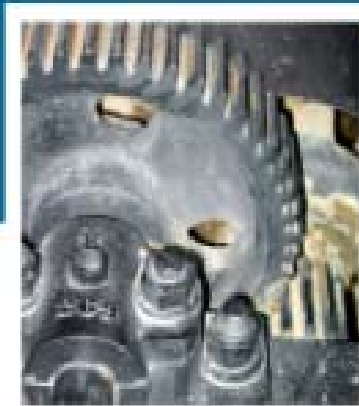


Measuring the **True Value** of Maintenance Activities



Introduction

Gaining full value from capital or physical assets is an important challenge for organizations operating in increasingly competitive environments, where production interruptions due to equipment failures lead to expensive repair costs and lost revenue opportunities.

A key requirement for ensuring that capital assets deliver value is an enterprise asset management (EAM) system that automates maintenance planning and scheduling, tracks supplies of inventory, enables on-line procurement, and integrates with financial and other information systems.

While implementing an EAM solution can be a relatively straight-forward initiative, identifying the right solution, determining which organizational processes need adjustment, and ensuring that maintenance best practices are deployed are essential to ensuring that your EAM solution delivers promised benefits.

The purpose of this whitepaper, "Measuring the True Value of Maintenance Activities," is to help you gain maximum value from your EAM investment and to support continuous improvement of all related maintenance activities. Key topics include:

- Understanding all of the components of enterprise asset management
- Understanding some of the operational and organizational changes needed to gain advantages from EAM solutions
- Measuring your maintenance activities against industry best practices
- Measuring bottom-line results from your maintenance investments:
 - o The Scoreboard for Maintenance Excellence for Maximizing Overall Best Practices
 - o The Benchmarking System for Optimizing Your IT Investment
 - o The Maintenance Excellence Index for Validating Bottom Line Results

The Maintenance Excellence Institute (TMEI) has developed this white paper to help senior executives understand the value of maintenance activities and help maintenance professionals align resources to ensure that they are contributing positively to bottom-line results.

The mission of TMEI is to help organizations gain greater value from their assets. We do this by helping clients more effectively manage each stage of the physical asset lifecycle process – from acquisition to disposition. But we believe that people assets are the most important resource and our Training for Maintenance Excellence builds leadership and technical reliability and maintenance skills at all levels.



Understanding The True Value Of Maintenance and Physical Asset Management

There can be a very high cost when we gamble with deferred maintenance costs. This applies to all operations where maintenance activities occur, such as exploration and production facilities in the oil and gas sector, manufacturing plant operations, university facility complexes, equipment fleet operations, healthcare facilities, chemical plants, or power plants.

With this context, the maxim “maintenance is forever” always holds true. It is also true that if we do not achieve the existing “maintenance requirements” of each physical asset, we are gambling with mission-critical assets. The “high cost of gambling with maintenance” may become a catastrophic failure that causes loss of innocent lives, time, profits or service. Gambling with maintenance costs is not an option when we fully understand the enormous potential from improving maintenance activities and then invest wisely in maintenance.

Maintenance activities and effective asset management add value to every type of operation. Very often, the true value of maintenance is not understood by everyone in the organization. Leaders within the maintenance organization must communicate to top-level leaders a complete understanding of the importance of maintenance. Maintenance Leaders must measure and communicate the true value of maintenance activities to Top Leaders. Craft Leaders on the shop must clearly see that those at or near the “top” truly appreciate the service that maintenance performs. Everyone in maintenance must continuously demonstrate the true value of their own maintenance activities and build understanding across the organization.

Likewise, all senior level positions of an organization must gain an understanding that effective management of physical assets and related maintenance processes is vital to total operations success. The chief financial officer, for example, must see how maintenance contributes to profit and profit optimization. Everyone must understand the following four strategic maintenance challenges that most growing organizations face. Regardless of the operation’s current size or scope, plant maintenance and facilities management leaders in the public and private sectors are faced with four unique but very inter-related challenges:

- Challenge One: Maintain existing production assets and facilities in safe and sound conditions.
- Challenge Two: Improve, enhance and then maintain existing assets and facilities to achieve environmental/regulatory standards, greater production capacity at better quality and while using the best energy practices.
- Challenge Three: Enhance, renovate and modify/overhaul existing assets/facilities using capital funds or funds from tenant/customer and then maintain the additions.
- Challenge Four: Commission new production assets or facilities. Assume increased scope of work to maintain the new assets. Be prepared to assume more work from Challenges One, Two and Three above as production assets and facilities get older and older.

Many organizations experience all four challenges concurrently. And often some organizations face indiscriminate budget cuts by executives who do not understand the true value of maintenance. Subsequently, maintenance budget cuts often fall in the one place they can hurt the worst. And that is the reduction of maintenance craft people, the technicians within all of the necessary trade areas who are out there doing hands on repair, the emergency responses and weekend service calls. The indiscriminate cutting of these scarce craft resources has been an unfortunate by-product of the recent trend toward cost cutting.

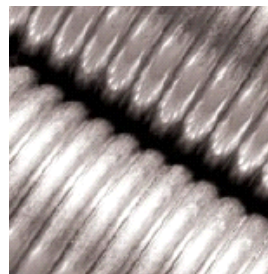
Unfortunately, if an organization is not doing Continuous Reliability Improvement (CRI) across all its maintenance resources or defining true maintenance requirements and achieving them, cutting craft positions to generate cost savings will have the opposite effect.

The core competency for doing maintenance may not be present so contracted skills from a service provider may truly be needed. But regardless of the operation's size or scope, the core requirement for executing required maintenance remains forever. The two core needs for an effective facility management or plant maintenance operation need to be understood both by maintenance leaders and senior executives:

- Maintenance business process improvement: Maintenance leaders must be pursuing business process improvement with a profit and customer-centered strategy and related attitudes toward their maintenance operation and customers. Top leaders should require it, support it and understand it. There must be Continuous Reliability Improvement across all resources: people, materials, the asset, capital dollars and information resources. If continuous improvement is truly present, then the plant maintenance leader or facilities management leader at least, has a chance to survive. They must be able to show top leaders that they really are measuring results and maximizing all available maintenance resources. Then there is a true need and a clear case for adding resources to address the new requirements plus the baseline maintenance requirements for the asset.
- Maintenance requirements for the physical asset: The primary mission is executing the required maintenance activities for each asset while improving the equipment or facilities for the customer. This is what maintenance leaders must achieve in addition to many other activities that compete for engineering, craft and administrative resources. Defining true maintenance requirements to top leaders is extremely important. Because when all resources are strained and basic preventive maintenance or regulatory compliance is neglected, top leaders must have the right information to make the right choices. Eliminating maintenance resources at a time when basic maintenance requirements are not being met should not be considered even as a short-term option.

Eliminating maintenance resources to match lean manufacturing trends can be fatal. It really will not work if one has truly maximized use of existing resources and your baseline maintenance requirements are not being accomplished. The labor resource needs for the existing maintenance requirements must come from somewhere. Labor resource needs can be offset by either new craft resources and/or greater productivity of existing craft resources.

Therefore, the existing baseline of maintenance requirements and any growing maintenance needs of an organization must continuously be highlighted to top-level leaders. Equally important, the maintenance operation must continuously improve its operation and be provided investments for implementing operational improvements such as an EAM or CMMS system that supports continuous improvement of maintenance activities.



II. Determining Where You Are & Where You Need To Go With Maintenance Best Practices

Do you know where you stand with applying today's best practices for maintenance and physical asset management? Do you have a baseline as to what is considered today's best practice and whether or not you have applied them effectively? Are there best practices that you have heard about that need to be considered and implemented? If not, you may very well be gambling with the long-term success of your total operation.

Effective maintenance and physical asset management add value and can be measured, as we will review later. There are many maintenance practices to consider and many software solutions to support profit optimization whether at one site or across multiple sites. There are some very important steps that you should take to gain maximum value from your maintenance operation and your investment in an EAM/CMMS system and help on your journey to maintenance excellence. Now is the time to take action to gain maximum return on all maintenance investments.

Make the Commitment: The very first step is to make a commitment to Continuous Reliability Improvement of your total maintenance operation. You should take the time to benchmark your current operation against today's best practices for Continuous Reliability Improvement, preventive/predictive maintenance, planning and scheduling, effective MRO materials management, storeroom operations, inventory control, work orders, work control, and the effective use of computerized systems for maintenance and respective business systems. Making the initial commitment is often the hardest first step.



How to Determine "Where You Are": Make a commitment to conduct an objective evaluation of your total maintenance operation. Within plant maintenance operations this is maintenance and repair of all production and facility assets, supporting infrastructure, overhaul and renovation activities, engineering support processes as well as all material management and procurement of typical repair parts, supplies plus contracted services.

Facilities management operations, fleet operations and healthcare all have unique differences to be considered. You should benchmark your current operation against today's best practices for preventive maintenance, planning and scheduling, effective spare parts control, work orders, work management, the effective use of computerized systems for maintenance business management. A complete review of maintenance operations and the physical asset management process is important because it gives you a baseline as to your starting point for making improvements and for validating results. It will help to ensure that you are taking the right steps for taking care of your mission-essential physical assets. An independent evaluation, in most cases, helps to reinforce the local maintenance leader or facilities manager's desire to take positive action in the first place. Most want to do something to improve the overall maintenance process but never have the resources.

Measuring the True Value of Maintenance Activities

For multiple site operations, an evaluation of several sites provides a great opportunity for developing standard best practices that can be used across the corporation and for new sites. There are a number of very good benchmarking tools to help you get started with this important first step and others along the path forward to maintenance excellence.

The Scoreboard for Maintenance Excellence: Today's most comprehensive benchmarking guide, *The Scoreboard for Maintenance Excellence*, is available to define "where you are" in terms of today's maintenance best practices. Developed by the Maintenance Excellence Institute, this external benchmarking process has evolved from over 20 years of successful application to many different types of public and private organizations.

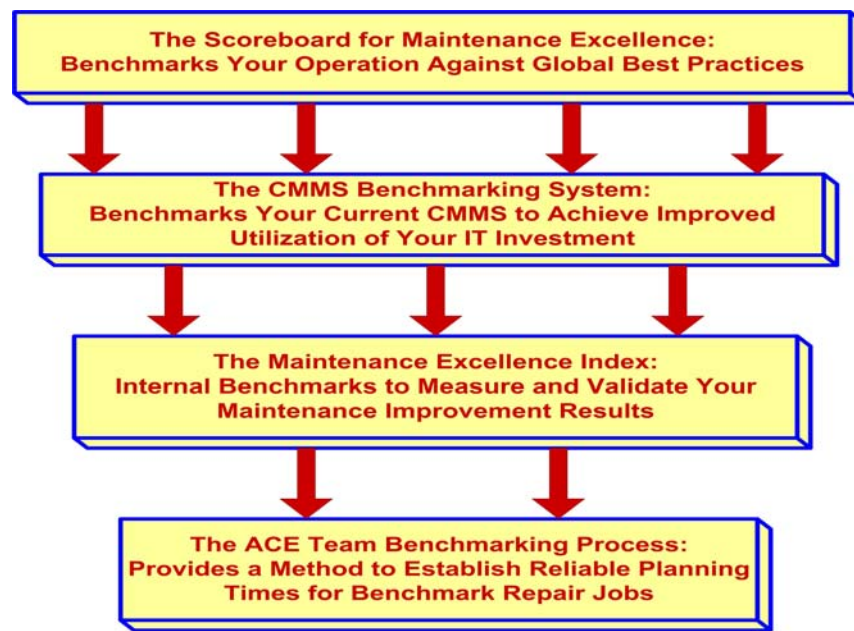
Currently there are four versions of the Scoreboard for Excellence:

- The Scoreboard for Maintenance Excellence
- The Scoreboard for Facilities Management Excellence
- The Scoreboard for Fleet Management Excellence
- The Scoreboard Healthcare Facilities Management Excellence

This benchmarking process or maintenance audit gets down to the detailed level of "determining where you are" with actually applying today's best practices for maintenance in 27 major evaluation categories with 300 very specific evaluation criteria. *The Scoreboard for Maintenance Excellence* provides the first of three benchmarking tools introduced here and is the major one that benchmarks where you are with applying external best practices that other successful maintenance operations recognize and use.

The Scoreboard for Excellence concept and the various versions of the scoreboard have been used to perform over 200 maintenance evaluations and over 5,000 organizations have requested and received information for their internal use.

The Scoreboard for Maintenance Excellence, as shown in the summary, includes 27 evaluation categories (plant maintenance best practices areas). It evaluates the total maintenance operation within the scope of coverage for a manufacturing organization. But there can also be well-defined focus areas when an evaluation is conducted such as on an EAM/CMMS system, planning/scheduling, MRO materials management or application of Continuous Reliability Improvement and predictive maintenance technologies.



Four Levels of Maintenance Benchmarking

The Scoreboard for Maintenance Excellence

Summary of Evaluation Categories

Category	Category Descriptions (Part 1)	Evaluation Items	Total Points in Category
A.	The Organizational Culture and P.R.I.D.E. in Maintenance	6	60
B.	Maintenance Organization, Administration and Human Resources	12	120
C.	Craft Skills Development and P.R.I.D.E. in Maintenance	12	120
D.	Operator Based Maintenance and PRIDE in Ownership	6	60
E.	Maintenance Supervision/Leadership	9	90
F.	Maintenance Business Operations, Budget and Cost Control	12	120
G.	Work Management and Control: Maintenance and Repair (M/R)	12	120
H.	Work Management and Control: Shutdowns and Major Overhauls	6	60
I.	Shop Level Planning and Scheduling	18	180
J.	Shutdown and Major Planning/Scheduling and Project Management	9	90
K.	Manufacturing Facilities Planning and Property Management	9	90
L.	Production Asset and Facilities Condition Evaluation Program	6	60
M.	Storeroom Operations and Internal MRO Customer Service	12	120
N.	MRO Materials Management and Procurement	12	120
O.	Preventive Maintenance and Lubrication	18	180
P.	Predictive Maintenance and Condition Monitoring Technology Applications	15	150
Q.	Process Control, Building Automation and Instrumentation Systems Technology	9	90
R.	Energy Management and Control	12	120
S.	Maintenance Engineering Support	9	90
T.	Safety and Regulatory Compliance	12	120
U.	Maintenance and Quality Control	9	90
V.	Maintenance Performance Measurement	12	120
W.	Computerized Maintenance Management System (CMMS) and Business System	18	180
X.	Shop Facilities, Equipment, and Tools	9	90
Y.	Continuous Reliability Improvement	15	150
Z.	Asset Facilitation and Overall Equipment Effectiveness (OEE)	15	150
ZZ.	Overall Craft Effectiveness (OCE)	6	60
Total Evaluation Items and Points		300	3000

A Complete Evaluation is Recommended: For example, MRO materials management, storeroom operation and procurement may be areas needing special attention. Shop-level planning and scheduling is often a typical need and can be a primary focus area. Regardless of the different areas creating the obvious concerns and “organizational pain,” a short-term, piecemeal approach to an evaluation is not recommended. A complete evaluation of the total maintenance operation is highly recommended. There are 300 specific evaluation items that are evaluated through direct shop floor interviews, close observations, and review of information or procedures. Each one is important; some apply and provide more value more than others. But each of the 300 items on *The Scoreboard for Maintenance Excellence* summarized on the next page is part of establishing a solid foundation for profit-centered maintenance. Long-term Continuous Reliability Improvement is also a very important connecting link.

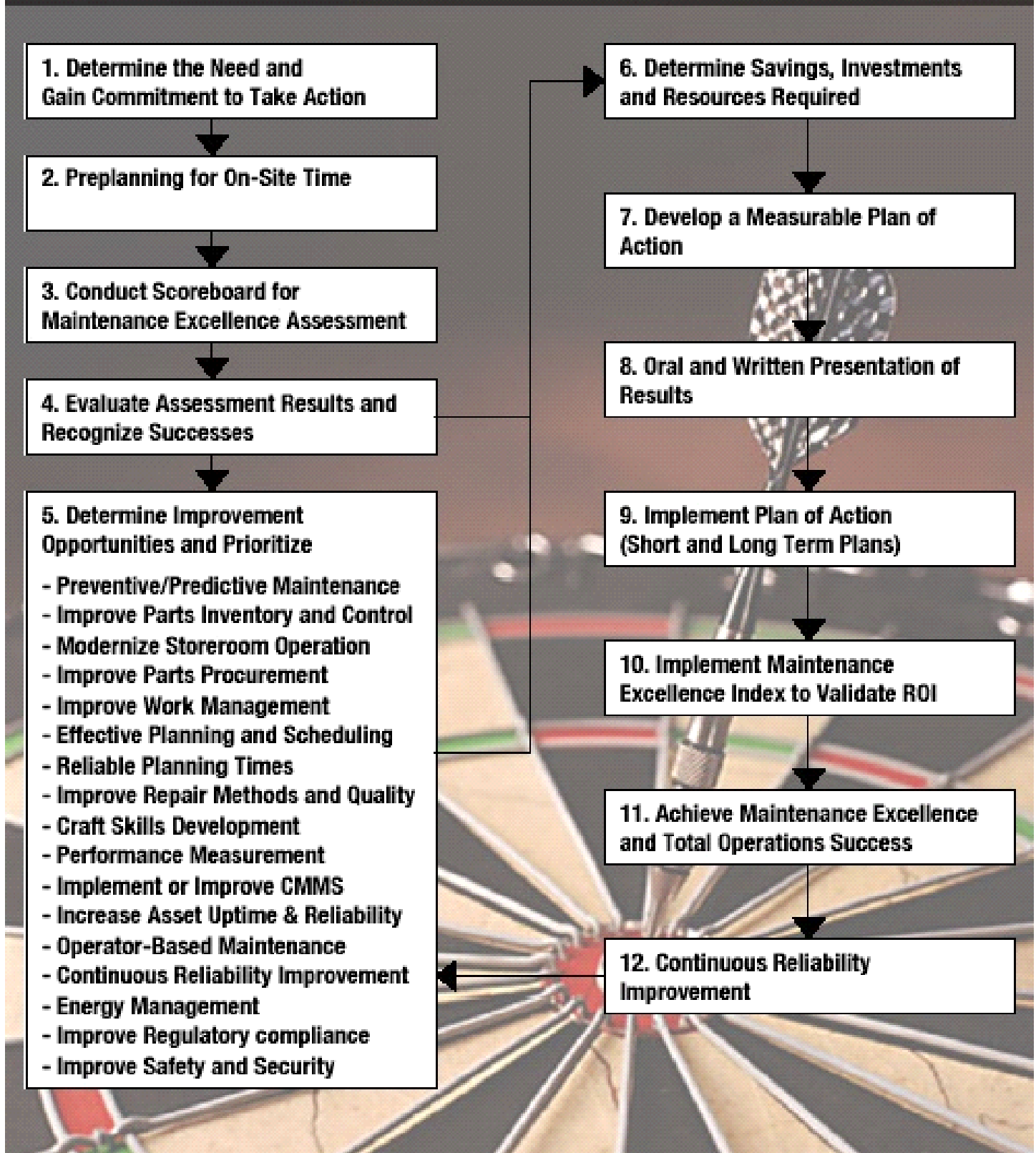
Guidelines for Conducting a Total Maintenance Operations Evaluation:

While a self-evaluation has benefits; a comprehensive evaluation conducted by an external resource provides a greater sense of the “big picture” in terms of objectivity and completeness. Regardless of your situation, it is important that you do something to “determine where you are.” Should you want to conduct an evaluation of maintenance activities, here are some guidelines to consider when using *The Scoreboard for Maintenance Excellence*.

Key Steps for Using The Scoreboard for Maintenance Excellence

1. Obtain Leadership Buy-in
2. Create a Maintenance Excellence Strategy Team
3. Understand the Evaluation Categories and Evaluation Criteria
4. Develop an Action Plan
5. Conduct Evaluation of Total Maintenance Operation
6. Analyze, Review and Present Results
7. Develop Path Forward for Maintenance Excellence
8. Summary of Deliverables to Achieve Results:
 - a. A recommended Maintenance Excellence Strategy Team Charter and functioning team
 - b. *The Scoreboard for Maintenance Excellence* developed for the organization and revised if required after the pilot evaluation
 - c. In-depth evaluation of current maintenance practices at a pilot site
 - d. Recommendations in all 27 maintenance evaluation categories
 - e. Benchmark evaluation of the current EAM systems installation based on the Benchmarking System criteria
 - f. Recommendations to improve utilization of the current EAM installation
 - g. Recommended path forward for a strategic level plan with tactical/operational items
 - h. Definition of improvement opportunities
 - i. Summary of potential benefits with an estimate of savings and gained value for each
 - j. Documented evaluation of results in a written report
 - k. Recommended performance measurement process ready for immediate implementation
 - l. A Maintenance Excellence Index that validates overall performance improvement
 - m. Recommended metrics, data sources, and documentation in a standard operating procedure guide for the client-specific MEI
 - n. Plan of action for future evaluations at other sites
 - o. An organization maintenance champion (CMO) established
 - p. Oral presentation of results to top leaders

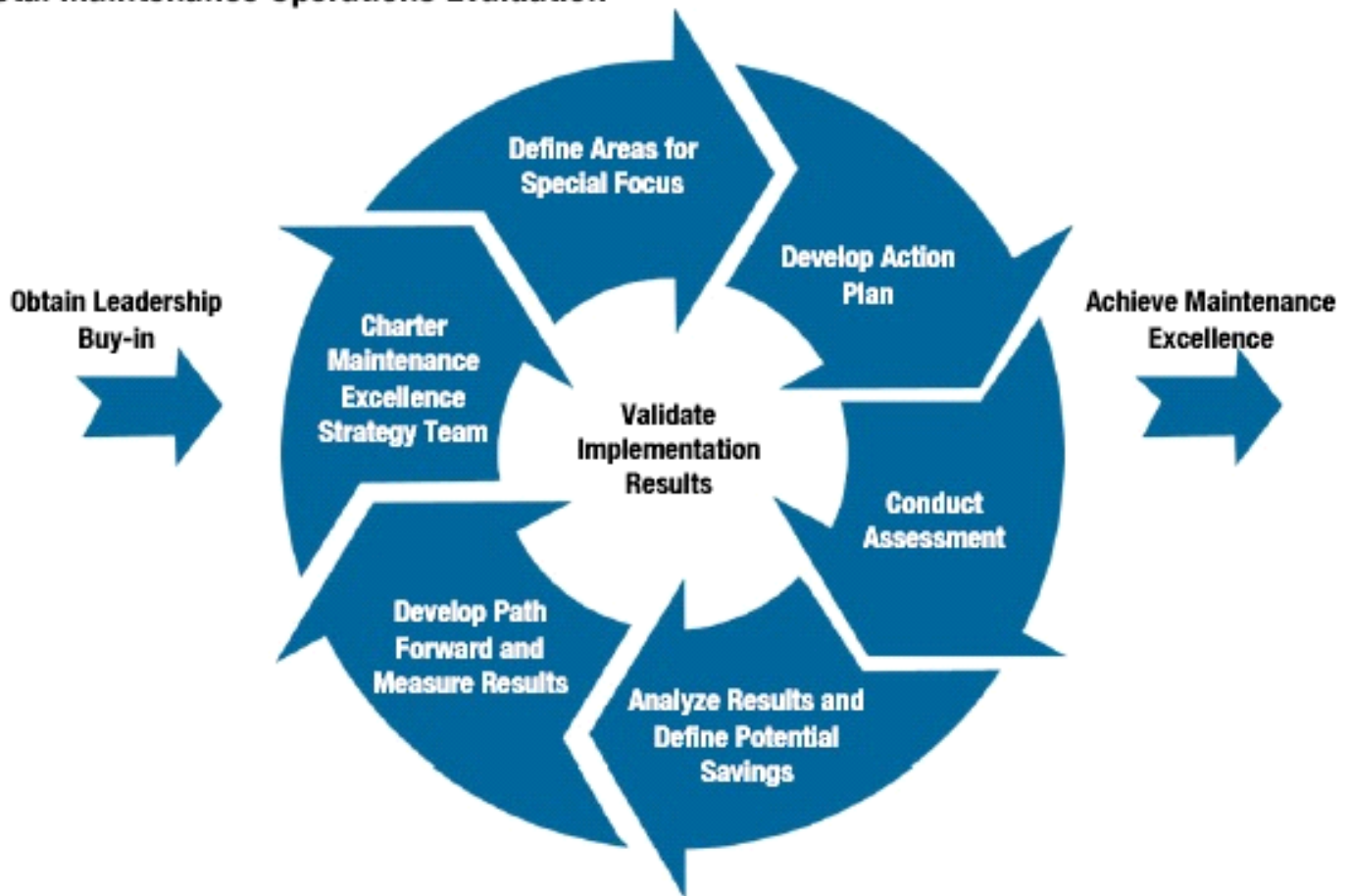
The Scoreboard for Maintenance Excellence Assessment: Key Steps to Continuous Reliability Improvement



Establish a Maintenance Excellence Strategy Team: One key element of success is having a commitment from top-level leaders across the organization. Establishing a Maintenance Excellence Strategy Team is highly recommended. This high level, leadership driven cross function team made up from maintenance leaders, key operations leaders, shop-level maintenance staff, IT, engineering, procurement, operations/customer, financial and planners. The mission of this team is to lead and facilitate the overall Continuous Reliability Improvement process and to ensure measurement of the results that are achieved. This team would also sponsor other teams within the organization to support implementation of the recommended path forward. One of the very first things that this team should do is to sponsor a comprehensive evaluation of the total physical asset management and maintenance operation and help to determine "where you are." There are a number of very good benchmarking tools to help you get started with this important first step and others along the path forward to maintenance excellence.

Invest in External Resources: It is extremely important to know where your organization stands on physical asset management and maintenance issues and challenges so it can quickly identify areas for improvement. Every delay along the way delays receiving the potential benefits and added value. Self-evaluations can be a starting point when nothing else is available for using external support. But a more comprehensive, objective evaluation performed by external consulting resources (or possibly qualified corporate level staff) with maintenance-focused expertise is highly recommended. In the long run, external resources will provide additional justification and measurable results. Use external resources to support this essential first step after your organization makes the initial commitment.

Total Maintenance Operations Evaluation



III. Developing Your EAM/CMMS System To Successfully Manage The Business Of Maintenance

Today's information technology for EAM offers the maintenance leader or facilities manager an exceptional tool for managing maintenance activities and the overall maintenance operation. Maintenance processes and services can be managed as an internal business. There are many improvement opportunities identified when a Scoreboard for Maintenance Excellence type evaluation is conducted. Maintenance surveys and benchmark evaluations conducted by external sources validate that poor utilization of existing EAM systems is a major improvement opportunity. What are some of the typical benefits of an improved EAM System that could be missing from your operation?

- Improved Work Control
- Improved Planning and Scheduling
- Enhanced Preventive and Predictive Maintenance
- Improved Parts and Materials Availability
- Improved MRO Materials Management
- Improved Reliability Analysis
- Increased Budget Accountability
- Increased Capability to Measure Performance and Service
- Increased Level of Maintenance Information

Benchmark Your EAM System Installation: *The EAM Benchmarking System* is another tool available to evaluate the utilization of an EAM system installation. It is designed as a methodology for developing a benchmark rating of your current EAM system (Class A, B, C, or D) to determine how well this tool is supporting best practices and the total maintenance process. It is not designed to evaluate the functionality of various EAM systems nor is it intended to compare vendors.

The system provides a methodology for developing a benchmark rating of your existing EAM installation to determine how well this tool is supporting best practices and the total maintenance process. It can also be used as a method to measure the future success and progress of a new EAM system implementation that is now being installed. Maintenance best practices are the key and the EAM is the information technology tool that links it all together. *The EAM Benchmarking System* gives you an easy way to evaluate how well you are using your EAM investment.

Maintenance Information is a Key Resource: We illustrate below some key points on maintenance information as one of the key resources for Continuous Reliability Improvement. A summary of *The EAM Benchmarking System* is shown with nine major evaluation categories that include a total of 50 evaluation items for benchmarking your EAM installation.



The EAM System Benchmarking System

EAM System Benchmark Evaluation Categories	Evaluation Items
1. Data Integrity	6
2. EAM System Education and Training	4
3. Work Control	5
4. Budget and Cost Control	5
5. Planning and Scheduling	7
6. MRO materials Management	7
7. Preventative and Predictive Maintenance	6
8. Maintenance Performance Measurement	4
9. Other uses of EAM System	6
TOTAL EAM EVALUATION ITEMS	50

EAM System Benchmarking Rating Scale	
Class A	180 – 200 points (90% +)
Class B	140 – 179 points (70% to 89%)
Class C	100 – 139 points (50% to 69%)
Class D	0 – 99 points (up to 49%)

IV. Measuring The Bottom Line Results From Your Maintenance Investments

Maximizing maintenance for profit optimization or increased service to customers is the goal. The goal is successful implementation of prioritized improvement opportunities and to help improve all internal resources do a better job for the tenant/customer. We can measure the "true value" of maintenance activities.

Here we will introduce the third benchmarking tool, The Maintenance Excellence Index. As a result of applying all three benchmarking tools in this proven approach, the journey to maintenance excellence is well underway with these world-class methodologies in place to measure results and long-term contribution to profit:

- *The Scoreboard for Maintenance Excellence* for Maximizing Overall Best Practices
- *The EAM System Benchmarking System* for Optimizing Your IT Investment
- *Maintenance Excellence Index (MEI)* for Validating Bottom Line Results

This section covers the process of defining and gaining consensus on very specific key performance indicators related to the total maintenance operation. It covers a recommended set of internal benchmarks or metrics for today's facilities leader, the purpose for each and where they traditionally can be found in the EAM or financial system. Most important this section illustrates how your own uniquely developed *Maintenance Excellence Index* will validate results and ROI for maintenance operations.

Measure and Validate Results: The topic of measurement must be foremost in our minds as we begin to determine "where we are" with the evaluation of physical asset management and the maintenance activities. Each of the 300 evaluation items on *The Scoreboard for Maintenance Excellence* must be viewed in terms of whether or not there are tangible or intangible benefits possible. If we are able to make improvements that generate benefits and can we measure them? Often performance measurement is something new to the in house maintenance operation, but we highly recommend that a performance measurement system be put in place.

Contract maintenance providers understand the value of measurement so that their customers clearly see value added services received. Justification for investments in maintenance best practices for in-house maintenance operations must be validated. If your maintenance operation were a third-party contract maintenance provider that you owned and operated, you would expect a profit. So we too must measure and validate results from internal maintenance improvement.

Initiate a Maintenance Excellence Index: A proven approach has been to help clients create a Maintenance Excellence Index (MEI) that includes 10 to 15 key performance indicators with agreed upon weighted values. These metrics are then used to provide a spreadsheet that brings them all together into a composite Total MEI Performance Value, an index of how all resources are contributing to your part of profit optimization. The metrics selected should be applicable to the specific organization. For example, a pure facilities maintenance operation without critical production or operations equipment to maintain would not use OEE as part its MEI to measure Overall Equipment Effectiveness, a world-class metric best suited to a small number of mission essential critical assets within a production operations. The metrics encompass the measurement of all key resources necessary for effective physical asset management:

- People resources and craft labor
- Dollar resources and overall budget dollars from both maintenance and the customer
- MRO material resources
- Planning resources and customer service
- The physical asset as a key resource, its uptime, availability and reliability to perform its function
- Information resources and how data become true information via effective EAM
-

Potential Performance Metrics for Using on a Maintenance Excellence Index (MEI): The following section provides a review of 21 key metrics that should be considered. There are numerous other metrics and key performance indicators available, but these 21 metrics encompass the measurement of all key resources necessary for effective physical asset management:

Measuring the True Value of Maintenance Activities

Number	Performance Metric, Purpose and Data Source
1.	% Overall Maintenance Budget Compliance: To evaluate management of \$ assets; <i>Obtained from monthly financials</i>
2.	Actual Maintenance Cost per Unit of Production: To evaluate/benchmark actual costs against stated goals/baselines or against industry standards; <i>Obtained from asset records and monthly EAM WO file of completed WOs for the month. Obtained from production results and financial report. Provides ideal support to ABC Costing practices</i>
3.	% Customer or Capital Funded Jobs Completed as Scheduled and within +/- 5% of Cost Estimate: To measure customer service & \$ assets plus planning effectiveness; <i>Obtained from funded WO types from the EAM WO files, comparing date promised to date completed and estimated cost to actual cost</i>
4.	% Other Planned Work Orders Completed as Scheduled: To measure customer service and planning effectiveness; <i>Obtained from a query of all planned WO types in EAM WO files and comparing date promised to date completed. Could be expressed in % based on craft hours</i>
5.	Schedule Compliance: To evaluate how effectiveness scheduling was in regards to executing to meet scheduled dates/time; <i>Obtained from query of EAM completed WO file where all scheduled jobs coded and their actual completion compared to actual planned completion date/time</i>
6.	% Planned Work Orders versus % True Emergency Work Orders: To evaluate positive impact of PM, planning processes and other proactive improvement initiatives (CRI, /RCM/etc); <i>Obtained from a query of all true emergency WO types in EAM WO files and comparing to total WOs completed. Could be expressed in % based on craft hours</i>
7.	% Craft Time to Work Order for Customer Charge Back: To monitor craft resource Accountability for Internal Revenue Generation (or External); <i>Obtained from a query of all WO types in EAM WO files that are charged back comparing these craft hours to total craft hours paid</i>
8.	% Craft Time to Work Orders: To monitor overall craft resource accountability and to support internal revenue generation; <i>Obtained from a query of all WO types in EAM WO files and summation of actual craft hours</i>
9.	% Craft Utilization (Actual Wrench Time): To maximize craft resources for productive, value-adding work and to evaluate effectiveness of planning process; <i>Obtained from a query of all craft hours reported to non craft work from EAM time keeping WO files and summation of actual craft hours</i>
10.	% Craft Performance (Against reliable estimates for PM and planned work): To maximize craft resources, to evaluate planning effectiveness and also to determine training ROI; <i>Obtained from completed WO file in EAM System</i>
11.	Craft Quality and Service Level: To evaluate quality and service level of repair work as defined by customer; <i>Obtained from WO file in CMMS where all call backs are tracked and monitored via work control and planning processes</i>
12.	Overall Craft Effectiveness (OCE): To evaluate cumulative positive impact of overall improvements to Craft Utilization (CU), Craft Performance (CP) and Craft Quality and Service Excellence (CQSE) in combination; <i>Obtained from using results of measuring all three OCE Factors: a) Craft Utilization, b) Craft Performance and c) Craft Quality and Service Excellence</i>
13.	% Work Orders with Reliable Planned Times: To measure planner's effectiveness at developing reliable planning times; <i>Obtained from completed WO file in EAM where planning times are being established for as many jobs as possible by planner/supervisor</i>
14.	% Overall Preventive Maintenance Compliance (Could be by type asset, production department/location or by supervisory area): To evaluate compliance to actual PM requirements as established for assets under scope of responsibilities; <i>Obtained from completed WO file in EAM System</i>

Measuring the True Value of Maintenance Activities

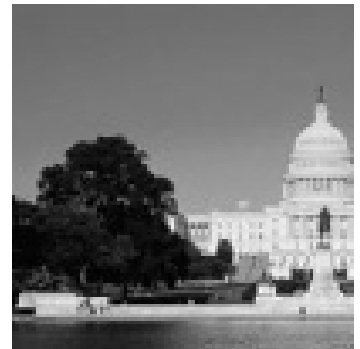
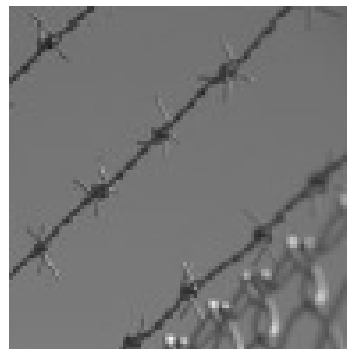
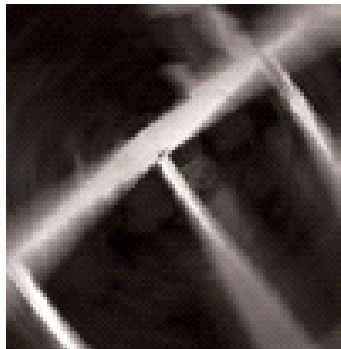
15.	Gained \$Value from Craft Utilization/Performance: To determine actual gained \$ value of craft productivity gains as compared to original estimate and/or the initial baseline; <i>Obtained only from using results of measuring two of the OCE Factors: a) Craft Utilization, b) Craft Performance</i>
16.	% Inventory Accuracy: To evaluate one element of MRO material management and inventory control policies; <i>Obtained from cycle count results and could be based on item count variances or on cost variance</i>
17.	% or \$ Value of Actual MRO Inventory Reduction: To evaluate another element of MRO material management against original estimates and the initial baseline MRO inventory value; <i>Obtained from inventory valuation summation at end of each reporting period</i>
18.	Number of Stock Outs of Inventoried Stock Items: To monitor actual stock item availability per demand plus to monitor any negative impact of MRO inventory reduction goals; <i>Obtained from tracking stock item demand and recording stock outs manually or by coding requisition/purchase orders for the items not available per demand</i>
19.	\$ Value of Direct Purchasing Cost Savings: To track direct cost savings from progressive procurement practices as another element of MRO materials management. Could apply to contracted services, valid benefits received from performance contracting, contracted storerooms, vendor managed inventory; <i>Obtained via best method per a standard procedure that defines how direct purchasing savings are to be accounted for</i>
20.	Overall Equipment Effectiveness (OEE): World-class metric to evaluate cumulative positive impact of overall reliability improvements to Asset Availability (A), Asset Performance (P) and Quality (Q) of output all in combination. (Similar to OCE above but for the most critical production assets); <i>Obtained via downtime reporting process, operations performance on critical assets and the resulting quality of output</i>
21.	% Asset Availability/Uptime: To evaluate trends in downtime due to maintenance and the positive impact of actions to increase uptime; <i>Obtained via downtime reporting process</i>



The Maintenance Excellence Institute

Worldwide Services – Measured Shop Level Results

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V. Using EAM to Develop Your Maintenance as a Profit Center

This section summarizes 12 direct and indirect savings opportunities and illustrates how one of those opportunities increased craft productivity. It also shows how just one of many best practice areas from *The Scoreboard for Maintenance Excellence*, effective shop-level planning and scheduling, provides more than a five to-one return on the investment for just one planner position for a 20 person craft work force.

Understand the Power of EAM to Support Potential Savings: The evaluation of your EAM using *The EAM Benchmarking System* will identify improvement opportunities that translate into direct savings. It is important that these areas be highlighted and that the future process for performance measurement is focused upon these specific areas which may have been used initially for EAM capital project justification. The opportunities to realize both quantifiable and qualitative benefits are numerous.

Maintenance must be given the best practice tools, the people resources, and capital investments to address the improvement opportunities and in turn be held accountable for results. Direct savings, cost avoidances and gained value can be established and documented with an effective EAM system. Applied best practices plus the right EAM/CMMS system, will help to increase the:

1. Value of asset/equipment uptime providing increased capacity and throughput
2. Value of increased quality and service levels due to maintenance
3. Value of facility availability or cost avoidance from non-availability
4. Value of increased direct labor utilization (production operations)
5. Gained value from increased craft labor utilization/effectiveness via gains in wrench time
6. Gained value from increased craft labor performance/efficiency
7. Gained value of clerical time for supervisors, planners, engineering and admin staff
8. Value of MRO materials and parts inventory reduction
9. Value of overall MRO materials management improvement
10. Value of overall maintenance costs reductions with equal or greater service levels
11. Value of increased facility and equipment life and net life cycle cost reduction
12. Other manufacturing and maintenance operational benefits; improved reliability and other reduced cost

What is Your Craft Utilization? Surveys consistently show that wrench time (craft utilization) within a reactive maintenance environment is within the range of 30 to 40 percent. This means that for a 10-hour day there are only four hours of actual hands-on wrench time. Typically, low-craft utilization is due to no fault of the craft work force. Most of the lost craft labor productivity can be attributed to the following reasons:

1. Running from emergency to emergency (a reactive operation)
2. Waiting on parts and finding parts or part information
3. Waiting on other information, drawings, instructions
4. Waiting for the equipment to be shut down
5. Waiting on rental equipment to arrive
6. Waiting on other crafts to finish their part of the job
7. Travel to/from job site
8. Lack of effective planning and scheduling
9. Make-ready, put away, clean up, meetings, troubleshooting

The Most Valuable Resource: Maintenance operations that continue to operate in a reactive, run-to-failure, fire fighting mode and disregard implementation of today's best practices will continue to waste their most valuable asset and very costly technical resource - craft time. Best practices such as effective maintenance planning/scheduling, preventive/predictive maintenance, more effective storerooms and parts support all contribute to proactive, planned maintenance and more productive hands on, "wrench time."

An improvement in actual wrench time from 40 percent to 50 percent represents a 25 percent net gain in craft time available and a significant gained value. When we are able to combine gains in wrench time with increased craft performance when doing the job we increase our total gain in craft productivity.

Measuring the True Value of Maintenance Activities

Measuring and improving overall craft productivity can be a key component to justify an effective EAM system and other investments for maintenance improvement.

Example: Gained Value from 10% increase in Wrench Time. What if through better planning and scheduling, good parts availability and having equipment available to fix it on a scheduled basis, we are able to increase actual wrench time by 10 percent? What is the value to us if we get that 10 percent increase across the board for a 20-person crew operating now at 40 percent wrench time and being paid an average hourly rate of \$18 per hour.

Total Craft Hours Available and Annual Craft Labor Costs

20 Crafts x	40 hours/week x	52 weeks/year =	41,600 Craft Hours Available
41,600 Craft Hours @ \$18 /hour =			\$748,800 Craft labor Cost/Year

Summary for Crew of 20 Craft at \$18.00/Hr Average Rate:

Wrench Time with Actual Costs Per Hour at Various Levels of Craft Utilization

Level of Craft Utilization	Total Wrench Time (Hours)	Actual Hands On Cost Per Hour	Average Wrench Time Hours Per Craft Position
30%	12,480	\$60.00	624
40%	16,640	\$45.00	832
50%	20,800	\$36.00	1040
60%	24,960	\$30.00	1248
70%	29,120	\$25.71	1456
80%	49,920	\$22.50	1664
*85%	35,360	\$21.18	1768
90%	37,440	\$20.00	1872
100%	41,600	\$18.00	2080

Note: Maximum possible craft utilization is = 85 percent considering paid holidays, vacation time, breaks, clean-up, employees meetings, craft training, etc.

How Your Valuable Craft Time Can Slip Away

Total Available Days: 52 Weeks/Year x 5 Days/Week
=260 Days Maximum Without Overtime

260 Total Days – 10 Holiday/Year
=250 Days Now Available

250 Days/Year – 15 Vacation/Sick Days/Year
=235 Days Now Available

235 Days/Year – 15 Days/Year Break Time*
=220 Days Now Available

BOTTOM LINE: 220 Days / 260 Days = .846
= 85% +/- Maximum Craft Time Available for Work

Various Levels of
Wrench Time

85%
= Maximum Craft Time Utilization

70%
= World Class Wrench Time

60%
= Very Good Wrench Time

50%
= Good Wrench Time

30%-40%
= Typical for Reactive

10%-20%
= On Call

Where is your Craft Utilization?

*Note: 15 minutes x 2 breaks/day = .5 hour/day x 235 days = 117.5 hours / 8 hours/day = 15 days/year

Measuring the True Value of Maintenance Activities

Example: Gained Value of 10% Increase in Wrench Time. With effective planning and scheduling we can achieve at a minimum a 10-point improvement in craft utilization. From a baseline of 40 percent up to a level of 50 percent we in effect get a 25 percent increase in craft capacity for actual work. The 40 percent baseline for our example is very conservative since wrench time typically is normally 30 to 40 percent and/or below.

Total Hours Gained in Wrench Time: 4,160 hours gained

20,800 hours @ 50% - 16,640 hours @40% = 4,160 hours gained

Total Gain in Equivalent Number of Crafts Positions: 5

4,160 hours gained

832 Average Wrench Time Hours @ 40% = 5 Equivalent Craft positions

Total Gained Value of 5 Equivalent Positions: \$187,200

5 Equivalents x 40 hours/week x 52 weeks/year x \$18.00/hour = \$187,200 Gained Value

Valuable Craft Time Can Slip Away: With only a 10 percent improvement 40 percent up to 50 percent wrench time, the 20-person craft work force gains 4,160 hours of wrench time, which represents a 25 percent increase in craft labor capacity. The maintenance best practice for planning and scheduling requires a dedicated planner(s). An effective maintenance planner in turn can support and plan for 20 to 30 craft positions. With only a 10 percent increase in craft utilization for a 20-person craft work force, can be much more than a five to one return to offset a maintenance planner position.

If the wrench time in our example is really at the 30 percent level, then the gain up to 50 percent craft utilization is 8,320 hours of wrench time and this increase in craft labor capacity is extraordinary as shown below:

Total Gain in Equivalent Craft Positions: 13.3 Equivalent Positions

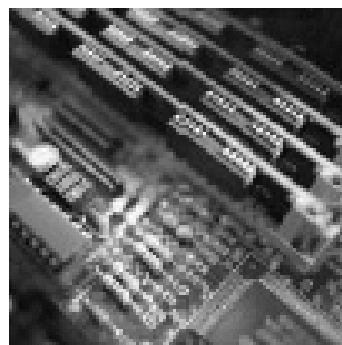
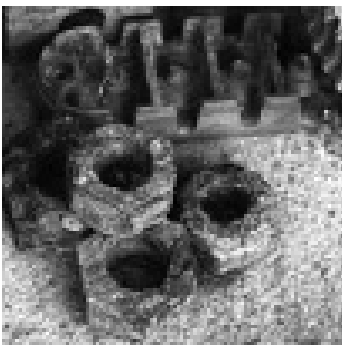
8,320 hours gained

624 Average Wrench Time Hours @ 30% = 13.3 Equivalent Craft Positions

Total Gained Value of 13.3 Equivalent Positions: \$497,952

13.3 Equivalents x 40 hours/week x 52 weeks/year x \$18.00/hour = \$497,952 Gained Value

Your Maintenance Operation as a Profit Center: A fully-utilized EAM system is your business management system to support the business of maintenance and a philosophy of profit-centered maintenance. Your EAM System is a mission-essential information technology tool that can support planning and scheduling, better MRO materials management and effective preventive maintenance, three key elements for improving craft wrench time. Bottom-line results that give us five to 13 more equivalent craft positions and up to \$500,000 in gained value of more wrench time with existing staff can be dramatic proof that internal maintenance operations can be profit centered.



Summary

We can measure the true value of maintenance activities and document savings that go directly to the bottom line. We can change the status quo and view all maintenance operations as potential profit centers. Maintenance and physical asset management operations within your organization can be true contributors to profit generation or increased service levels. We know that the value of effective EAM can have tremendous ROI potential. The cost of external resources and support services for getting started with a Scoreboard for Maintenance Excellence evaluation is also a very good investment. The value of our investments in information technology and best practices is now something that can be validated by the three tools we have discussed previously:

- *The Scoreboard for Maintenance Excellence* for Maximizing Overall Best Practices
- *The EAM System Benchmarking System* for Optimizing Your IT Investment
- *Maintenance Excellence Index (MEI)* for Validating Bottom Line Results

Go Beyond RCM and TPM

We understand the need for the reliability-centered maintenance (RCM) and total productive maintenance (TPM) types of improvement processes. On the shop floor we often see a trend toward forgetting about the basics of "blocking and tackling" while going for the long touchdown pass with some new analysis paralysis scheme. We strongly believe in basic maintenance best practices as the foundation for maintenance excellence. Build your approach upon the basics but then go well beyond the traditional RCM/TPM approaches with Continuous Reliability Improvement (CRI); an improvement process includes all maintenance resources, equipment and facility assets as well as the crafts people and equipment operators. It also includes MRO materials management assets, maintenance informational assets and the added value resource of synergistic team-based processes. Continuous Reliability Improvement improves the total maintenance operation.

A Profit-Centered Approach is Needed: Both large and small maintenance operations can operate as a true profit-centered maintenance organization. This must encompass all aspects of their extensive business enterprise: administration, financial, design, maintenance, construction, planning/scheduling, procurement and overall MRO materials management. Constraints may continue from within the public sector organizations. Attitudes that in house maintenance is a "necessary evil" will die-hard. But to survive in the 21st Century, both private and public sectors must put in place effective performance measurement processes that truly validate profit-centered results.

By

Ralph W. "Pete" Peters

Founder - President - Coach: The Maintenance Excellence Institute

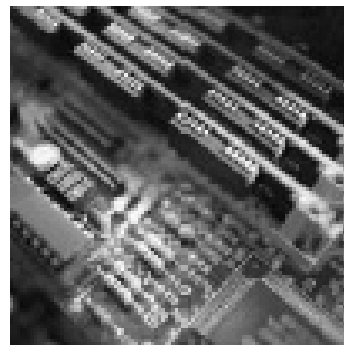
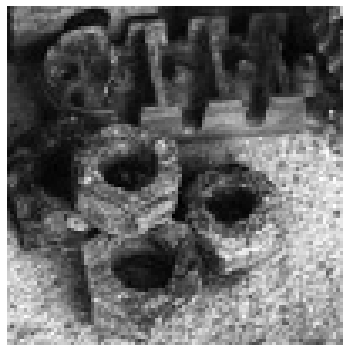
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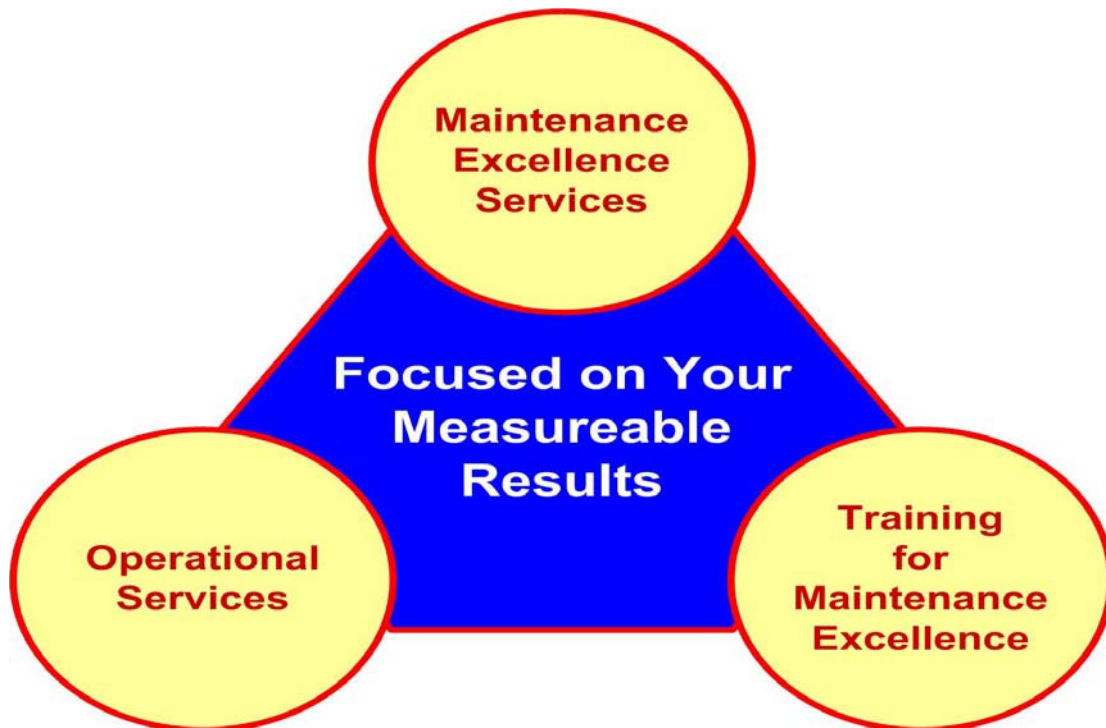


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About The Maintenance Excellence Institute

The Maintenance Excellence Institute is an alliance of highly qualified individuals and organizations with the technical knowledge and practical experience to help you manage and lead your maintenance operation as an internal business. Our cornerstone value is to implement profit-centered practices and attitudes in large and small maintenance operations. Our profit-centered approach for Maintenance Excellence Services and continuous reliability improvement are focused on four main areas of physical asset management and maintenance: plant maintenance operations; healthcare facilities management; facilities management operations; and fleet maintenance operations.



The banner has a light blue background with a world map showing the Americas. Overlaid on the map is a large blue oval containing the text **The Maintenance Excellence Institute** in yellow, with *Worldwide Services – Measured Shop Level Results* in yellow below it. At the bottom of the banner, a light blue box contains the website www.PRIDE-in-Maintenance.com and the phone number 919-270-1173.