DOING the "RIGHT THINGS RIGHT" – A FRAMEWORK for MAINTENANCE EFFECTIVENESS

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ABSTRACT

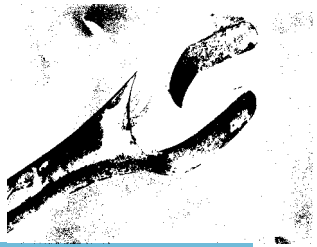
Maintenance and asset management for today's companies must be business-centered to support corporate productivity goals, by providing equipment availability, performance and overall minimum costs. In spite of the development of new maintenance strategies such as Reliability-centered Maintenance, the widespread use of computer maintenance systems (CMMS) and new tools for condition monitoring, it is somewhat questionable whether maintenance organizations in general, are better able to meet the real needs of today's industry that they were a decade ago. Have we have drifted away from the "basics" of sound work practices to rely blindly on technology and maintenance-management strategies? Perhaps we are not consistently doing "the right things" with the diminishing resources available to our maintenance organizations.

This paper addresses the issue of today's maintenance requirements with statistics to support these concerns. The essentials of maintenance are revisited, with a proposal for a new framework for maintenance effectiveness based on "Core Values". These serve as a "roadmaps" to take us to where we need to go. Without these, we in maintenance will get somewhere, but perhaps too late to play the necessary role in supporting the profitability of our Western industries.

1. INTRODUCTION

Our maintenance and maintenance-management practices, in the Western world, have generally failed to keep pace with the evolution of technology. Modern manufacturing and processing equipment has become much larger, faster and more technology dependent. Capital and operating costs have vastly increased, requiring near-design operating rates with less downtime for planned or unplanned maintenance. One writer [f] reports that surveys of industries throughout the United States indicate that as many as 90% of companies do not follow best maintenance practices, and as many as 70% of equipment failures are self induced. Another [d] reports that at least 17% of asset reliability problems can be attributed directly to improper maintenance, and that generally one-third to one-half of the maintenance tasks performed in a typical plant have no real benefit. Still another [i] states in a prominent paper industry journal that approximately 25% of the money spent each year on maintenance in the U.S. paper industry is unnecessary These statistics support my belief that we are not practising the "essentials" and doing the "right things" in an industrial world of limited time and resources.

This situation is echoed continually in industry periodicals and books. The necessity and cost-justification for effective maintenance programs is stressed by the authors of the selected technical articles of the Reference list. Better asset management is needed to support industry productivity, and probably the very survival of some companies is at stake. Maintenance must operating economically as a "profit center", to provide maximum equipment availability and reliability, with design or better-than-design operating performance.



Unplanned Downtime Can Throw a "Monkey" Wrench into any Company's Productivity

The general purpose of this paper and the accompanying presentation is to challenge maintenance leaders and their organizations to stop and take a good look at the "forest", and not just see the "trees". It is my opinion that we tend to get caught up in a reliance on modern maintenance strategies such as RCM, TPM and Reliability methodologies, rather than build our maintenance programs on basic core "values" which will support productive asset management and utilisation. It appears that we need to focus more strongly on identifying the "right" things to do, then utilizing the "right" ways with best practices to get these things done. But, let's not lose sight of the need for a competent workforce to achieve this end.

A View from the "Trenches"

This paper is unique in that it presents not the traditional view "from the top", or from industry maintenance "gurus", but rather a view "from the trenches" – that of an experienced paper-industry maintenance engineer. Front-line personnel, especially supervisors and trades people, can see things in a different light, but for a number reasons, not regularly sharing their observations and ideas on improvements. I have has seen the "programs and strategies-of-the-month" come and go, with little gain or improvement – the very paradigm of maintenance changed or even questioned.

This Paper and Its Objectives

It is the author's belief that we must start by first learning the "right things to do", to assure that best use of diminishing maintenance resources – people, time and money. These are what will be called the ***core values*** which serve collectively as the road map for an effective maintenance program. Let's first explore the very nature of the maintenance function, how maintenance has evolved to today's situation, and then look at a proposed approach to refocus on the fundamentals for a truly "world class" program.

My objectives for this paper are:

a) establish clearly the role of today's maintenance as a necessary element to meet industry's productivity goals
b) justify the need to refocus on the "basics" of maintenance, to assure first that the "right things" are always done
c) propose a new framework for maintenance improvement and effective asset management with specific tactical activities
d) challenge you to take a serious look at your maintenance organization for improvements by building on the basics of knowledge and skills, and using 9 essential elements or "core values" as the focal points for strategic action.

Specific background information and the statistics cited in this paper are taken from the selected references listed at the end [specific sources indicated]. Much of the information presented stems from the writer's literature sources and personal experience. The "Core -Value" maintenance framework is essentially that of our Mill's Strategic Improvement Plan which although somewhat still in its early stages, has already proven its potential through success.

2. A SHORT HISTORY of the EVOLUTION of MAINTENANCE

In the early years of the twentieth century, equipment was relatively simple. Downtime was not the dominant issue that it is today, since the cost of production interruption was not as high in relation to the value of the equipment and its preservation. Maintenance was basically "reactive", with repairs carried out as required. "If it ain't broke, don't fix it!" Asset preservation and failure prevention were not established maintenance objectives.

By the 1950's, production rates of the post-war years had increased significantly in response to increasing demands for consumer and industrial goods. In the early 1960's, the concept of *Preventive Maintenance* (PM) was introduced – maintenance to prevent failure. Some machinery started to be designed, built and installed

with the concept of PM in mind. The accepted thinking of the time was that the failure of machinery and production equipment was generally time and service based – parts replacement and periodic overhauls would essentially eliminate failure and unplanned production outages.
The early years of PM proved somewhat disappointing as failure rates did not decrease as expected. It was discovered that the scheduled maintenance action did not always prevent pre-mature failure, often because the very action of replacing parts and dismantling/re-assembling introduced defects previously not present. The very maintenance action itself was "intrusive" and often had the opposite effect of actually increasing the failure probability.

It was then suggested that if the "health" of operating equipment could be assessed, then it would be possible to detect early indications of failure for timely repair. Hence, the concept of condition monitoring and trending was introduced in the 1970's. This became widely know as Predictive Maintenance (PdM). The maintenance action arising out of PdM is probably best termed "on-condition maintenance" or Condition-based Maintenance. (CBM). When integrated with good PM (especially essential care including cleaning, inspections and lubrication), PdM through the 1970's and into the 1980's began to prove effective in preventing unexpected failures and their costly production.

In the late 1980's and into the 1990's Western industry began to be aware of the need to improve quality in manufacturing and processing in response to the "global" challenges of Japanese and European industry. Industry leaders became aware of the need for production machinery to be more reliable in both operation and consistent in performance. It became obvious to many that maintenance would largely dictate the degree of improvement possible. Maintenance's role would no longer be that of a "servant" to Operations, but a true "partner" responsible for providing equipment availability and performance,; at the same time Operations would be responsible for its ownership and correct operation.

The 1990's brought stiff global competition with the ongoing need to reduce costs without sacrificing quality. Failures, both functional and physical, could not be tolerated because of their impact on production and quality. Maintenance began to embrace the Reliability Centered Maintenance (RCM) strategy developed years earlier for airline maintenance and reliability. As well, Root Cause Failure Analysis (RCFA) began to gain popularity as industry attempted to deal with failures and implement failure-prevention measures.

In the early part of the new century the idea of being "proactive" began to take on new meaning for maintenance. This concept entails a combination of all available strategies into an approach which purposes to prevent failure, maximize asset life and reliability, and assure that equipment performs as intended or better. This strategy requires that we utilize the best of "high-technology" methods and maintenance strategies, but built upon a solid foundation of quality equipment, good installation, proper operation and application of maintenance best practices by a dedicated maintenance force. Hence the evolution of maintenance into today's Proactive Maintenance.

Simplified Overview of the Classes of Maintenance

Maintenance Type	Basic Focus and Strategy	Maintenance Action
Repair (or Corrective) Maintenance	Reactive and action on failure; often called corrective maintenance	▪ repairs as required, generally after failure has occurred
Preventive Maintenance (PM)	Action on a scheduled basis (time or service) to prevent failure and maximize asset service life	▪ essential care … lubrication, cleaning, routine adjustments ▪ inspections ▪ periodic rebuilds to return to like-new or better condition
Condition-based & Predictive & Condition-based Maintenance (PdM/CBM)	Action taken on the basis of equipment condition monitoring	▪ condition assessment and monitoring (vibration measurement, thermal imaging, etc.) ▪ determine faults early and plan repairs or machinery rebuilds

Maintenance Type	Basic Focus and Strategy	Maintenance Action
Proactive Maintenance (PrM)	Forward thinking action to assure good equipment,properly installed and operated, then maintained to perform reliably through a combination of PM and CBM. Equipment improvements for better reliability, and maintainability. (Note: PrM may not so much a separate class of maintenance, but an integration of all maintenance classes and strategies as a "way of life", focusing on results.)	▪ good equipment selection to assure good design, maintainability and reliability ▪ anticipation of possible failure modes, and use of appropriate inspections and PM to minimise the risk of interruption to production ▪ appropriate combination of PM for essential care and rebuilds, and condition assessment/ monitoring (vibration measurement, thermal imaging, etc.) for as-required repairs ▪ involvement of Operations group for to assure correct asset operation

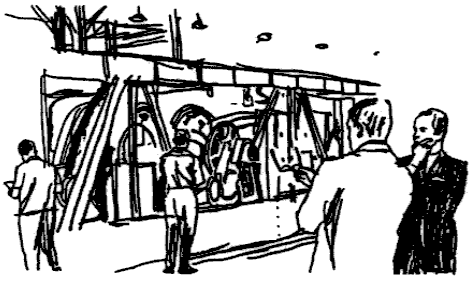
3. **TODAY'S MAINTENANCE REALITIES and the NEED to REFOCUS**

With the evolution of Maintenance and the changes to companies have arisen major concerns and challenges for maintenance operations:

a) The ability to detect faults early and allow corrective action (PdM) tends to instil a sense of confidence against surprise failure. However, this does nothing to address the fact that some of these failures are the result of incorrect or inadequate maintenance action itself!
b) With industry-wide cutbacks in operational budgets and numbers of maintenance personnel, it becomes more necessary than ever to do the "right things". What is more, if resources are used for PM inspections and failure-prevention action that really have little or no value, other maintenance areas will further suffer.
c) Much of the valuable skills and experience in industry at large has been and is being lost as senior personnel (staff and labor) are offered early retirement, "going out the door" without adequate provision to capture their knowledge. Reduced budgets further restrict already insufficient training efforts.
d) As maintenance has become more sophisticated in an attempt to accommodate today's modern machinery, there is a tendency to not place the justifiable attention on the basic tasks of "walk-about" inspections and routine lubrication. This is unfortunate, since these activities support the essential care which is more-than-ever necessary for operational reliability.
e) Our failure to widely develop and utilize "best practices" results in having to carry out "preventable" maintenance (Example: misalignment can be traced as the root cause of nearly 50% of all rotating equipment breakdowns).
f) Attempts for quick fixes to improve maintenance effectiveness by simply allocating high-technology and lots of money have generally not been successful. We are simply attacking the symptoms, not the real problem [b].

The real dilemma is that we in maintenance are mandated to do more but with less: less money, less skills, less experience and less people!

But take heart! One effective way to reduce maintenance costs and stretch resources is to reduce the need for maintenance itself [h]. Some enlightened companies have addressed the issue of "self-induced" failures and actually increased production capacity by as much as 20% [f].



Maintenance Improvement ……. Reduced Costs and Increased Production Capacity

4. A SIMPLIFIED but POWERFUL MAINTENANCE STRATEGY

The focus of this paper is on first finding the "right things to do", then on " how to do them right". Rather than relying on "magic" strategies and technology, let's start with the basics of maintenance, clearly define where we want to go, and then build a framework to guide our action. This framework is not something to "get-and-forget", but a "live" document that will be used constantly to guide maintenance action and decision-making. The goal is to develop an effective asset management program, not just a maintenance program; let's think of the term "maintenance" from this point as implying asset management. Our target is Proactive Maintenance, not just maintaining equipment, but continually improving all aspects of our business in support of the company's productivity and profitability.

Purpose and Building Blocks of the Maintenance Program

The purpose of the maintenance function is of course, to preserve the physical assets and make them available to perform the required functions, in a manner as good or better than originally required, all; the while doing this with an adherence to effective cost management. Because as we have established, the effectiveness of the overall maintenance function can drastically impact the company's productivity and profitability, we must now think of Maintenance as a "profit" center, and bury the traditional view of it's being a "cost area and necessary evil". Note however, that the view of Maintenance by top management and other functional groups within the company will not change simply by the use of fancy terms and slogans. Maintenance must work hard to establish a clear purpose-driven identity, by striving strategically to achieve its goals. Then, we must clearly report our successes to upper management who often are not fully aware of the very nature of the asset management function and the overall environment. Specific performance and effectiveness goals for Maintenance must, of course, be integrated with those of the overall organization.

To build and sustain an effective program requires establishing carefully the following: 1) a statement of the maintenance Mission; 2) the Principles (or beliefs) on which operation of the maintenance organization will be based; and 3) specific Core Values which, as Stephen Covey suggests in his book The 7 Habits of Highly Effective People [k], will serve as the "roadmaps" to keep the focus on the "right things" to do.

Mission and Principles

Let's start with establishing clearly the *maintenance* ***Mission***, which is essentially a more specific statement of the purpose of a maintenance organization. A suggested Mission Statement is: to provide the operations group (equipment owners) with maximum equipment availability, performance to meet or exceed requirements, asset preservation to maximize life-cycle value, and related support services, all at overall lowest-possible cost. An effective maintenance program must have a vision of success [l].

If you don't know where you are going, you will probably end up somewhere else.
Lawrence J. Peter

Specific achievement goals can also be established to quantify the ongoing degree to which the Mission is satisfied, and to provide for continuing progress toward a Vision of perfect compliance. These goals are time-based, with provisions to track progress of maintenance effectiveness. As previously noted, Maintenance's goals must be integrated with corporate plans and targets for production and productivity.

It is next necessary to establish and convey to all employees the ***Principles*** on which the maintenance program will be based and operated. A suggested list should include: good leadership and management, sharing of responsibility for the Mission between labor and staff personnel, respect for all employees and their desire to gain a degree of self satisfaction through work well done, a constant goal of quality workmanship supported by training and competency, and open, honest communication between labor and staff.

5. CORE VALUES – the FRAMEWORK for MAINTENANCE EFFECTIVENESS

The ***Core Values*** represent the areas for strategic action which, if constantly made the focal points of the maintenance effort, will assure that the "right" things are done, and in the "right" way. Out of each Value comes tactical action to allow Maintenance to satisfy its Mission, meeting specific performance and achievement goals. Proposed in the following (tabular format) are nine Core Values, not necessarily listed in an order of importance. Each Core Value is presented with suggested Action areas for tactical activities. These activities lists are by no means complete, but are intended to indicate those with the greatest benefit.

These Core Values follow from the Mission and Principles presented above, and will serve as the strategic building blocks for an effective asset management program. However, remember that success and effectiveness comes only from building on a continuous effort to acquire the fundamental knowledge and skills - by management, support personnel and crafts.

Each maintenance organization must ultimately establish and detail Core Values to suit its own corporate environment. However, the important thing to remember is that there must be a commitment by the entire maintenance workforce to endorse and act on these Values, with a constant emphasis on the "basics". Management personnel must continually lead by example.

Value 1 – Preventive Maintenance and Maintenance Prevention

The emphasis here is asset preservation through basic Preventive Maintenance, and in so doing, eliminate unnecessary maintenance resulting from equipment neglect and poor maintenance practices.

Action	Typical Activities	Comments
Essential care	- Cleaning, lubrication, regular inspections, adjustments, minor parts replacement	• This is probably the least "high-tech" of maintenance action but necessary for equipment life and performance.
Fixed-time maintenance	- Lubrication, inspections and adjustments which can be beneficially done on a scheduled time or service basis	• Includes planned equipment rebuilds to return to as-new condition
Periodic equipment rebuilds	- Recondition & repair to return an asset to or near as-new condition	• The schedule for rebuilds must be chosen carefully and the value of the planned rebuild established; many equipment items are taken out of service and rebuilt with no gain in performance or reliability.

(Value 1 – continued)

Elimination of self-induced failures	- Attention to correct practices for essential care activities, especially routine lubrication - Elimination of existing inspections and rebuilds which will likely do nothing to improve reliability or life, but possibly interfere with a good-operating equipment item - Alignment and balancing of all rotating machinery to acceptable standards	• The ability to detect defects at an early stage is very effective in avoiding unplanned downtime, but should not be relied on to detect defects resulting from poor maintenance practices (Example: shortened bearing life as a result of poor alignment and balance). • Over 25% of bearings used in rotating equipment fail prematurely as a result or poor installation or lubrication practices.
Inspections for general equipment health	- "Walk-about" inspections of operating equipment for indications of faults, deterioration, lubricant loss, etc. which will lead to failure	• Operators need to be recruited to participate as part of their daily tasks. • Oilers need to be empowered to carry out more inspections as they do their routes, their findings then used for necessary follow-up action.
Constant action to reduce maintenance work load	- Finding ways to do the basic tasks more efficiently and consistently (Example: installation of grease line to allow a machine to be greased more quickly without having to enter a confined area)	• Craftspersons must be encouraged and challenged to look for ways of making PM activities more efficient to free up resources for other needed work.

<u>Value 2</u> – Continuous Improvement (Equipment and Processes)

Continuous effort to improve equipment, as well as maintenance processes and practices, is essential to find "hidden" resources and equipment capacity/performance. All maintenance personnel must be made aware of the importance of this effort, and be empowered by training and leadership to make this a "way of life".

Action	Comments
Improvements to maintenance processes and practices	• The purpose here is to increase productivity and work quality, to do more with less. This will free up resources for the "right" things. • Benchmarking of other top-performing maintenance organizations can be a powerful tool. • A big opportunity area is lubrication – handling, storage and application of lubricants. For example: it has been reported that 70% of plant and industrial hydraulic system failures are the result of contaminated oil. • Keep an eye open for repeat-work items and repairs as candidates for work changes and/or equipment improvements
Improvements to equipment performance, reliability and its maintainability	• Equipment can often improved in-house over the as–supplied condition (Example: a tighter alignment tolerance can be used for pumps to improve to reduce vibration and extend bearing life). • Rebuilds of equipment items can incorporate improvements which are now a part of new versions offered by the manufacturer (Example: an improved gear reduced seal for longer life and easier replacement). • Skilled trades people must be included in improvement efforts, and as has be so often shown, can contribute greatly from their experience.

(Value 2– continued)

Problem-solving and elimination	• The recurring failure of an equipment item is often not investigated to find the root cause and take corrective/preventive action. We frequently keep repairing without addressing the real issue. For example: a pump location experiences a bearing failure every 2-3 months but the pump is rebuilt and returned to service – it could be learned that the root cause is a badly-corroded base, preventing correct adjustment of the drive belts tension to eliminate excessive shaft side loading. • Training must be provided for both staff and trades, to establish the importance of this action, and develop the necessary skills for trouble-shooting and failure analysis.

<u>Value 3</u> – WORK Management (Doing the "Right" Thing)

The management of maintenance work is separate from overseeing actually how the work is done. The latter is the focus of Value 4.

Action	Comments
Identifying what is to be done and when	• This is done on the basis of immediate need (usually failure) or pending failure.
Effective work scheduling and work assignments with time management	• For "world class" maintenance performance it is generally considered that 70% of all work should be planned and scheduled no less than 24 hr ahead. • Note that scheduling a job is NOT the same as planning that job (see Value 4, job planning). In general, a job should not be scheduled until it is properly planned and prepared.
Planning ahead, especially for major jobs and shutdowns	• This is particularly important since it allows time to proper job preparation by adequate job planning, integration with other jobs, parts/materials acquisition, etc. • A shutdown planning cycle should be considered, to plan work and schedule jobs well in advance of the planned dates, then include a follow-up, post-shutdown review to access outcomes and consider future improvements for future times.

We tend to Resist Planning – "Don't have the time!" Actually …. "We don't have the time NOT to Plan "

Utilization of a good work order (WO) system	• All maintenance jobs should be initiated and managed through a WO system. A properly written work request indicates the need for maintenance action ("why ") and a degree of criticality ("priority"). The work order controls the scheduling of action ("when") and provides work details and/or job plan ("what"). • The completed WO with record of work done serves for future reference and maintenance history of that equipment item. • A CMMS is an effective and often necessary tool, but to meet its potential it is necessary that a good basic WO process be in place and supported by both maintenance and operations personnel.

(Value 3– continued)

Prioritizing ("criticality") on the basis of failure considerations [See Value 6 for more information on failure]	• This should be done using parameters including: potential production loss, environmental concerns, failure risk, spares/parts on hand or availability, and expected repair costs. A coding system may be useful here. • The Reliability-centered Maintenance (RCM) strategy which has gained popularity in recent years is founded largely on failure probability and modes and action that can be taken to prevent/manage failure.
Managing the maintenance backlog	• The backlog should be maintained to track progress in handling current workload, schedule jobs on a priority/criticality basis and arrange for additional resources as required.
Keeping and using equipment service/maintenance history	• Good records, especially utilized with a computerized maintenance-management system (CMMS), will indicate equipment items with recurring problems and failures to allow for improvement action. • Good records will also provide an information base for effectively identifying PM needs, and for planning details for future repairs and periodic rebuilds.

Value 4* – *JOB Execution (Doing things "Right")

Maintenance jobs and work must be done in a quality manner, with efficiency and timeliness. A job "well planned" is well on the way to being a job "well done". Time is costly in both labor and materials, and especially machine downtime. It is vital that maintenance jobs and tasks are done correctly and efficiently the first time, without any need for rework.

Action	Comments
Job/work planning before scheduling	• As mentioned in Value 3, a job should not be scheduled until properly planned. This includes a work/task plan, list of tools, equipment and parts, also requirements for lock-out and job safety. Planned jobs result in better work efficiency, less likelihood of errors and most of all, a greater degree of work safety.
Job preparation before starting work	• Jobs should be prepared if at all possible, before being started – tools and rigging collected and on site, parts assembled, and work plan/procedure reviewed with the work crew.
Safety management	• Always the highest priority in job planning and all maintenance activities. All personnel MUST receive appropriate training and be committed to a safe working environment and work practices.
Availability of necessary technical information (staff and labor personnel) [See also Value 9]	• Equipment-information for each item should be compiled and readily available to show model number, supplier, date of purchase, drawings, etc. • Spare parts, both stocked and to be ordered, must be listed for easy reference in planning jobs, as well as for emergency repairs.
Establishment and utilization of "best practices"	• Best practices for routine work such as lubrication, alignment, piping system layouts, motor storage must be a "way of life".
Development and use of maintenance procedures	• Major periodic jobs such as major equipment rebuilds, roll changes for the paper industry, and overhauls of gear reducers are best planned and best executed with the use of procedures. Crafts personnel should participate in preparing these procedures to assure a workable and safe job plan. They will then be utilized and continually improved with a sense of "ownership".

Value 5* – *A Working "Partnership" with Operations and Other Mill Groups

In the early industrial years and up to recent past, Maintenance was considered something of a "servant" to Operations. This then began to changed to the perceived role of providing a service. Today's progressive companies consider Maintenance to be true "partner" in the overall productivity effort. However, we in Maintenance must constantly demonstrate leadership in the "partnership" relationship, in spite of some old attitudes which tend to linger on.

Action	Comments
Continuous focus on the organization's productivity goals	• Our Mill ties specific yearly Maintenance productivity goals into those of Operations, to support them in meeting production and quality targets.
Anticipation of Operations' needs for productivity support	• Maintenance needs to learn more about the Operations world in order to be better able to provide necessary support (ie. utilize more "know about" training).
Effective communication of information	• Use every effort to interact with Operations' personnel to develop a sense of shared production responsibility. • Periodic meetings with our Operations partner can be helpful to identify opportunities for better Maintenance' support and opportunities for mutual improvement action. • Make a regular habit of keeping Operations personnel advised on maintenance concerns and the status of current action items and major jobs..
Mutual planning for shutdown jobs	• Will help integrate maintenance and operations activities and minimize the chance of conflicts and valuable downtime wastage.

Value 6* – *Failure Management

A failure can be an actual physical failure (Example: burn-out of an electric motor) or a function failure with the equipment item unable to perform its task to requirements (Example: a process pump which will not produce the necessary head and flow).

> "Failure is not an option" – *the NASA "Apollo 13" Team during the tense days of the 1970 moon mission.*

In spite of our maximum efforts, all failures cannot be prevented. Hence, dealing with failure involves not only prevention, but planning for contingency action to minimize the consequences.

Action	Comments
Awareness of the "criticality" of equipment items and use of appropriate inspections to minimize the probability of failure	• Analyze major equipment for probable failure modes, consequences and preventive action. • This action must be balanced with other maintenance activities or much of the limited resources wasted at the expense of other "right" things to do.
Contingency planning for failure	• This involves anticipating possible significant failures and making contingency plans for expediting repair parts, utilizing back-up systems, etc.
Working to prevent "self-induced: failures	• Previously addressed under Value 1.

(Value 6– continued)

Failure analysis and corrective/preventive action	• See previous Value 2, "problem-solving and elimination" for recurring failures. • Each major failure should be investigated to attempt to find the "root" cause(s) on which action can be taken for improvement and prevention of recurrence. Much is being written about Root Cause Failure Analysis (RCFA) and training is readily available. Our mill has utilized this tool with beneficial outcomes.

Value 7* – *Cost-effective Purchasing and Maintenance Projects

Money for equipment acquisitions as well as for major capital-improvement projects is always scarce. It is vital then, that effective practices be developed and utilized for cost and quality control in the acquisition of equipment, materials and maintenance services.

Action	Comments
Continually seeking out quality equipment and materials at the minimum "life cycle" cost	• Develop and utilize lists of standard construction, performance and reliability standards for equipment items such as motors, hydraulic control valves and electric switchgear.
Use of quality-assurance methods for outside services	• Provide clear details of what is required and what standards, tolerances, etc. to be satisfied.
Development of "win-win" partnerships with key suppliers	• Seek out good suppliers and develop "partnerships" (both contractual and informal), and negotiate agreements for supply of materials with appropriate technical support. Remember that the supplier must also earn a living, and hence a unrealistic price may cost both parties in the long run. • A good supplier network can be an invaluable source of information on new products, materials and even industry practices. • Aim to be a "preferred" customer.
Use of "life-cycle" principles for equipment acquisitions	• The cheapest items may be the most expensive in the long run (Example: the cheapest solenoid-controlled valve may not provide the required life without high ongoing maintenance or replacement costs).
Use of discounted cash-flow principles to evaluate proposed major expenditures	• For major proposed projects and equipment acquisitions, expected $ outcomes should be stated clearly, and discounted cash-flow principles used to analyze costs versus benefits to justify the action. Proposed monies might be better utilized for other ventures. • It has been the writer's experience that this technique is under-utilised, especially in the paper industry, with the result that monies are not always expended for the greatest return.

<u>Value 8</u> – A Capable and Committed Workforce (Staff and Labor)

This element is probably missing from the typical checklist for building an effective maintenance program. However, when we acknowledge that literally nothing of actual mill or plant maintenance can be executed without our labor personnel, this Core Value takes on a special significance. In essence, the major function of maintenance management personnel is to determine the "what is to be done", then empower trades personnel to carrying out the necessary work in a correct and efficient manner.

Action	Comments
Continuous and "needs-driven" training	• Much has been written about the need for adequate training, but still this is seen as a "cost" item, rather than a necessary investment. Western industry falls far behind European and Japanese industry in training for both staff and trades. • Training consists of both acquiring information ("knowing about") and developing skills ("knowing how to do"). Appropriate training should be based on assessed needs but be continuous to develop and maintain a competent workforce.
Constant emphasis on safety	• Safety management starts with job planning. Every effort must be made by management to minimize risks; however, all personnel must assume a constant responsibility for safe work environments and working practices.
Job planning and work order handling	• Trades personnel should participate to a great degree in job planning. This will result in more realistic work plans and shorter completion times. • Trades personnel must receive training in the work order system and use of work orders for work instructions, and to report back actual work carried out.
Effective communication of the organization's productivity and financial "health"	• The hourly employees are often the last to know but have just as concerned about their financial futures as top management. • Even "bad" information is better shared since the employees can feel a sense of involvement and commitment to support often unpopular measures that may have to be taken from time to time.
Involvement in setting maintenance productivity and competitiveness goals	• Without some involvement of all personnel, it will be difficult to feel a sense of personal responsibility and commitment.
Effective management leadership	• Good leadership is necessary to "show the way", while working side-by-side to get things done. This requires genuine honesty in relations with all subordinates, but without failing to discharge the management responsibilities.
Empowering" all employees to be productive and take responsibility for their work	• All personnel should be encouraged to be "the best that they can be" and given all reasonable opportunities for accomplishment. It has been shown that recognition and a sense of personal job satisfaction is a very powerful factor for motivating and maintaining a "world-class" workforce.
Technical maintenance information	• Technical information on equipment items, spare parts, maintenance instructions, etc. must be available and easily accessed either manually or through a computer database. For computer-based storage, employees must have access to terminals and receive the necessary training and support to be able to access the information easily and when required.

Value 9* – *Technical Information and Documentation

Technical information must be assembled and made readily available to all maintenance personnel. Without this, valuable time of the trades group will be wasted in trying to plan for maintenance jobs. Accurate and complete information will help assure work efficiency, quality and consistency.

Action	Comments
Maintenance procedures for major and repetitive jobs	• The value of these previously discussed. These should generally be in electronic form with network storage for ease of reference and periodic revisions. A CMMS can provide "linking " to the equipment item(s) involved for access by the equipment number (this is the approach being used by our Mill). • Procedures will help to assure that the job can be done without requiring certain persons with the knowledge and familiarity. They can also be valuable as a training tool to familiarize new personnel with equipment maintenance needs.
Equipment information, specifications and spare parts	• Must have a record for each equipment position (sometimes called an entity) showing description, specifications, manufacturer's drawings and manuals, and spare parts information. • Drawings and operating/service manuals should be stocked and catalogued for ease of access.
Access to maintenance information by trades	• It is vital that trades personnel are given appropriate training to confidently use the information library, whether a physical location or electronic data storage. Assembly of important information is of little value if it cannot be accessed readily by the trades people and their supervisors.
Equipment service and maintenance reports	• As earlier mentioned, these are valuable in establishing PM activities, identifying "problem" equipment items for improvement action, and for planning future maintenance repairs and/or rebuilds.

5. CLOSING COMMENTS – *The Road from Here?*

The preceding paper has presented an overview of today's maintenance, and its shortcomings which must be overcome if Western industry is to improve in productivity and profitability. It is clear that Maintenance must play a crucial role by providing better equipment availability and reliability, a minimum of unplanned downtime, and reduced overall costs, through more efficient asset management, and maintenance prevention. Maintenance must be viewed as a true production "partner", rather than just a service. To support this paradigm shift in thinking, Maintenance must prove itself a true "profit center", providing cost-effective maintenance and technical support.

The paper has proposed a different foundation for maintenance action – one that builds on "Core Values" as focal points for strategic action. However, the constant message throughout the text is the need to strengthen the "basics" – practices, procedures, planning, scheduling, training, and the availability of necessary technical information. The theme throughout is to continually direct resources to the "right" things to do. It is possible to do the "wrong" things "right"! We must not get so caught up in today's fast-moving, electronic, high-tech. world that we fail to utilize good basics and best practices.

One Core Value is particularly of note – your maintenance workforce. This is your key to greater productivity. Invite their increased involvement and commitment.

The challenge – look at your maintenance organization and its operations with a critical eye. Are you doing the "right" things "right"? You cannot afford in today's world to do anything less.

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