce the occurrence of unexpected failures in the majority of industries around the world.

Over the past thirty years the author has witnessed a large number of plants initiate a condition monitoring programme only to see it scaled back or cancelled altogether. In some cases they were poorly organized or the technicians were poorly trained. In other cases they were too successful (reducing the number of unexpected failures) and they failed to inform upper management of their success and on-going importance, and management saw an opportunity to save money by cutting condition monitoring staff.

Regardless of the outcome of the condition monitoring programme it is rare to find companies that have successfully gone beyond condition monitoring to eliminate the root causes of the defects. While it is not possible to totally eliminate failures it is possible to greatly reduce the source of defects that are ultimately detected by the condition monitoring group.

CONDITION BASED MAINTENANCE

When condition monitoring is used to determine the health of equipment, and the corrective maintenance required, it enables a plant to move away from pure 'reactive' maintenance. We will explore this point further.

Reactive maintenance

When equipment fails unexpectedly, thus requiring Maintenance to react immediately in order to bring the machine back on line, the plant is said to be conducting reactive maintenance, which is expensive for many reasons, including:

1. The downtime can result in lost production which, in many industries, can never be recovered.
2. The labour costs of the maintenance action are typically higher, especially if the failure occurs at night or on a weekend.
3. The repair costs will be higher due to the severity of the fault and the likelihood of secondary damage.

In addition, reactive maintenance can result in an increase in safety and environmental incidents.

Preventive maintenance

When reactive maintenance is common an organization often turns to a 'preventive maintenance' strategy where maintenance work is based on age - typically elapsed time or running hours. This assumes that failures are age-related.

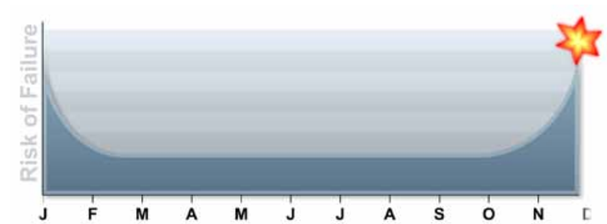


Figure 1 Classic 'bath tub' curve

In a landmark study (Nowlan and Heap, 1978) completed in 1978 (and repeated by others with similar results) research showed that just 4% of assets followed the classic, Type A, 'bath tub' failure pattern (infant mortality followed by age-related failure) as shown in Figure 1.

A total of 11% of assets demonstrated age-related failure patterns. That means that 89% of failures were random in nature, so preventive maintenance is a flawed approach for rotating machinery and other types of assets. As a result, some assets will fail before they are scheduled to be maintained, and many other assets will have perfectly good parts replaced during the maintenance shutdown. The cost of the shutdown, and the high likelihood that new faults will be introduced during the maintenance work, results in a substantial waste of resources.

Predictive maintenance

Condition based maintenance (CBM), also known as predictive maintenance (PdM), recognizes the fact that the majority of failures are not age-related. Utilizing CBM makes it possible to perform maintenance only when the assets need that maintenance.

DOES CONDITION MONITORING IMPROVE RELIABILITY?

Many people believe that the condition based maintenance strategy results in improved reliability. If your definition of reliability is a measure of the frequency of unexpected failures then you could conclude that condition based maintenance does result in improved reliability. However, if your definition of reliability correctly includes a measure of how frequently equipment requires maintenance, then condition monitoring does not improve reliability. The condition monitoring technologies, for the most part, simply alert you to problems that should not exist.

For the remainder of this paper we will explore how to improve reliability through defect elimination, and discuss the role of the condition monitoring technicians and analysts in this process.

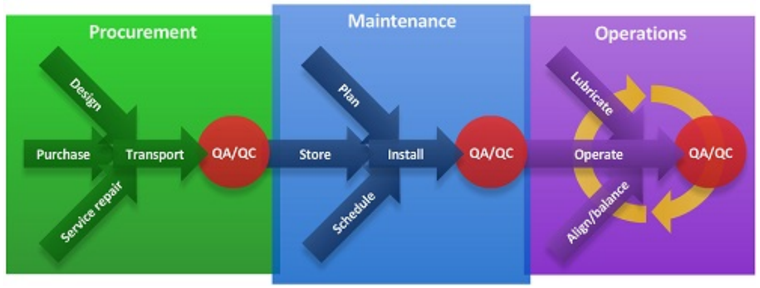


Figure 2
Defect elimination process

DEFECT ELIMINATION

It is necessary to understand the root cause of the reliability problems. It is possible to approach this in two ways.

1. A company can perform a detailed Reliability Centred Maintenance (RCM) study in order to attempt to identify the failure modes, and then examin the root cause of those failures.
2. Or you can learn from thousands of industrial plants and consider the common sources of defects that result in poor reliability.

The first option can take a very long time and consume substantial resources. Many such programmes have failed. Instead, we will take a closer look at the second alternative.

Common solutions to common problems

Many industrial organizations suffer from the same problems. If you seek to eliminate those root causes then you will go a long way to solving the reliability problems at the plant.

The following is a summary of the most common sources of defects (also see Figure 2).

Design

Reliability problems typically begin with the design. The system must be designed for reliability and maintainability. The lifecycle cost must take a higher priority than the purchase cost.

Procurement

Once again, the reliability and maintainability must be prioritized over the purchase price. The right design makes it harder to buy 'cheap' unreliable equipment. But the incentive to purchase the option with the lowest up-front cost must be replaced with an incentive to purchase the items with the lowest lifecycle cost.

External overhaul and service work

The same desire for reliability and maintainability must exist when selecting companies that provide services such as balancing, motor re-winds, lubricants, bearings, etc. Specifications must be provided to vendors; for example, rotors should be balanced to G 1.0.

Transportation

Equipment can be damaged during transport. The vendor may produce equipment that meets requirements, but if it is damaged during transport then you will still experience poor reliability.

Acceptance testing

As part of the design, procurement, overhaul, and transportation process it is essential to implement acceptance testing. The vendor must be told that if the equipment does not meet minimum requirements then it will not be accepted. An acceptance testing specification may put limits on vibration, balance tolerance, resonance, oil cleanliness, & other parameters.

Storage and inventory management

A great deal can be said about the financial impact that efficient inventory management has on an organization. And it is essential to have an organized system so that maintenance planning and scheduling functions correctly. However, the way in which spares are stored can also introduce defects. Bearings can be damaged while they sit on shelves that vibrate. Lubricants and parts such as greases and bearings become contaminated if they are not stored correctly.

Planning and scheduling

It is not possible to improve reliability until the planning and scheduling function is working correctly. The condition monitoring group will feed information to this group. However, corrective work cannot be performed efficiently unless the job can be planned, kitted, and scheduled with the right people, parts and tools.

Repair, overhaul and installation

When assets are repaired and overhauled - and when new, overhauled, or repaired equipment is installed - it is essential that the installation is performed with precision. Bearings must be installed correctly. Machines must be precision aligned and balanced. Soft foot must be eliminated. Resonance must be eliminated. Bolts must be correctly tightened. If these things are not done then the life of the machine will be reduced. The extra time required to perform these tasks correctly will pay for itself many times in increased life, and in many cases, improved product quality, reduced energy consumption, and greater throughput.

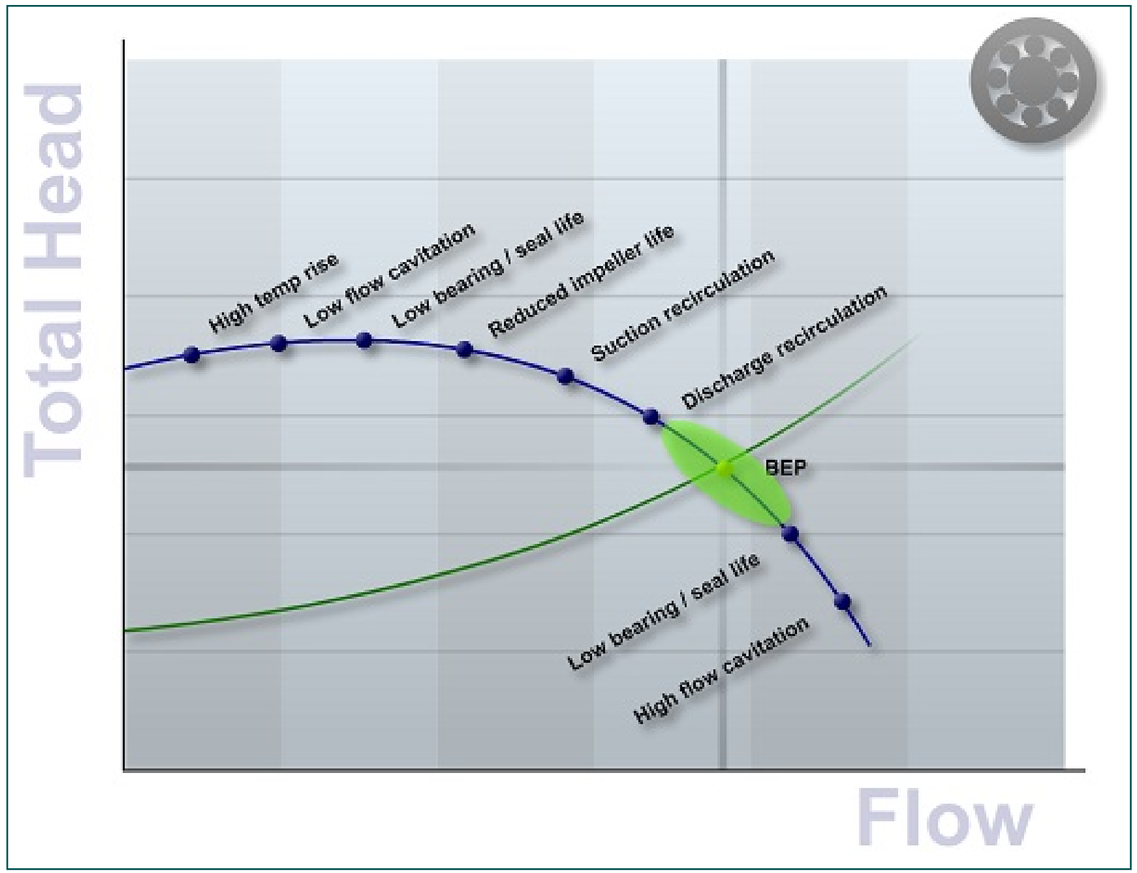
Equipment operation

The way equipment is operated has a huge impact on its reliability. Operators and production supervisors and managers must appreciate the importance of operating equipment within specification. For example, if pumps are not operated at the best efficiency point (BEP), the life of the pump will be reduced due to cavitation (damage to the impellor), excessive bearing wear, seal damage, and more, as illustrated in Figure 3.

Lubrication

One of the most important steps you can take in order to extend the life of rotating machinery is to lubricate bearings and gears with the correct volume of contaminant-free lubricant that has the correct specification (e.g. viscosity, additive pack, etc.). Lubricants can be contaminated during transportation, storage, dispensing, and while inside the machine. Each source of contamination must be identified and eliminated.

Figure 3 Pump operating curve and BEP



SOLVING THE PLANT'S UNIQUE RELIABILITY PROBLEMS

If all of the foregoing issues are addressed then the plant will achieve significantly improved financial results and there will be fewer safety and environmental incidents. However there will be unique issues at your particular plant. It is recommended that you take a two-pronged approach to identifying and resolving them.

Plant walk-through

Performing a plant walk-through, and inviting mechanics and operators to point out the common problems experienced on the 'plant floor' will achieve two goals:

1. By listening to the mechanics and operators you will learn about problems that an RCM team may never identify – and you will do it quickly and effectively.
2. Taking action on the identifi ed problems will generate a lot of goodwill between the reliability group and the 'plant floor' staff. Additional suggestions will be forthcoming. This process will accelerate the culture change process

Perform an RCM

There will be processes and equipment that demonstrate poor reliability where it will be more difficult to identify the root cause. This is where it is recommended to carry out an RCM, a Failure Modes and Effects Analysis (FMEA), or a Root Cause Failure Analysis (RCFA). You may need to involve consultants, the OEM, or people from a sister plant to get to the bottom of the problems. It may be necessary to replace equipment, re-design a process, or install monitoring and/or control systems. Whichever way, these processes can be performed in parallel with the defect elimination programme.

UTILIZING CONDITION MONITORING SKILLS TO IMPROVE RELIABILITY

The condition monitoring technicians and analysts can play a role beyond detecting fault conditions and advising the maintenance group.

Acceptance testing (QA/QC)

As described earlier, it is important that acceptance testing is performed on new and overhauled equipment. The condition monitoring group can help to define the standard and conduct the tests. A form of acceptance testing can be performed when new, repaired or overhauled equipment is installed. Vibration and other checks should be performed to ensure that the equipment is fit to provide long, reliable life.

Detecting conditions that will lead to reduced life

Too many vibration analysis programmes focus on the detection of bearing defects and pay less attention to their prevention. Conditions such as unbalance, misalignment, bent shaft, run-out, looseness, resonance, soft foot, cavitation, cocked bearing and others will result in excessive load and reduced life. In many condition monitoring programmes, if these conditions are detected, they are typically not reported until the condition appears to be severe. The same is true for a wide range of fault conditions (lubricant contamination, under-lubricated bearings, over-lubricated bearings, electrical unbalance, poor performance characteristics, etc.) detected via other technologies.

The fact is that all of these conditions result in reduced life. All of the rotating components, especially the bearings, will develop faults far more quickly when any of these conditions exist.

Therefore, although the vibration amplitude may not indicate that the unbalance is severe, it must be understood that the life of the bearings will be reduced.

Root cause failure analysis (RCFA)

The condition monitoring team holds important evidence in their database that will explain why a machine failed. It may be necessary, for example, to look at data that was collected before the bearing defect was detected. The analyst may see signs of unbalance, misalignment or some other condition. Of course, it is always important that actions are taken to reduce the likelihood of that root cause occurring again.

IMPROVING RELIABILITY – THE MISSING INGREDIENTS

More needs to be said regarding the implementation of a reliability improvement programme. Everything discussed in this paper is common sense, and it has been tried in many plants. However, a large percentage of the reliability improvement initiatives have failed. Some progress may have been made, but many programmes either get started and then peter out, or they make more substantial progress that proves to be unsustainable.

There are five important steps that are often missed in these programmes:

1. They do not have commitment from senior management. Leadership from the top is essential.
2. The plant does not have a clear understanding of asset criticality, and it does not have a maintenance and reliability strategy. In the author's opinion it is often not necessary to perform a full RCM analysis. However, a more effi cient process should be undertaken in order to form that strategy.
3. They try to do too much before they have a proper plan in place. For example, a plant needs proper maintenance and production planning before RCM or CBM programmes should be embarked upon.
4. They do not take change management issues into account. Any plant can change if small, strategic steps are taken. Larger steps will be resisted.
5. Everyone within the plant contributes to the reliability problem, therefore everyone needs to receive training; from basic awareness training to detailed skill-building training. People who do not receive training will feel left out and will act as anchors on the programme

CONCLUSIONS

Condition monitoring provides a great service to an organization, reducing unexpected break-downs and thus reducing maintenance costs, downtime, safety incidents and environmental incidents. But the condition monitoring group should also work to improve reliability by assisting in the acceptance testing process, identifying conditions that will lead to reduced reliability, and assisting in the root cause failure analysis process when equipment does eventually fail. But all of this work should be part of a properly planned and orchestrated reliability improvement programme that involves defect elimination and process optimization.

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Nowlan F S and Heap H F, Reliability-Centered Maintenance, Department of Defence, Washington, D.C., Report No. AD-A066579, 1978.

This paper was first presented at the EuroMaintenance Symposium, Helsinki, 2014

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Can You Have Too Much Detail In An RCM Study?

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Surely if some is good, more is better? Like many things in life, there can be too much of a good thing when it comes to detail in an RCM study and finding the right balance can be tricky. Too little detail and you may miss things, too much and you could suffer from 'analysis paralysis!'

So how do we know when we've 'drilled down' far enough to be thorough but not too far?

John Moubray summarised it nicely in his RCM 2 textbook:

"Failure Modes should be defined in enough detail for it to be possible to select a suitable failure management policy" (Moubray, 2007)

So what is a suitable failure management policy? The failure management policy is the approach chosen in order to mitigate the consequences of failure to an acceptable level.

Let's consider two pumps; one is a large, complex gas compression pump and the other is a small air conditioning pump on a fork lift.

When trying to understand what the 'suitable failure management policy' is, it is necessary to take into account the 'bigger picture' of the equipment under consideration:

Function

What is the function of the machine? What is its purpose? Understanding this will help to understand the consequences of the failure, which in turn will help define the criticality.

Criticality

How critical is it if the failure occurs? Criticality is a product of the severity of the consequences of a failure multiplied and the frequency of occurrence.

In the case of large gas compression pump, a failure could result in product not being delivered, costing $1000's per hour of downtime. Or for the forklift a/c pump it could be returning the forklift to be swapped for another in the fleet.

Repair vs. replace policy

Another aspect to consider is what is the corrective action? Is it feasible/cost effective to stock the spares and perform a repair activity in-situ, or to simply replace with a new unit?

For a large, expensive pump it would be more expensive to replace the entire unit than to replace a worn seal. Whereas for a small a/c pump it would be more cost effective to discard it and replace with a new one.

Hidden failure

Are the failures evident in normal operation, or do they require fault finding to be performed? Can the seals be seen to check for signs of leakage?

Operating context

How accessible is the equipment? Is scaffolding required? Is the plant required to be shut down? Does the equipment need to be partially dismantled e.g. removing guards etc? Is there any redundancy in place? Is the equipment in a remote location, or a challenging environment?

These are just some things to consider when considering what a 'suitable failure management policy' might be for your particular piece of equipment.

Back to our pump examples;

For the large gas compression pump, it is expensive to replace, critical if it fails and is accessible for in-situ repair during scheduled shut downs. In this case the FMEA would be far more detailed, including several failure modes, each with its own inspection or planned maintenance tasks, which would combine to form the 'Failure Management Policy' for this pump. (See Figure 1)

Figure 1

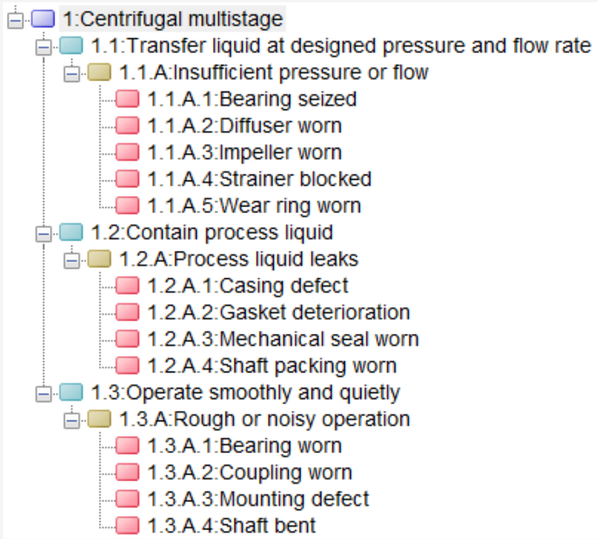
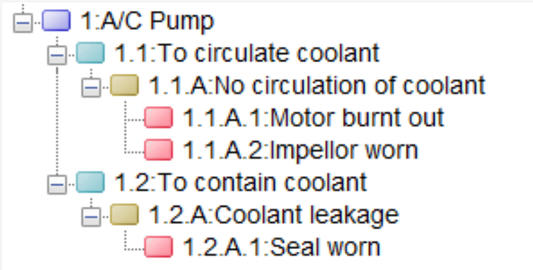


Figure 2



For the small AC pump on a forklift, let's say it's inaccessible for inspection, not critical if it fails and would be replaced rather than repaired. Our FMEA might only include a small number of failure modes, such as 'Seal worn', 'Impellor worn' and 'Motor burnt out' and our corresponding 'Failure Management Policy' would be 'No scheduled maintenance' and the corrective action would be to 'Replace AC pump'.

In conclusion, it can be a challenge to know how much detail to go into when performing a FMEA analysis, but the aim is to go into enough detail to determine a suitable failure management policy. Considering the 'bigger picture' of the equipment you are analysing will help guide you as to the level of detail required.

ARMS Reliability provides training in RCM and other reliability methods.
Contact ARMS Reliability at: www.armsreliability.com

Organising for Effective Asset Management: Leadership

Scott Yates Assetivity www.assetivity.com.au

Creating an Asset Management Department

If you're considering how to implement ISO 55000, you are probably working for an existing organisation. That means you are grappling with the complexities of locating and arranging human resources for asset management tasks in an environment where existing personnel are already fully employed and additional resources are difficult or impossible to obtain. This segment discusses the options, including the costs, risks and benefits and should help you prepare your business case.

While neither ISO 55001:2014 nor ISO 55002:2014 provide significant guidance on how to build an appropriate lower level structure to support an asset management system, our experience suggests that the possible models fall on a spectrum between the following two extremes:

- Fully dispersed model – everybody in the organisation is an "asset manager" with knowledge and skills matched to their specific role
- Fully centralised model – "all" asset management activities are undertaken in a single central area, staffed with genuine experts in the discipline of asset management

As with most spectra, there are costs benefits and risks associated with each option. The trade-off is illustrated in Figure 1.

As an organisation moves towards the dispersed end, it imposes higher and higher skill requirements on personnel that are not specialists in the asset management discipline. For example, maintenance experts might be required to lead the design of an asset management plan and then integrate content from projects, operations and disposals that they don't really understand. This has the benefit of breaking down silos and forcing a "whole of organisation" approach, where everybody has an understanding of the purposes and benefits of asset management, but it creates risks around a lack of specialist asset management skills/ knowledge and a lack of focus as already busy people add more tasks to their "to do" list. Ultimately, this has potential to undermine the effectiveness of the asset management system, with inconsistent, incomplete and inaccurate planning and execution of tasks.

One organisation we worked with was close to this extreme, where the division of responsibility was primarily functional, with each operational manager taking responsibility for a group of assets that

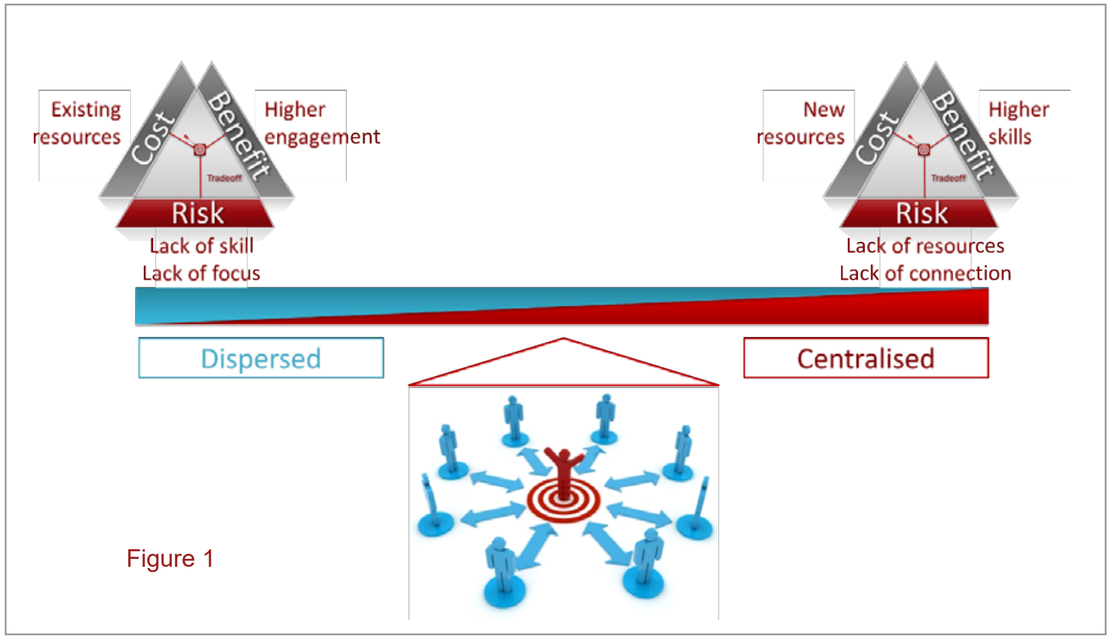


Figure 1

were geographically and functionally linked. These managers had their own operational and maintenance resources, with central "technical" support minimised. This central support was also functionally grouped into (for example) projects, maintenance and information systems. There was no dedicated asset management workforce, although a reliability manager was appointed as part of the development of asset management capability and the technical manager would be considered the "champion" for asset management within the organisation. This arrangement was close to the "fully distributed" model and required minimal on-going investment in personal and modest temporary investment in consulting resources. Unfortunately, it was only partially effective as the various operational managers could not be held to account by the centralised technical support. More "teeth" in this organisation were required.

If the organisation reverses direction and tries to centralise its asset management activities, we see the above problems go away and another set of issues appear in their place. Firstly, the organisation needs to establish new positions with dedicated asset management skill sets and finding the resources to do this can be a challenge. Next, these highly skilled asset management experts need to find a way to engage with the day to day maintenance and operating activities of the organisation without creating a silo mentality, where asset management is seen as something done "over there" with no real connection to the actual workings of the organisation. If these challenges are not navigated successfully, then the asset management department will be under-resourced and disconnected from the remainder of the organisation. It will (quite rightly) be seen as an ineffective overhead and the asset management system will fail.

Another client organisation we worked with had an existing, strong, centralised asset management group which was charged with supporting the operational managers. This model was initially close to the fully centralised model, with the operational managers and their staff having minimal asset management skills. Unfortunately, it became clear that these operational staff had the essential knowledge to conduct asset management planning and the organisation needed to shift its strategy to build skills in this workforce. In this model, a larger investment in on-going resources was required to staff the asset management group, although consulting resources were minimised.

Perhaps the best gains we have seen with the implementation of asset management were in an organisation where there was already a strong discipline-based technical workforce (i.e. an electrical engineering department, a mechanical engineering department and so on). An asset management "centre of expertise" of just a few personnel fitted naturally into this organisational model and was able to focus on building processes and templates while the disciplines applied these templates to their particular classes of asset. This required a moderate on-going investment to staff the centre of expertise, but with consulting resources only required to transfer new knowledge and skills into the organisation.

In our opinion, this "centre of expertise" structure located between the two extremes is the most likely to generate a sustainable improvement in asset management capability.

The exact size and structure will depend on the organisation, so we offer the following guidance to support selection of an appropriate structure:

- There must adequate resources to prepare asset management tools, templates and processes as required
- These resources may be any mix of consulting, specialist asset management or other staff as appropriate to the specific organisation
- The asset "owners" must be actively engaged with asset planning, regardless of who is nominally responsible for this process
- Every individual must possess competencies appropriate to their specific roles and responsibilities

There is one more key ingredient – there must be what we like to call a "visible champion" amongst top management and they must have sufficient control over the asset management resources to drive the system forward. Of course, control over the resources is not the only requirement for this visible champion, so let's take a deeper look at who they might be and where they might fit.

Finding an Asset Management Champion

The requirement for a visible champion is part of the ISO 55001:2014 requirement for the organisation to assign and communicate relevant roles, responsibilities and authorities (clause 5.3) . This occurs through ISO 55002:2014, which clarifies in clause 5.1 that the intent is to retain ownership and accountability at the top management level . These clauses recognise the fundamental importance of high level accountability for the asset management system if the system is to be effective. Where, then, should this high level accountable manager sit?

In one organisation we have worked with, a specific but temporary position was created at the executive level to oversee the creation of the asset management system.

When this temporary position ceased, the responsibility reverted to another executive who was already heavily tasked with line management of a significant element of the asset portfolio. A small number of staff, including a mid-level manager were also transferred. We saw the following:

- The organisation made good progress while the temporary position was in place
- The true "champion" of asset management became the mid-level manager when the temporary position ceased
- Progress slowed significantly when the temporary position ceased
- The organisation had no success in implementing asset management practices beyond the executive's area of responsibility

In another organisation, the "champion" was the senior technical manager, who reported to the operations executive. In this structure, we observed a reluctance for asset management activities to be directed at the organisation's real problems, with artificial boundaries drawn around the technical and operating disciplines.

We note from these examples that accountability is not enough. To create a reasonable chance of success in an asset management implementation, we suggest that the accountable manager needs to have the following characteristics:

- The executive's existing responsibilities must span the full asset portfolio
- The executive's existing responsibilities must span the full asset life cycle
- The executive must be motivated and committed to implementing an effective asset management system

This last criterion is particularly important and is why we prefer the term "visible champion", which gives a sense of how the individual must act to engender success.

Given the criticality of visible top management support to success of any change initiative, the preferred approach to implementing an asset management system must be to appoint a dedicated executive-level "champion." We acknowledge, however, that this is simply not practical for most organisations and a suitable position must be found from within the existing executive workforce. Our criteria suggest allocation of asset management accountability (and, therefore, associated resources) to either the operations executive or a corporate strategy/risk executive. It should be noted, however, that such individuals may require significant support to understand their responsibilities as the majority of asset management professionals currently come from technical backgrounds.

One more note on leadership: top level involvement is essential, but this does not mean that mean that asset management leadership stops with the CEO. Leadership is independent of organisational position, and a Maintenance Manager, an Operations Supervisor, or even a Reliability Engineer can still shape the culture within their circle of influence and create meaningful change. There will be limits to what you can achieve at lower levels in the organisation – particularly where your people interact with those from other workgroups who may not share the same cultural beliefs or perspectives. Nevertheless, you CAN make a difference.

Conclusion

Just as with so many other elements of asset management, there is no one right structure for an asset management organisation. There are, however, some clear principles to follow in designing yours: adequate resources with appropriate competencies and engaged asset owners. These principles point towards a "centre of expertise" structure, where a small group of asset management professionals provide tools, training and advice to support the rest of the organisation to manage their assets.

The organisation also needs to identify a visible champion that will not just hold the accountability for asset management but also provide the leadership and guidance to make it happen. We suggest that the ideal solution is a dedicated executive, but also acknowledge that this will often be impossible. In such cases, it is worth looking beyond the technical side of the workforce as operations or corporate risk executives might have broader interest in the life cycle management of the assets, provided they have adequate links to technical experts to mitigate any shortcomings in their knowledge.

Good luck and happy organising! If you believe you need assistance to design or enhance your organisational structure to promote better asset management, we would be delighted to hear from you. Click here<hyperlink> to request an obligation-free consultation with me or one of our other experienced consultants.

www.assetivity.com.au

Success Only After Dealing With Reactive Maintenance

What If Something Breaks?

This article explains the final concepts necessary to make planning work. These concepts make planners do different things for different types of jobs and greatly influence the overall application of the principles. Lack of appreciating these factors frequently makes planning programs fail. The programs fail because they try a one-size-fits-all approach to different types of jobs. Primarily, the programs are not sensitive to the immediate needs of reactive jobs. This article distinguishes between proactive and reactive maintenance. Likewise, it distinguishes between extensive and minimum maintenance. Most importantly, it describes the resulting planning adjustments. It also discusses communication and management support regarding these adjustments.

Many plants nowadays understand proactive maintenance along with reactive maintenance. While the plant should actively engage in activities to prevent problems, problems must be dealt with quickly once they arise.

Maintenance crews understand the importance of accomplishing scheduled preventive maintenance and other work to keep the plant reactive work to a minimum. Furthermore, crews also never fail to take charge of emergencies and are quick to resolve otherwise urgent situations before they become emergencies. Management ensures that supervisors understand their role to keep the plant out of trouble.

On one hand, maintenance supervisors must change their past philosophy of executing mostly reactive work. Supervisors must assign more proactive work to head off reactive work. Advance scheduling helps facilitate this change. But, on the other hand, planners must change their past philosophy of planning all jobs as proactive work. Planning must adapt to an alternative method of planning reactive work. Making several adjustments to the planning department's process removes the last barrier to having an effective system.

Proactive versus Reactive Maintenance

The recognition of the existing maintenance culture helps management change maintenance crews to focus on proactive work. Proactive work heads off problems before they occur. John E. Day, Jr. (1993 SMRP Conference in Nashville, Tennessee, USA) has done excellent work developing the concept of proactive maintenance. He points out the standard definitions of maintenance:

Repair: To restore by replacing a part or putting together what is torn or *broken: fix, rejuvenate, etc.*

Maintenance: The act of maintaining. To keep in an existing state: preserve from failure or decline, *protect*, etc.

He explains that, "The key paradigm is that the maintenance product is capacity. Maintenance does *not* produce a service."

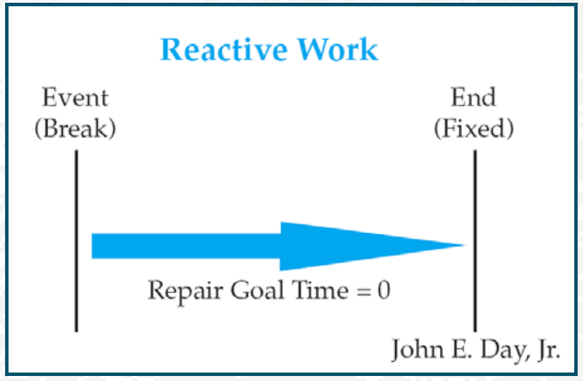
Day points out that initial disenchantment in implementing the planning system is primarily due to an attempt to provide detailed work plans on reactive jobs.

Figure 1 shows that when something has already broken, the job of maintenance becomes fixing it as soon as possible. "As soon as possible" means the sooner the better.

Theoretically, reducing the time to fix it approaches zero (instantaneous fix) as maintenance achieves perfection. When something breaks, to suggest interrupting the crew with notions of waiting to plan the job would not be appreciated. Waiting would only add time and hinder maintenance's quest for perfection on that individual job. The concept of keeping the equipment from breaking in the first place actually achieves the zero repair time because the reactive event never occurs. This is not possible once something has already broken.

There are three different schools of thought on how maintenance planning should handle planning and scheduling for reactive work. One school holds that once something breaks, planning does not become involved and leaves the resolution entirely to the pertinent crew supervisor. The second school holds that planning treats all jobs alike. The third school of thought espoused by this article requires planning to become involved in all the jobs, but treat reactive jobs differently from proactive ones. None of the schools recommends planning in true plant emergencies that would delay job start, although it is okay for planners to "chase parts" and help a true emergency already in progress.

Figure 1 The goal for executing reactive maintenance.



The first school concentrates only on proactive work, which makes considerable sense for a plant that is in specification condition. That is, all of the equipment is either new or has been maintained well so there are not many reactive situations. Adopting this planning philosophy for an existing plant that has a considerable amount of reactive maintenance forces management to consider two options. Option one is to invest capital to bring the plant into a specification condition. Option two is to only plan and schedule the proactive work. The advance schedule would not include reactive work since there are no time estimates planned for those jobs. Instead, the advance allocation would consist of a small, manageable amount of proactive work to head off future reactive work. Gradually, the proportion of crew reactive work should subside relative to a growing proportion of planned, allocated work.

The second school insists on always planning information to head off probable job delays. If there is not file information available, planners must find and research equipment manuals, even for reactive work. This school counts on files quickly becoming developed and the incidences of having to plan jobs from scratch diminishing. Adopting this philosophy also makes sense for a specification plant where there is not much reactive work. In a plant with considerable reactive work, this philosophy might have planners working quickly to supply information to jobs about to start. Having extra planners at first could help.

There are difficulties seen with the above approaches. In the first school, a plant with much reactive work would not begin doing much planned work. In the second school, planning might develop a bad reputation early on because of the initially underdeveloped files. Planners might be trying to slow the start of jobs they have to research and the technicians might be expecting too much from the job plans.

A third school of thought resolves these difficulties. Management begins the planning effort primarily as a filing service for the technicians and the maintenance group and understands the technician's role in gathering information that might later be helpful. Therefore, when reactive jobs are first worked, there simply is little information expected from planning. Planning's job is to file the reactive job feedback to help a future job. The scheduling effort is begun to help encourage supervisors to assign more work, especially more proactive work. I favor this approach for several reasons. There are a great number of plants that have considerable amounts of reactive work. These plants are unable or unwilling to invest in immediately upgrading the plant to specification conditions. These plants could still benefit from planning most of their work. Another reason is that experience has shown that planning usually has a very difficult time becoming established. This is mostly due to early false expectations from supervisors and technicians expecting perfect, complex job plans instead of simply helpful information. Finally, one of the greatest contributions planning makes for improving maintenance productivity is through advance scheduling. This approach allows planning enough detail on job plans to accomplish advance scheduling even while files are becoming developed near the infancy of the program. *Above all, this school (as well as the first school) advocates not holding up reactive work.*

As planning organizations become more mature and plants become more reliable, the differences in these schools of thought become less relevant. For one thing, the plants experience less reactive work. For another thing, files have become fully developed. The schools seem to go apart, but then come together.

In actual practice planning becomes successful when it begins to concentrate on planning proactive work. By concentrating on work to circumvent later breakdowns, the planning organization is able to produce good work plans without schedule pressure. Reactive work still receives planning before crew assignment, but the planners rely more on the technicians in the field researching a job for parts information if there is currently no file information. *For every job, the planner still provides a job scope, craft requirements, and time estimates.* However, the planner treats file information much differently for reactive jobs than for proactive jobs. The planner will always look in the equipment specific files for information. If there is no helpful file information on a proactive job, the planner will investigate other sources. These sources may include vendor or O&M manuals, consultations with more experienced personnel, or any other avenue thought to yield sought-after information. On a reactive job, however, the planner will not look beyond the specific files. If there is no file or no helpful information in a file, the technicians are on their own for a reactive job. Not only does this methodology allow all the work to be planned to allow scheduling, but it reinforces the need for feedback.

The challenge is to keep planning and scheduling proactive work while a significant amount of reactive work orders are still being written and planned. Enough personnel resources exist to perform all the reactive and proactive work, but only if all the work is planned so that schedules can be created to set goals for getting it all done.

Planners must develop the work plans for all the reactive jobs to show the craft skills and estimated times required.

The objective of proactive maintenance is to stay involved with the equipment to prevent decline or loss of capacity. Planning and scheduling a sufficient amount of proactive work reduces the number of urgent problems and breakdowns. Reactive work receives minimal planning attention beyond a field inspection and file check before it is made available to be worked into crew schedules. Crews may have to look up technical information themselves on reactive jobs if the information is not available in the files. Nevertheless, because the repetitive nature of maintenance work continually enhances minifiles with crew feedback, planners are soon able to give complete information and even procedures on reactive jobs.

Deciding to plan differently for proactive and reactive jobs requires definitions for the two types of work when first received by planning. Typical definitions follow.

Reactive maintenance is

- Where equipment is actually broken down or fails to operate properly.
- Priority-0 jobs are defined as emergency and so they are reactive.
- Priority-1 jobs are defined as urgent and so they are reactive.

Proactive maintenance is

- Work done to prevent equipment from failing.
- Any preventive maintenance (PM) job.
- Work orders initiated by the predictive maintenance group when the need is not otherwise readily apparent.
- Project work to upgrade equipment.

The essential determination for proactive maintenance is that work is done now to save additional work later. Proactive work heads off trouble. Once reactive situations develop, the operations group is already suffering. Reactive work is where equipment has failed and the plant is reacting to the equipment situation. Reactive work does not include where a specific device or component on a piece of equipment has failed, but the equipment is delivering its intended service satisfactorily to the operations group. For example, a slightly leaking flange on a pipeline might not be considered reactive if the drip is not causing a problem even though the flange itself has failed. (Alternative definitions for reactive versus proactive might be made on the basis of the customer, the operations group. Any job requested by the operations group is reactive because maintenance wants to produce plant capacity for operations, not react to operations problems. Operators should not have problems that they notice. Any job written up by maintenance would therefore be proactive. Maintenance wants to find all the plant deficiencies and correct them before they are noticed by the operations group. A practical definition of *reactive* is anything that the planner feels that someone may be pushing for soon completion. In this case, the planner should try to convince the originator to make it a priority -0 or -1 job.)

Examples of proactive work include a job to replace the coating on a condenser tube sheet because maintenance has noticed some peeling; a predictive maintenance request to overhaul a pump; changing a filter at a set routine time; changing a filter that has a moderate pressure drop but is not bothering operations; noticing a small noise from a pump, moderate corrosion, painting, a dripping flange, or a sump pump running rough that would not cause an immediate plant problem if it failed; noticing a potentially inaccurate pressure gauge; or a project to replace a troublesome pump.

Examples of reactive work include a condenser tube leak, changing a filter at operations' request, a loud noise from a pump, a dripping acid flange, an operator report of a frozen valve, a clogged filter causing an operations problem, a failed sump pump even if not reported, a dead or obviously wrong pressure gauge, or a work order to restore a pump to service.

The result of implementation of these definitions should be the planning of all reactive work before lunch time for new jobs received that morning. For reactive jobs, the planner scopes the job in the field (maybe), checks the file, estimates craft and hours, and puts the job into the waiting to be scheduled file. The crew supervisor then has the option of assigning the job if desired or waiting for the next week's schedule to include it if appropriate in the overall priority of plant needs.

Industry commonly sets about 20% as a threshold for having a reasonable amount of reactive work. This means that approximately one out of five work orders might be reactive and should not wait for the following week's schedule, as shown by Figure 2.

Figure 2 Even good plants have to deal with some reactive maintenance.

Reactive Maintenance

- Goal is to have < 20% 0's and 1's
  - Priority 0: Cannot wait until tomorrow
  - Priority 1: Cannot wait until next week
- Few plants have few 0's and 1's
- Most plants have a significant amount of reactive work

With such a significant amount of reactive work, we cannot implement a system of planning or scheduling that presumes that we would have less than 5% (fewer than 1 of 20) of work orders being reactive. Therefore, not only does a proper planning and scheduling system allow supervisors to break the schedule but also not making crews wait on planning. The proper application is to schedule even though crews can break the schedule and quickly plan reactive work even though crews do not have to wait on planned work, as shown by Figure 3. Although planners can chase parts on priority -0 emergency work, they otherwise should stay out of jobs-in-progress. Although this staying out generally means staying out of the daily process altogether, the planners should coordinate a bit when planning priority -1 work to see if the supervisors might start any of those jobs immediately or not. Planners deal with supervisors at a peer level and do have a significant amount of interaction working in maintenance together.

Figure 4 illustrates an additional crucial reason to plan reactive work that is not an emergency quickly. Presume that the five 1's in the figure represent new priority-1 work orders written on Monday. In accordance with the reactive guidelines, planners quickly plan all five jobs that very morning. But notice that two of those jobs are still in the backlog on Friday when the scheduler is selecting work for the following week. The supervisor states that the crew will not even start them today. Furthermore, the crew will not work them on overtime later today or during the weekend. One could correctly make the case that the priority system was abused and these two left-over jobs should have been made priority-2 work orders. Management does need to support correctly using the priority system, but it is difficult to make fine distinctions at times between 1's and 2's. Rather, the planners, by quickly planning them, have time and craft estimates available on each for the scheduler. With time and crafts identified, the scheduler can properly include these priority-1 work orders in the schedule for next week. They should be in the schedule because they are among the highest priority work. In addition, by quickly planning the work, should the planners have extra time during the week, they can add additional planning effort to the 1's not yet started. Finally, 1's written later in the week, as late as Friday, should be planned in time for the weekly schedule, if at all possible. Any work planned before the creation of the weekly schedule helps the plant to create a better schedule.

Figure 3 Adapting planning and scheduling to reactive work.

Application

- Schedule weekly, but allow breaking the schedule for true reactive work.
- Plan reactive work quickly, but do not make crews wait on planning.

Figure 4 Although 1's should be completed this week, realize that some are not.

Realistic Life of 1's

M	T	W	TH	F
1				
1				
1				1
1				1
1				

Extensive versus Minimum Maintenance

Following the line of reasoning that not all jobs should be planned the same way, it is also not cost effective to spend much time planning certain small jobs. This work is considered minimum maintenance.

This is a different consideration than that of reactive versus proactive. A proactive job may be minimum maintenance or extensive maintenance. A reactive job might also be minimum maintenance or extensive maintenance.

The following definitions are typical for defining the complexity of maintenance.

Minimum maintenance work must meet *all* of the following conditions:

- Work has no historical value.
- Work estimate is not more than 4 total work hours (e.g., two persons for 2 hours each or one person for 4 hours).
- While parts may be required, no ordering or reserving is necessary.

Extensive maintenance is defined as all other work.

Figure 5 indicates the different classifications of work that require different planner treatment. The practical result of implementation of these definitions should be the reduction of maintenance planner time spent on certain jobs. Suffice it to say for now that on minimum maintenance jobs, the planners may put less effort into developing the job plan than they would if the work were extensive.

Figure 5 Classification allows different planning treatment.

Classification of Work Orders

- Reactive versus proactive maintenance
- Minimum versus extensive maintenance

Examples of minimum maintenance work include hanging a bulletin board, moving barrels, cleaning the shop, tightening valve packing, replacing deck grating (maybe), replacing a 1-inch drain valve (maybe), replacing a frayed electrical cord, washing a fan (maybe), painting (maybe), posting a sign, adjusting dampers, replacing a filter on special request.

Examples of extensive maintenance work include overhauling a pump, changing seals on a pump, changing bearings on a pump, troubleshooting or inspecting a pump, replacing a valve over 2 inches in size, replacing a valve critical to a process, replacing valve packing (maybe), repairing structural steel, welding boiler tubes, or replacing a filter on special request.

Originators still should write individual work orders, and planners should plan minimum maintenance work. The workforce should not use blanket work orders for this work. It might seem that it is a waste of time to create a work order for every little minor job that comes along. Nevertheless, blanket work orders cannot be scheduled. Simply having a work order with time involved should suffice. The main difference in planning regular work and minimum maintenance work is that for minimum maintenance work, the planner might not create or use a file (or not use the CMMS job plan module). The planner also might not use more than a few words of direction as a "plan." The plan does not have to be complicated, but it should allow proper scheduling. Scheduling drives productivity. In addition, plants that do not require work orders for such small jobs experience significant abuse of the policy and have larger, more significant jobs creep in under the "no work order needed" policy. Such plants seriously compromise their planning retention of institutional knowledge and further erode the scheduling ability to increase productivity.

What Kind of Job Plan Is That!?!

Communication among the maintenance groups is especially important regarding these issues. Management support is necessary to keep planning involved and effective.

With an existing planning organization, trying to have a planner reduce the amount of planning that goes into an individual work order is difficult for two reasons. First, the planner may have a hard time recognizing the skill of the crafts. Second, the planner must understand that even with nothing more than a limited field scope and file check, the job is still adequately planned. A field technician's viewpoint on the latter case is similar. When a planned job was received in the past, it had quite a bit of detail.

However, in the past, the crew did not receive all its work as planned. Now it does. In the past, the crew did not want to wait on any planning for an urgent job. Now, the urgent jobs at least start off with the benefit of the crew supervisor knowing which skill to assign, for how long, for exactly what scope, and with readily available file information, all without waiting. Crews and planners take these things for granted and insist that a job plan without an extensive parts list and set of instructions is not really a plan. Nothing could be further from the truth. The problem stems from a lack of recognition of the value of what technicians and supervisors do receive. Technicians receive all the work as planned taking advantage of previous delay information. A supervisor receiving a week's worth of jobs even with only correct scopes and skill assignments is a tremendous boost toward superior wrench time. Remember that the vision of planning is to leverage productivity, not necessarily to provide "A, B, and C" on any particular job plan even as the plan moves toward having more of a procedure.

This is a sensitive area for the existing planning group that did not come into existence doing it this way. The technicians claim that planning used to provide detailed plans (on the few planned jobs). They ask, "What kind of job is that!?!" So communication to the workforce with management commitment to understand and explain what is going on is certainly required to avoid derailing planning at this point.

Another point requiring communication and management support, of course, is helping the technicians understand their role to gather information and send feedback to the planners. This support allows the few planners to plan almost 100% of the work and the many technicians doing a lot of job research in the early days of planning. This is a serious controversy regarding who should do the initial research that management must not take lightly. For every one planner there are 20 to 30 technicians. The planners simply cannot research jobs from scratch and keep up with the workload. One should remember that before planning, the technicians did this anyway. Management does not want to transfer their duties to a specialist group. Management wants to create a valueadded group, namely, planning for filing information to use on future jobs and gradually to build ideal plans. "It's a great job plan!"

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Supervisor Buy-In

This article on reactive maintenance should confirm that it is okay to break the schedule. The definition of stress is telling supervisors that they are responsible for meeting the weekly schedule and even tying it to their pay. This is not right. Rather, the management should hold supervisors accountable for starting each week with a goal of work and using some manner of a daily scheduling process. The management should hold supervisors responsible for knowing why they did not meet schedules. When the management assures supervisors that they can quickly react to emergencies and urgent work, even if it means breaking the schedule or not waiting for planning, supervisors are supportive of the weekly scheduling effort.

Comments From Other Authors:

* W. Edwards Deming

Two points of Dr. Deming (Out Of The Crisis 1986) should be reemphasized with regard to this article. These two points are all about allowing persons freedom within a system to do what they feel is right.

Point 8 states: Drive out fear.

Companies must allow and encourage employees to express ideas and ask questions. The status quo should be challenged. Blind obedience is not desirable. Maintenance management not only must allow supervisors to break the schedule but also must allow them to not wait on even planning when necessary. Supervisors must be allowed to use their judgment and skills in supervising their crews. Likewise, planners should not become enmeshed in a one-size-fits-all planning approach. They should use their skills to quickly plan reactive work considering the skills of trained technicians on the shop floor to do what is right. The most effective maintenance system considers the skill and judgment of planners, supervisors, and technicians and does not try to do away with the human element. The system should support persons using their talents and abilities. Maintenance personnel must not be afraid to act in the best interest of the plant.

Point 12 states: Remove barriers that rob people of pride of workmanship.

Deming condemns management's ability to deal with issues that arise from the shop floor. Encouraging persons to do what is right and report the results should identify problems with the system for management to address. Management must not treat deviations from plans and schedules as problems but rather as opportunities to fix the system, not fix the people. The system should be made to support the personnel rather than the personnel being made to support the system.

* Peter F. Drucker

Likewise, Dr. Drucker (The Practice Of Management 1954) insists that management must develop alternatives to fear as worker motivation. Among other elements of motivation, management should give workers adequate information to make sound decisions on their own. The maintenance planner develops job plans to give information to the technician in terms of known parts and job steps, past history, and cost so that technicians can use their minds for thinking instead of simply remembering. Proper maintenance management establishes planning to a large degree as an information file service to support competent professional technicians. Management expects technicians to exercise sound skill and judgment rather than blindly follow a job plan. Management also expects technicians to give good feedback to further increase the institutional knowledge of the plant.

Summary

After establishing fundamental principles for planning and scheduling, a few final concepts become apparent for making planning work. Planners must plan different types of jobs differently. This is primarily due to the immediate needs of reactive jobs. Planners put less effort into planning reactive work to accommodate crews that must soon begin work. This also allows the planners time to plan all the work and concentrate more on important proactive jobs to head off failures. Planners also abbreviate their efforts on small tasks that do not justify much planning effort. These tasks are called minimum maintenance jobs. These planning adjustments require communication and support from management because of their effect on the plans that crews receive. Management must be sensitive to crews that previously received detailed job plans that now may receive less information on individual jobs without appreciating its value. These concepts make the difference and pull it all together.

Planning and scheduling offer tremendous opportunities for significant productivity improvement when management properly applies the principles of planning and scheduling with an appreciation for real-life reactive maintenance. Schedule even though it is okay to break the schedule. Plan quickly even though it is okay for crews not to wait on planning. Persist. Experience has shown great improvements at plants across America and the world.

For a much more detailed view of Planning Principles read Doc Palmer's Book:

Maintenance Planning and Scheduling Handbook"

To purchase this excellent Handbook go to either:

McGrawHill:
http://www.mhprofessional.com/product.php?isbn=0071784128

or Amazon:
http://www.amazon.com/Maintenance-Planning-Scheduling-Handbook-Richard/dp/007178411X

Richard (Doc) Palmer (USA)

Doc Palmer has over three decades of industrial experience as a practitioner within maintenance. He was responsible for overhauling maintenance planning in a major utility. Publisher McGraw-Hill subsequently sought out Palmer to author the Maintenance Planning and Scheduling Handbook first published in 1999 (now in its 3rd edition).

He is recognised as one of the best in the World in providing training and consulting in the area of Maintenance Planning and Scheduling. Contact him at:

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Achieving Top-Quartile Reliability Returns

Bob DiStefano and Bruce Hawkins
Emerson Process Management

The Reliability Value Chain provides a systematic approach to optimising asset reliability in top-performing enterprises. Global businesses should strive for consistent, standards-based reliability practices throughout their plants. The short-comings of ad-hoc or laissez faire approaches that allow inconsistent practices at different plants are well documented. Understanding the Reliability Value Chain and addressing imbalances and broken links brings enterprises into the top-performing quartile.

Introduction

A business problem

Global enterprises are challenged to fi nd the resources needed to implement asset management systems consistently across their global fl eet of assets. Chances are good that your organisation spends too much on maintenance and receives too little in return. This fact simply means that you have opportunities for benefi ts in both maintenance and operations. Executives are interested in this because they recognise signifi cant opportunities to improve profi tability, availability, and safety. In fact, a company with multiple plants can uncover even greater savings and signifi cantly increase shareholder value.

"Every 1% gain in availability is worth $8.4 million of additional margin capture per year in a typical 200,000 bpd refinery."

Doug White, Emerson industry expert - based on current refinery economics

A Solomon Associates global study of reliability practices measured maintenance costs as a function of the replacement value of the assets. If a top-performing site spends10 million dollars per year on maintenance, a poor performing plant will spend orders of magnitude more - three and one half times more - for the same size plant. In most cases, the value of the operational benefi ts is three to seven times the value of the maintenance-spend reduction. The value of moving into the top-performing quartile is high. According to the same study, top-quartile plants also experience very little down time as a result of equipment problems. Fourth-quartile (poorest) performers experience disruptive levels of down time that are almost 15-percent greater than top performers. A big difference. Research also shows that a top-quartile performing organisation possesses a 'Reliability Value Chain', a set of well-linked elements in four categories: data, information, knowledge, and action - as shown in Figure 1.

This sets the path for transforming data into information, into knowledge, and into action. Ultimately, the ability to achieve top performance status is dependent on the robustness of each element and, perhaps more importantly, on the effective connectedness of all of the elements into a continuous improvement cycle.

The reliability value chain

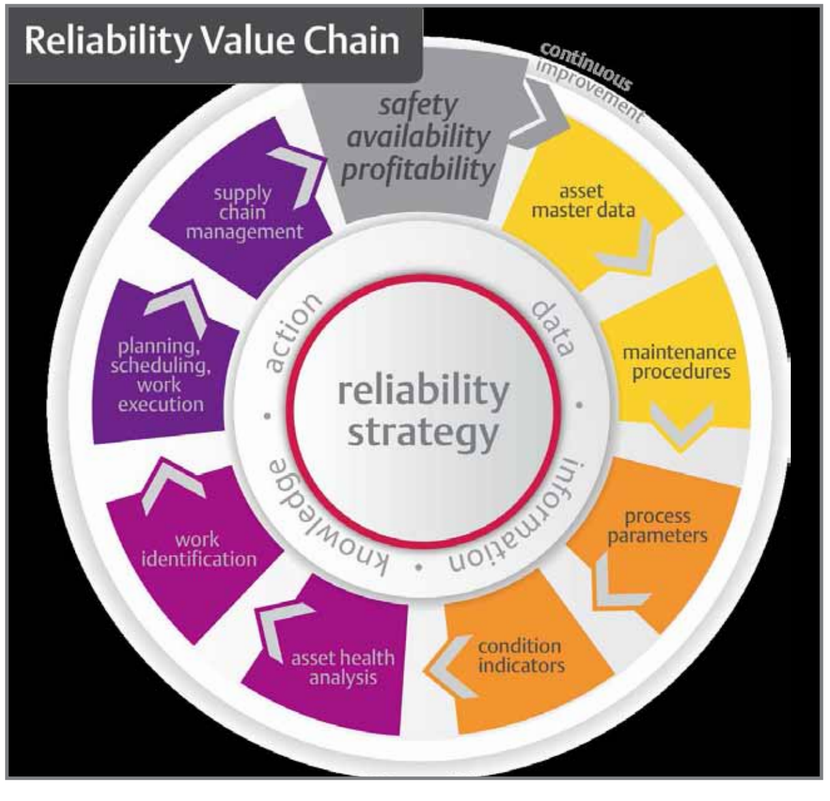
Improving each ring in the reliability value chain - and improving the links between them - leads to signifi cant reductions in maintenance spending as well as signifi cant decreases in unscheduled downtime.

Reliability strategy, the analyses used to understand and catalogue failure modes, is pivotal to the value chain.

The core of reliability strategy emanates radially and shapes all facets of the chain. For instance, the characteristics and classifications chosen to characterise asset master data are driven by the requirements of the reliability strategy. Further, the mitigation of failure modes drives the selection of maintenance procedures, process parameter data, condition indicators, and spares stocking strategies.

Asset health analysis is interpreted from an understanding of the failure effects observed from process data and condition indicators. Most importantly, setting the reliability strategy must strike a balance between the engineering characteristics of the assets and the capabilities of the organisation to perform the function required within each ring in the chain. Let us now examine each area of the chain and determine potential opportunities for growth.

Figure 1 A complete, accurate, and well-connected Reliability Value Chain is present in top-quartile performing companies.



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Data elements are necessary as the foundational enablers for reliability. The foundation includes asset master data: a complete and accurate list of equipment that includes equipment physical attributes, importance of the equipment to the enterprise, and more. Important is a logical location hierarchy that facilitates subsequent analysis; the parts and technical information that relate to the asset; and the appropriate failure codes that will enable feedback and refinement of maintenance strategies. Foundational data also includes the maintenance procedures that are performed to monitor and maintain the assets in healthy condition.

This foundational data will be used throughout the chain, establishing what conditions indicate poor health. Understanding conditions helps technicians understand how the equipment behaves or fails, which in turn helps define the early warning signs that identify whether the asset is in distress. Actions can then be taken to prevent failure or mitigate the consequences of failure.

These procedures are developed as a result of various analyses such as Reliability-Centred Maintenance (RCM) and Failure Modes and Effects Analysis (FMEA). Proper and consistent use of these analytical tools for a particular class of asset throughout the enterprise will lead to the optimum set of maintenance procedures for that asset class: how best to maintain and monitor that equipment.

Allowing a variety of maintenance procedures to be applied to the same equipment at different plants is an outdated and unacceptable practice in today's modern world of reliability.

Information is derived from asset condition indicators and process parameters that have been collected and analysed. Asset condition indicators are routinely used to monitor and analyse asset health and come from predictive technologies and from condition monitoring capabilities like vibration analysis, oil analysis, infrared thermography, ultrasonic leak inspection, and other modes of machinery health monitoring.

Process data (temperature, pressure, flow, etc.) - available in almost every plant via the distributed control system - is typically used only for plant operation and control. The new standard of practice for top- quartile performers requires leveraging this data for maintenance purposes.

The process data and the condition indicators are contained often in separate silos or databases with separate methods of access. An accurate understanding of equipment and process health relies on the data being connected together. To obtain useful information, process condition data and equipment health data must be brought together in a robust dashboard or view. The view must cross-reference which specific process parameter sensors provide information about which assets.

Knowledge comes from the union of asset health analysis and work identification - a culmination of experience. It is the result of interpreting data and information, then drawing conclusions. For example, we might find a high vibration reading on a pump, low discharge pressure, and an erratic discharge flow rate. That combination tells us we have a problem. But what is the problem? Together, vibration analysis, experience, and process knowledge might indicate that cavitation is likely to be the problem. This call would be much more difficult using vibration analysis alone.

We must have accurate data and solid experience to know what is good and what is normal. The foundational data, if rendered properly, will establish what is normal for each asset. The deployed monitoring technologies will alert us when abnormal conditions are reached, so that an expert can review the information and diagnose the problem.

Action translates knowledge into a traditional work management process, which is the oldest part of maintenance: planning, scheduling, and work execution plus supply chain management. When abnormal conditions are found and proper diagnosis is established, a work order can be generated to correct the condition. But in lower-quartile performers, inefficiencies and associated costs arise because repairs come mostly from urgent or emergency failures of equipment. That is because in those plants the information and knowledge areas have not been deployed effectively. Facilities do not detect early warning signs of failures. This is a very reactive way of working which can be eliminated with effective deployment of technology available today.

Organisational priorities can also cause reactive maintenance. For example, an analyst might say there is something wrong with the equipment based on the analysis techniques deployed. But the operators rely on their human senses and might not bring the machine to a stop for repairs because they cannot see, smell, hear, or feel anything wrong with the equipment. This is a typical cultural bias that must be altered to allow operators to understand and trust what the technology is telling us about the health of an asset.

Operators and managers need to understand that while it may feel counter- intuitive to remove a seemingly healthy machine from service, in the long run that machine will deliver more reliable production if removed from service now for a short, well-managed restoration.

Top-quartile performers rely on solid data, information, and knowledge to obtain a diagnosis. The plant workers trust the diagnosis and they know how to fix the problem and have the tools to put the plans into action. Knowledge guides them to the right actions to avoid unplanned downtime and excess repair costs. In this scenario, all of the links in the Reliability Value Chain are fully connected and effective.

Fundamental problems: Addressed and corrected

In most plants the robustness of each element in the chain is lacking or suboptimal. For top-quartile performance, every element in the chain must be optimised. A few common problems are described here.

Asset master data is a fundamental element of success, yet many facilities cannot produce an accurate and complete version of this essential tool.

They might have an asset master data list that comes from their asset management system, but not all classes of equipment are represented. Or equipment might have been moved but the asset list was not updated accordingly. In some cases even if all the equipment is listed, and even if locations of equipment are accurately tracked, the level of detail about each piece of equipment is not enough for top-quartile performance.

For example, operating in a rudimentary or fourth-quartile mode does not require detailed technical attribute information such as how many gears are in a gear box or what are the gear ratios. But that type of technical attribute information is necessary in a top-quartile practice to perform proper analysis and arrive at effective diagnosisof problems. When this foundational information is faulty, all of the other processes built on this information become suspect and will not enable a company to achieve high-quality results.

Another common problem is an over-reliance on time-based preventive maintenance (PM) procedures that may be recommended by the OEM but that do not address known failure modes, and are therefore adding little if any value (other than driving spare parts sales for the OEMs).

Proper analysis and optimisation of the PM programme, including deployment of significantly more condition monitoring tools, are necessary to optimise this element. Establishing envelopes of normal operating parameters and setting alarms for abnormal conditions is also fundamental and necessary.

These, and many other issues with various elements in the chain, can and must be addressed and corrected.

Recognising broken links and fixing them

Whether top performers or lower performers, most companies have all of the elements in the Reliability Value Chain (albeit many of which are sub-optimised). But the elements themselves - even when optimised - do not drive value. The connection points between them do. Top-quartile plants have linked all of the elements effectively. So where are the breaks?

A very prevalent break in the chain is the one between knowing and acting. As alluded to earlier, most plants measure equipment conditions (at least for some equipment), analyse alarms, and recommend work activities, but the operations organisation might not trust the information because it emanates from a faulty foundation of master data. In addition, operations might not understand, appreciate, or respect what the science and technology is telling the organisation to do. Traditionally, the operations group has been bound to keep the plant running and not take a machine down until there is a definite issue, for example seeing or hearing a problem.

These are cultural issues of duty and of understanding, and they hinder the effective linkage between knowing we have a developing problem and doing something about it before significant consequences occur.

Another common broken link is between the process parameter data and condition indicator elements, which are often not combined. This hinders the organisation's ability to make accurate calls about what is wrong and what needs to be done – causing difficulty in keeping later links in the chain properly connected.

There is plenty of work to do in terms of properly linking the elements in the chain and changing the culture of an organisation. Although this is difficult to do, our own company has partnered with clients to accomplish it. From the bottom up, we must help operators understand and value technology, analysis, and actionable intelligence.

From the top down, executives must understand the business case - financial and otherwise - associated with insisting on non-negotiable reliability standards and best practices. When the business case is established, understood, and believed by the executive management team, the rewards systems start to change as well, and this enables culture change within the organisation from top to bottom.

Our own organisation has taken appropriate pages from the management consulting playbook and has incorporated management consulting practices that address the cultural discrepancies. Once we fix the foundational problems, we must ensure that people understand what the information indicates. In the long run, if we trust the knowledge, we have better results — even though it may seem that taking a machine out of service is intuitively not a good idea. We must appreciate that in the long run the organisation will attain better operational performance and lower maintenance expense by taking machines out of service well before they fail catastrophically.

The top-down influence combined with the bottom-up influence is necessary and eventually is very effective in terms of organisational cultural transformation. Individual habits that need to change start to change.

Areas Needing Standardisation

Across an enterprise, the master data sets the stage for success, but standardisation does not end with master data. It continues into every element of the Reliability Value Chain. But staying with master data for the moment, standardisation does not only benefit asset data. It also applies to spare parts. As we work with clients, we find a great deal of duplication of spare parts. For example, unclear taxonomy (how you name things in the store room item catalogue) can lead to duplication of parts and bloated inventories: 6 "bearings for the big green gear box" and 6 "bearings for the crusher" could mean 12 of the same type of bearing. But if you are looking for a specific bearing by its number, and the bearing number was not entered into these 12 bearing records in the catalogue, you might wrongly conclude that you have none of this bearing in stock and buy more.

Beyond master data, the way an enterprise analyses pieces of equipment and identifies the ways they fail is also important and benefits from standardisation. If one facility uses one failure code and another facility uses another code, the two sites will never recognise they could be dealing with similar issues. That means the enterprise needs consistency in the method by which it determines how and why equipment fails. Standardised codes help ensure consistency so that patterns can be seen more easily.

Consistent criticality rating is key in helping to determine what failures are important. Facilities across an enterprise need to base criticality on a core set of priorities rather than opinions of the person on duty that shift, or recent history fresh in the minds of the plant workers. This enables enterprises to deploy resources where there will be the most benefit.

Conclusions

Experience top performance.

While implementing standard maintenance practices is a large task that requires solidarity of purpose, standards, tools and experienced partners, the return on investment is large and long-lasting. Further than that, without non-negotiable enterprise-wide standard practices an enterprise can bleed costs and chase solutions that have little effect. Reliability, much like financial reporting and safety, should rise to a strategic level of importance and priority in any industrial company. Executives should insist on consistent standards of practice to drive meaningful business results.

The authors' own work is driven by the business case and is based on experience, intellectual property, standards, software, and tools: their advanced starting point assists enterprises to roll out best practices consistently and see the result. The goal is to move their clients to top-quartile performance so they can stop wasting time and money on ineffective reliability programmes.

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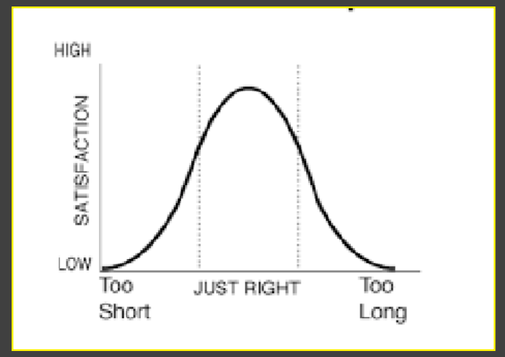
The Goldilocks Principle



Trent Phillips

Hopefully, the importance of proper work creation, work approval, planning, scheduling, work execution, work follow-up, documentation (feedback) and reliability engineering is understood within your organization. The maintenance backlog is a very important functioning part that helps ensure the effectiveness of these processes.

The Goldilocks principle states that something must fall within certain margins without reaching extremes. This is definitely true for your maintenance backlog! Goldilocks would tell you that to be "just right" work must be created and executed with the correct priority, criticality and date. Doing each of these incorrectly will lead to unwanted equipment downtime, higher costs, higher risks, lost capacity and lost profits.

Track and measure the effectiveness of your backlog. Track how long it takes for work to progress through the backlog to completion (30, 60, 90, 120 days, etc) and how much work is in each stage of the process. Monitor the type and amount of work that is feeding your backlog. For example, you should have a healthy percentage of work being generated from proactive activities like condition monitoring and PM tasks. All of these factors are very important indicators that should be used to ensure efficiency in the back log process and proactively manage your equipment maintenance.

Your facility must devote the "just right" amount of resources to the work as well. Having a high backlog could be an indication that the proper resources have not been allocated to complete work. Or it could indicate that the process in place is not efficient or being followed.

The maintenance backlog is a very dynamic process that must be constantly adjusted, updated, completed, reviewed and tracked. Otherwise, your maintenance organization will always struggle with planning, scheduling and execution of work. Follow the lesion from Goldilocks and ensure that your backlog amount and management process is "just right" for your facility.

How well does your organization manage backlog? Many we see have a year or more of backlog. At that level, the is an opportunity to go through and clean out the backlog as much of that will never be done. What are your thoughts? Please comment below so that others can learn too.

Trent Phillips, Global Leader, Reliability
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Risk Based Maintenance

A Unique Approach of Maintenance Management

Aashish Khaira
Research Scholar (PhD), MANIT-India

Major Challenges to Maintenance Engineer

The major challenge to maintenance engineer is to utilize a maintenance strategy:–

- That maximizes the availability and efficiency of the equipment.
- Controls the rate of equipment deterioration.
- Ensures the safe and Eco friendly operation.
- Minimizes the total cost of the operation.

These challenges enhances further when the maintenance engineers deal with equipment handling toxic or hazardous materials, either during production or transportation like in chemical process industries. Further, it is common to have industrial complexes where groups of chemical industries are in close proximity, so the possibility of a chain of accidents or domino effects increases.

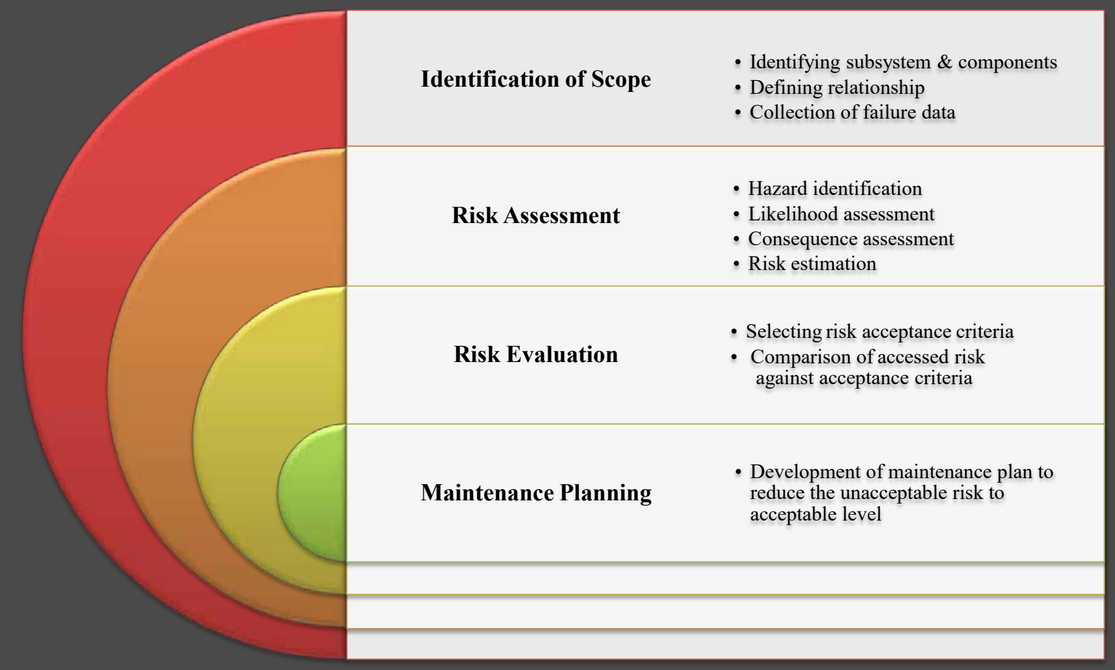
Every problem has a solution but we have to think outside the box. To know about the possible solution read further.

The Possible Solutions

Condition based maintenance (CBM), Reliability Centered maintenance (RCM) and Risk-Based Maintenance (RBM) are the most suited methodologies for this purpose.

- Among these methodologies, in CBM decision-making is mainly based on equipment self condition, without considering the impact of equipment on the whole system.
- RCM (Reliability Centered Maintenance) considers both two factors: "equipment condition" and "importance of equipment to system" but the above methods have a common shortage: they don't solve the problem of quantification, which would bring them big limitations when used in practice.
- RBM (Risk Based Maintenance), as the next generation of RCM, is the trend of modern maintenance management. In case of RBM, the method is used for determining the priority of maintenance using risk which integrates both safety and failure. *RBM can reduce the maintenance cost by 15%-40%.*

Figure 1 Risk Based Maintenance Framework



Before applying RBM one should aware about the basics of RBM because *moving with incomplete knowledge ends with failure.*

So read below points carefully.

Best Solution: Risk Based Maintenance (RBM)

- A quantitative, financially based analysis technique which establishes the relative worth of various maintenance tasks and serves as a continuous improvement tool.
- RBM defines opportunities and benefits of incremental improvement by eliminating low-value tasks and introducing tasks that address high commercial risk areas.
- This is not any specific maintenance strategy but it is a combination of various other strategies which is devoted to the risk factor of the plant/equipment.
- The risk-based maintenance methodology is designed to study all the failure modes, determining the risk associated with those failure modes, and developing a maintenance strategy that minimizes the occurrence of the high-risk failure modes.
- Such type of strategy plays a vital role in managing risks at many sites like mines, chemical industries etc.

Success needs a number of small efforts.

So to apply RBM in your plant read the remaining article carefully.

Risk Based Maintenance Framework

The high-risk components are inspected and maintained usually with greater frequency and thoroughness and are maintained in a greater manner, to achieve tolerable risk criteria.

Risk-based maintenance framework is composed of three main phases:-

(I) Risk assessment.
(II) Risk estimation
(III) Maintenance planning based on risk.

(I) Risk assessment –

1) Hazard identification- It is done to dentify the failure scenario which is developed based on the operational characteristics of the system, physical conditions under which operations occur, the geometry of the system and safety arrangements.
2) Likelihood assessment - The objective here is to calculate occurrence of the undesired event. The frequency of failure or failure probability for a defined period of time is calculated in this step.
3) Consequence assessment - The objective here is to quantify the potential consequences of the credible failure scenario. The consequences are production loss, asset loss, environmental loss, and health and safety loss. In some of the literature, the production loss is specified as performance loss and operational loss.
4) Risk estimation - Based on the result of consequence analysis and probabilistic failure analysis, the risk is estimated for each unit.

   Risk = Likelihood X Consequence

(II) Risk acceptance -

The computed risk is compared against the risk acceptance criteria. If any of the unit/ component risk exceeds the acceptance criteria, maintenance is required to reduce the risk.

(III) Maintenance planning based on risk -

The maintenance planning should be assigned to lower the risk to meet the acceptance criterion and to reduce the probability of failure. So far the reverse fault tree analysis is used in the calculation of maintenance interval based on risk. It involves top to bottom analysis approach.

A reverse fault tree analysis is conducted to calculate the probability of failure of the basic events, by assigning a desired failure probability to the top event (failure scenario of the unit).

This assigned value of the failure probability is estimated considering acceptable risk value. The new probabilities of failure of the basic events were used to calculate the corresponding maintenance interval

Advantages of RBM

- Save on maintenance cost
- Improves reliability & plant availability
- Accurate estimation of residual life
- Prioritize urgency of maintenance

"No one is perfect"

I believe in the above quote. I also believe on KAIZEN. This is a Japanese philosophy of management which means change for better. Please give your valuable feedbacks, advice's & guidance for improvement in this article as well as for my future, send me an email at ashish.2285@gmail.com

Physical Assets Mean Nothing Without Empowered Employees

R. Keith Mobley Principal, Life Cycle Engineering

If you have followed the recurring theme of asset reliability in most of the trade and organizational magazines, it would seem that the physical assets that we all rely on to produce our products and services are the determinant factor in our success as an organization. I read the articles, listen to the "experts" and wonder how they could be so wrong. Obviously, we need reliable machinery and process systems to produce an adequate revenue stream, but are they the critical factor?

Over my 50 years in the global business world, I have seen highly profitable plants that were comprised of old, misused and under-maintained systems, yet they turned out quality products at standard cost and consistently met market demands. Conversely, I have seen plants made up of the newest and best systems money could buy that could not meet minimum quality, cost or demand levels. What is the difference between these plants? To me the answer is simple: the workforce—the people who operate and maintain those physical assets. Even in organizations where management really did not value its human assets and too often created barriers that artificially restricted performance, an empowered workforce (even when they empower themselves) perseveres and meets business objectives.

I could recount thousands of examples where an empowered workforce has worked miracles to produce high-quality, low-cost products on systems that should have been decommissioned decades ago and in cultures that were diametrically opposed to success. The converse is also true, there are thousands of examples where the only missing piece of the puzzle is an empowered workforce that cannot seem to succeed no matter how much money is invested in physical assets, automated systems and programs that are the latest panacea for organizational shortcomings.

Before you go off on a tangent and think that I am referring to the popularized definition of empowerment, let me clarify. It is not management by consensus or the chaos that would follow. Nor is it beginning each shift with group calisthenics or any of the other myths that evolved from our interpretation of Total Productive Maintenance, the Toyota Production Systems, or the myriad derivatives of these management systems that are in vogue today. Instead, in this sense empowered is a mandate to executive management to create a culture where the employees are given the tools, support and authority to do their job and then allowed to do so. Business organizations are not, nor should they be, democracies where popular vote or consensus decides all aspects of the business. However, a common trait of successful organizations is a culture that enables, intentionally or not, the workforce and each employee to pursue success and their common goals.

Most organizations are about to learn just how indispensable their human assets really are to their success. Over the past decade there have been repeated warnings about the maturing workforce and its potential impact on business continuity. Few in decision-making positions have heeded these warnings and will soon suffer the results. In the near future they will be shocked to learn that the workforce that they have undervalued all these years is gone. Gone to well-deserved retirement. Now what? How will you meet market demands with no one to sell your products, to do your planning or to operate your physical assets?

This Is Mobley's 49th Law:

Thank you for taking the time to read this article. Hopefully, it has raised a few thoughts that will help you take the next step in your journey to excellence. I welcome your feedback and am happy to respond to specific questions. You can reach me at kmobley@LCE.com

Contact Keith if you wish to receive more of Mobley's Laws.

Automated Best Practices for Driving Asset Performance

5G Automatika Ltd
Canada www.5gautomatika.com

1. Introduction

With the advent of Smart Manufacturing and Industrial Internet of Things, interconnectivity between devices, disparate systems, and correspondingly, synergistic collaboration between multiple business processes and stakeholders within a manufacturing enterprise are becoming a reality. Be it mining, oil and gas, water or power utilities, or process and discrete manufacturing industries, major players are embarking on using real time intelligence to make informed decisions using an universally integrated IT infrastructure. In this white paper we shall address one such synergistic integration between maintenance and operations. We shall showcase some best practices that are enabled by integrating operations and maintenance in real time – more specifically, by illustrating how maintenance can drive superior asset performance.

2. Asset Performance

Asset Performance Management (APM) is the term used in the industry to maximize the availability and reliability of assets. When these two metrics are improved, the return on assets (production assets) is maximized. Given the fact that a major investment of the manufacturing (or utility) industry is on production assets, achieving a better return on assets increases shareholder value - and therefore is a strategic goal for most large enterprises.

Today, given the advancement in the state of the art, it is possible to automatically capture machine (production asset) data, transform the raw machine data to meta-data, discover actionable intelligence from the meta-data and generate proactive maintenance actions to maintain continuous and superior asset performance.

Therefore, “opportunistic” maintenance interventions can be generated in response to the “emerging” real time intelligence on the condition of an asset in the plant floor. This capability is useful beyond just maintaining operational performance. In many instances, asset degradation can relate to regulatory non-compliance, a safety risk, and/or, a quality failure leading to a major financial loss. Therefore, APM is now seen in the industry as a multi-disciplinary and a continuous improvement program as opposed to being a one-time initiative.

3. Asset Intelligence

As stated earlier, in order to perform good and continuously effective APM, there is a need for generating proactive real time actions that is based on intelligence and not data. In today’s manufacturing environment, according to some reports, about 15,000 terabytes of data can be generated every day. This is a lot of data. Most of the collected data, unless converted into meta-data and further into intelligence, is not useful. Asset Intelligence Systems are a breed of software programs that enable the collection of raw data from the plant assets, controllers and drives and convert them into actionable intelligence. The conversion process will involve the selection of data to be converted, aggregation of data in multiple dimensions and automatically deriving some useful conclusions about the “status” or “condition” of assets. The output of an Asset Intelligence System is the automatic generation of useful and timely maintenance actions in resident asset management (or CMMS) systems in order to proactively respond to a certain emerging behavior of assets that could result in a failure.

4. Enterprise Gateway – Enabler of Continuous Improvement in Asset Performance

Enterprise Gateway (EG) is one of the first commercially available off the shelf Asset Intelligence Systems. EG enables APM in three ways :–

- It connects the plant floor assets to the Enterprise Asset Management (EAM) systems in a standard open systems manner and enables the continuous and real time derivation of meta-data from raw data.
- It enables proactive improvement in availability – mainly, it eliminates unplanned downtimes by discovering intelligence (on emergent failures of assets that can result in a downtime) from the said meta-data in order to proactively generate appropriate maintenance interventions before an asset fails. This is achieved using a templated set of “business rules”. The business rules achieve two things – to discover intelligence and to generate preventive, predictive or corrective maintenance actions (based on the discovered intelligence) in a resident EAM system.
- It enables proactive improvement in reliability – this is made possible by means of a supervisory machine intelligence algorithm that constantly uses the raw data to “learn” about the “failure dynamics” of the assets in their specific environment.

Using this algorithm, EG, over time, achieves the capability of predicting the probabilities of specific types of machine failures in a future time period. This allows for better and proactive health management of the assets and reduced failure rates (or improved reliability).

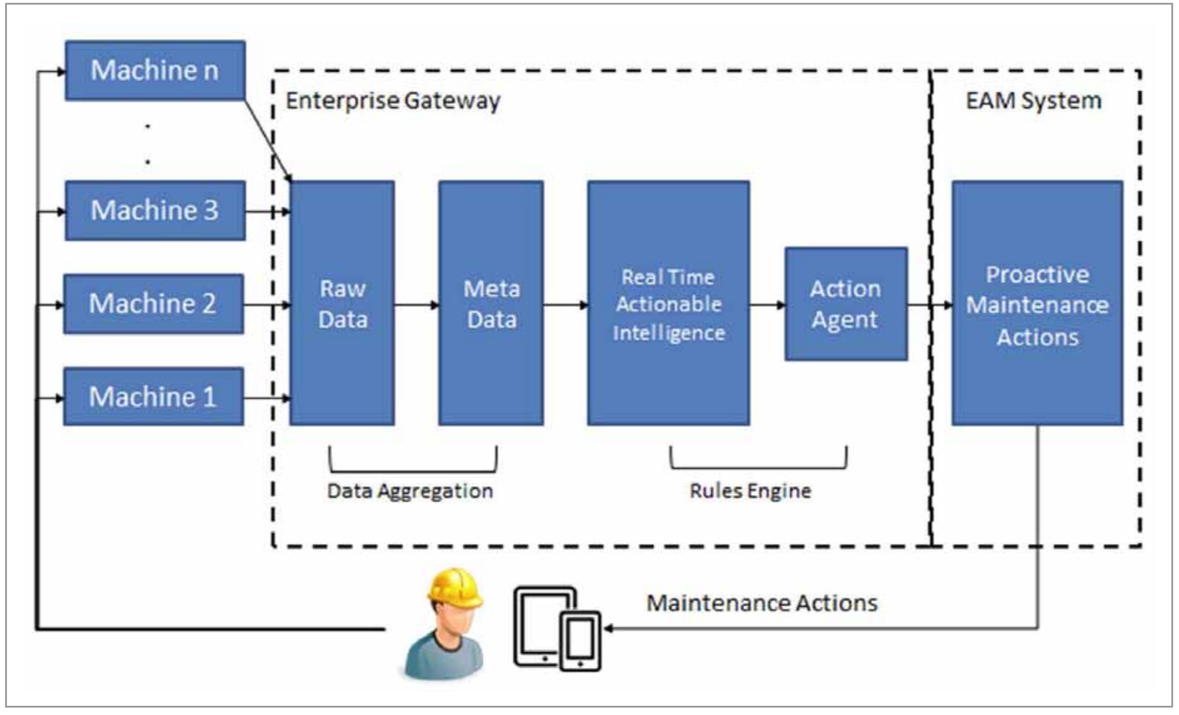
Figure 1 below depicts the scope and functionality of EG. The critical element in an Asset Intelligence System is the automated workflows that are enabled between plant and enterprise systems based on real time intelligence. Examples of such automated workflows are provided in Section 6.

5. Benefits of Real Time Asset Intelligence

The above-mentioned capability of generating actionable intelligence and automated workflows results in the following benefits to the customer:

- Significant reduction in unplanned downtimes (by up to 80 %!);
- Significant reduction in failure rates (or improvement in reliability);
- Removal of non-value added labor due to the integration of workflows and business processes between plant and enterprise;
- Unified visibility of production and maintenance information – in fact, maintenance actions are driven by the need for enhanced performance;
- Reduction in the maintenance spend year on year;
- Mitigation of regulatory risks; and
- Due to most of the above-mentioned, increased return on assets.

Figure 1 The Transformation of Data into Actionable Intelligence and Actions



6. Illustrated Cases of Asset Intelligence and Automated Best Practices

Best Practice 1: Removal of Non-Value Added Labor In Asset Usage Updates

Preventive Maintenance (PM) is normally performed by tracking "elapsed time" (timebased PMs), run hours, and/or, the number of cycles (usage-based PMs). The problem with using "elapsed time" or Time-Based PMs is that machines could be undermaintained or over-maintained. Usage-Based PMs are therefore more preferred because they present an opportunity to conduct PM interventions based on actual data on usage rather than elapsed time.

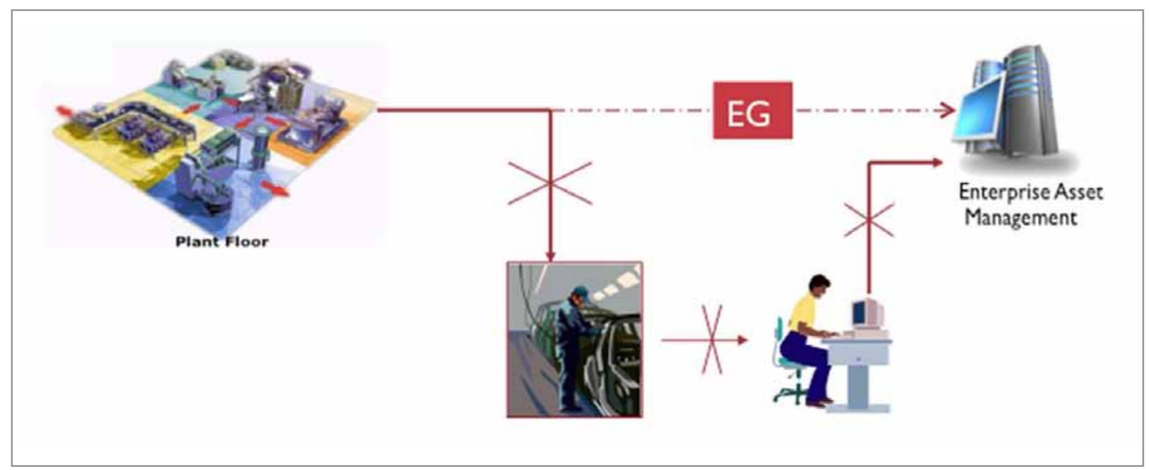
In order to perform usage-based PMs, the usage data has to be updated periodically (say, every shift or day) in order to ensure that the resident EAM system is able to generate a PM work order when the usage crosses a certain threshold. The recording of such data in the EAM system happens in a counter called "meters". Meters are instantiated for every asset whose usage data has to be updated.

Typically, meter updates are manually entered by a human operator once in formatted paper forms inside the plant, and subsequently entered (copied) manually using the data input screens in the enterprise application. As shown in the figure below, EG establishes a seamless connectivity and this totally eliminates manual intervention, which means two major benefits:

- Removal of a Non-value Added Activity and Cost of such labor.
- Removal of Potential Errors due to Human Fallibility.

Typically, this best practice results in immediate cost savings by eliminating one, if not two, full-time, non-value added labor activities.

Figure 2 Automated workflow for updating usage of assets ("meter updates")



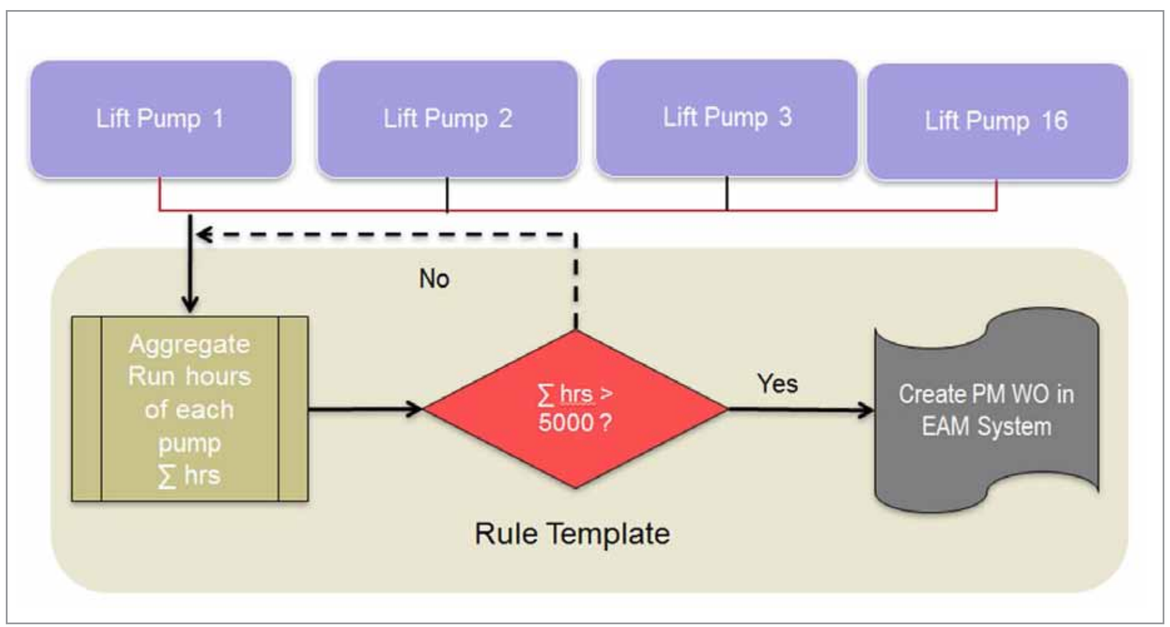
Best Practice 2: Asset Usage-Based Preventive Maintenance

As opposed to updating meters in an asset management system that in turn will trigger workflows for usage-based maintenance actions when thresholds for PM are crossed, it may be useful at times to generate maintenance work order actions directly when usage for an asset has crossed a limit. This is made possible by aggregating the run times ofan asset continuously using EG, and when the values of the run times cross a threshold value, a PM work order can be automatically generated in a resident EAM system.

The example shown below in Figure 3 is an illustration of this best practice in a water utility. In this case, EG connects multiple lift pumps in a waste water utility to the EAM system and aggregates the usage of the lift pumps individually. When any of the lift pumps cross the given threshold of 5000 hours, a PM work order is automatically generated in the EAM system.

This best practice (a) improves effectiveness of PM; (b) enforces “adequate” asset maintenance as opposed to “over-maintenance” or “under maintenance” which are both costly; and (c) improves the efficiency of the PM workflow by eliminating human inputs or systems that are not essential.

Figure 3 Automated generation of a Preventive Maintenance Work Order based on usage

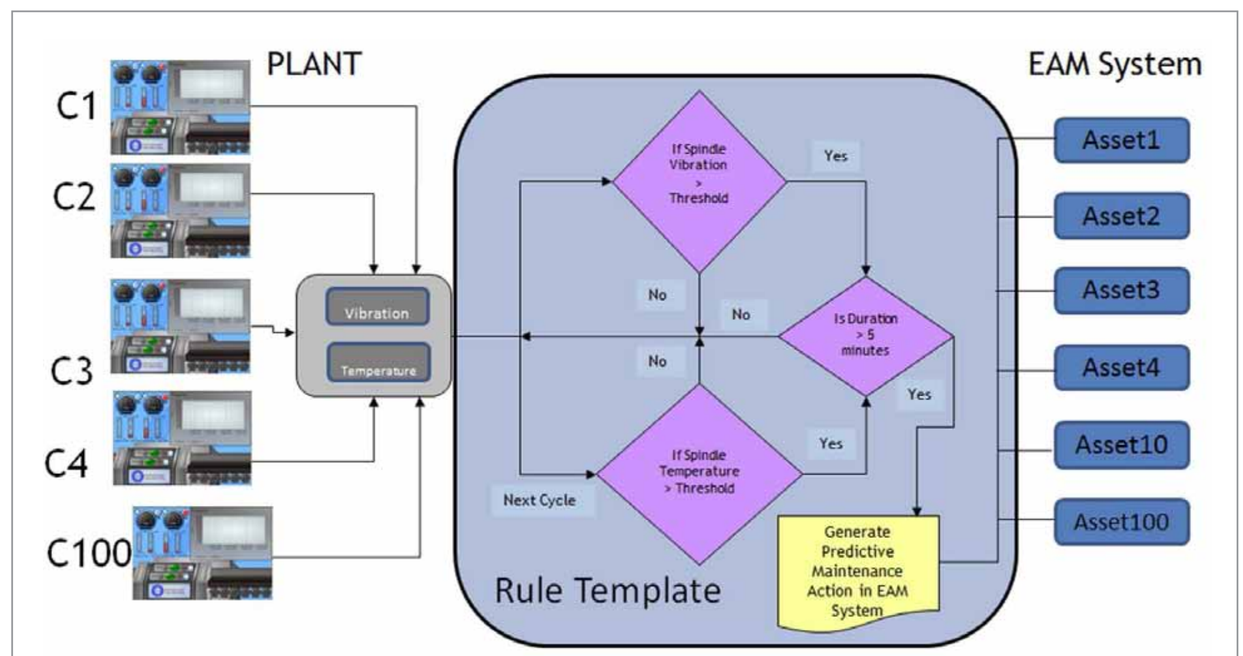


Best Practice 3: Asset Condition-Based Predictive Maintenance

The advantage of having an Asset Intelligence System like EG is that a logical evaluation of an asset condition can be made in real time based on its performance and proactively acted upon. In other words, process variables such as vibration, temperature, pressure, etc., can be logically combined to provide the “current” condition of an asset. This logical assessment can be used to generate appropriate maintenance actions to predictively prevent a failure or even degradation in asset performance. EG implements the above-mentioned using a business rules engine.

The example below (figure 4) is an illustration of a press shop responding opportunistically and proactively to an emerging failure condition. This case shows two process variables being monitored – spindle vibration and temperature. The logical condition illustrated herein is both variables crossing a threshold and staying above the threshold for more than (say) 5 minutes – which would be a symptom for failure of the press. EG will monitor the values of the two variables as well as the duration of time they exceed the threshold, and will generate a Predictive Maintenance work order if the duration of both variables exceeds 5 minutes (in this case).

Figure 4 Create triggers for Predictive Maintenance when the spindle temperature AND spindle vibration increases above threshold for more than 5 minutes in any of the CNC presses.

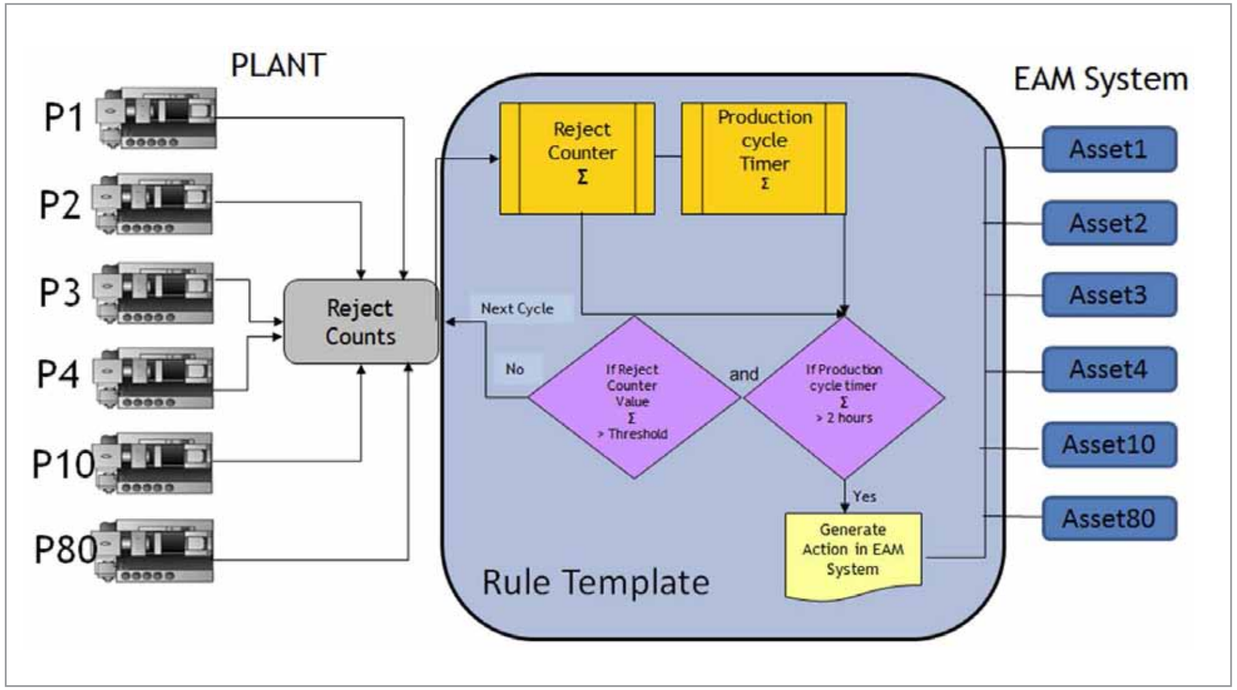


Another example of Predictive Maintenance helping the reduction of waste is shown in Figure 5. In this case, EG monitors the reject counts of the parts produced by the assets and if they cross 2% in any 2 hour period during production then EG generates a Predictive Maintenance work order. This is an illustration of how a plant can proactively respond to a "current" situation and rectify the situation if possible as opposed to a post mortem analysis after the shift. Typically, say, if the reject counts in a plant is less than 1% and it is suddenly found to be 2% in a 2 hour period (real time intelligence), obviously something is going wrong and the asset in question needs to be checked. EG enables such timely actions and prevents waste.

Best Practices 4
Based on "Rates of Change"

The rate of change of a process variable denotes the 'speed" in which a variable is changing – which is, in most instances, more important than the absolute value of the variable itself. EG automates, using its business rules, the best practice of generating proactive maintenance actions in response to rapid changes observed in process variables.

Figure 5: Generating a Predictive Maintenance workflow when the number of reject counts in any 2 hour production cycle is more than 2%.



In the illustration below (figure6) which is derived from a water utility, EG monitors the rates of change of temperature or discharge pressure drop – and if any of these two values are greater than 1.5 times their last 30 minute average then it generates a Predictive Maintenance work order automatically.

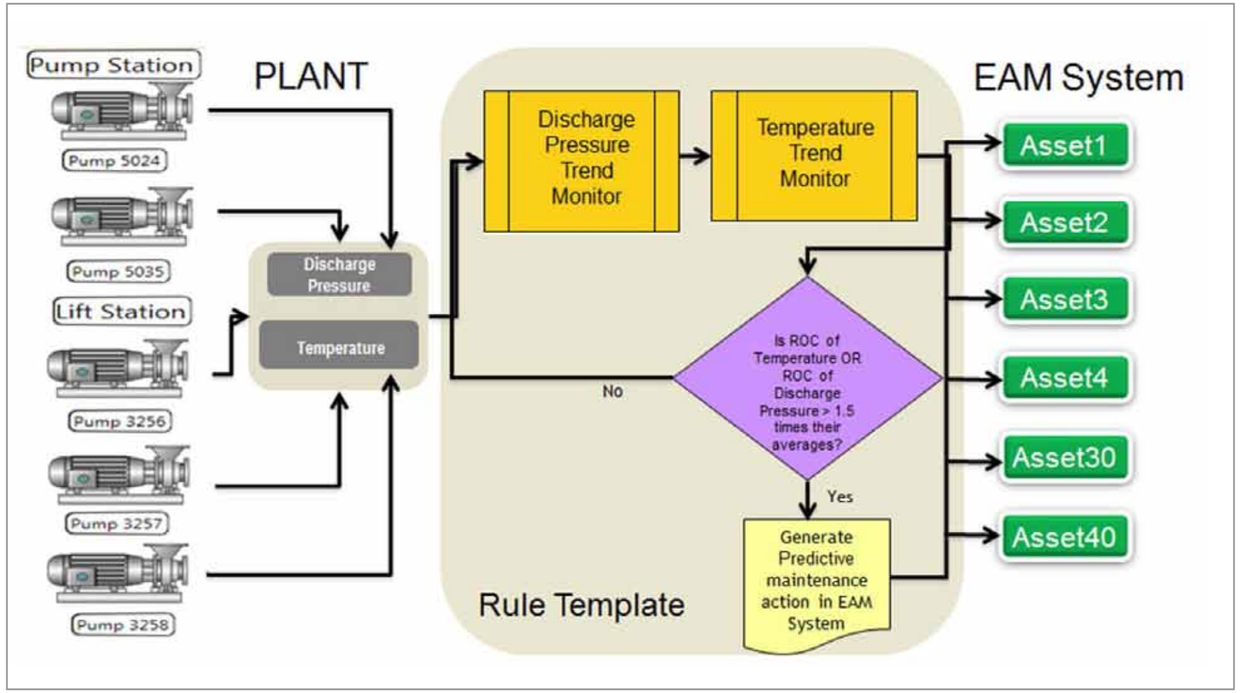
7. Flexible Business Rules

The business rules mentioned above are just some examples of how EG can help in automating best practices. In other words, it establishes useful workflows between the plant operations and maintenance in order to continuously maximize the performance of production assets.

Any useful "logical condition" can be constructed (configured) as a business rule in EG to allow for better monitoring of asset performance as it relates to safety, regulatory compliance, availability, reliability and/or quality. By means of these "templated" business rules that can be applied to multiple assets across the plant (and/or multiple plants), Enterprise Gateway monitors potential downtime or fault conditions, avoids them by proactive maintenance actions, and therefore, enables continuous improvement in Asset Performance.

www.5gautomatika.com

Figure 6: Generating a Predictive Maintenance workflow Based on "Rates of Change" of multiple process variables.



2016 Listing of CMMS/EAM's

AGILITY

SoftSols (Asia/Pacific) P/L
www.getagility.com.au

- In Country Support: Australia, United Kingdom, China, Philippines and Poland
- This CMMS/EAM is designed for:

Agility is a multi industry solution and is used in manufacturing, facility management, oil and gas, mining, health care, government, defence, Pharmaceutical, commercial office and fleet management industrys.

- Typical Cost: AUD$1650 per concurrent user
- Available as a stand-alone system: yes
- Able to be integrated with a larger management system: yes

CMMS/EAM Description

Agility is a simple and affordable CMMS/EAM solution. It provides all the key features that managers need to generate a rapid return on investment.

Browser-Based:

Completely configurable web browser system. Instant access from your web browser, anywhere, at any time.

Flexible and Easy to Use:

Agility offers a user-friendly screen to ensure that both engineers & operations staff find it incredibly easy to use & as a result Agility will swiftly identify poor performing plant & opportunities to improve reliability.

Asset Management

- Simplified screens providing a personalized dashboard overview of your site(s)
- Graphical views of key KPI's
- Unlimited attachments at asset levels (Managing Health and Safety Risk).
- Work order/PPM scheduling

Work Order & Preventative Maintenance

- Full description of standard maintenance work
- Breakdown Jobs
- Planned Preventative Maintenance (PPM).
- Help Desk and Work Requests
- Pictures, Documents, Unlimited Attachments, Printable
- Inventory and Spare parts
- Work order costing.

Employee Allocation / Resourcing

- Graphical "drag & drop" scheduling tools
- Employee database
- Multiple skills, and Pay Rates.
- Shift patterns and availability.

Powerful Scheduling

- Skills/Individual scheduling.
- Employee drill down.
- Live feedback from mobile engineers, using our PDA solution MOBILE EXPERT.

Customised Reporting

For a FREE demo, please contact us at: ssap@softsolsgroup.com or call +61 (0)8 9467 9800.

Other Related Services

We also offer onsite/offsite services, including Industry Solution Consulting Services; System Customsation; Bespoke Development; Installation and General Implementation; Training Courses; Data Integration; Reports writing, and Project Management.

AGILITY - Mobile Expert/Lite

SoftSols (Asia/Pacific) P/L
www.getagility.com.au

- In Country Support: Australia, United Kingdom, China, Philippines and Poland
- This CMMS/EAM is designed for: Agility is a multi industry solution and is used accross all industries.
- Typical Cost: AUD$299 per user per annum.
- Available as a stand-alone system no
- Able to be integrated with a larger management system: yes Mobile Expert/Lite is a PDA solution.

CMMS/EAM Description

Mobile Lite

Mobile Lite is a simple to use PDA application used for real time processing of work orders including recording status updates, recording of time spent and completion details.

Mobile Expert

Mobile Expert is a complete mobile maintenance management PDA solution used for real time processing of work orders including status updates, recording of time spent, recording of delays and lost time, recording fault codes, issuing of spare parts, checking on spare parts availability, signature capture on completion and creation of new work orders.

Mobile Lite / Expert both use proven Microsoft. NET technologies, are highly configurable and can be used in both online and offline modes

For a FREE demo, please contact us at ssap@softsolsgroup.com, or call +61 (0)8 9467 9800.

Other Related Services

We also offer onsite/offsite services, including Industry Solution Consulting Services; System Customsation; Bespoke Development; Installation and General Implementation; Training Courses; Data Integration; Reports writing, and Project Management.

Please find below a link to a video case study that shows from a client's perspective how Agility can transform how an organisation works, in this case the iconic Fiona Stanley Hospital:

https://youtu.be/2zTm8vHzNv8

Also please find an basic product overview which is located at our central marketing site: https://www.youtube.com/user/GetAgilityMarketing where you will find a range of information with regard to our products and services.

Listing of CMMS and EAM's

AssetOptics

AssetOptics
www.assetoptics.com
AssetOptics Facilities, Equipment and Fleet Maintenance for Salesforce

- In Country Support:
  United States, Netherlands, Colombia
- AssetOptics Facilities, Equipment and Fleet Maintenance for Salesforce is a multi-industry solution that has proven particularly ideal for the following types of organizations:
  Manufacturing; Food & Beverage; Oil & Gas; Municipal/Government; Fleet Management; Healthcare; Real Estate; Equipment Service and Aviation.
- **Typical cost of are:** US$65/User/Month
- Asset Optics is vailable as a stand alone system.
- Asset Optics is able to be integrated with other systems

AssetOptics Facilities, Equipment and Fleet Maintenance for Salesforce is a reliable, scalable and performance driven solution backed by Salesforce.com's trusted enterprise cloud computing platform.

AssetOptics is designed by former maintenance professionals to be easy to use from the shop floor to the storeroom. Our solution's simple navigation, powerful search features and intuitive screens ensure that everyone from mechanics to managers to executives will use the software. Every aspect of AssetOptics' solution is available on-demand, from any place with internet access.

Since AssetOptics is built on Salesforce.com's Force.com platform, there are no hardware or software components to purchase, no lengthy software installations and no annual maintenance fees.

AssetOptics is highly scalable. Our subscription-based pricing model makes the solution affordable for organizations of any size. There are no minimum user license requirements. Additional users are easily added. Because AssetOptics leverages the power of the world's most popular on-demand platform provider, salesforce.com, and because it is hosted in salesforce.com data centers around the world, no company is too big or too small to use the solution.

CMMS/EAM Solution

- Asset Management
- Inventory Management
- Procurement
- Planning & Scheduling
- Preventive Maintenance
- Work Management

Platform Features

- Cloud Computing
- Document Management
- Dashboards & KPI's
- Reporting
- Mobile
- Workflow

Bigfoot

Smartware Group Inc
www.bigfootcmms.com

- In Country Support:
  USA, Nigeria, Saudi Arabia and Australia.
- Bigfoot CMMS works well for organizations within manufacturing, distribution, energy and utilities, mining, hospitality, and data center industries.
- Bigfoot is available as a stand alone system.
- Bigfoot is able to be integrated with other systems

CMMS/EAM Description:

With over 10,000 users worldwide, Smartware Group designed the modern Bigfoot CMMS Enterprise+ solution to serve the needs of the maintenance professional. Bigfoot pairs an intuitive, easy-to-use interface with powerful functionality to help users learn the program quickly for quick results, often within a matter of weeks. The core functionality of Bigfoot CMMS Enterprise+ includes Occupational Safety & Health (OSH), Preventive and Predictive Maintenance, Spare Parts Inventory, Asset and Equipment Management, Work Orders and Maintenance Requests, Purchasing, Built-in Reporting and Analysis, "On-the-Go" Mobile – all within one, configurable maintenance solution.

Cloud-based Bigfoot CMMS Enterprise+ provides maintenance professionals with a number of benefits, such as:

- Leverage barcode scanning, camera integration, and geo-location tagging with the new Bigfoot mobile app for iOS and Android
- Easily schedule preventive maintenance with drag-and-drop calendar configurations
- Oversee safety programs as an integrated function of your maintenance operations with Bigfoot OSH
- Increase efficiency by automating processes through advanced workflows
- Stay on top of goals and objectives with configurable KPIs and a native report designer
- Control security access across regions, sites, departments, users, roles, and other settings
- Accommodate the native language of personnel and global locations through multi-language localization and a plethora of language options, such as Spanish, French, Arabic, Chinese, and more

To learn more about Bigfoot CMMS, visit http://www.bigfootcmms.com/product/bigfoot-cmms/

CMMS/EAM Related Services

Smartware Group provides a variety of related Professional Services to complement the Bigfoot CMMS solution. Training is available, in both Virtual and Onsite formats, to give your team a comprehensive educational journey through all of Bigfoot CMMS.

Data Migration Services are available to import your existing data – regardless of data format or condition – into Bigfoot for greater historical analysis.

Listing of CMMS and EAM's

Consulting Services are offered to assist your team through implementation, software configurations, maintenance reorganization, and more. Read the full listing of Bigfoot Professional Services at http://www.bigfootcmms.com/services/cmms-services/.

Other Related Services

There are a number of add-on solutions available for Bigfoot CMMS. This simple-to-use maintenance solution can be integrated with other systems, including Enterprise Resource Planning (ERP) and building automation solutions through the Bigfoot OPC Interface for the live capture of meter reading data. Bar coded spare parts can be rapidly checked in/out from your spare parts area through Bigfoot Part Express. For organizations with an existing Active Directory (AD), your user login/ password information may be stored within your corporate AD using Bigfoot Active Directory for even easier maintenance of this information.

Bigfoot Web Services Tool Kit (WSTK) gives your software programmers the ability to create custom interfaces, integrations, and more. For advanced custom reporting, Bigfoot SQL Data Views allows your Database Administrators and Analysts to access raw maintenance data for use with any reporting tool.

All Bigfoot Add-On Solutions may be viewed online at http://www.bigfootcmms.com/product/add-on-solutions/ for further details.

eMaint CMMS

eMaint EMEA Ltd.
www.emaint.eu

- In Country Support: United States & Ireland
- This CMMS/EAM is designed for: Manufacturing, Facilities & Property Management, Facilities, Services, Transportation & Fleet, Oil & Gas, Warehouses & DCs, Food & Beverage, Government, Healthcare, Education
- Typical Cost Of The CMMS Software: Pricing ranges from US$65/user/month to US$120/user/month.
- Available as a stand-alone system - Yes
- This CMMS/EAM can be integrated with third party applications including ERP and Financial Systems.

CMMS/EAM Description:

As the leader in Computerised Maintenance Management Software (CMMS), eMaint has been improving the way over 35,000 users in 55 countries manage their maintenance operations to control costs and boost overall productivity. Thirty years ago, eMaint was founded, and soon became one of the first CMMS providers to develop a completely web-based, "Software as a Service" model.

eMaint CMMS can be tailored to meet the exact specifications of any maintenance, facilities or operations department, and saves companies valuable time and money by better organising, planning and managing maintenance activities. eMaint's CMMS software encompasses functionality for managing work orders and work requests, preventive maintenance, purchasing and inventory control, asset history, and reporting in one user-friendly and affordable solution. This on-demand solution can be accessed across multiple locations in multiple languages from any browser-based device, including smartphones and tablets.

Key Components:

- Work Management – boost labour productivity with work orders, work requests and project management tools
- Inventory Management – manage inventory across multiple locations with ease, and track it using FIFO, LIFO or moving average accounting methods
- Asset Management – track and report on all of your most critical assets to help maximise your return, and extend the life of assets
- Preventive Maintenance – automatically generate calendar-based, meter-based or condition monitoring PMs
- Predictive Maintenance – define acceptable boundaries for equipment operation, import readings, graph results and automatically trigger an email or generate a work order when boundaries are exceeded
- Reporting – create and modify reports (or select from over 95 pre-loaded reports), and output them as text, PDFs, charts or graphs.
- Maintenance Scheduling – plan, schedule and assign work orders for greater control over maintenance processes
- Mobile Maintenance – access real-time data and perform functions throughout your facility and on the road, including work requests, work orders, parts, meter readings, inventory and assets
- Multi-Site Toolkit – manage multiple inventory locations through standardisation, visibility and consolidation
- eProcurement "PunchOut" Catalog Solution – order parts from major supplier catalogs (such as Grainger®) from within eMaint.

CMMS/EAM Related Services

eMaint offers a full range of training, implementation, consulting and technical services that support their customers in achieving their ongoing CMMS goals.

- In-person Training Services: Boot Camp Training; Custom Training; Xcelerate User & Training Conferences
- Web-based Training Services: eMaint University (online learning portal); eMaint Community & Knowledge Base; Best Practices Webinars; Web-Workshops
- Implementation Services: 10 Keys to Success Approach; CMMS Implementation Assessment; Continuous Improvement Assessment; Project Management Support; Project Kick Off; Project Close Out; Go Live Support
- Consulting Services: Asset Data Management; MRO - Inventory & Stores Consulting; Planned Maintenance & Scheduling; Reports & KPIs Facilitation; Workflow Process Development & SOPs; Reliability Concepts & eMaint Consulting
- Technical Services: Data Collection; Data Cleansing / Standardization; Data Conversion; Integration Services; Computer System Validation (CSV); PM Optimization Facilitation; Functional / Technical Specification Development

Maintenance & Reliability News

FLIR announces availability of world's first thermal imaging clamp meter

For a long time, electricians were forced to troubleshoot complex compounded problems by chasing down the cause – one electrical measurement at a time. A lot of the time the true source of the problem was never found, leading to call-backs from customers asking the electrician to fix the same issue over and over again. Not only did they waste time troubleshooting problems they thought they had resolved, but they also put their safety at risk without knowing what dangers they faced.

Today FLIR announced availability of the world's first thermal imaging clamp meter – the FLIR CM174 Imaging Clamp Meter with IGM™ (Infrared Guided Measurement).

The CM174 600A AC/DC Clamp Meter has a built-in thermal camera that powers FLIR's IGM technology, which visually guides users to temperature differences and pinpoints anomalies, so they can fix the system, not just the fault, to get the equipment up and running and ensure that it won't go down again. Electricians may even find new issues they didn't expect to see, expanding their scope of work and resulting in more business. For instance, they might have a hunch that a faulty motor controller caused an equipment failure, but after using CM174 they discover that an overheating motor or a loose connection was to blame.

If an electrician is facing cluttered wires or scanning complex panels for hazards, he can stay at a safe distance and use IGM to show them the anomalies without reaching into the panel. And the narrow-jaw design and built-in work lights make it easier to clamp the meter around wires in tight spaces and in poor lighting conditions. The CM174 validates findings with advanced measurement features to help solve the most complex electrical issues, and is vital for checking repairs and ensuring problem areas have returned to normal.

Find out more about what CM174 can do at www.flir.com/CM174.

About FLIR Systems

FLIR Systems, Inc. is a world leader in the design, manufacture, and marketing of sensor systems that enhance perception and awareness. FLIR's advanced thermal imaging and threat detection systems are used for a wide variety of imaging, thermography, and security applications, including airborne and ground-based surveillance, condition monitoring, research and development, manufacturing process control, search and rescue, drug interdiction, navigation, transportation safety, border and maritime patrol, environmental monitoring, and chemical, biological, radiological, nuclear, and explosives (CBRNE) detection. For more information, go to FLIR's web site at www.FLIR.com

Emerson technology and expertise to support Maersk Oil's Culzean project

Control and safety technology to help ensure safe and efficient operation of Culzean development in North Sea

Emerson Process Management, a global business of Emerson, has been awarded a contract to automate the Maersk Oil Culzean gas field development in the North Sea. One of the largest gas discoveries in the area, the Culzean field is expected to meet around five percent of the UK's total demand.

Maersk and its co-venturers are investing around $4.5 billion in the Culzean development. Three offshore platforms will support 12-slot wellheads and house a central processing facility, control room and living quarters. As the main automation contractor, Emerson will provide automation services and technologies for the three offshore platforms as well as for an onshore observation facility that can support remote operations if needed.

"Emerson has proven technology and a successful track record of managing budget and schedule risk in North Sea automation projects," said Steve Sonnenberg, president of Emerson Process Management. "This experience positions us to support Maersk Oil in both the initial construction phase and the long-term operational success of this prestigious and important project."

Emerson will provide a range of project and support services from its UK headquarters in Leicester to help ensure on-schedule project execution, including system design and engineering, configuration, testing, installation and commissioning.

An operator training system will support both engineering and workforce training to help bring the production online safely and as quickly as possible.

Emerson process control and safety systems will help ensure safe and efficient production, perform emergency shutdowns if required, and control fire and gas detection systems.

Emerson will also provide measurement and control technologies designed to meet the challenges of this ultra-high pressure and high temperature application, as well as asset management and machinery health monitoring technologies to improve maintenance efficiency and help avoid unscheduled downtime.

Production is expected to start in 2019 and continue for at least 13 years.

For more on how Emerson can help improve project and operational performance in offshore oil and gas production, visit http://www2.emersonprocess.com/en-US/industries/oil-gas/OffshoreExplorationProduction.

Prevent Leaks and Bring Lead Leaching Into Compliance with ePIPE

Pipe Restoration Inc., Technologies, LLC, (PRT), a world-leading pipe lining innovator and manufacturer of the patented, proven ePIPE pipe restoration technology, offers the fastest, 2 hour return to service barrier coating that prevents water pipe leaks, as well as bringing lead leaching into compliance. In honor of the United States' Environmental Protection Agency's national Fix a Leak Week and United Nations' World Water Day on March 22, PRT announces that it is helping to combat the global issue of water conservation and access to clean water with the ePIPE patented leak protection process.

With PRT's several leak sealing patents and the addition of its latest patent granted by the USPTO, covering the in-place coating of metallic pipes curing the resin in at least one hour, the patented ePIPE technology is proven to be the industry's fastest and most effective in-place pipe lining process that prevents leaks and greatly reduces lead and metals from leaching into the clean drinking water supply.

"We are constantly innovating to tackle water conservation and lead leaching, thereby enhancing the process of providing clean water to homes and buildings," ACE DuraFlo CEO Larry Gillanders said. "These are global and national crises. Wasted water through leaks and lead leaching must be addressed at city and national government levels. We are proud to offer a technology that combats both problems, while also being more economical, less disruptive and less destructive than pipe replacements."

The Flint, MI, water crisis has brought major attention to the cumulative effects of lead exposure, especially in pregnant women and small children. Lead is a dangerous toxin, poisoning drinking water, with medical experts agreeing there is no amount of lead deemed safe for consumption.

Pinhole leaks are one of the leading causes of water loss in the United States. It is estimated that 10 percent of homes have pipe leaks, which contributes to more than 1 trillion gallons of water that leaks from American homes every year. Approximately 1/6 of the U.S.'s clean water is believed to be lost each year due to pipe leaks, including billions of gallons of clean water in Southern California.

PRT's patented, in-place epoxy lining solution, ePIPE, restores the pipes from the inside and prevents pinhole leaks from occurring. This minimally-invasive method is preferred over traditional pipe replacement techniques, which are extremely expensive, disruptive, destructive, time-consuming and harmful to the environment.

About Pipe Restoration Technologies, LLC:

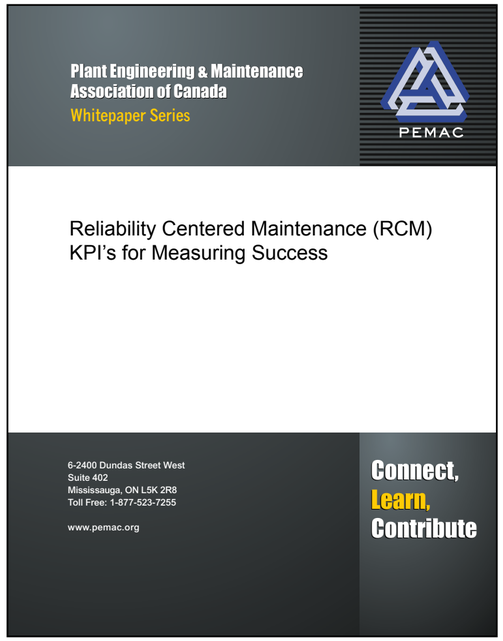
PRT is the parent company of the ePIPE product and worldwide group of installers that utilize the patented ePIPE process to restore pipes in-place. An alternative to a destructive repipe, this process is achieved using an application of an epoxy barrier coating, which results in a restored, epoxy lined piping system. The process provides a remedy for pinhole leaks, corrosion control and prevention of lead leaching from pipes without the destruction or disruption encountered by pipe replacements. PRT and its affiliated companies have locations throughout the United States, United Kingdom, Belgium, Spain, Mexico and Hong Kong. www.epipeinfo.com

PEMAC Shares Insights in its First Whitepaper Focusing on Reliability Centered Maintenance KPI's for Measuring Success

The Plant Engineering & Maintenance Association of Canada (PEMAC), a non-profit association providing global leadership, education and certification in asset management. Maintenance and reliability practices, announces the release of its first whitepaper entitled: Reliability Centred Maintenance (RCM) KPI's for Measuring Success. "Our members embody a tremendous amount of knowledge, and PEMAC is excited to facilitate opportunities for them to share that knowledge with others. This inaugural whitepaper represents the launch of an informative series that will allow members to share the great work they are doing, and to learn from others," notes Cindy Snedden, Executive Director of PEMAC.

The whitepaper is a result of a culmination of work by the RCM working group initiated by the Greater Toronto Area (GTA) Chapter of PEMAC. Composed of experts from a number of industries, the working group combined their experience, knowledge and insights, to develop a whitepaper that focuses on the key KPI's that maintenance and reliability professionals should use to measure the effectiveness and success of RCM programs.

Working group members include Jeff Bonnell, Alexandru Ivan, James Reyes-Picknell and Faisal Shaheen, representing experiences from both service providers and asset owning organizations. Their results of their work has produced a whitepaper that shares the



role and history of RCM, insight to choosing RCM methods as well as alternative options. The document highlights how to get started with RCM, as well as tips to ensure success. "PEMAC is doing great work to bring like-minded professionals together through initiatives across the country and locally, as well as providing specialized education in an effort to improve the professionalism and recognition of its members. Our work locally in the GTA Chapter to expand knowledge is evidence that great things can happen when we join together to share our insights and experiences," states Nigel D'Souza, Manager, Asset & Maintenance Management (AMM) Group at Ontario Clean Water Agency, and President of PEMAC GTA Chapter.

To receive a complimentary, full copy of PEMAC's Reliability Centred Maintenance (RCM) KPI's for Measuring Success Whitepaper visit www.pemac.org or email events@pemac.org

Maintenance & Reliability NEWS

AssetOptics Debuts Version 2.9 of CMMS/EAM Solution for Salesforce;

Enhances Platform with Beneficial User-Focused Productivity Enhancements

AssetOptics, a leader in cloud-based CMMS/EAM solutions, today announced the release of AssetOptics Facilities, Equipment and Fleet Maintenance for Salesforce version 2.9 (v2.9). The release offers four significant new features that will further increase operating efficiency and streamline scheduling, tracking and updating maintenance information in the system.

"With the exception of serialized parts tracking, our last update was about 'under the covers' tweaks," said AssetOptics Founder Mike Edwards. "With the release of v2.9, we focused on user productivity improvements, and I believe our customers and their personnel will appreciate the difference, right away."

- Preventive Maintenance (PM) Group Scheduling: Users will now be able to set up, with a single operation, maintenance schedules containing multiple intervals from monthly to quarterly to semi-annual, and further. Because the schedules follow a hierarchal system, longer-interval schedules will supersede shorter ones (e.g. 24-month will supplant 12-month), reducing the number of work orders and eliminating the need to manually consolidate or reschedule redundant work orders to avoid work duplication. Furthermore, date-based scheduling will enable users to select specific dates each month, or specific weekdays or weekends, on which they wish a maintenance event to fall.

- PM Schedule Revision Tracking: Now, users can track the revision history of a PM Schedule, seeing how many times any user has modified or updated the schedule and route the changes for approval. This feature strengthens change management and is highly valuable for regulatory reporting.

- Update Geo-Locations: Using a mobile device equipped with the AssetOptics mobile application, users can now update the geo-location of an asset tag or a work order using a Mobile Quick Action 'Update Geo Location' feature without logging into the GIS platform.

- Mass Receive Purchase Order "Miscellaneous Costs": When the Purchase Order (PO) main detail page contains multiple miscellaneous cost lines, users will be able to receive them as a group rather than as individual lines, promoting greater user productivity during the creation of Services receipts.

About AssetOptics

AssetOptics is a privately held company with deep domain expertise in enterprise asset management. AssetOptics Facilities, Equipment and Fleet Maintenance for Salesforce is a native Force.com application, benefiting from the reliability, scalability and performance of salesforce.com's trusted enterprise cloud computing platform. For more information, visit www.assetoptics.com

Fluke Ti450 Infrared Camera with MultiSharp™ Focus

The new Fluke® Ti450 Infrared Camera takes focus to a higher plane with MultiSharp™ Focus. An out-of-focus thermal image can be off by 20 degrees or more with no way to correct it once it has been captured - short of retaking new images. The new Fluke® Ti450 Infrared Camera solves this problem by delivering in-focus images of everything in the field of view.

MultiSharp Focus is a new technology that rapidly takes multiple images focused near to far and combines them to produce one image with all objects in focus. The advanced focusing system lets users capture an automated, in-focus image of all potential targets, delivering the image clarity needed by professional thermographers and maintenance managers to provide better images and avoid costly rework.

MultiSharp Focus is also available as a free upgrade to Fluke's TiX500, TiX520, and TiX560 Infrared Cameras when owners update the camera's firmware.

For instant focus on a single target, the high performance 320 x 240 resolution Ti450 features LaserSharp® Auto Focus that uses a built-in laser distance meter to calculate and display the distance to the designated target with pinpoint accuracy. Other auto focus systems may focus on the surrounding landscape or closer targets, compromising focus and the ability to capture accurate temperature measurements. The SuperResolution mode on the Ti450 increases image resolution to 640 x 480. This delivers images with four times more pixel data than normal resolution. The higher resolution lets users see even more detail for greater analysis capability and better reporting.

For more information visit: http://www.fluke.com/fluke/auen/thermal-cameras/fluke-ti450.htm?PID=80858

Fluke ScopeMeter® 120B Series simplifies and speeds electro-mechanical troubleshooting

Today's industrial machinery is more reliable and efficient, but can also be more difficult to troubleshoot because of the complexities of its advanced systems. The new Fluke® ScopeMeter® 120B Series Industrial Handheld Oscilloscope is designed to address these challenges with innovative features that improve the speed, efficiency, and accuracy of troubleshooting complex electro-mechanical systems.

The compact ScopeMeter 120B Series features Connect-and-View™ technology that recognises signal patterns and automatically sets up the scope's triggering, amplitude, and time base eliminating the typical trial-and-error setup process. Once the waveform is captured, the new IntellaSet™ intelligent measurement detection automatically selects key measurements based on the acquired waveform type and displays the most relevant measurement values (for example, Vrms and Hz for a line voltage signal, or Vpeak-peak and Hz for a square wave), helping technicians easily identify and characterise potential signal faults. The 120B Series also features Event Capture function that captures and identifies elusive intermittent events and lists all those events that exceed a predetermined threshold. This lets technicians identify key events quickly, rather than combing through large data sets, reading by reading.

As part of Fluke Connect®, a system of wireless test tools that communicate via the Fluke Connect® app, or Fluke Connect Assets software, a cloud-based solution that gathers measurements to provide a comprehensive view of critical equipment status, the 120B Series can automatically record waveform data to the Fluke Connect app on smartphones or tablets ensuring accuracy and eliminating manual recording of data. Those measurements are then wirelessly uploaded to the cloud and can be combined with measurement data from multiple Fluke Connect test tools to create and share reports from the job site via email and collaborate in real time with other colleagues, increasing productivity in the field.* Storing then comparing and contrasting waveforms of specific asset test points over time enables maintenance engineers to better identify and troubleshoot conditions that can lead to failures. www.fluke.com.au.

Giant Multinational Danone Chooses ManWinWin Software

Navaltik Management was chosen by Danone Group for the implementation of AutoWinWin, fleet maintenance software, in its subsidiary in Egypt.

The Danone Group is the fastest growing multinational in the world in the food sector, it is present in more than 120 countries on five continents. In 2014 Danone had more than 160 factories and around 100,000 employees, generating sales of € 17 billion, half of which were in emerging markets.

The use of AutoWinWin program in Cairo and 5 other cities, comprises of a project which included the system configuration, data logging and intensive training of users, and the main goals were:

- The configuration of the software with the operating standards of Danone;
- Recording the entire vehicle fleet in the software;
- Set the preventive maintenance plans for the vehicles;
- Recording and organizing the parts used for maintenance;
- Reports for all types of Work Orders;
- Keep track of Stock Ins and Outs;
- Define the key performance indicators;

ManWinWin has gradually been gaining strength in the Arab countries as a competent maintenance management solution provider. Other projects and several efforts are already planned in these markets, which are strategic for the company in the long run.

For further information contact rcabral@navaltik.com

www.manwinwin.com

Spotless re-signs Housing New South Wales contract

Spotless has been awarded a five-year contract to deliver Asset Services Maintenance for the New South Wales Land and Housing Corporation (LAHC). This contract extends for an additional five years and builds on Spotless' long term partnership with LAHC since 2002. The annualised total revenue from the contract is over $62m. Under the contract Spotless maintains over 24,000 properties, including maintenance, capital works and restoration/ heritage works.

Spotless is very pleased to continue this valued relationship with LAHC, said Martin Sheppard, Spotless' Chief Executive Officer. "Under the contract, we will manage responsive, planned and capital replacement works (facilities management service) to residential properties across three regions in Central Coast New South Wales, Inner West Sydney and Illawarra."

Spotless (ASX: SPO) is a leading provider of integrated facility services in Australia and New Zealand. Spotless' 39,000 people deliver millions of service hours a year across more than 100 support services – including catering and hospitality, asset maintenance, facility management, cleaning, laundry and linen, waste management, environmental services and security. Our clients are from a diverse range of industry sectors including Business and Industry; Defence; Education; Government; Health; Laundries; Leisure, Sports and Entertainment; and Resources. They receive increased efficiency and reduced costs by entrusting the delivery of these essential services to an industry expert. Apart from Spotless, we are known as AE Smith, UASG, Epicure, Alliance, Asset Services, Ensign, Clean Event, Clean Domain, Mustard, Taylor's, TGS and Nationwide Venue Management. Spotless had an annual turnover of over $2.8B in the period ending 30 June 2015.

www.spotless.com

Boliden Garpenberg to monitor flotation cells with DuoTech

Sweden's most modern mine is located in Garpenberg in southern Dalecarlia. In connection with the recent expansion of the mine a new concentrator was built, in which the flotation cells serve an important function. To ensure their reliable operation, Boliden Garpenberg now makes further investments in condition monitoring equipment.

The flotation cells play a central part in the extraction of ore. In the flotation process, the ore is concentrated and valuable minerals are separated from the waste rock in a surface-chemical process, where air and small amounts of chemicals cause the mineral particles to float up to the surface of the flotation cell, where they can be removed.

Initially, eighteen of the thirty-six flotation cells will be equipped with four DuoTech accelerometers each. The cells will be included in route-based condition measurement with Leonova Diamond, a handheld instrument which has already contributed to increased reliability in the flotation section of the concentrator plant.

The new DuoTech accelerometer makes it possible to monitor operating condition through vibration as well as shock pulse measurement using a single sensor. DuoTech supports vibration measurement with HD ENV and shock pulse measurement with SPM HD. Thanks to the combination of these unique methods, bearing and lubrication condition, unbalance, misalignment, loose parts and other machine problems can be efficiently monitored and identified with maximum prewarning time.

Maintenance engineer Mattias Danielsson comments on the investment: "To secure high availability, DuoTech accelerometers with remote measuring terminals are installed on the flotation section, which is done not only for productivity purposes but also from an ergonomic and time-efficient perspective. Prior to this installation, we had to go to each individual cell for measurements, which took a long time and some measuring points were very difficult to access."

In the Garpenberg mine, the SPM HD measuring technique is used also for monitoring the operating condition of an autogenous mill, where the ore is ground after being hoisted from the mine. The Boliden mine in Renström in Västerbotten also uses SPM HD for condition monitoring of critical equipment.

Dating back to the 13th century, Boliden Garpenberg is Sweden's oldest mine still in operation. The mine produces complex ores containing zinc, lead, silver, copper, and gold. Successful exploration, coupled with industry-leading technological development, has enabled the recent SEK 3.9 billion investments at the Garpenberg mine, increasing production from 1.4 million tonnes of ore to 2.5 million tonnes annually. As a result of these investments, Garpenberg is now one of the world's most cost-effective and modern mines. Boliden Garpenberg has approximately 400 employees.

http://www.spminstrument.com
http://www.aptgroup.com.au
Info@aptgroup.com.au

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eMaint Wins 2016 Bronze Stevie Award for Customer Service Department of the Year

eMaint Enterprises, the leader in Computerized Maintenance Management Software (CMMS) solutions, was awarded a Bronze Stevie Award in the Customer Service Department of the Year category.

"Three consecutive years as a winner of the Stevie Awards for Sales & Customer Service is an exciting achievement, and represents that our commitment to customers has remained a top priority throughout eMaint's growth over the past few years." said eMaint CEO & President Brian Samelson.

The Stevie Awards for Sales & Customer Service are the world's top sales awards, business development awards, contact center awards, and customer service awards. The Stevie Awards organizes several of the world's leading business awards shows including the prestigious American Business Awards and International Business Awards.

More than 2,100 nominations from organizations of all sizes and in virtually every industry were evaluated in this year's competition, an increase of 11% over 2015. Finalists were determined by the average scores of 115 professionals worldwide, acting as preliminary judges. More than 60 members of several specialized judging committees determined the Gold, Silver and Bronze Stevie Award placements from among the Finalists during final judging earlier this month.

eMaint's achievements include an expansion and restructuring of the Professional Services team to facilitate greater customer success. This commitment to customer success, coupled with extensive online and in-person training and professional services, has paved the way for eMaint's sustained customer retention rate of 90+%.

"Entries to the Stevie Awards for Sales & Customer Service continue to grow every year, further validating the essential roles that business development, customer service, and sales play in business success," said Michael Gallagher, president and founder of the Stevie Awards. "The widespread support of this program made the 2016 competition that much more intense among finalists. The judges were deeply impressed by the winner's accomplishments and we congratulate all of the winners on their commitment to excellence and innovation."

"It is the mission of our Customer Success team to deliver 'Service on 11.' This means ensuring eMaint is not only meeting, but exceeding, customer expectations," said Jennifer Einhorn, CCO of eMaint. "Receiving the Stevie Award yet again helps to recognize and reinforce our efforts on a national scale."

Details about the Stevie Awards for Sales & Customer Service and the list of Stevie winners in all categories are available at www.StevieAwards.com/sales.

About eMaint Enterprises, LLC

eMaint is a global leader in Computerized Maintenance Management Software (CMMS) with operations in Florida, New Jersey and Ireland. eMaint's software solutions helps organizations better manage, monitor and control maintenance operations, resources, equipment and compliance. Established in 1986, eMaint's client base consists of more than 35,000 users in over 55 countries, ranging from small/medium-sized organizations to Fortune 500 corporations in industries such as manufacturing, facilities, services, fleet, energy, government and education.

www.emaint.com

Global Marine Services install MPM & MSK for "AHTS Excelsior" & "AHTS Warrior"

U.K. Based Marine Software have supplied UAE based Global Marine Services with MPMWin - Marine Planned Maintenance Gold Version & MSKWin - Marine Storekeeper software packages for the control and management of their DP-2 vessels "AHTS Excelsior" and "AHTS Warrior".

These vessels will be managed by the OPM - Office Planned Maintenance & OSK - Office Storekeeper packages installed in head office and complemented with centralised remote access by Mumbai office users.

AHTS Excelsior is a 2014 built, ABS classed, DP-2 offshore support vessel equipped for Towing, Anchor Handling, Fire-fighting, Oil recovery & Carriage of Noxious liquid substance, currently operating offshore India while AHTS Warrior is a 2015 built sister vessel, currently operating offshore Qatar.

Established in 1993, GMS started operations in Sharjah, UAE to provide specialised offshore marine solutions with their fleet of ocean going tugs and offshore support vessels. The company has become a major player in the Gulf marine industry.

This contract was organised through Dubai based partners "Sicil Marine Ship Management & Operation" who were contracted by GMS to provide a fully configured, ship-specific, ready to operate Planned Maintenance database covering all Deck, Machinery, Safety & Dynamic Positioning equipment followed by Office and vessels installation & onshore/offshore user training.

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Fluke 902 FC True-rms HVAC Clamp Meter

Fluke 902 FC True-rms HVAC Clamp Meter enables HVAC technicians to create reports and collaborate with peers from the work site.

The Fluke 902 FC True-rms HVAC Clamp Meter, a wireless Fluke Connect®-enabled meter, improves the productivity of HVAC technicians in the field. The rugged dual rated (CAT III, 600 /CAT IV, 300 V) meter performs the essential measurements of HVAC systems (microamps for testing pilot light sensors, resistance up to 60 kilohms, AC current, AC/DC voltage, capacitance and contact temperature) eliminating the need to carry multiple tools. Its small body is easy to hold and the jaw fits perfectly in tight work spaces.

As part of Fluke Connect (the industry's largest system of software and more than 40 wireless test tools) the 902 FC can transmit measurements to a smartphone or tablet for later, detailed analysis. Those measurements can be uploaded to the cloud. Technicians can combine measurement data from multiple Fluke Connect test tools to create and share reports from the job site via email and collaborate in real time with other colleagues with ShareLive™ video calls or email, increasing productivity in the field.

The clamp meter also decreases the frequency that technicians will need to wear personal protective equipment when working on high voltage/current panels. Simply turn off the panel, verify the panel is de-energized using standard safety procedures, place the clamp and sync it to a smartphone with the Fluke Connect app, close the panel, reenergize it, and take measurements from a safe distance.

http://www.fluke.com

The Mainstream Conference Melbourne 21-22 March 2016

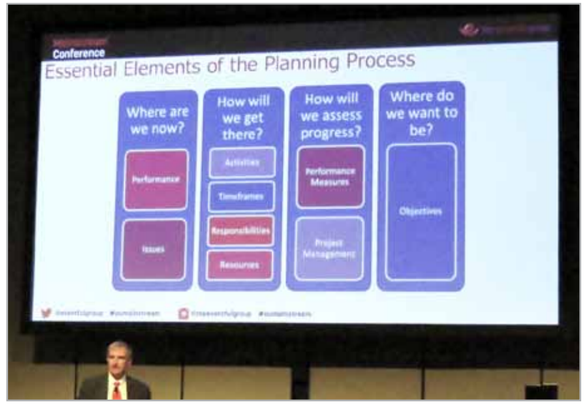
A report by Len Bradshaw, Editor, AMMJ:

I had the pleasure of attending the first day of this conference. As usual at Mainstream Conferences the venue and food were excellent and the quality of the speakers was very good.

The openning address had a title of "Why Asset Management Matters So Much to Chief Operating Officers". The speakers were Rio Tinto's Ivan Vella (Chief Operating Officer) and John Searls (Programme Director - World Class Asset Management). It was without doubt one of the most interesting presentations I have heard in a very long time.

The youngest guest at the Mainstream Conference was the very popular Layla.

Jason Trantor of Mobius presenting a paper on Why In-House Training Is The Best Way To Overcome Cultural Change and Skills- Shortage Barriers



Sandy Dunn of Assetivity presenting a paper on Using ISO 55000 to Create A Maintenance Strategy That DeliversReal Business Value

CORRECTING CONCRETE CORROSION

Australasian Corrosion Association http://www.corrosion.com.au

Spalling concrete on a hotel wall showing corroded reinforcing rods

Corrosion of the reinforcing steel in concrete is a worldwide problem that causes a range of economic, aesthetic and utilisation issues. However, if corrosion effects are considered in the design phase and the right decisions made prior to construction, buildings can be built to last and protected for as long as possible.

The corrosion of steel in concrete is accelerated in harsh environments, especially coastal, tropical or desert hotels and resorts where high salt levels or extreme temperatures can accelerate the rate of decay. Usually, the most exposed elements deteriorate first but because the active corrosion may take 5 to 15 years to initiate cracks in the concrete, much of the actual corroded reinforcement is not visible.

It is important that owners of high-value assets, such as hotels, understand the cost implications of ignoring the effects of corrosion on concrete buildings and structures. There are many advantages of planning for corrosion control and mitigation. Two of the main ones are that the life of an asset is extended and maintenance time and costs are reduced. In addition, reduced maintenance requirements increases the asset's overall utilisation and can improve its environmental sustainability.

Dangerously damaged hand rails with exposed rusting metalwork

It's not OK just because it can't be seen...

The alkaline (high pH) conditions in concrete forms a passive film on the surface of the steel reinforcing rods, thus preventing or minimising corrosion. Reduction of the pH caused by "Carbonation" or ingress of chloride (salt) causes the passive film to degrade, allowing the reinforcement to corrode in the presence of oxygen and moisture. A voltage differential of approximately 0.5 V is set up between the corroding (anodic) sites and the passive (cathodic) sites resulting in a corrosion cell where electrons move through the steel from anode to cathode. The rate of the reaction is largely controlled by the resistance or resistivity of the concrete. Acid forms at the anodic (corroding) site which reduces the pH and promotes the corrosion of the steel.

The Australasian Corrosion Association (ACA) works with industry and academia to research all aspects of corrosion in order to provide an extensive knowledge base that supports best practice in corrosion management, thereby ensuring all impacts of corrosion are responsibly managed, the environment is protected, public safety enhanced and economies improved.

The ACA also conducts educational activities such as seminars and training courses to inform and guide organisations and practitioners about topics including the latest protective technologies and processes. Throughout the year, the ACA conducts training courses and hosts seminars across Australia and New Zealand. Corrosion specialists certified by the ACA, and other organisations, have the experience and understanding of corrosion causes and solutions that allow them to recommend mechanisms and procedures to consultants and asset owners.

Corrosion affects all concrete buildings and structures around the world to some extent, with an estimated annual cost of billions of dollars to national economies. However, it is often more of an aesthetic issue for hotels than office buildings because they need to project a certain ambiance to provide guests with a comfortable and pleasant environment. In addition, the falling concrete from buildings, where spalling is occurring, represents a real safety risk. Hotel operators do not want scaffolding, cabling and exposed metalwork on display for extended periods of time.

There are also constraints on when necessary repair or remediation work can be carried out. Commercial office buildings are usually unoccupied for several hours overnight when disruptive drilling and grinding can be done, but hotels operate 24 hours per day making it almost impossible to find convenient times to do the work.

The idyllic location of a tropical beachside resort increases the speed of concrete corrosion

The two commonest causes of concrete corrosion are carbonation and chloride or 'salt attack'.

In broad terms, when carbonation, chlorides and other aggressive agents penetrate concrete, they initiate corrosion that results in cracking, spalling and weakening of concrete infrastructure. As reinforcing rods rust, the volume of the rust products can increase up to six times that of the original steel, thus increasing pressure on the surrounding material which slowly cracks the concrete.

Over the course of many years, the cracks eventually appear on the surface and concrete starts to flake off or spall.

As the degradation of the steel and weakening of the concrete occurs from the inside and may not be seen for many years, it is often referred to as 'concrete cancer'. According to Ian Godson, Managing Director of Infracorr Consulting PL, it might take up to 15 years before any cracking is visible. "It is a hidden problem which means that, when you find it, it is often well advanced, very much like the tip of the iceberg" Godson said.

Carbonation is the result of CO2 dissolving in the concrete pore fluid and this reacts with calcium from calcium hydroxide and calcium silicate hydrate to form calcite (CaCO3).

Within a relatively short space of time, the surface of fresh concrete will have reacted with CO2 from the air. Gradually, the process penetrates deeper into the concrete and after a year or so it may typically have reached a depth of 1 mm for dense concrete of low permeability, or up to 5 mm for more porous and permeable concrete depending on the water/cement ratio.

Chlorides, usually from seaside splash or windblown locations, migrate into the porous concrete over time, causing corrosion when the concentration of chlorides reach critical levels at the reinforcement. In addition, older structures may have utilised calcium chloride as concrete 'set accelerators' at the time of construction, again resulting in serious corrosion issues.

Concrete corrosion repair and prevention

According to Justin Rigby, coatings consultant at Remedy Asset Protection, "Concrete is a great material and is generally impervious at the start, but to increase durability, a coating should be applied."

Elastomeric waterproofing membranes can be either rolled or sprayed on to a concrete surface. Flat rooftops allow membranes to be rolled on, but where there are complex geometries, spraying the coating is the most effective method of application.

The traditional method of concrete repair is to remove the cracked and spalling concrete to a depth of 20-30mm behind the reinforcing bars to fully expose the rusted material and remove the contaminated concrete from the steel. All the corroded material is then removed and the steel treated or replaced, after which specialist repair concrete mortars are applied and the surface made good. A modern development is for the repair mortars to be polymer modified to improve adhesion and resist further ingress of contaminants. Coatings are commonly used in combination with patch repairs to reduce further entry of carbonation or chlorides.

These "patch repairs" that remove the contaminated concrete from the deteriorating sections often do not address this hidden corrosion and result in accelerated deterioration to the surrounding areas, commonly failing again within 3-5 years. Godson added, "One of the limitations of patch repairs is that you have to remove large quantities of sound concrete to solve the problem, causing significant noise and disruption to the building occupants."

The main alternative to patch repair is Cathodic Protection.

One type, Impressed Current Cathodic Protection (ICCP), is a technique whereby a small, permanent current is passed through the concrete to the reinforcement in order to virtually stop the corrosion of the steel.

Elastomeric polymer membrance on a city high-rise mitigates the effects of exposure

Hybrid anode installation, typically with Anodes installed in 30mm diameter holes, typically spaced at approximately 400mm, with titanium connector wires. Repair mortar then completely covers the hybrid system components

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The main benefit of ICCP is that the extent of removal and repair of concrete is vastly reduced, with only the spalled and delaminated concrete required to be repaired. Once installed, the ongoing corrosion can be controlled for the long term, eliminating future spalling and deterioration even in severely chloride or carbonation contaminated concrete.

The selection of anode systems is the most vital design consideration for a durable and efficient ICCP system. Incorrect selection and placement of the anode system can result in poor performance and vastly reduced life of the installation.

According to Godson, cathodic protection is relatively simple in theory. "Insert anodes into the concrete at set spacing attached to the positive terminal of a DC power supply and connect the negative terminal to the reinforcing steel. ICCP systems commonly operate at 2 to 5 Volts DC," he said. "The drawback is that you need lots of cables and permanent power supplies which results in this technology being mainly restricted to civil structures such as wharves and bridges with very rare applications to buildings."

A relatively recent development has been Hybrid CP which utilises zinc anodes installed in drilled holes with the anodes powered for an initial period of around 10 days. The high initial CP current totally passivates the steel reinforcement, migrating chloride away from the bars and restoring an alkaline (high pH) environment in the concrete.

Following the initial impressed current phase, the temporary power supply and cables are removed, with the anodes then connected to the reinforcement via locally placed junction boxes to provide ongoing galvanic protection.

This relatively low galvanic current maintains the ongoing passive condition at the reinforcement and prevents further concrete damage. Hybrid CP systems are usually designed to give a 30 year or longer design life.

Hybrid CP offers all the advantages of ICCP, including corrosion control and reduced concrete removal, without the high cost and maintenance of power supplies, cables and control systems. Areas and structures that were previously difficult and uneconomical to treat with ICCP can now be protected using Hybrid CP technology. This includes small scale and remote structures including those situated in non-powered sites such as bridges, marine dolphins and culverts. In the case of building repairs, Hybrid CP offers significant advantages over ICCP by eliminating the need for unsightly and costly cabling and power supplies.

About the Australasian Corrosion Association

The ACA is a not-for-profit, membership Association which disseminates information on corrosion and its prevention or control, by providing training, seminars, conferences, publications and other activities.. The ACA was established in 1955 to service the needs of Australian and New Zealand companies, organisations and individuals involved in the fight against corrosion.The ACA is the leader throughout Australasia in disseminating knowledge to enable best practice in corrosion management, thereby ensuring the environment is protected, public safety enhanced and economies improved.. ACA members are drawn from a wide cross section of industries united by their common interest in reducing the impact of corrosion in Australasia.

http://www.corrosion.com.au

Partnership with the community generates $2m of people power

Lake Macquarie City Council

http://www.lakemac.com.au/

Using a subsidiary body, such as a board, volunteer committee or incorporated organisation to provide a service under a council's delegated authority is not a new concept, but Lake Macquarie City Council (NSW, Australia) has adapted this model as an innovative solution to managing more than 100 community facilities across the City.

Community facilities are essential for the health, wellbeing and economic prosperity of communities. While these facilities contribute greatly to social outcomes of the community through the services they provide, they also present a unique challenge for Lake Macquarie City Council because of the geography of the City.

A lake twice the size of Sydney Harbour makes travelling to all the suburbs and community facilities time-consuming, and makes managing these wide-spread assets resource-intensive for Council.

So, the Council utilises a vast delegated authority strategy to operate all the facilities and provide a daily presence at each of them.

Lake Macquarie City Council's Manager Community Planning, John Ferguson, said delegated authorities undertake the care, control and operation of more than 100 local facilities, and the strategy is working well.

"A delegated authority model has allowed us to expand our capacity to provide relevant community facilities by establishing partnerships with the people who use our community and recreational facilities," Mr Ferguson said.

"These partnerships bring to fruition the equivalent of about $2 million of people-power each year."

It's no secret that many councils struggle to manage and maintain their portfolio of ageing community assets and are sometimes unable to monitor closely who uses each facility and for what purpose they are being used. This shortfall leads to further disadvantages because these facilities can become out of step with community needs.

"Devolving management responsibilities to community groups increases a sense of ownership, control and pride in local communities," Mr Ferguson said.

"These groups are able to monitor the usage and finances of the facility more closely, to identify improvements that will meet the specific needs of its users. Therefore, the provision of service is improved over time, and this model is a better option compared to the level of service Council could provide if it directly managed the facility."

Lake Macquarie City Council has a long and successful history of using an external body for facilitating community-based services in the City. Using the same concept, but with varying legal and management structures, Council has also partnered with the community to manage facilities such as The Place, a community centre in Charlestown, the Hunter Sports Centre at Glendale, the Business Growth Centre at Gateshead and, more recently, and in a commercial capacity, the establishment of an economic development board and subsidiary company, Dantia.

Council's model for increasing its capacity by building collaborative partnerships produces a wonderful by-product; it grows more leaders within the community and opens opportunity for people to learn new skills and take ownership of the community facilities they enjoy using.

Belmont North

Cameron Park

Plastic and Non-metallic Piping for Plants and Equipment with the Focus on Reliability and Safety

Amin Almasi

Introduction

The advantages of plastic piping are excellent resistance to a very wide range of different types of untreated water, chemical effluent and aggressive fluids, good flow characteristics, and costs. Plastic piping usually operate at lower friction-loss levels than metals. Disadvantages might be poor structural stability requiring close support, susceptibility of some materials to changes resulting from exposure to ultraviolet (UV) rays or sunlight, poor fire resistance, lowering of pressure ratings with elevated temperature, and production of toxic gases released by some materials when burning. Considering all these advantages and disadvantages, plastic piping systems are superior to other options (including metallic piping) for some applications.

Plastic piping is as descriptive a phrase as metallic piping. The properties of various plastic materials are obtained from the basic chemical composition of the polymer resin, additives, and the manufacturing process itself. Plastic is a material whose essential ingredient is an organic substance of large molecular weight which at some stage in its manufacture can be shaped by flow and becomes solid in its finished state.

Plastic piping is manufactured in two types: thermoset (TS) and thermoplastic (TP). Thermoset piping is permanently rigid; examples are epoxy and phenolics. Thermoplastic material will soften when subject to a degree of heat and re-harden upon removal of the heat. This will affect the strength of the pipe; therefore, extreme care should be used when selecting the material type and support system for the material.

Connections in Plastic Piping

Solvent-welding (also known as solvent-cementing) are commonly used for the connections of many plastic piping, they can be used with specific types of plastic pipe and fittings with plain and socket ends. For example, PVC piping is usually connected by proper solvent-cement (although other methods might be applicable). Specific solvents and cements can be used only with specific plastic pipe types. The cement used to fabricate the joint reacts chemically with the pipe and fitting and dissolves the material it contacts. It is spread on the male section, which is then inserted in the female portion of the joint. The dissolved portions in contact with each other flow together and, when dry, are fused into a single mass, producing a leak-proof joint.

Heat fusion can be used only with specific types of plain end thermoplastic plastic pipe and fittings manufactured for this purpose. The socket joint is fabricated by first placing a fitted wire with multiple loops around the outside of the plain end of the pipe. The wire will conduct electricity and has two leads, called pigtails. The pipe and wire are then placed into the socket of a fitting. These leads are connected to a carefully controlled source of electricity provided by the pipe manufacturer for this purpose. When the electricity is turned on, the wires inside the joint are heated, causing those portions of the pipe and the fittings contacting each other to melt and fuse together. After the electricity is turned off, the plastic hardens, creating a tight joint. The fused butt joint is made by separately heating the pipe ends to the melting point and then bringing them together. When the joint hardens a leak-proof seal is formed.

PVC Piping

PVC (Poly-vinyl chloride) can be considered as the strongest and the most widely used plastic pipe; it is used for both pressure and non-pressure applications. It usually has very poor resistance to solvents. A generally accepted upper service temperature limit is a value between 60°C and 65°C. The PVC-U (or UPVC) is made only from compounds containing no plasticizers and a minimum amount of other materials; this is referred to un-plasticized in Europe (and rigid in the United States). PVC pipe is available in schedule 40, 80 and 120 and in diameters up to 20 in (500 mm) [rough figures]. PVC pipe is self-extinguishing and will not burn. However, when subject to conditions of a fire, a toxic gas is emitted.

CPVC is a chemical modification of PVC, with an extra chlorine atom in its structure that extends its service temperature limitation to a value between 90°C and 93°C; this is about 30°C more than PVC-U pipe. Available sizes and other properties are more or less similar.

PP Piping

Polypropylene (PP) is a polyolefin available in two types, type-1: homo-polymer, and type-2: copolymer. It has superior resistance to sulfur-bearing compounds and is capable of withstanding a wide range of applications. It is the most resistant to organic solvents of all the common plastic pipe materials, and is only slightly less rigid than PVC. It is superior to PE (Polyethylene) at higher temperatures. PP is usually available in schedule 40 and 80 and in diameters up to 12 in (300 mm) [rough figure]. Joining methods usually include solvent-welded socket joints, heat-fused socket-welded joints and heat-fused

butt-welded joints (threaded joints might be available, but not recommended). PP piping system do not usually conform to ASTM and other standards for dimensions or wall thickness of pipe or fittings; they are more manufacturer's dependent; each manufacturer provides exact dimensions and details.

Polypropylene (PP) is one of the lightest plastics used in piping systems; PP piping have high heat resistance; some references have noted relatively high softening point for PP.

Acrylonitrile Butadiene Styrene (ABS) Piping

Acrylonitrile Butadiene Styrene (ABS) is used for different applications, for example, interior and exterior industrial drainage and vent systems and pressurized liquid lines such as those used for salty water, untreated water, crude oil, and different waste liquids. It is slightly more rigid than PVC and is the least resistant to solvents of all the popular plastic materials. The generally accepted upper service temperature limit is around 80°C. ABS is usually available in schedule 40 and 80, and in diameters up to 12 inch (300 mm) [rough figure].

Reinforced Thermosetting Resin Pipe (RTHP)

RTHP is a class of composite pipe that consists of a reinforcement either imbedded in, or surrounded by, cured thermosetting resin. The most common reinforcement is fiberglass. This type of pipe is known as fiberglass reinforced pipe (FRP). Reinforcement can be theoretically composed of any mineral fiber. RTHP is also available in a variety of resins, liners, and wall construction; it has a high strength-to-weight ratio.

The generally accepted maximum temperature rating (with some exceptions) is around 120°C. Pipe is usually available in sizes from 1 to 48 in (approximate values). Because of its construction, the piping is capable of withstanding much higher temperatures than most plastic pipe, and is much stronger both physically and mechanically while being resistant to a wide variety of chemicals. The resin is the binder that holds the composite structure together. It supplies the source of temperature and chemical resistance. There are usually four resin types: "epoxy", "polyester", "vinyl ester", and "furans". Furans are difficult to work with and are rarely used. Epoxy and vinyl ester are the most widely used. Epoxy resin is stronger than vinyl ester. The curing agent (or catalyst) also has an effect on the chemical resistance of the pipe. Aromatic amine-cured epoxy has better chemical resistance than polyamide-cured epoxy. The various combinations of materials are resistant to a great variety of chemicals and suitable for many services.

Joints for FRP piping is usually implemented by tapered adhesive joint. This type of joint is most often made by machine tapering the outside of the male pipe and inserting it into a matching female end. An adhesive spread on the male section secures the joint. A coupling with tapers at each side is used to join two lengths of tapered male pipe ends. A straight coupling (used with straight pipe ends) with no taper is also available for some applications.

Double-Wall Piping

Installing an outer pipe around an inner pipe has been found to prevent the release of hazardous liquids being transported in the inner pipe. This system as a whole is called a secondary contained piping system, or double-walled pipe. A major use for these systems is for transporting high risk fluids such as liquid fuels. There are no generally recognized codes for dimensions of these piping systems. The interior pipe transporting the liquid is called the carrier or primary pipe. The outer pipe around the carrier pipe is called the containment pipe or secondary containment. The two pipes are kept apart by spacers, often called frogs or spiders by manufacturers.

Double-wall systems are manufactured from many different piping materials. There is no requirement for the primary and secondary pipe to be made of the same material except where a possible incompatibility may exist. Because the secondary containment pipe does not have to be in contact with the fluid, it is very cost effective to have the secondary containment pipe made from a different, less costly material. This is possible because the selected outside pipe will not have to be in constant contact with the fluid and, therefore, may be acceptable for only limited contact at a lower temperature and pressure; on the other hand it should be suitable to deal with outside environment. The major problem in the design of double-wall systems is thermal expansion and contraction of the primary and secondary pipes. If transporting hot liquids, the primary and secondary pipes will expand at different rates, even if they are made of the same materials, since the secondary pipe is at a lower temperature. Compensation methods for expansion and contraction include expansion loops between restraints with oversize containment, changes of direction with oversize containment elbows, expansion offsets between restraints, expansion joints, and proprietary fittings to keep the containment pipe in alignment if the temperature difference is not too large. Since each manufacturer uses different materials and jointing methods, expansion compensation methods for each specific system should be obtained from specific manufacturers.

With the potential for polluting the environment if any product leaks from the piping system, a leak detection system is mandatory to detect leaks from the primary pipe. For facilities, the two methods used most often are (1) an electronic resistance or capacitance cable with sensing panel and (2) capped tees with a probe installed so that any product leaking into the containment will spill into the tees and be detected by an immersion probe. In the first method, a cable is installed throughout the pipe run and is located at the bottom of the pipe. If the cable cannot be correctly routed through changes of direction, it should be interrupted. The cable has usually the ability to detect moisture anywhere along its length and the sensing panel will indicate where the leak is located along the cable. In the second method, a probe in the tee is connected by cable to a panel that will show which tee probe detected the liquid. Experience has shown that the cable is difficult to install and is prone to false annunciation due to condensation in the pipe. Because of this, the second method (the probes installed in a tee) has usually been preferred. The tees are generally spaced from 6 to 15 m apart depending on economics and, often, on distances established by specific application.

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instrumentation for oil and gas pipelines

http://www.olympus-ims.com

Pipelines are an important part of many phases of production, in a range of industries. In the oil and gas industry for example, they form the gathering systems joining wells to process facilities and the distribution system delivering products to refineries and markets. Pipelines vary from simple steel tubes to state-of-the-art spiral-wound, flexible lines, with diameters ranging from 50 millimetres to two metres.

Laying of oil and gas pipelines can be expensive, particularly offshore where the traditional method is to weld lengths of pipe together on a lay barge and progressively lower or slide the pipeline to its designated sea bed location. Sophisticated techniques are used to ensure the pipe is properly positioned. An alternative shallow water method involves welding the pipe lengths together onshore and then transporting the completed line into the desired location as one whole unit. Onshore pipelines are also welded and laid in sections.

Many onshore lines are buried, thus the laying operation is preceded by trench cutting and followed by back fill. Shallow water offshore lines are also often buried, usually where there is a threat of scouring and movement from currents and tides. Whether buried or exposed, all pipelines are exposed to a range of physical, climatic and chemical environments that can cause corrosion.

The economic impact of all types corrosion and it's degradation of infrastructure, such as pipelines, oil rigs and towers, represents an annual cost of many millions of dollars to the industry.

Internal pipe maintenance and cleaning is usually conducted by sending a scrubbing device or 'pig' (originally named because of the squealing noise early versions made as they traversed the line) through the pipeline at regular time intervals. Other, more sophisticated pigs, fitted with cameras and sensors, are able to inspect the integrity of welds and the internal condition of the pipe as they move along.

Olympus has an extensive range of Inspection and Measurement Systems, many of which have been developed by the company specifically to simplify the inspection of corrosion in pipes and vessels. The company displayed and demonstrated part of its inspection, non-destructive testing (NDT) and measurement instrument range at the 2015 Australasian Oil and Gas Exhibition and Conference (AOG) in Perth. AOG is Australia's largest oil and gas exhibition and showcases products and services for the industry

NDT is any analysis technique used to evaluate the properties of materials or components without causing damage nor permanently alter the article being inspected. NDT can save both money and time in product evaluation, troubleshooting and research. Olympus has been developing RVI technology for many years and expanding its application to a range of markets. It has become a critical technique within the Oil and Gas industry to minimise confined space entries as well as enable viewing small areas previously not accessible.

Colm Kinsella, Industrial Sales Specialist with Olympus, added "The range of analysis, testing and imaging instrumentation featured at AOG this year illustrates our commitment to the development of new technologies for maintaining pipelines, and related oil and gas infrastructure."

Historically, maintenance of pipelines has been based around scheduled inspections at set intervals, but in many instances this resulted in unnecessary shutdowns of plant or production lines. Implementation of risk-based assessment, where the statistical likelihood of a problem occurring is determined, allows the inspection intervals to be amended in accordance with operating conditions and parameters. Some inspection intervals might often be increased, although equipment such as flare drums might require shorter inspection intervals due to the greater variability in their service conditions and the estimated corrosion rates.

Inspection to determine the internal condition of equipment is deemed non-intrusive if there is no requirement to remove a component or open the equipment. The process is one way for companies to avoid costly plant shutdowns. These inspections mainly use the NDT methods of Ultrasonic Testing (UT), including ultrasonic corrosion mapping,

The lightweight iPLEX RX videoscope from Olympus

The Olympus Nortec 600: portable, rugged eddy current analysis in virtually any environment

Radiographic Testing (RT) and Time of Flight Diffraction ultrasonics (ToFD). The Time of Flight technique is used to inspect for weld defects. The actual techniques used in a particular inspection and the coverage required, would be determined by the suspected degradation methods a piece of equipment might suffer.

Obviously, the planning required for any type of inspection for a major plant or process that has to be shutdown begins often months before the date of the inspection. Factors that take time include getting equipment and technicians to the inspection site at the appropriate time.

One instrument of interest to pipeline maintenance personnel is Olympus' new Dual Linear Array (DLA) probe for corrosion inspection which offers many advantages over conventional ultrasonic dual element transducers. The DLA solution improves productivity through features such as larger beam coverage, faster scan speed, and C-scan imaging with increased data-point density. The pitch-catch technique used by the DLA probe provides better near-surface resolution and pit detection in corrosion survey applications.

The hand-held RollerFORM probe supports ultrasonic phased array analysis of complex structures

The Dual Linear Array™ probe adds a new low-cost entry-level inspection capability to the company's existing HydroFORM® and RexoFORM corrosion solutions, especially when combined with the OmniScan® SX. Operation of the new probe is a stramlined procedure of loading the setup file, checking the calibration, running the inspection and recording the data.

Like traditional dual element UT probes, the DLA incorporates separate transmitting and receiving elements mounted on delay lines that are cut at an angle. Such a configuration generates beams that focus beneath the surface of the test piece, considerably decreasing the amplitude of surface reflection. This results in improved near-surface resolution making it particularly good for identifying microbial corrosion, which can be easily missed using other techniques.

Olympus has noticed an increase in the use of X-Ray fluorescence analysis as part of QC/QA programmes in Australia resulting from the growing trend of overseas fabrication and component sourcing. These programmes rely on NDT techniques and one example is the high demand for Positive Material Identification (PMI) at dock receiving bays using the Olympus Delta Professional handheld XRF analyser.

Inspecting the integrity of a pipeline weld

The RollerFORM phased array wheel probe is another tool that can be combined with an OmniScan® SX to inspect structures such as pipelines and complex steel structures such as rigs and towers. The probe uses zero-degree ultrasonic beams for manufacturing and maintenance inspections. The unique tyre material of the RollerFORM has been designed to guarantee high-quality, immersion-like ultrasonic testing in a durable, hand-held instrument.

Another Olympus instrument for pipeline inspection is the Nortec 600, which is a compact, durable unit that is ideal for industrial quality assurance in construction, oil and gas production and exploration. The rugged housing of the device makes it ideal for use in a wide range of harsh operating environments. The Nortec 600 can be used to identify surface cracks under paint and is critical for any load bearing structure from cranes and gantries to offshore rigs.

Olympus has been at the forefront of videoscope and RVI development for many decades and advances in imaging and battery technology have enabled the company to build one of the lightest and most compact videoscopes available.

The iPlex RX videoscope is an invaluable tool for inspectors looking for superb image reproduction in difficult applications and locations with limited operator access.

According to Graham Maxwell, National Key Accounts & Technical Manager at Olympus, participating in AOG this year has been successful for the company. "For us it was the quality of potential customers that was important," he said. "Attendees were very knowledgeable and knew what they were looking for."

Kinsela added that Olympus had sought out the oil and gas service companies in addition to the asset owners. "We wrote several solid quotations for customers and even received a couple of purchase orders for equipment, including a Nortec 600."

Olympus IBD is a business division of Olympus Corporation, an international company operating in industrial, medical and consumer markets, specialising in optics, electronics and precision engineering. Olympus IBD continues its commitment to actively pursue the development of new technologies, products, and services that offer the best solutions to customers' needs.

http://www.olympus-ims.com

Assets, Equipment, Services & People - News

Emerson to help Cameron LNG deliver complex, multi-billion dollar LNG project on schedule

Emerson Process Management, a global business of Emerson (NYSE: EMR), has been tapped by Cameron LNG to help automate its new liquefaction project, adding three LNG trains to facilitate export of domestic natural gas to international markets. Because of its LNG expertise and proven track record in delivering complex projects on time, Emerson has been awarded automation contracts for more than half of all North American LNG export capacity.

Cameron has chosen Emerson Process Management to provide automation expertise and technologies that will help Cameron manage the LNG facility's operations safely and efficiently. Estimated value of the project to Emerson is $20 million.

Three new liquefaction trains will give the Hackberry, Louisiana, facility the flexibility to export up to 12 million metric tons per year of U.S.-produced natural gas. The plant can also continue to import LNG for domestic use, or re-export LNG from other countries.

Emerson will provide its DeltaV™ distributed control and DeltaV SIS integrated safety system for both new and existing portions of the facility, plus its AMS Suite predictive maintenance software to optimize the availability and performance of key production assets. Project specialists in Houston and in Pune, India, will provide related design and configuration services to help accelerate the project schedule.

To learn more about Emerson's capabilities for natural gas processing operations, visit http://www2.emersonprocess.com/en-US/industries/oil-gas/Natural-Gas-Processing

About Emerson

Emerson (NYSE: EMR), based in St. Louis, Missouri (USA), is a global leader in bringing technology and engineering together to provide innovative solutions for customers in industrial, commercial, and consumer markets around the world. The company is comprised of five business segments: Process Management, Industrial Automation, Network Power, Climate Technologies, and Commercial & Residential Solutions. Sales in fiscal 2015 were $22.3 billion.

For more information, visit Emerson.com.

Interconnected: The future of road transport

Isuzu Australia Limited (IAL) is already fully engaged with offering greater vehicle and driver visibility to customers with their current telematics offerings, Isuzu Connect and Isuzu Connect Plus.

Using on-board vehicle sensors, vehicle positioning and management software, Isuzu Telematics provides real-time, 24/7 data for drivers, operators and fleet managers to access from anywhere on the web.

The benefits of Telematics are many, and include opportunities to significantly optimise driver safety, improve fuel efficiency and keep better informed about a vehicle's health and servicing requirements.

One key benefit is Isuzu's two-way messaging system, which has been added to the Isuzu Telematics 2016 package. The technology enables two-way communication between fleet controllers (home base) and vehicles out on the road.

Additionally, Isuzu is also anticipating the introduction of electronic work diaries (EWDs) as part of its intelligent truck platform.

Currently, Australian drivers are required to keep written work diaries if operating more than 100 kilometres from home base. The up-keep and accuracy of these diaries are a constant source of angst within the industry, although an electronic format is expected to eliminate human error, reduce fatigue and increase overall road safety.

Due to government process and specifications, wholesale take-up of EWDs is not expected until well into 2017, although Isuzu will have the technology and hardware in place when these arrangements become finalised.

V2I technology will help further improve road safety by enabling vehicles to communicate with other elements in the road infrastructure network such as traffic lights and on-ramp meters.

Put into practice, V2I technology could inform a driver of an upcoming red light and indicate the speed they will need to take to hit the intersection in perfect time to get the green light.

V2X

V2X encompasses both V2I and V2V technology, to create a comprehensive road communication technology that offers all road users more control over their vehicles and their own safety.

Although still in its infancy, V2X is considered the technology which could eventually create a safe framework for autonomous vehicles to operate within.

For most consumers, self-driving vehicles are still the stuff of the future, however, commentators are now saying with undivided attention and efforts by the industry, the technology could be rolled-out in the next ten years.

In terms of safety, V2X technology could potentially alert pedestrians and drivers of danger before any incident occurs. Bluetooth is set to become increasingly important in V2X communications, in terms of the vehicle's communication to everything around them, including people.

Through Bluetooth, every pedestrian who carries a smart phone becomes part of the connectivity network.

The technology can also issue a warning to drivers of unseen dangers such as collision risks or a car approaching which is speeding.

Eventually the technology will also be able to inform drivers if the car next to them has worn breaks, or warn about a driver who is braking unexpectedly up ahead.

V2X could significantly reduce traffic congestion by alerting drivers to rush hour traffic, accidents, and suggest alternate routes before they set off on their journey. In turn, this would improve fuel economy and save drivers money in the long run.

The issues innovators in V2X face is that in order for V2X to work effectively, all infrastructures involved will have to be 'V2X optimised' and there'll need to be a widespread take-up of the technology by individuals and fleets across the industry for the results to prove really beneficial.

Australia is already well positioned to stay on the crest of global advances in areas of V2X developments and related technologies.

Adelaide only recently hosted the International Driverless Cars Conference, which explored issues such as the research, work and regulations that need to be taken up before a safe roll-out of connected, automated vehicles in this country.

In an Australian first, South Australian Minister for Transport and Infrastructure Stephen Mullighan introduced a bill to state parliament last September which would allow 'real life' testing of the automated technology on public roads.

This move could jumpstart the market towards the goal of using V2X technology to improve road and vehicle safety, enhance collision avoidance systems, fuel economy and develop smarter traffic management systems.

South Australian based company Cohda Wireless are also playing their part in forging the way, with their hardware and software being used in 60 per cent of all Vehicle to Infrastructure and Vehicle to Vehicle field trials worldwide.

As companies like Cohda lead the way, intelligent, V2X technology looks certain to be an inevitable part of our transport future.

Autonomous trucks may also one day become a reality but it will depend on highly optimised road networks and a massive uptake across the board.

For further information, please contact:

Jeff Birdseye Marketing Manager

Isuzu Australia Limited

Phone: 03 9644 6666

Assets, Equipment, Services & People - News

Leading engineering design firm selects breakthrough solution to rapidly capture, organize and manage large volumes of existing unstructured information.

SmartPlant Fusion is a breakthrough solution for both engineering, procurement and construction (EPC) companies and plant operators to rapidly find, capture, organize, link and visualize large volumes of information through a simple web portal. This information includes documents, drawings, models, lists and datasheets, which exist in multiple formats and are found scattered – and often duplicated – in various folders and databases.

Such was the case at a coal-fired power plant where Burns & McDonnell was engaged to perform a revamp. The owner required that all documents be cross-referenced with engineering tags to create a tag index. Burns & McDonnell chose SmartPlant Fusion to assist.

"Burns & McDonnell is one of the top engineering design firms serving the electrical power industry. Our customers expect innovative approaches to complicated situations," said Rick Halil, General Manager of the Burns & McDonnell Energy Division. "Intergraph SmartPlant Fusion helped fulfill the owner's requirements on a very tight schedule.

"Mastering this new technology in its early stages also gives Burns & McDonnell opportunities to use SmartPlant Fusion on both greenfield and brownfield projects," Halil said. "We can help owners with decades-old legacy information quickly organize their data and documents while assisting with facility start-ups, modifications, revamps and shutdown planning. SmartPlant Fusion opens new business opportunities for Burns & McDonnell by bringing solutions to the owners we serve."

Gerhard Sallinger, Intergraph Process, Power & Marine president, said, "Burns & McDonnell's use of SmartPlant Fusion is a perfect example of our innovative customers applying Intergraph technology to solve problems. SmartPlant Fusion provides interoperability with Intergraph's SmartPlant Enterprise for Owner Operators (SPO), which means owners can take what contractors like Burns & McDonnell does and promote those to a fully managed environment."

SmartPlant Fusion is designed to rapidly capture, organize and make large volumes of existing unstructured information available through a simple web portal interface in a highly organized and intuitive manner. The types of unstructured information include documents, drawings, images, 3D models and even high-definition surveying, which comprises integrated laser scan point clouds and high-resolution photography. SmartPlant Fusion is the fastest and smartest way to make information available for decision support. It enables intuitive navigation with a photo-realistic representation of the way things are really connected, making unintelligent information smart.

For more information about SmartPlant Fusion, visit: http://ppm.intergraph.com/products/information-management-product-family/smartplant-fusion.

Intergraph Technical User Forum (TUF) LinkedIn groups provide an online discussion forum for year-round networking between users. To learn more about Intergraph solutions and network with other Intergraph users, visit http://ppm.intergraph.com/technical-user-forums

ISM Introduces New Line of Miniature Filters for Flow Control

Industrial Specialties Mfg. (ISM) now offers manufacturers and OEM designers a more extensive lineup of miniature in-line filters with many new feature options.

Miniaturization has long been a design trend in electronics. This approach has evolved to include air and fluid flow control miniaturization. The proliferation of "smaller-is-better" designs continue to deliver reduced manufacturing costs, consumables expenses, shipping costs and space requirements. "Customer design specifications continue to evolve and expand", said James Davis, president of Colorado based ISM, "and flow control miniaturization has become a major driver of product development."

ISM recognizes that OEM design preferences include an increasing need to reduce operating complexity and costs while increasing accuracy and reliability. They also believe current market trends require miniature in-line filter offerings comprehensive enough to meet the ever-increasing demand for compact components. The recent expansion of ISM's miniature in-line filters offering is part of the company's ongoing commitment to provide an extensive and useful assortment of miniature parts, manufactured in North America with quality as the number one priority.

In addition, ISM has taken advantage of developments in manufacturing techniques for producing ever-smaller miniature in-line filters. These filter designs come with ports and micron ranges to handle a wide range of applications in smaller spaces. Flow diameters range down to 3 millimeters or 1/16 inch and pore sizes run as low as 0.2 microns while housing and filter media are offered in an increased variety of materials. Miniature filters are offered from tiny inserts to completed assemblies in plastic housings for immediate use in flow control circuitry.

Examples of the range of ISM customer miniature flow control design projects include:

- Biological specimen flexible transport system with built in gas venting and filtration
- Automated lens cleaning system for miniature video cameras in exposed environments
- Course particle filtration for small-scale portable and easy-to-maintain potable water systems

ISM is ISO 9001:2008 certified to assure quality control processes. This emphasis on quality guides all product development, customer service, logistics and custom component and sub-assembly projects.

For more information, samples or technical specifications call Industrial Specialties Mfg. at 303-781-8486 or visit www.industrialspec.com

Assets, Equipment, Services & People - News

ISO 55001 certification demonstrates London Heathrow's commitment to delivering value and boosting customer satisfaction through effective Asset Management

Lloyd's Register (LR) has confirmed that Heathrow Airport Limited (HAL) has achieved certification to international asset management system standard ISO 55001, thereby demonstrating HAL's commitment to delivering value and boosting customer satisfaction levels through effective asset management. The certificate itself was presented to Steve Chambers, Heathrow's Engineering and Asset Management Director by Jamie Thompson representing LR during an award ceremony at London Heathrow on 24 February 2016.

The certification was carried out by Lloyd's Register Energy and LRQA. LRQA is the only certification body to hold a global scope of accreditation for ISO 55001:2014, (which replaces PAS 55) and is one of the first group of certification bodies to be awarded accreditation against the standard. Both LR Energy and LRQA are members of the Lloyd's Register group and hereafter collectively referred to as Lloyd's Register.

London Heathrow's asset base is large and spans a wide range of types including runways, terminals, transit systems, a mainline railway, power generation and distribution, water and pollution control, security systems, fuel systems and baggage systems.

This work builds on LR's work with London Heathrow which commenced back in 2014 with maturity assessments, designed to evaluate the efficiency of HAL's asset management arrangements. Lloyd's Register has wide experience of asset management good practice, having supported organisations across the world in the development of their systems across multiple sectors.

Demonstrating that a system is meeting or exceeding the requirements requires a good design for the management system, implemented well across the full range of assets and covering all lifecycle stages of the asset base. The LR approach samples the three dimensions of asset lifecycle stage, asset type and all aspects of ISO 55001. Reflecting on their certification to ISO 55001 Paul Weal, Head of Asset Management said, "This is a fantastic achievement across the airport that is a reflection on the level of professionalism and accountability towards our approach to asset management. It is by understanding why we do things, that we can influence the 'what' and the 'how' in terms of delivering value from our assets, for all our customers."

"The team at Heathrow is clearly passionate about the airport and the quality of service it delivers," said Chris Knowles, Global VP Asset Management Consulting at LR. "This is demonstrated by the way they have built on good practices across the airport at all levels to implement an Asset Management system which demonstrates effective risk based control and delivery of value from the asset base."

About LRQA

LRQA is a member of the Lloyd's Register group. LRQA is a leading independent provider of assurance services including assessment, certification, validation, verification and training across a broad spectrum of standards and schemes. http://www.lrqa.com/

Siemens and IBM team on next generation of cloud-based building energy management solutions

Cloud-based building management platform leverages enterprise asset management and data analytics technologies to help meet sustainability goals.

Today, the Siemens Buildings Technologies Division and IBM (NYSE:IBM) announced cloud-based solutions that will leverage Siemens' building expertise and IBM Internet of Things (IoT) capabilities to maximize the potential of connected buildings and the data they create, helping corporate real estate owners across multiple industries drive business results and meet energy efficiency goals.

Building intelligence is evolving through emerging technologies in cloud computing, data analytics, and intelligent field devices – effectively merging the virtual and real worlds within the built environment. This shift provides an opportunity to transform real estate assets into active contributors to business success. The solution addresses this opportunity by delivering greater transparency and flexibility to support the decision making process while creating greater efficiency and cost savings to help impact the bottom line.

Siemens is integrating software from IBM's Watson IoT Business Unit, including analytics and asset management, into its cloud-based Navigator energy and sustainability management platform. This combination will help benefit corporate real estate customers in many ways, including:

- Corporate real estate owners and operators will now be able to leverage internal and external data on Siemens' Navigator platform to benchmark building performance and forecast operational budgets.
- Predictive analytics can be applied for fault detection and diagnosis so potential issues can be addressed before anything happens.
- Text recognition and analytics for utility invoice validation can identify billing errors and enhance data quality.
- Mobile applications can enable energy audits and creation of audit reports from anywhere.

"Of all the software solutions available to corporate real estate owners today, none leverage facility optimization solutions from a service provider like Siemens," explained Matthias Rebellius, CEO, Siemens Building Technologies Division. "By interfacing our Navigator platform with IBM's software, we can bring Siemens' proven expertise in energy optimization and building performance together with IBM's real estate and asset management systems to create an unrivaled combination that will dramatically improve the productivity of buildings."

The Siemens Navigator platform provides a customizable suite of services that enables monitoring of building system performance, energy demand, and energy supply more effectively and efficiently across a single building, a campus, or an entire real estate portfolio. With IBM's IoT technologies integrated into the new Navigator platform, customers will experience a user-friendly interface and will benefit from more advanced analytics capabilities as well as the ability to process more robust data sets from their real estate portfolios. The Navigator platform can also integrate with any system, including the Siemens Desigo CC building management system and third party technologies. The new Navigator functionality will be rolled-out in packages over the coming years starting this year, with releases in May and October.

"Connected 'things' – everything from hospital beds, train tracks, cars, buildings and more – are generating massive amounts of data that can be analyzed to provide quick, actionable insights," said Harriet Green, General Manager, Watson IoT, Education & Commerce, IBM. "Siemens and IBM are bringing together deep knowledge of new efficiencies for smarter buildings with advances in cloud-based IoT to transform business and society alike."

"Our collaboration will form a strong foundation for the development of a greater ecosystem that will support other providers to bring improved

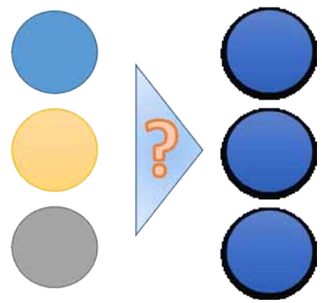
functionality and innovations to the services and solutions we offer to our shared clients," said Matthias Rebellius.

The corporate real estate industry is just beginning to scratch the surface of advanced data analytics for the purpose of producing consistent results and enabling easier decision-making. Operating costs account for 71 percent of the total cost of owning a buildingi and real estate is often the second largest expense on the income statement for large enterprise organizationsii. Building owners and operators can now leverage solutions across the entire lifecycle of their real estate assets to predict energy efficiency trends and equipment availability issues in advance, so that building operation can be as reliable, cost-effective, and sustainable as possible.

Siemens is making further significant investments in Digitalization and has developed the Sinalytics platform for advanced, predictive data analytics across its various businesses. Siemens Building Technologies is combining its analytics capabilities and IBM software tools for a next generation software platform for energy management and sustainability – Navigator, powered by Sinalytics.

http://www.siemens.com
http://www.ibm.com/iot
http://www.siemens.com/buildingtechnologies

The 3 Questions to Ask Before Standardizing Spare Parts



Phill Slater *Phill@PhillipSlater.com*

Spare Parts Standardization: An Enduring Debate

Whether or not to standardize equipment and spare parts is one of the enduring debates of engineering, maintenance and spare parts management. On the one hand, standardization is said to lead to improved operating and manpower efficiency, as well as reduced inventories; on the other hand, not standardizing is said to enable companies to take advantage of technical developments and innovation. One thing that is certain is that the impact of explicit pros and cons are hard to quantify and will be specific to the individual circumstance.

First, let's define standardization. The Merriam-Webster online dictionary suggests a simple definition of standardize as: 'to change things so that they are similar and consistent and agree with rules about what is proper and acceptable'.

Standardizing for spare parts management, usually means agreeing that a certain type/model of equipment will be used and with that the spare parts required for each installation will be the same. This is different to industry-wide standardization such as the use of metric nuts as bolts.

The Pros and Cons of Standardizing Spare Parts

So just what are the pros and cons of standardization? Here are the most commonly cited:

Pro's

- Fewer parts to manage
- Lower inventories
- Operational familiarity
- Improved maintenance efficiencies
- Improved purchasing efficiencies
- Fewer invoices to process
- Lower parts costs

Con's

- Missed innovation
- Reduced operational efficiency
- Increased obsolescence risk
- Increased parts costs
- The perceived risk of using non-OEM parts

This list demonstrates why the arguments for and against standardization are not straightforward: One of the pro's is the potential for reduced parts costs and one of the cons is the potential for increased parts costs! How can both arguments be true? It all depends on the specific circumstance.

Three Spare Parts Standardization Questions

In deciding whether or not to standardize on a particular type/model of equipment, and the associated spare parts, a detailed examination of the specific circumstance needs to be completed. This will include determining the real impact on your company of any change of policy and ensuring that the motivation for ordering non-standard equipment is justified. These are the three key questions to ask:

1. Is there a genuine innovation/operational advantage?
2. How much more/less inventory is required and what does that cost/save?
3. If a change in type/model is agreed, is there a way to gradually move to the new type/model as the old ones are used up (meaning that the old type/model will no longer be ordered)

When working through the decision whether or not to standardize there is a need to be mindful of the motivation. Is it because someone just wants the latest thing? (Some might call this the 'cool factor'.) Is it motivated by vendor bias? (A preference for, or dislike of, a specific vendor.) Is it motivated by a perception of quality for high priced components (Sometimes referred to as 'gold plating').

Standardization is not trivial. At a minimum is requires a quantification of the costs or savings that might arise and an assessment of the associated risks. Like all management and investment decisions relating to spare parts holdings, it is not simply an engineering, operations, storeroom, or procurement decision but the result of the consideration of all functions that are involved.

Phillip Slater is the Founder of the online resource and training website, SparePartsKnowHow.com and the author of 8 books, including Smart Inventory Solutions and The Optimization Trap. For a complimentary copy of the e-book 5 Myths of Inventory Reduction please visit Phillip's personal website at www.PhillipSlater.com

3D printing and the supply chain

ICECORP, www.icecorp.ca

3D printing, or "additive manufacturing" is not new. Invented in the 1980s, it really started to gain traction with engineers and designers in the first decade of this century as a tool to quickly develop product prototypes.

Since then, however, the sophistication of 3D printers and the expansion of the number of materials that can be used to manufacture items has opened new horizons for the technology.

It works like this: layers of material are deposited using one of a number of different technologies (see http://3dprinting.com/what-is-3d-printing/ for a detailed explanation) gradually building a physical object. The design is encoded in a digital file that is transmitted to the printer, just as a regular print job would be.

Objects to be printed can be created from scratch, using computer-aided design software, or scanned from an existing item, using a 3D scanner.

3D printing capabilities are advancing rapidly. Potential raw materials have progressed from plastic to paper and metal foils, and most recently laser sintering, which can build parts from metal powders.

Forecasters think the 3D printing industry will show revenues of US$21 billion by 2020, with growth of 31 percent a year.

But 3D printing is a disruptive technology because it has the potential to turn the supply chain on its head. It has been called the third industrial revolution.

Imagine the possibilities if the replacement parts needed for airplanes that might be sitting on a runway anywhere in the world, could be made on the spot, as they are required. Similarly, remotely located resource extraction operations could reduce downtime by having spares made on the spot instead of transported on demand.

Instead of having rush courier orders, with the accompanying high prices, and production delays or cancelled flights, the parts could be manufactured close to where they are needed. In a fraction of the time it takes to fly a part in, it could be made on a 3D printer, inspected and installed.

The supply chain is shortened, lead times reduced, and the carbon footprint of business minimized.

There will have to be a shift to bulk transport of the raw materials that go into the 3D-printed parts, and that may be at the expense of those whose business is to deliver manufactured replacement parts on short notice.

Some in the courier business have already realized the potential upheaval this may mean to their operations and are reacting accordingly. UPS has partnered with a 3D printing firm to provide next day delivery of 3D printed parts.

For third-party logistics providers (3PLs) there may be a significant opportunity as the 3D printing technology matures. Instead of warehousing inventory for other companies, the 3PL may find a new business niche in becoming a localized 3D printer for hire.

Vast warehouses storing parts inventory could become a thing of the past as 3PLs shift to becoming just-in-time parts makers, proximate to their final destination. Parts designs would be available through a digital library, and the 3D printing depots would thus be able to serve multiple customers, just as they do now.

Although this all remains in the realm of future possibility, experiments are being conducted to test the viability of the 3D parts printing concept. A trial is being conducted by a consortium of 26 companies to manufacture replacement parts for ships. Screws, sealing rings and fluid conductors were among the types of parts being trialed.

Broekman Logistics based in Rotterdam, Holland, is the only logistics services provider to participate in the 3D-print consortium.

Broekman CEO Raymond Riemen said: "We recognize the value of 3D printing for a number of our customers for whom we store and transport cargo. In addition to the physical warehouses we operate, our membership in the consortium may be the first step in creating a digital warehouse for these customers. We will then also be able to use these warehouses as a basis for supplying products, at the right time and in the right location."

3D printing may not have reached maturity yet, but its potential impact on the supply chain is undeniable. As Broekman Logistics and UPS are demonstrating, it is clearly among the top technologies that supply chain leaders need to watch and plan for to ensure the future viability of their business.

www.icecorp.ca

ICECORP is a total supply chain solution company, with services ranging from Global transportation management to North American clearance & Compliance to Contract Warehouse management. For more details please visit www.icecorp.ca

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University of Tennessee Appoints SparePartsKnowHow.com as Approved Training Partner

The Reliability and Maintainability Center (RMC) at the University of Tennessee, Knoxville has appointed SparePartsKnowHow.com as an approved training partner for its Reliability & Maintainability Implementation Certification (RMIC) program.

This recognition by the University of Tennessee means that anyone who completes the Spare Parts Management Certificate at SparePartsKnowHow.com, and registers through the RMIC program, will receive course credit towards gaining and maintaining their Reliability and Maintainability Implementation Certification.

The RMC exists to advance reliability and maintenance education and practices within the academic and industrial communities. The RMIC program provides the foundations of R&M knowledge and offers the flexibility to include specific training based on individual needs. The RMC has designed the program for working professionals and gives the most practical maintenance and reliability education.

SparePartsKnowHow.com is a world-leading provider of spare parts inventory management training and, in keeping with the RMC's vision of educating working professionals, exclusively delivers its Spare Parts Management Certificate course online, with online coaching support.

The Spare Parts Management Certificate is designed for people with an interest in the management of spare parts used to support maintenance and operational activities. The Spare Parts Management Certificate course covers everything required to develop the skills, know-how, policies and systems to maximize spare parts availability while minimizing the spare parts investment.

For more information please visit http://sparepartsknowhow.com/university-tennessee-certification/ or contact Phillip Slater, Founder, SparePartsKnowHow.com via pslater@initiateaction.com

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WANTED your articles, news and case studies relating to the management, procurement and use of spare parts & materials in the world of asset management & maintenance. Contact Len Bradshaw at:

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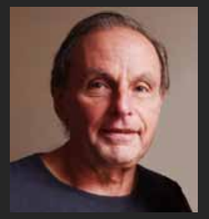

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