

“Back to the basics – Now what were they again?”

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Summary: Maintenance managers universally are distracted by technology, computer systems, tasks and daily problems. This results in them thinking and acting in a short term manner and not concerning themselves with the long term, the broader business processes, people issues and enterprise aspects to the extent they should. In turn this means less than optimal maintenance performance, compromise operations and reduced profit. This paper calls on maintenance managers to sit back and take a fresh look at the maintenance organisation and examine the maintenance business processes. The nature of maintenance business processes is examined and methods discussed to ensure adequate design and development of processes to suit the business needs and ensure maintenance is effective, efficient, economical, safe and performed in a manner that ensures asset integrity and the continual provision of productive capacity. Tips on managing the top 10 maintenance processes are presented together with the reasons they need to be analysed and developed. The top 10 were selected on the basis that they are required to form a solid foundation for maintenance, and because they are so frequently neglected.

Keywords: Maintenance processes, business processes, asset management processes, maintenance performance, audits, excellence model, process design, process development, procedures, informal processes, political processes, strategic planning, review, improvement, continuous improvement, asset identification, change management, planning & scheduling, shutdown management, root cause analysis, document & data control, compliance & work control.

INTRODUCTION

Since man invented the wheel he has had great difficulty convincing others of the value, and the need, to look after it properly. In the early industrial development period labour and materials were plentiful and cheap. Unfortunately it is still difficult today, in a competitive business environment, to convince many of the need and the value of maintenance. In addition it is difficult to gain approval for the appropriate labour, materials and tools necessary to deliver effective and efficient maintenance. Perhaps there are some clues to a better way given by the Master when addressing the apprentice. *“Now listen Jimmy and listen good, you are my best maintenance apprentice. I want you to take a walk around the mill, smell the vapour, touch the bearings, tap the wheels, put your ear to the pipe, oil the gears until they drip, clean the sight glass until it shines, blackjack the belts, fix every little thing that looks like it needs fixing. Take as long as it takes and then polish the brassware so I can see to comb my hair. Use only the methods we discussed, keep them to yourself, confide in me failures looming, spread only good news to the weavers and bailers, and remember young man - no tattle tales to the secretary – she’s well connected you know! Now make haste lad. Listen and learn every day, for this game may not be what it appears to be.”* It seems that the apprentice is learning that there are some important matters not included in his formal technical training.

This raises the question – What are the basic things we need to do to effectively and efficiently to maintain our machinery? We certainly still need to oil the gears, clean up the factory, fix small faults and perform a whole range of basic physical tasks. Unfortunately many organisations have great difficulty in ensuring that these basic things get done, which in turn adversely affects those around us. Clearly there is another range of basic processes that must happen in order to provide effective and efficient maintenance. It may be time for a new perspective, to have a fresh look at maintenance and develop new paths to excellence.

1 WHERE THEY GO WRONG

Typically maintenance organisations and management are problem driven, task orientated, dazzled by technology, fail to deliver what is demanded and needed and consequently viewed poorly by others. As evidenced in many audits maintenance managers and their organisations exhibit the following symptoms:

- Give insufficient attention to people and organisational related issues including training, teamwork, involvement, commitment and motivation
- Do not give sufficient priority to the business and financial aspects of maintenance and its impact on the broader productive effort
- Most become problem driven, concentrating on the last 24 hours, the last month, day-to-day and therefore tend to manage short term.
- They are task orientated, tending to look mainly at specific maintenance jobs (engineers love the detail).
- Many are looking for magic solutions to boost flagging performance including RCM, TPM, Six Sigma, Balanced Scorecard, and PMO etc.
- They make superficial changes such as restructuring the department, renaming, changing titles from maintenance to asset management and gaining no real benefit.
- Implementation difficulties for costly systems such as CMMS or RCM etc.
- Overlook the importance of properly establishing the building blocks for maintenance systems and processes.
- Have temporary enthusiasms resulting in a range of purchased systems remaining partially implemented
- Believe that a computerised system will solve their problems
- Fail to do very basic maintenance, engineering and business practices
- Fail to deliver what is requested, and what is needed, and don't realise the difference

The underlying problems to these observations result in:

- Maintenance people have a poor image with colleagues and senior management in turn reflecting what actually gets done
- Maintenance not being seen as an important ingredient or profit contributor, but rather as a cost burden in manufacturing and other businesses,
- The businesses they serve fail to adequately deliver acceptable plant reliability, production output and return on investment.

It is clear that maintenance organisations must take on broader business processes to achieve the desired performance.

2 MAINTENANCE PERFORMANCE

Many organisations will from time to time review performance and examine the maintenance organisation though external audit or benchmarking. Figure 1 is a composite result from a large number of Maintenance Operations Reviews © (audits). The results are depicted on a vertical scale where 1=Minimal, 2=Emerging, 3=Developing, 4=Competent and 5=Excellence. These results show the high, low and average rating for each of the 18 "Elements". The average rating for all elements is 1.7. By any standards this is not good and leaves plenty of room for improvement.

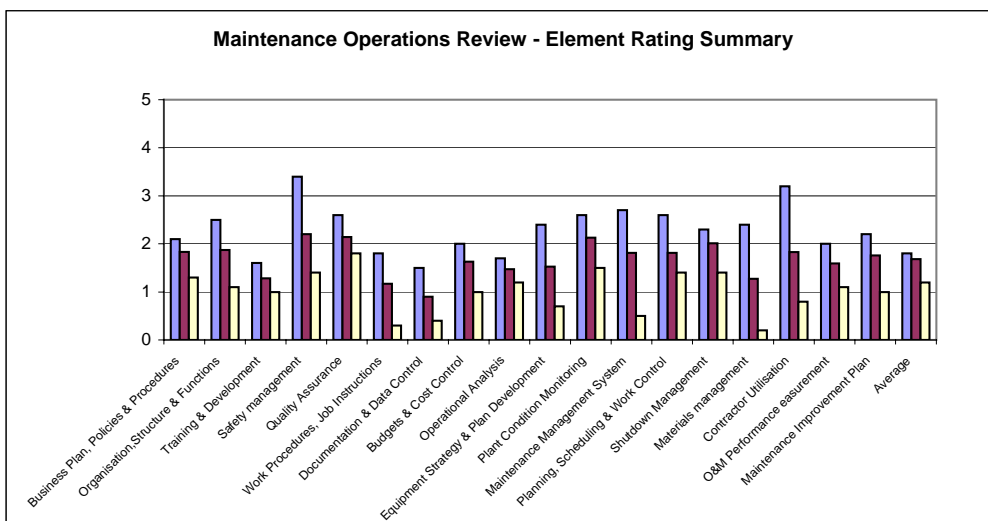
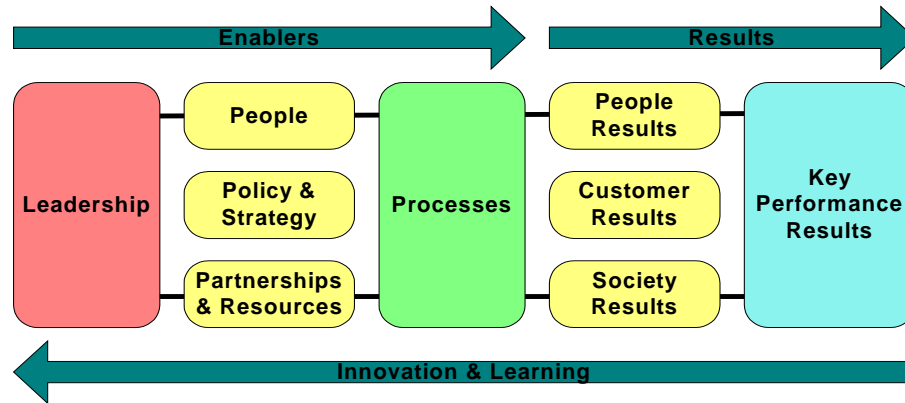


Figure 1

This particular audit approach looks at maintenance organisational performance in 18 Elements including Planning & Scheduling, Shutdown Management, Equipment Strategy etc. These elements could well be regarded as the key processes for maintenance. Perhaps the path to excellence lies in an analysis of these processes.

3 ABOUT PROCESSES

Have you ever requested a task to be done and find that after a few days, a week, a month or 6 months that no action has been taken? Conversely have you ever noticed how sometimes actions are taken or things (documents) appear when they are not really required. Have you noticed how difficult it is to change staff work practices, how difficult it is to change regular meeting dates for special circumstances. These symptoms and phenomena are due to organisational processes, good and bad, strong and weak relentlessly churning along. The importance of processes is reflected in the European Federation for Quality Managements' Excellence model, (Figure 2) where processes are central to the conversion of leadership challenges to real business results.



EFQM Excellence Model®

Figure 2

What are processes and what are systems and how do they relate? In summary Processes are integrated sets of activities that transform inputs into outputs. A system exists when several processes are interconnected either by having common activities and/or by input-output relationships. Generally the output from one process becomes the input (or a given) for another process. It can be said that the inputs and outputs bind processes together. They can also confuse the analysis of processes by making them forever expansive. An attempt to map all of the processes in, or required by, an organisation will result in a giant process "molecule". Refer to Figure 3

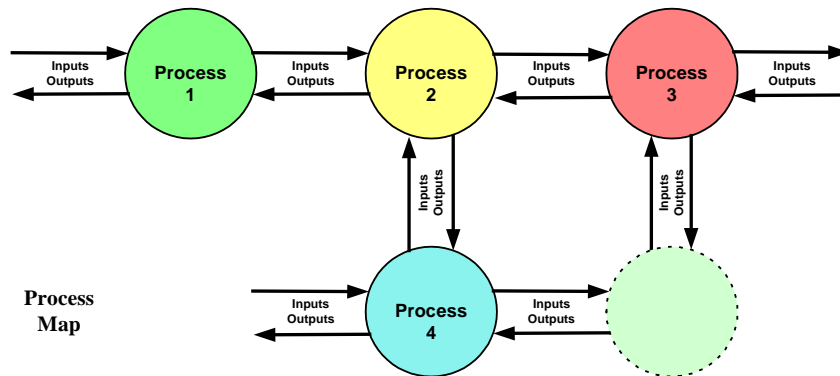


Figure 3

An initial review of a maintenance organisation from a process perspective may reveal a range of process types:

- Default processes – The trades persons had to do something to get out of trouble
- Evolved processes – They just evolved without proper thought, design or review
- Ineffective processes – Cumbersome, bureaucratic, many forms, multi level approvals
- Inappropriate processes – Duplicated in different departments
- Critical processes – Essential for the business, required for compliance
- Sub processes – They are numerous and surround every task
- Related processes – Connecting key business functions and departments

An audit of the maintenance function will quickly lead to those processes that require an overhaul. To take this one step further we need to understand the characteristics of well-designed processes. They include:

- Documented (process flow and procedure)
- Defined Inputs (type, format, quality, source, timing)

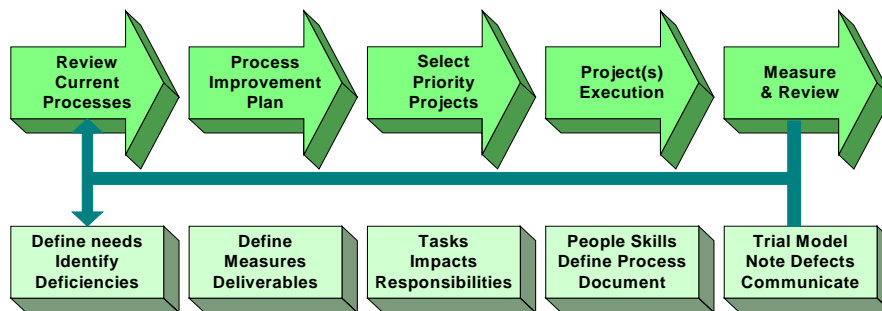
- Defined Outputs (type, format, quality, destination, timing)
- Easily understood at all levels in the organisation
- User friendly and practical to allow all stakeholders to follow
- Up-to-date
- Minimise the use of resources
- Minimise the use of materials
- Minimise delays in the process
- Resilient (designed to cater for the unusual events)

Importantly the process description, procedure and process flow will make it clear where and when the involvement of all people required in the process are needed.

It should be noted that many processes might correspond predominantly to organisational department or section responsibility, e.g. Planning and Scheduling. Processes can also be significantly contained within systems, e.g. CMMS. Despite popular belief in some management circles processes are not just an IT thing, but rather a much broader key aspect of managing a business. Unfortunately many computer systems dominate and restrict our thinking on how business should be done. The important thing is what are the processes that go on around the computer system that actually make things happen.

4 PROCESS DEVELOPMENT & DESIGN

We have all been bombarded with BPD, BPI, BPE, BPR, BPO, Process mapping, CI and many more acronyms. Perhaps this is a reflection of their need, importance and complexity. Process design and development will happen quicker if it is kept as simple as possible. It can be worked into an improvement program and with appropriate staff involvement buy-in for new maintenance practices and implementation will flow. Good process development can also allow for current practice and future best practice in processes and procedures. Figure 4 shows the basic steps in process development.

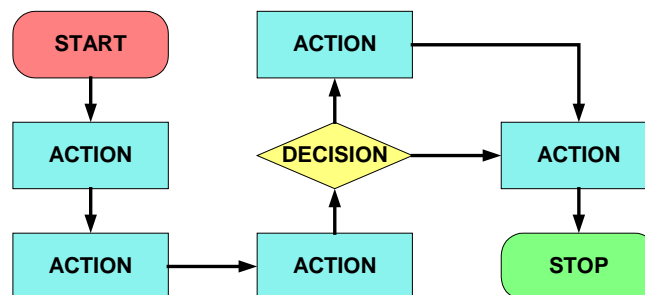


Process Design & Development

Figure 4

Rather than attempting to understand the big picture (process molecule) it is recommended that flowcharts be developed one process at a time in accordance with a plan. It is important also to have a corresponding written procedure for every process. To complete the picture the process flow chart and procedure may require a number of specific work instructions.

Process flow charts can be very simple or complex depending on the organisational needs. Generally they should be easily understood at all levels in the organisation, practical, up-to-date, and user friendly. It is often forgotten that these documents are (or should be) an aid to ensuring consistent, effective and efficient work practices and used to institutionalise best practice. Generally procedural flowcharts are drawn similar to the sample in Figure 5.



Basic Procedural Flowchart

Figure 5

5 BUSINESS PROCESSES

Design, development and mastering processes is a complex matter. A process perspective is, however, worth taking on board as it may well give you a fresh approach to the way you go about your daily tasks, and what those daily tasks are and how they are managed. Let us have a look at what some of these processes may be. Corporate Business processes are described in many ways and may include:

Corporate Business Processes

- Quality Management
- Risk Management
- Information Management
- Information Technology
- Service provision
- Document & data control
- Monitoring & measuring
- Internal Audit
- Production
- Financial
- Communication Internal
- Human Resource
- Procurement
- Compliance
- Customer Communication
- Planning
- Non-conformance
- Management review
- Resources management
- Materials Management
- Performance
- Change & Configuration
- Project Control
- Product design
- Customer satisfaction
- Training
- Continual Improvement
- IP protection
- **Asset Management**
- Legal & Corp Governance

This list contains Asset Management, which in turn may be divided into a number of processes:

Asset Management Processes ⁽¹⁾

- Acquisition
- Supply
- Disposal
- Quality management
- Enterprise Environment
- Investment management
- System Life Cycle
- Resource management
- Project Planning
- Project Assessment
- Project Control
- Decision-making
- Risk Management
- Configuration
- Information
- Validation
- Requirement Definition
- Requirement Analysis
- Transition
- Implementation
- Integration
- Verification
- Operation
- **Maintenance**

From an examination of such lists we can readily see that they could be expanded to take in other processes, divided differently, combined or further sub divided. This observation is true even for the processes list that make up major ISO and other Standards. It is a very difficult to compile and exhaustive list of business processes. This is evidenced by a university in the USA that offers courses for 420 different Organisation and Management Processes.

A list of Asset Management processes invariably includes Maintenance. It is not difficult to also take the view that the other processes in these lists could be sub lists of maintenance. This makes the analysis of processes complex.

6 INFORMAL PROCESSES

It is clear from the Masters address to the Apprentice that there is more to maintenance than inspection, monitoring, repair, adjustment, overhaul, replacement and the basic trade skills. Later he may learn that for every good engineer there are 3 very clever politicians supported by many informal political processes. Even many well-respected staff may have spent a lifetime learning how to manipulate processes and systems, bypass them and use them to their own advantage. This topic is far too complex, difficult to map and beyond the scope of the current discussion. There are, however, a number of human relations aspects you can get right to ensure acceptance, buy-in, compliance, and everyday use of maintenance processes to achieve best practice. They include:

- Ensure your key systems at least are well designed and continually reviewed
- Educate production and service sections in maintenance and what it means to production and profitability
- Be proactive and expand your sphere of influence throughout the organisation
- Express your process development needs in terms management understand (Accounting, finance, marketing, business)
- Educate Production and General Management in Maintenance and involve them in maintenance process design
- Market the new processes and what you do up, down and across the organisation
- Read the signs, keep your eyes open and be aware.

7 MAINTENANCE PROCESSES

From a large number of possible processes we will discuss only the “Top 10” Processes for Maintenance. These processes have been chosen because they can be considered to form an essential foundation for the maintenance function. They are also the processes frequently most neglected. It should be noted that there are clearly other critical corporate processes, e.g. OH&S that are not included here but are also fundamental to good management.

7.1 Strategic Planning

Many Maintenance Managers do not realise the importance of having a basic living strategic plan, and hence no defined direction. People within maintenance and other sections will therefore assume a direction, push their own barrow possibly against the real direction that is required. Every organisation must have a document that describes the current situation, where they aim to be at a defined time in the future and the actions required to move from the current situation to the desired. The current situation can be determined by audit, benchmark, and other inputs such as imposed or agreed direction/goals, budgets, market plans, capital developments etc.

Every single person in maintenance and production, to shop floor, must clearly understand the direction. A direction document can be in many forms and may contain a Vision, Mission, Goals, KRA's Scorecard, Business Plan and be in whatever form is deemed to be appropriate for the organisation.

Although it may not have couched in the terms of a business plan or strategy document, Henry Ford once said, “*I will build a car for the great multitude. It will be large enough for the family, but small enough for the individual to run and care for. It will be constructed of the best materials, by the best men to be hired, after the simplest designs that modern engineering can devise. But it will be low in price that no man making a good salary will be unable to own one and enjoy with his family the blessing of hours of pleasure in God's great open spaces*” Thus the direction of the Ford Motor Company was very clear to all concerned at the time. In case there was also any ambiguity he also said “*The customer can have any colour he wants so long as it's black*”.

Generally a strategic plan will define where we are now, where we want to be and how do we get there. The current situation is best determined by an independent review so that an accurate snapshot of what is actually being achieved is obtained rather than a self-assessment laden with good intentions. The future situation can be determined by internal or external benchmarking. It is critical then to have viable strategies to initiate the required action for both business continuance and future development. There must be strategies for each Key Result Area identified and relate directly to assignable action steps and specific measurable goals so that performance improvement can be verified at review time. The KRA's may be the key functions of your business (e.g. Financial, OH&S, Planning & Scheduling etc.) or any significant areas where a requirement or need to improve has been identified (e.g. Compliance, Shutdown Management etc.). The important thing is that a strategy/business plan/direction document must be relevant, current, understandable, available, actionable and measurable.

7.2 Review & Improvement

If you do not have an effective proactive review and improvement process now at your workplace then attending this conference is likely to be 100% waste of time. Your one brilliant idea will only ever have a chance of succeeding if you can feed it into an effective review and improvement process. Back in the real world there will be a build up of problems, demands, needs and wants that will overshadow a good idea. There are many mediocre maintenance managers with a plethora of good intentions that may never see the light of day.

Have a structured Maintenance Improvement Program and develop an improvement culture. A system must be in place to ensure that the appropriate maintenance, operations and business performance measures are regularly recorded and reported as appropriate to reflect the effectiveness and efficiency of the Maintenance program. It is important to establish a completely separate forum and keep it separated from your normal operational cost reviews, production reviews and weekly work planning sessions and establish a wide scope agenda. The agenda should include topics along the lines:

- Review recorded performance measures as a basis for identifying improvement opportunities. (May include plant and equipment history and associated PM's, high cost items, downtime, KPI's, cost/budget)
- Review Plant Condition reports and the relationship with forward budget requirements and maintenance plans
- Program Operational Analysis to determine areas for reliability engineering and maintenance improvement opportunities.
- Review Audit recommendations as a basis for establishing a program of improvement.
- Review applicable benchmarking studies and acquired Benchmark information.
- Assess the potential application of new and emerging maintenance systems, tools, techniques and technologies.
- Assess draft Legislative and Compliance requirements to establish future programs and budgetary requirements
- Review forward staff development
- Review the forward Capital Budget to pre-empt forward maintenance requirements
- Review the Maintenance Improvement Program to ensure projects are identified, responsibilities assigned and that an action plan is in place to enshrine achieved improvements through the revision of procedures, work instructions, PM's, maintenance plans and budgets.

A good initiative is to prepare a maintenance budget for improvement. Senior management tend to look only at the maintenance cost budget. Frequently organisations prepare a cost budget for the year and have a separate improvement budget and forget to relate the two. Cost budgets are most often a revamp (10% off) of last years, thus providing for ongoing operations in the current environment, and accompanied by a very strong desire or hope that something will improve along the way. We all know about the behaviour of continually doing the same thing and expecting a different result.

Generally the improvement and cost budgets are inextricably related. A plan to reduce unplanned shut time must be related to an increased effort in developing improved PM's for example. It is a good idea to line these two budgets up side by side so that budget reviews can examine the cause and effect relationships. It is also good promotion for maintenance as improvements such as reduced plant downtime are worth very large dollars in comparison to the cost budget.

7.3 Asset Identification & Registration

Facilities are continually being upgrading but organisations do not have a process for controlling the master files and registers. Sadly 95% of manufacturing organisations do not know with any surety the assets they have to maintain. The most important thing in maintenance is to audit the asset and determine exactly what is installed and then have a process to track asset movements and keep control of new projects and modifications.

The basis of the CMMS (and hence maintenance management) is a data base structured on a hierarchy of plant and equipment that allows all other maintenance information and technical data to be located and linked to facilitate searching, filtering, grouping and reporting. This process ensures that the basis for this essential database is established on sound and consistent principles and standards, changing of the database is controlled, and it is used consistently as the foundation for maintenance activities. The plant and equipment database should be considered the centre or heart of the CMMS. The database is made up of controlled information about plant systems, components and provides descriptions, location and a means for attaching all relevant technical information.

The basis of the database is a plant hierarchy that relates all plant and equipment in the format of levels and locations. This subsequently is used for linking working data such as history, preventive maintenance schedules, technical parameters, nameplate data, bills of material (BOM's) documents & drawings and cost information for each equipment identified in the hierarchy. Every piece of equipment in the plant hierarchy is identified with a unique Equipment Number and descriptor. Generally the equipment number will apply to equipment (assets or maintainable items) at a level in the hierarchy where maintenance actions are normally applied and to which maintenance and cost history is normally assigned. Data associated with an item of plant will be "attached" to the entity representing the assets and include design data, drawings, control parameters, maintenance strategy, routine and non-routine work orders, routines, inspection and test procedures, inspection and test results, appropriate maintenance work history, spares and Bills of Material.

7.4 Change Management

A change management process is critically important to ensure that changes to not slip under managements' guard and key processes move out of control. A change management process is a link to maintain security, integrity and compliance of the complete operations. From a plant perspective we can identify 8 major areas of change - External, People, Production Process, Assets, OH&S, Environment, Business and Procedural. It is clear therefore that change management can be looked at a number of related sub-processes. It is very unusual for a change in any one of these areas not to involve or have an impact on one or a number of the other areas.

Confining ourselves to Asset Management we can readily see the huge impact of change. Our operating plants are changing every day either through new capital projects, modifications, process changes and technological enhancements. The following list gives some perspective of the impact of changing an item of equipment by listing the areas in Engineering and Maintenance by indicating the areas that must be checked and updated for even a small modification.

- Project handover approval
- Deficiency list
- Obsolete Asset list
- New Equipment manifest
- OEM manuals
- Equipment warranties
- Vibration Signatures
- HAZOP results
- Alignment, balancing records
- Layout Drawings
- P&ID's
- Schematics
- Single Line Diagrams
- Dangerous Goods Register
- Lifting Device Register
- Pressure vessel Register
- Drawing Register
- Switchboard Register
- Motor Register
- Transformer Register
- Valve Register
- Loop Register
- Cable Register
- Confined Space Procedure
- Operator Training materials
- DCS & PLC Drgs
- Maintenance Budget Variation
- Maintenance Cost Codes
- Update Equip Hierarchy
- Criticality Analysis
- Review Maintenance Strategy
- PM's & Predictive Routines
- Update History Recording
- Update Spares
- Update BOM's
- Optimise Spares
- DCS Interface
- Equip Identification labels
- Software Database

7.5 Planning & Scheduling

Everything we do in maintenance requires the organisation of people to undertake tasks in a coordinated manner. Every improvement we introduce requires some or all of our people to organise or undertake tasks in a different manner. The Planning and Scheduling process takes care of the management of all maintenance work, it is pivotal, and without this nothing gets done. The complete process comprises many parts notably the Computerised Maintenance Management System (CMMS), the main tool, and the Work Order, which is the vehicle for issuing and controlling maintenance work. The maintenance planning and scheduling system utilises an integrated Computerised Maintenance Management System as the central tool for managing maintenance work incorporating a work request, work order, job scheduling, backlog management and links to stores and spares and commercial systems. The Computerised Maintenance Management System contains a listing of all assets on the site arranged in a hierarchy of plant and equipment. The participation of a wide range of people in this process is important most notably production personnel.

Plant wide access to the Computerised Maintenance Management System is available to production personnel, project personnel, contractors and service providers in accordance with agreed access controls. The plant wide accessibility makes the implications of having a good process more important.

The Planning & Scheduling process is also frequently misunderstood and often not clearly defined. This may well be a good starting point for defining maintenance processes. The best way is to start with a simple model that shows the keys steps in the process.

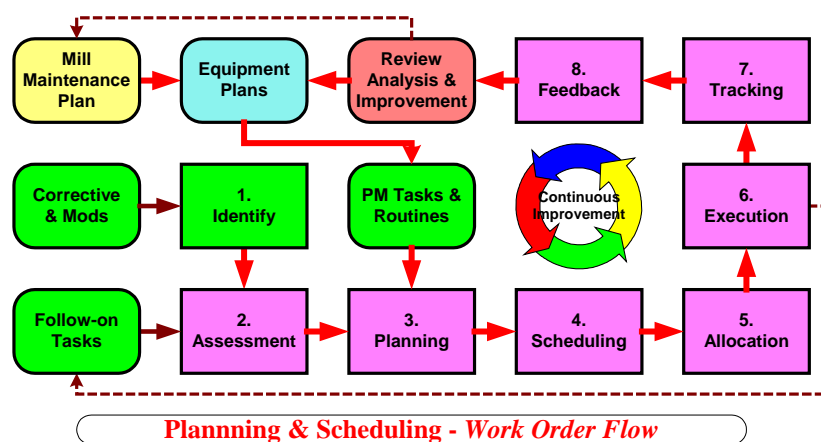


Figure 6

Figure 6 shows the main 8 steps in a work order macro-level process flow and the follow-on review and improvement loop. This can be enhanced by adding in the forums, decisions points, approvals and then different types of work such as weekly, breakdown and shutdown etc to suit the particular business needs.

7.6 Shutdown Management

From a maintenance perspective shut time can be considered to be more important than uptime. This is due to shutdowns comprising a small amount of the total time available for maintenance and hence the need to use the time as effectively and efficiently as possible. In addition we are forever trying to reduce shut time even further and yet it is essential to undertake inspection and testing program, perform statutory inspections, execute corrective maintenance and carry out any required work that cannot be done during normal operations. Work planned and scheduled for shutdowns must be optimised to ensure the provision of short and long-term productive capacity and asset integrity.

In considering major shutdowns there are a number of aspects we need to consider including:

- There are often large peak resource requirements.
- Contractors are required who may not be familiar with the site or equipment
- Major shutdowns may still have a very short duration
- Lead times can be long
- There are frequently large penalties for overrun, including loss of production
- Large number of interrelated tasks
- Equipment is opened up that is normally inaccessible
- Requires involvement of groups other than maintenance including external services, condition monitoring, painters, OEM's, Project, production, senior management and spectators

If we are to manage shutdowns allowing for these factors then it is essential that our shutdown planning and scheduling processes and shut management processes are well established and finely tuned. Below are a few matters to consider building into your shut processes and procedures:

- Appoint a nominated shut manager for every shut. This person will act as the central point of contact, be informed and keep abreast of all shut activities, understand the progress to schedule and where the trouble spots are, make decisions to progress the shut or ensure that the appropriate referrals are made to ensure the right decisions are made.
- Ensure that the shut determinants, policies and goals are properly determined and documented.
- Install a risk assessment sub-process to ensure sound decisions are made to change a scheduled shutdown with respect to timing duration and work content.
- All stakeholders have joint and separate responsibilities and this implies their active participation and contribution for their immediate discipline, work group, area and tasks as well as those around them. Responsibilities commence at the first pre-shut planning meeting and continue through the shut (including programmed reviews) to the post shut review
- Every job (regardless of discipline and work group) must be centrally monitored with respect to start, duration, scope and completion.
- Have a review and approval process for late job additions after cut-off.
- Have a review and approval process for jobs deferred or dropped.
- Ensure that work progresses on all critical path jobs continuously
- Ensure all stakeholders understand their influence on the critical path and ways it can change

7.7 Work Control

Maintenance work is controlled via a range of processes, sub-processes and related processes. Some of the possibilities are shown below:

- | | | |
|-------------------------------|---------------------------|------------------------------|
| • Asset Identification & Reg | • Performance Measurement | • Permit to Work |
| • Plant & Equipment Hierarchy | • Audits | • Stores & Spares |
| • Maintenance Plans | • Budgets | • Authority levels |
| • Criticality definition | • Shut Planning meetings | • Documentation & Data |
| • Budget | • Shut Progress Meetings | • Resource Management |
| • Data Backup | • Shut Plans | • Urgent Work |
| • Work order Mgt - CMMS | • Job Packs | • Production Work |
| • Data Cards - CMMS | • Repair Inspection Tags | • Capital Project Work |
| • Integrated P&S process | • Inspection Test Forms | • Plant & Equipment Handover |
| • Authorisation | • Standard Operating Proc | • Work Instructions |
| • Reporting | • Job Safety Analysis | • Materials logistics |
| • Scheduling Review forums | • Engineering Standards | • Job tracking |
| • Review & CI | • Work Procedures | • Equip Labelling |
| • System Access | • Data entry | • Naming and numbering |

Work Control may be considered an extension of planning & scheduling. Figure 6 therefore could be expanded to accommodate many of these sub-processes to completely track the path of a work order from beginning to end. In this way we could be sure that we have control of the maintenance work we undertake. It is clear that many of these are small processes or parts of other very large processes. It is critical however to review the total processes you have in place to ensure maintenance jobs are controlled from identification through to final completion and signoff.

7.8 Root Cause Analysis

Strangely maintenance people and their production colleagues tolerate the continuance of annoying and costly problems week after week and year after year. Unfortunately the emphasis is always on the short-term goal of restoring breakdowns and getting the plant back into operation. This frequently overrides any attempt to solve the problems at the source. A continuance of repeated problems is very costly and unnecessary. A proven method to get to the bottom of maintenance and operational problems is through Root Cause Analysis (RCA). It is well known, well documented and supported by a range of user-friendly flexible software packages and yet is not really commonplace in organisations. A generic problem solving process can be considered to consist of the following key elements ⁽²⁾:

- Recognition that a problem exists that should be solved
- Allocation of an appropriate priority to the solution of this problem
- Identification of the possible causes of the problem
- Identification of alternative solutions to the problem
- Selection of a solution (or solutions) to be applied to resolve the problem
- Monitoring the situation to determine whether the solution has been effective in solving the problem

Root Cause Analysis must be an organised and regular feature of management if excellence is to be achieved. Team based problem solving processes are generally the most effective way of solving problems, especially those that are more complex ⁽²⁾. The advantages of team-based problem solving processes include:

- Those closest to the work know best how to perform and improve their jobs
- Application of a broader range of knowledge from multiple disciplines
- Broader, more creative solutions to different problems
- Greater chance of risk taking to challenge the status quo
- Teams tend to be more successful in implementing complex plans
- Higher level of ownership of results

Joint problem solving with the use of such a process is probably the greatest maintenance – production team building tool available if it is applied effectively. This type of process will ensure that the key teams are striving for the same goals. A good springboard for this is a regular joint review of unplanned equipment stoppages and shutdowns. In addition the solution to any given problem will almost certainly involve more than one discipline, section or department in the organisation.

7.9 Document & Data Control

Generally maintenance people and their engineering colleagues take a very carefree attitude to the care of documents and data. Typically plant drawings, design data and equipment manuals are kept in non-fireproof or unprotected buildings and frequently not properly indexed or backed up. Electronic data is becoming the practice but here too so much is stored in an uncontrolled environment even on individual hard drives and often on portable computers. Unfortunately this approach most likely reflects a practice of not adequately understanding the importance of data and technical information for effective maintenance.

Key aspects of an effective document and data management process includes:

- All electronic data and paper based data and records are stored and controlled in a manner.
- Data, records and documents are readily available to plant personnel to assist them effectively carry out their maintenance activities.
- Access security systems are in place to ensure data is available to be modified, deleted and used by authorised personnel.
- Document and data is protected from fire and other destructive elements by use of proper storage methods and remote storage as appropriate.
- Control strategies are included that ensure that data and records are continually reviewed for effectiveness
- Data and records are catalogued and registered in structured systems that allow ready retrieval from current use and archive storage.
- The integrity of electronic data by provision of backup systems and procedures
- A nominated person must be accountable for data and information management.

A document and data control system will be provided to record all relevant maintenance information including:

- Manufacturers data
- Design data
- Drawings
- Process description and design limits
- Maintenance Strategy development base data
- Spares specifications
- Risk assessments
- Engineering standards
- Maintenance procedures
- Inspection reports
- Work orders and attached information
- Maintenance work history

The Computerised Maintenance Management System can be used as an information kiosk for maintenance information through the provision of links to applicable documentation attached to equipment items in the plant and equipment hierarchy.

It is not only one of the important foundations for good maintenance it is also worth big dollars. One benchmarking study ⁽³⁾ has revealed that the difference between a good asset information system and a poor one will be at least 5% of the total operating and maintenance budget, and that is not allowing for the financial benefit of having good information on which to make good decisions.

7.10 Compliance

Risk management is now continually on the minds of Senior Management and Company Boards. Maintenance managers need to ensure they have adequate programs in place to protect the organisation through a compliance process. It is too easy to say that this is covered by our inspections and routines, or we keep up to date with our statutory work. We need to take a broader look at the topic. A Maintenance Compliance process can readily be dovetailed into a broader business compliance process.

Key aspects of a Compliance Management Process include:

- A list of requirements due to new or amended Acts, codes, regulations, internal standards, external standards, OEM requirements and Company agreements are identified and acted upon.
- Non-conformances (for Acts, codes, regulations, internal standards, external standards, OEM requirements and Company agreements) are identified for all plant and equipment and action assigned.
- A register that lists all acts, codes, regulations, standards, OEM requirements, and agreements to be complied with.
- A register cross-referencing appropriate corporate elements, related procedures, instructions & supporting documents, and indicating the review schedule and current status.
- Training to ensure the relevant employees are aware of Compliance activities that form part of their responsibilities and are competent in ensuring compliance.
- Maintenance improvement, equipment maintenance plans and audit procedures ensure compliance issues are regularly addressed.
- Registration of plant and equipment with external authorities and a process that ensures registration is maintained.
- Independent testing is applied where necessary or required to verify the adequacy of the inspection and testing program, the integrity of processes for plant and equipment and the level of compliance.
- A method of recording all unplanned trips of safety and environmental critical equipment
- An incident reporting and investigation system to determine the cause of deviations outside of the design operating envelope and related maintenance requirements.
- Safety critical equipment (including pressure equipment, radiation devices etc.) have separate procedures to ensure compliance with the relevant codes and standards.
- Routines for emergency equipment, exit signs and alarm systems and registration of these in the CMMS to ensure they are inspected, tested and maintained at regular intervals.

This is a daunting list of requirements and ensuring long-term asset integrity and personnel safety is difficult when everyone around you cannot think past Friday. Compliance is not an issue until it's too late and then the human and financial costs can be horrendous. All plant and equipment must be maintained in accordance with the relevant Regulations and Standards and in a manner that eliminates the risk associated with use of the plant, and where not practicable to eliminate the risk steps are taken to reduce the risk so far as is practicable. It is important, therefore, to link and embed a compliance process in the other key maintenance processes.

8 CONCLUSION

Regrettably many organisations seem to have great difficulty in implementing and managing good processes. Many managers assume they have processes and assume that they work. This is despite the fact that a number of the well-known ISO Standards effectively make it mandatory to manage the processes that make up their quality management systems. Even more distressing is that we often see great effort go into hurriedly developing systems, processes and procedures to ensure the organisation "passes" a required audit. This then results in a "shelf" quality organisation. A Quality System is, or should be, a network of processes and includes the things that are used to regulate, control and improve the quality of products and services.

The matter of processes can become complex as there are overlapping processes and sub-processes. How many different ways have you seen the Maintenance Processes described? Despite the complexity the path to excellence is in implementing and managing processes rather than delivering and directing tasks. Tasks will pile up if they cannot be accommodated and acted upon as part of a process. For every task that is required to be completed there must be an effective process of dealing with it or there is a certainty that it will not be dealt with.

If the processes are conflicting, poor design, too complex, impractical, unfriendly – then they will not function adequately. It then does not matter how loud you shout, your job will not get done. Skilled and motivated staff and teams can only improve organisational performance to the extent business processes allow. It is far more effective to develop well-designed processes and free the people for further and more far reaching improvements. An organisation is only as effective as its processes.

Improve your maintenance management by looking at it from a different perspective. A perspective that cuts across department, section, level boundaries and takes the focus away from the more confined technical and computer system focus. Don't think systems, don't think tasks, and don't think problems. Adopt processes as a way of thinking. This will help improve maintenance performance and force an appropriate emphasis on the people and broader business aspects of maintenance. Management are responsible for not only managing the processes but also ensuring continual review and improvement. As a manager you lead people and you manage processes.

9 WHAT CAN WE DO?

You must act now get the processes right regardless of your current performance and regardless of where you sit in any benchmarking review. For example unless you have a change process/C.I. process then things will not improve, you will keep treading water, solving problem after problem as they arise. Trying for that last part of a percent in efficiency of your plant

will not happen if you have relied on hard working people in the past and do not have robust processes in place. Here are some actions you can take now to move along the path to excellence:

- Develop a strategic plan for maintenance and communicate the plan to make it clear to all stakeholders where you are going and how you are going to get there
- Review maintenance processes and develop a plan for improvement of the processes in key result areas
- Determine and define the processes forming the building blocks for subsequent process and systems, e.g. do not commence CMMS improvement or RCM until an equipment numbering process has been soundly established
- Analyse key processes one at a time and ensure that it is implemented
- Define the inputs, major and minor required for each process
- Define the outputs, where they are going, how they will be used and how they are transmitted
- Ensure the involvement of key stakeholders in maintenance, production, finance, IT, project, stores as appropriate
- Draw a process flow to track the process steps. Good process flows indicate people forums and decision-making requirements
- Develop a user friendly procedure for every process
- Involve the stakeholders in process and procedure development to ensure good contribution, understanding and buy-in
- Establish quality standards for the development of processes and procedures
- Communicate every process to all stakeholders in a parcel that defines the big picture and the excellence goals

A Sweaty tired young Jimmy trudges back into the darkness of the workshop only to be confronted by the master yet again. “I see you’ve completed the assigned tasks, well done, now lets get down to some real work shall we!”

10 REFERENCES

- (1) AS/NZS 15288:2003 Systems Engineering – System Life Cycle Processes
- (2) Sandy Dunn, “Getting Root Cause Analysis to work for you”, ICOMS 2004
- (3) Ruth Wallsgrove, “The real cost of asset information – how better costs less”, ICOMS 2004

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