BENCHMARKING - BEST PRACTICES

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BENCHMARKING

The search for industry Best Practices which lead to Superior Performance

Keys:
- Best Practices
- Superior Performance

BENCHMARKING...

An ongoing process of measuring and improving practices and processes against the best that can be identified worldwide
- Must not accept constraints
- Must “Think outside the box”
- The more innovative the ideas - the greater the potential rewards

LESSON OUTLINE

- Defining Benchmarking
- Defining Core Competencies
- Types of Benchmarking
- Developing a Maintenance Strategy
- Conducting a Benchmarking Project
**Benchmarking a Definition**

It is the process of continuously comparing and measuring an organization with business leaders anywhere in the world to gain information that will help the organization take action to improve its performance.

**Benchmarking A Definition**

The search for BEST PRACTICES that will lead to superior performance.

**BENCHMARKING**

- Benchmarking sources "Best Practices" to feed continuous improvement.
- Research findings show that major innovations in any sector come from outside the industry sector.
- The need to develop an external perspective has never been more crucial.
BENCHMARKING

- During the past decade, competitive analysis has helped companies improve their market positions
- Benchmarking takes over where this ends
- From Parity to Superiority
- Learning from the Best can help your company

COMPETITIVE ANALYSIS

- Shows how firms compare with their competitors
- The technique does not show HOW to improve performance
- Note that there is a definite difference between a competitive analysis and a benchmarking project...

COMPETITIVE ANALYSIS...

- ...unlikely to lead to or highlight significant breakthrough opportunities that could change long entrenched paradigms of the vertical market
- Paradigms are similar for look-alike businesses in similar markets

WHAT IS YOUR GOAL???

- If the goal is only to meet some industry standard, then there is little to gain from investing to be superior...
Most organizations are hesitant to document their findings. Enablers and Critical Success Factors must be understood for any permanent improvement to be achieved. This requires internal data collection, as well as data collection from the benchmarking partners.

Although hard processes are compared, an essential part of the approach is the necessity to analyze the management skills and attitudes that combine to make the systems operate effectively. This hidden narrative is as important during the benchmarking exercise as are the visible factors.

A broad set of activities or conditions that help to enhance the implementation of a best practice.

These are behind the scenes or hidden factors (enablers..) that allow the development or continuation of best practices. Leadership – Motivated workforces – Management vision and focus are examples of enablers.
Real World Experience

Best Practices

- Leadership, management, or operational methods or approaches that lead to exceptional performance
- NOTE: Relative, not absolute

Critical Success Factors

Characteristics, conditions, or variables that have a direct influence on the customer’s satisfaction with a specific business process.

CSFs represent the few areas in which satisfactory performance is essential for a business to be successful and flourish.

INTERNAL ANALYSIS...

- You must have a thorough understanding of your internal processes for it to be possible to recognize and integrate the differences and innovations that will be found in “Best Practice” companies.
LESSON OUTLINE

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BENCHMARKING...

- Used to improve Core Competencies
- So...
- Is Maintenance Considered a Core Competency?
- Is it "Core" to your business?

BENCHMARKING - CORE COMPETENCIES

Core Competencies:
- Key Business outputs or processes through which an organization distinguishes itself positively
- Distinctive - A strength that sets an organization apart from its competition
- Examples are expert maintenance, low operating costs, and cross-trained labor

Operations Management - R. Schonberger - 1997

BENCHMARKING - CORE COMPETENCIES

Key business processes represent core functional efforts and are usually characterized by transactions that directly or indirectly influence the external customer’s perception of the company.
- Procure and Support Capital Equipment
- Manage and Support Facilities

The Benchmarking Workbook - G. Hines - 1992
Core Competencies should impact business measures:
- Return on Net Assets
- Customer Satisfaction
- Revenue per Employee
- Quality
- Asset Utilization
- Capacity

The Benchmarking Management Guide - APQC - 1993

Benchmarking Focus

Core Competencies

- Must have a wide application in the company's business
- Should make a significant contribution to the benefits perceived by the customer
- It should be difficult for a competitor to quickly imitate

I am using core competencies to refer to any aspect of the business operation that results in a strategic market advantage.
Expense Reduction | Efficiency Improvement

Throughput/Availability | Expenses | Throughput/Availability | Expenses

But what if we could do both?

**SAMPLE MAINTENANCE SAVINGS**

- **Labor**
  - $2M per year
  - Reactive
  - Estimated 20% red.
  - Potential = $400K

- **Materials**
  - $4M per Year
  - No Controls
  - Estimated 20% Red.
  - Potential = $800K

**SAMPLE ASSET MANAGEMENT SAVINGS**

- **Increased Uptime**
  - $38M lost production
  - Reduction Possible
    - 50%
  - Savings = $19M

- **Increased Efficiency**
  - Compressors
    - 57% & 65%
  - Lost Production
    - $5.4M / Yr.
  - Overhaul cost $450K
  - Payback 21.8 Days
  - Verified by accounting

**FINANCIAL OPTIMIZATION - THE ULTIMATE ROI**

Lost Production/Availability

Maintenance Cost
SINCE...

It is a CORE Competency.....

LESSON OUTLINE

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TYPES OF BENCHMARKING...

- Internal
- Interplant
- Divisional
- Multinational
- Similar Industry
- Competitors
- Best Practice

TYPES OF BENCHMARKING...

- Internal
  - Data collected easily
  - Similar culture
  - Similar organizations
  - Unlikely to result in major breakthroughs, but, should result in quick results and adequate ROI
  - Can fuel the desire for more extensive benchmarking
Types of Benchmarking

**Competitive Benchmarking**
- Measures organizational performance
- Focuses on Competitors
- Select set of measures

**Process Benchmarking**
- Measures discreet process performance
- Focuses on "Best of Best"
- Uses "Best Practice" for process
- Must understand practice
- Must adapt and apply to organization

**Types of Benchmarking**

- **Internal Studies**
  - Compares similar operations for different units within an organization

- **Competitive Studies**
  - Compares specific processes used by direct competitors

- **Functional or Industry Studies**
  - Compares similar processes within the same broad industry

- **Generic Benchmarking**
  - Compares similar processes independent of industry

**"Best Practice"**
- Must find the unarguable leader in the process being benchmarked
  - regardless of industry sector or location
- Define "BEST"...
  - Most Efficient?
  - Most Cost Effective?
  - Most Customer Service Oriented?
- Must determine criteria for "BEST"

**Types of Benchmarking...**

- Best Practice - (cont.)
  - No single Best Practice company will be found
  - Since reasons for benchmarking and practices being benchmarked will vary, "Best" companies will vary
  - Insuring the "Best" requires systematic and thorough planning and data collection
**TYPES OF BENCHMARKING...**

- Best Practice is Superior
  - Provides the opportunity to make the most significant improvement
  - Provides the opportunity for the highest Returns On the Investment
  - Provides the greatest potential for major breakthroughs

**BENCHMARKING - THE PROCESS**

- Conduct Internal Analysis
- Identify Areas for Improvement
- Find Partners
- Make Contact, Develop Questionnaire, Perform Site Visits
- Compile Results
- Develop and Implement Improvements
- Do it again...

**BENCHMARKING EVOLUTION**

- Step 1
  - Practice with Internal Partners
- Step 2
  - Progress to “Better Practice” internal/external partners
- Step 3
  - Gradually move to benchmarking with the “Best”

**Benchmarking**

4 Steps

1. Plan the project
2. Collect the Data
3. Analyze the data for performance gaps and process enablers
4. Improve by adopting the process enablers
**BENCHMARKING EVOLUTION...**

- Early "Best Practice" benchmarking requires finding a partner who is measurably better in the process.
- Once parity is achieved, begin searching for a still "Better" partner.
- Continued Steps lead to the ultimate "Best".
- THERE ARE NO SHORTCUTS!!

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**Identifying Partners**

**Secondary Research**

- Reliability Web - [www.reliabilityweb.com](http://www.reliabilityweb.com)
- Plant Engineering and Maintenance
- Plant Services
- Maintenance Technology
- Society of Maintenance and Reliability Professionals
- Association for Facilities Engineering
- Plant Engineering
- Society of Manufacturing Engineers
- Institute of Industrial Engineers
- Productivity Press

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**BENCHMARKING...**

- Successful benchmarking depends on cooperation between partners to be successful.

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**LESSON OUTLINE**

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**BUSINESS DEVELOPMENT CASE**

- Develop the Business
  - Mission – Vision Statements
- Organize to Execute the Business Plan
  - Geographical and Reporting Structures
  - Roles and Responsibilities
  - Determine Staffing Levels
- Develop a Performance Management System
  - Determine Linkage necessary to connect the maintenance and reliability business to corporate business objectives (Profitability)

**DEVELOPING A VISION -**

- Most Companies Struggle with developing a vision of what maintenance is, what it should be and how it contributes to the organization.

**MAINTENANCE ...**

What is it?

**LIFE CYCLE MANAGEMENT**

1. Specify Design
2. Procure Build
3. Operator Maintain
4. Asset Performance Management
5. MRO Procurement
6. Decommissioning
7. Commission/Operate
8. Investment Planning
9. Project Definition
10. Supplier Selection
11. Project Execution
Real World Experience.

ASSET MANAGEMENT OVERVIEW

SUPPORT THE ENTIRE LIFECYCLE OF THE ASSET

Real World Experience.

ASSET MANAGEMENT OVERVIEW

Asset Management in an Organizational Context

Real World Experience.

ASSET MANAGEMENT OVERVIEW

Asset Management and Organizational Dependencies

Real World Experience.

LINE OF SIGHT AND LIFE CYCLE COSTS

Figure 1.5 Commitment of life-cycle cost
**LIFE CYCLE DECISIONS**

- Does Finance know that we deactivated the equipment?
- What are the operating conditions?
- What was it designed to do?
- Details on start up issues
- Operate and Maintain
- Procure and Build
- Decommission and Disposal
- Specify and Design

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**Line of Sight for Asset Management**

**Business Goal**

- Increase Profit & Shareholder Value

**Financial Strategies**

- Increase Revenues
- Increase Capacity
- Reduce Expenses
- Reduce Capital Investments

**Asset Management Objectives**

- Decrease Downtime
- Improve Performance and Reliability Planning, Policy, Standards and Procedures
- Improve Maintenance and Operations Certifications and Training
- Achieve Design Reliability
- Computer Controls Reliability by applying reliability-centered techniques
- Asset Efficiency Improvement
- Align Equipment and Facility Planning, Policy, Standards and Procedures
- Improve Project Management for EOC
- Increased Capacity for Capital Investment
- Asset in New Needs to Host Market Demand
- Add Value: High Reliability of new assets in higher volume of desired market
- Control/ Reduce Expenses
- Labor (Labor, OPEX, Engineering)
- Energy
- Contractor
- Equipment
- Utilities
- OPEX Reliability and Efficiency
- Delay/ Eliminate Capital Expenses
- Reduce Asset Life Cycle Costs by achieving design life cycle of facility assets
- Eliminate redundant/ excess assets

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**TIMELINE STATUS**

- March 2011
- October 2011
- February 2012
- June 2012
- October 2012
- April 2013
- October/ November 2014
- February 2015

- Working Drafts
- First Draft
- Chose Drafts
- First Review
- January 2011
- May 2011
- September 2011

- For Comment
- For Ballot
- For Comment
- For Ballot
- DIS

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**Real World Experience**
A Vision must be compelling to the employees.
- It should be "worthy"
- It should challenge them to grow

Management must not only speak the vision, but must also live the vision.
- Communicate it
- Nurture and support it
- Empower employees to fulfill it

How do you challenge a maintenance/reliability organization?
- How to challenge the employees?

Management speaking the vision
- How?
  - Maintenance
  - Operations
  - Executives

Management living the vision
- How?
  - Maintenance
  - Operations
  - Executives
VISION VS. MISSION – THE DIFFERENCE

Vision:
- Vision is the big picture statement. It must be powerful, summarized in one memorable or motivating sentence or phrase. It should be general in scope, not restricting.

Mission:
- Mission is the answer to "What am I going to do about my vision?" This is more general than specific. The mission must inspire you and your customers. It points to the direction you are heading. It is not the map, just the compass heading.

WHAT ARE "BEST PRACTICES" IN MAINTENANCE?

Best Practices are critical success factors that enable a company to achieve an optimum and effective Asset Care Management process focusing on their Return on Investment.

Best Practices include, but are not limited to, areas such as:
- Preventive Maintenance
- Inventory and Purchasing
- Work Management
- Predictive Technologies
- Reliability Techniques
- Total Productive Maintenance

BEST PRACTICES
EVOLUTIONARY - NOT REVOLUTIONARY

Reactive Preventive Operator Involved
Predictive

T.P.M.
**WE ARE SO DIFFERENT:**

Conventional Techniques don’t Apply to US!

**Translation:**

- NOT INVENTED HERE!

**BEST PRACTICES IN MAINTENANCE MANAGEMENT**

*Why Do Companies have Problems Understanding Maintenance?*

- They don’t see the value of the maintenance function due to the fact they have never learned to measure it.
- Since they don’t measure it, they can not manage it.
- Without this understanding, they can not comprehend how their future hinges on maintenance / asset management

**BEST PRACTICES IN MAINTENANCE MANAGEMENT**

*Past Attempts…*

- Changing Organizational Structures
- Changing Reporting Structures
- Upsizing
- Downsizing
- Contracting Out
- Centralization
- Decentralization
- Team structures

**BEST PRACTICES IN MAINTENANCE MANAGEMENT**

*Atrocities…*

- Many of these attempts to improve were unsuccessful, simply because they were more of a knee-jerk reaction to a problem.
- They were never implemented as part of a long range strategic plan.
- How to Start Developing a Strategic Plan??
### Strategic Business Planning

- **Primary Steps for Maintenance Management:**
  - The Goals and Objectives are set
  - The organizational structure is implemented
  - The roles and responsibilities are defined
  - The staffing and skill requirements are determined
  - Develop Performance Indicators

### Equipment or Asset Maintenance Management

A typical definition of Maintenance (Asset) Management is “the management of all assets owned by a company, based on maximizing the return on investment in the asset”. This encompasses the philosophies contained in many of the more popular techniques currently being utilized by companies today.

### The Maintenance Management Pyramid

1. **Preventive Maintenance**
2. **CMMS**
3. **Technical and Interpersonal Training**
4. **CMMS**
5. **Total Productive Maintenance**
6. **Financial Optimization**
7. **Reliability Centered Maintenance**
8. **Operations Involvement**
9. **Predictive Maintenance**
10. **Stores and Procurement**
11. **Work Flow System**
12. **Continuous Improvement**

This pyramid represents the various components and priorities of maintenance management, from preventive maintenance at the bottom to continuous improvement at the top.
Preventive Maintenance is the heart of TPM and the core of every maintenance strategy.

PM Program Development

- Basics - Inspections, Lubrications, & Adjustments
- Must be "Owned" by the maintenance, operations, facilities, & engineering departments
- PM Program must be flexible
- All data must be recorded

The Maintenance Management Pyramid
**Best Practices in Maintenance Management**

**Current Conditions**
- Poor Service Levels
  - Results in “Hoarding & Pirating”
- Inaccuracies in Stock Counts
  - Delays in Work Execution
- No Tracking of Remote Stores
  - Results in excessive inventory

**Best Practices**
- 95 - 97% Service Levels
- 100% accuracy of data
- > 1 turn per year on inventory value
- Elimination of non-moving spares
- Reduction of slow moving spares
- Controlled Access
- Consignment arrangements
- Strategic Partnering with suppliers

**The Maintenance Management Pyramid**

**Work Order System Analysis**

- **Satisfied**
- **Not using W.O.**
- **Not satisfied**
BEST PRACTICES IN MAINTENANCE MANAGEMENT

Maintenance Planners

USE PLANNERS “Correctly”

NO PLANNERS Or “Incorrectly”


BEST PRACTICES IN MAINTENANCE MANAGEMENT

Craft Backlogs

KNOW BY CRAFT

DON’T KNOW BY CRAFT


BEST PRACTICES IN MAINTENANCE MANAGEMENT

The Maintenance Management Pyramid

Stores and Procurement Work Flow System CMMS

Preventive Maintenance


BEST PRACTICES IN MAINTENANCE MANAGEMENT

Percent of CMMS Usage

% Utilization

BEST PRACTICES IN MAINTENANCE MANAGEMENT

The Maintenance Management Pyramid

- Stores and Procurement
- Work Flow System
- CMMS
- Technical and Interpersonal Training

- Preventive Maintenance

SERVICE LIFE VS. DESIGN LIFE

Why is this important to a Maintenance Professional?

ISO 15686

The "bath tub" curve hazard function

BEST PRACTICES IN MAINTENANCE MANAGEMENT

Education

If you think education is expensive;
Try to count the cost of ignorance.
Importance of Training

80% of the skills of those now working in technical areas will be obsolete in three to five years.

TPM for America, page 52

Training Value

With a good crew one would make the inspections; with a poor crew, one would rather take a calculated risk of a failure up to a certain level of severity.

Training Statistics

- Expenditures per employee - $649.00
  - $607 – Low to $1,956.00 – High
- Percentage of payroll – 1.81%
  - 1.65% - Low to 4.39% High
- Employees per Trainer – 312
  - 97 to 1 – Low to 396 to 1 – High
- Percentage of Expenditures to Outside Firms
  - 25% was average – 31% was high
- Classroom Training – 60% of time
- Technology Training vs. Total – 22%

The Maintenance Management Pyramid

Operations Involvement

Stores and Procurement | Work Flow System | CMMS | Technical and Interpersonal Training

Preventive Maintenance
BEST PRACTICES IN MAINTENANCE MANAGEMENT

Operations Involvement
- This aspect varies dramatically between companies
- Union Agreements, Skill Levels, Types of Industry, Age of Equipment, and Staffing all impact the level of involvement
- Facilities will utilize “Occupant Involvement”
- Motive should not be “Downsizing”
- Focus on relieving maintenance personnel to perform higher level activities

BEST PRACTICES IN MAINTENANCE MANAGEMENT

Predictive Maintenance
- Focus on eliminating all critical equipment breakdowns
- Use the right techniques and tools for the right equipment
- Common tools include:
  - Vibration Analysis
  - Oil Analysis
  - Thermography
- Must capture data in CMMS

BEST PRACTICES IN MAINTENANCE MANAGEMENT

The Maintenance Management Pyramid

Cost of Maintenance
- Breakdown Maintenance
  - $17 - $18 per installed HP / YR
- Preventive Maintenance
  - $11 - $13 per installed HP / YR
- Predictive / Condition Monitoring
  - $7 - $9 per installed HP / YR
BEST PRACTICES IN MAINTENANCE MANAGEMENT

The Maintenance Management Pyramid

Preventive Maintenance

RCM

- RCM will help optimize the preventive and predictive maintenance programs
- This insures companies optimize their investment in the PM/PDM programs
- In addition to optimizing the maintenance resources, the equipment uptime increases and a corresponding increase in production occurs

RCM Consists of ...

- Functions
- Functional failures
- Root causes
- Failure effects

Based on the type of failure
Develop an appropriate maintenance strategy

The Maintenance Management Pyramid

Preventive Maintenance
**BEST PRACTICES IN MAINTENANCE MANAGEMENT**

**Total Productive Maintenance**

- Operation
- Maintenance
- Design Engineering
- Purchasing
- Production Engineering
- Inventory
- Management
- Project Engineering

**TPM Definition**

TPM merges total employee involvement, quality improvement, and state of the art maintenance technology to improve the equipment capacity utilization of a plant and the quality of the product.

TPM for America, Herb Stienbecker

**BEST PRACTICES IN MAINTENANCE MANAGEMENT**

**The Maintenance Management Pyramid**

- Total Productive Maintenance
- Financial Optimization
- Predictive Maintenance
- Operations Involvement
- Reliability Centered Maintenance
- Stores and Procurement
- Work Flow System
- CMMS
- Technical and Interpersonal Training

**Financial Optimization**

- Once the maintenance and production components of the organization are controlled and focused, the next step is to optimize the financial impact on all parts of the company.
- Since the data is available, the consideration of all of the costs allow for an optimal financial decision to be derived.
BEST PRACTICES IN MAINTENANCE MANAGEMENT

MAXIMUM PROFITS
How Can Total Costs Assist in Maximizing Profits?

Consider the Following Areas:
1. Whether to Perform PM or Run to Failure
2. When to Perform Maintenance on Equipment
3. Whether to use Predictive Maintenance on Equipment and How Much to Invest
4. Whether to Replace or Repair Capital Assets
5. Which Type of Equipment to Purchase
6. How Many Units of a Critical Spare to Keep in Stock
7. How to Set the Reorder Level and Reorder Quantities for a Stock Item

BEST PRACTICES IN MAINTENANCE MANAGEMENT

The Maintenance Management Pyramid

Continuous Improvement – The Key to Competitiveness

“Best is the enemy of Better”
Benchmarking Definition

- “It is the process of continuously comparing and measuring and organization with business leaders anywhere in the world to gain information that will help the organization take action to improve it’s performance.”

Types of Benchmarking...

Of the Types of Benchmarking...

- **Best Practice is Superior**
  - Provides the opportunity to make the most significant improvement
  - Provides the opportunity for the highest Returns On the Investment
  - Provides the greatest potential for major breakthroughs

Attitude?

- It appears that each refinery’s performance reflects the collective attitude and spirit of the refinery personnel more than any other single factor examined.

Approach #1

- Repair Focused Organizations
  - This organizational style embraces the philosophy that equipment will fail and the mission of the maintenance force is to respond quickly to equipment in distress.
  - No opportunity to examine failure causes
  - When not fire fighting, focus on low priority work to stay busy.
Real World Experience

**BEST PRACTICES IN MAINTENANCE MANAGEMENT**

**Approach #2**

- Reliability Focused Organizations
  - Maintenance repairs in this style are viewed differently. They are not expected to happen but viewed rather as exceptional and resulting from some flaw of maintenance policy and management focus.
  - The specter of a recurring failure and its incumbent cost is unacceptable.

**BEST PRACTICES IN MAINTENANCE MANAGEMENT**

**Hierarchical Performance Indicators**

- **Corporate Indicators**
  - Financial Performance Indicators
    - Efficiency and Effectiveness Performance Indicators
  - Tactical Performance Indicators
  - Functional Performance Indicators

**BEST PRACTICES IN MAINTENANCE MANAGEMENT**

**Conclusion**

- Achieving “Best Practice” is being the best in your business.
- It is the ability to compete with any other company in your business in product/service price, quality, and timeliness of service.
- It is an attitude accompanied by business results.
- Maintenance is a big business –
- Are you striving for “Best Practice” Status??

**BUSINESS DEVELOPMENT CASE**

- Develop the Business
  - Mission – Vision Statements
- Organize to Execute the Business Plan
  - Geographical and Reporting Structures
  - Roles and Responsibilities
  - Determine Staffing Levels
- Develop a Performance Management System
  - Determine Linkage necessary to connect the maintenance and reliability business to corporate business objectives (Profitability)
OPTIMIZED BUSINESS ORGANIZATIONS

- To properly enable an organization, all of the following must be understood:
  - Business Objectives
  - Organizational structures
  - Roles and responsibilities
  - Staffing levels
- This methodology will insure an organization will be optimized

BUSINESS DEVELOPMENT - STEP 1

- Determining what the organization has for goals and objectives

GOALS & OBJECTIVES

- "FIX IT When It Breaks" - - Is not a goal for the maintenance department
- "If it Ain’t Broke Don’t Fix It" is not the Departmental Philosophy for Maintenance.

WHAT IS THE OBJECTIVE FOR THE MAINTENANCE/ RELIABILITY BUSINESS?

- The objective is to maintain the capability of the company’s assets to perform their designed function thereby maximizing the Company’s Return on Investment in the asset(s)

- With this in mind, "Who is the "Real Customer" for the Maintenance Business within any Company?"
WHAT IS THE OBJECTIVE FOR THE MAINTENANCE/RELIABILITY BUSINESS?

3. Reduce energy consumption to as low as level as possible.

OBJECTIVES FOR THE MAINTENANCE/RELIABILITY BUSINESS

- Maximum throughput/availability at the lowest cost, the highest quality, and the optimum safety standards
- Identify and implement cost reductions
- Provide accurate equipment maintenance records
- Collect necessary maintenance cost information
- Optimize maintenance resources
- Optimize capital equipment life
- Minimize energy usage
- Minimize inventory on hand
- Responsibility for Environmental, Safety and Health.
BUSINESS DEVELOPMENT -STEP 2

- Determine the correct organizational structure for the function
- Geographical and Functional

WHEN TO USE???

- Central - Geographically compact sites
- Area - Geographically dispersed
- Combination - Large sites where areas cannot cost effectively utilize all skilled labor resources required

## MAINTENANCE ORGANIZATIONS

<table>
<thead>
<tr>
<th></th>
<th>Centralized</th>
<th>Area</th>
<th>Combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher Utilization</td>
<td>Lower Utilization</td>
<td>Optimum Utilization</td>
<td></td>
</tr>
<tr>
<td>Slower Response</td>
<td>More Rapid Response</td>
<td>Optimum Response</td>
<td></td>
</tr>
<tr>
<td>Labor Pool</td>
<td>Equipment Ownership</td>
<td>Optimized Resources</td>
<td></td>
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</tbody>
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TYPICAL PRODUCTION CENTRIC ORGANIZATIONAL STRUCTURE

The “Shot Gun” Organization (SBU)

*STEP 3*

Determine the roles and responsibilities that must be developed to meet the goals and objectives based on the organizational structure.
MAINTENANCE SUPERVISOR OR COACH

- Directs maintenance work force providing on-site expertise
- Ensures work is accomplished in safe, efficient manner
- Coordinates work planning and scheduling with the planner
- Ensures quality assurance of work
- Ensures equipment availability is adequate to meet profit plan
- Works with Plant/Production foreman to ensure first line maintenance is being done by operators
- Verifies the qualifications of hourly personnel and recommends training as needed
- Enforces Environmental Covenant
- Focuses downward and is highly visible in the field
- Champions proactive maintenance versus reactive maintenance
- Administers the Union Collective Bargaining Agreement
- Monitors CMMS
- Implements P.M. & P.D.M. Programs

MAINTENANCE PLANNER

- Plans, Schedules and Coordinates corrective and preventive maintenance activities by studying and managing work requests, analyzing job requirements, and determining materials, equipment and labor needs (i.e. blueprints, tools, parts, craftsmen) in order to complete maintenance economically and efficiently.
- Develops a weekly maintenance schedule and ASSISTS the Maintenance Foreman in determining job priorities. Makes changes and adjustments to the schedule and work plans after a review with the Foreman. Maintains a complete and current backlog of work orders.
- Assures CMMS software data files are complete and current by gathering equipment and associated stores information of the entire Plant/Lease and developing standardized codes for equipment, stores, and task/craft assignments for all maintenance activities.
- Controls inventory by ordering, issuing, returning, adjusting, and receiving stores.
- Identifies, analyzes, and reviews maintenance problems with Maintenance Engineering and revises the maintenance management program as necessary to improve and enhance plant and field operations. Assists in the education of maintenance management to operations personnel.

THE MAINTENANCE BUSINESS

- These two pages of bullet items are required to start a maintenance business
- However, to fully develop the business more is required
- The following is required to develop a competitive maintenance business—

MAINTENANCE/ RELIABILITY ENGINEER

- Insures that equipment is properly designed, selected and installed based on life cycle philosophy.
- Ensures that equipment is performing effectively and efficiently.
- Establishes and monitors programs for engine/compressor analysis and vibration and other condition monitoring techniques.
- Reviews deficiencies noted during corrective maintenance.
- Provides technical guidance for CMMS.
- Maintains and advises on use and disposition of stock, surplus, and/or rental rotating equipment.
- Promotes equipment standardization, recommends spare parts levels and coordinates sharing of spare parts with other asset teams.
- Available for consultation with maintenance technicians.
- Monitors new technology and keeps management/staff appraised on the new developments.
MAINTENANCE/ RELIABILITY ENGINEER-2

- Champions quality assurance services including shop qualifications for outside services.
- Develops standards and procedures for major maintenance jobs.
- Periodically makes cost/benefit review of maintenance management programs for areas of responsibility and exchanges information across asset teams.
- Provides technical guidance for PM and PDM programs.
- Monitors competitors' activities in the field of Maintenance Management.
- Focal point for monitoring performance indicators for maintenance management program.
- Optimizes maintenance strategies.
- Focal point for analyzing equipment operating data.

MAINTENANCE MANAGER

- Responsible for the entire maintenance function, including the planning, supervising, and engineering staffs.
- Coordinates closely with counterparts in other in-house organizations.
- Promotes proper understanding of the maintenance function to other organizations.
- Ensures that all supervisors, planners, technicians, and maintenance engineers are properly educated and trained.
- Takes responsibility for planning, cost control, union activities, vacation planning, etc.
- Has responsibility for delegating assignments to the appropriate personnel.

GOLDSMITH’S LAW

- Silence gives consent

BUSINESS DEVELOPMENT - STEP 4

- Building a business ultimately must address the issue of number of employees in the organization.
- However, this is a later event - after the other decisions are made....
MAINTENANCE STAFFING

- Levels of skills required are also a deciding factor.
- Traditional craft skills
- Multi-craft skills
- Super Craft Skills
- Operator Based Maintenance
- Maintenance Based Operations

HISTORY...

For the past decade, American business has been in denial about long term workforce development and instead, has fixated on short term profit strategies such as global repositioning, outsourcing, or importing temporary workers.

TRAINING

"Training less to save money is like stopping the clock to save time."

John Tobin
CEO
Siemens Corporation

MAINTENANCE STAFFING OPTIONS

- Complete In-House Staff
- Combined In-House/Contract Staff
- Contract Maintenance Staff
- Complete Contracting Maintenance Staff
MAINTENANCE STAFFING

- Maintenance staffing levels should be determined by craft backlogs using the following formula.

\[
\text{Craft backlog} = \frac{\text{Open work orders ready to schedule}}{\text{Craft Capacity}}
\]

Where:
- Open work orders ready to schedule
- Craft Capacity

TANK ILLUSTRATION

- Real World Experience.

BACKLOGS AND TEAMS

- Teams still have a maintenance workload for their equipment.
- They must allocate enough team resources to accomplish their work in a timely fashion.
- Team backlogs should also be in a two to four week window...
- Resource allocation

BUSINESS DEVELOPMENT STEP 5 - PERFORMANCE INDICATORS

- After:
  - The goals and Objectives are set
  - The organizational structure is implemented
  - The roles and responsibilities are defined
  - The staffing and skill requirements are determined
- Performance Measures are developed that deal with the functions, the tactics, the efficiency and effectiveness, and the financial metrics to insure the organization is managed correctly.
Performance Management and KPI's

- Corporate Indicators
- Financial Performance Indicators
- Efficiency and Effectiveness Performance Indicators
- Tactical Performance Indicators
- Functional Performance Indicators

ASSET MANAGEMENT INDICATORS

- Return on Assets
- Overall Equipment Effectiveness
  - Measured at the "equipment" level
  - All initiatives to improve must be financially justified

THE MAINTENANCE/RELIABILITY BUSINESS -

- Is it a "business" in your Company?

The challenge is whether or not you can use this information or adapt this information to insure that your company will develop and optimize your Maintenance/Reliability Business.
In almost every industry, under the same rules and with the same players, the successes of a few companies rebut the excuses of the many.

**LESSON OUTLINE**
- Defining Benchmarking
- Defining Core Competencies
- Types of Benchmarking
- Developing a Maintenance Strategy
- Conducting a Benchmarking Project

**Benefiting from Benchmarking**
- Provides a measure for the benchmarked process among the target organizations
- Describes the organization's gap in performance as compared to the measure
- Identifies best practices and enablers that produced the results observed during the study
- Sets performance goals for the process and identifies actions that can be taken to improve performance
**Management**

If you don't measure it, You don't manage it!

---

**S-M-A-R-T**

- Specific
- Measurable
- Achievable
- Realistic
- Timeframed

---

**Benchmarking**

**Gap Analysis Measurement**

**Baseline**
The foundation
Where we are now

**Entitlement**
The best we can achieve by effective utilization of current resources

**Benchmark**
Best-in-class performance for a truly optimized process

---

**Gap Analysis**

Performance

Best Practice

Our Company

Today
Gap Analysis

Performance  Best Practice

Benchmark Gap  Your Performance

Today

Performance  Best in Class

Leadership Goal  Parity Goal

Gap  Your Performance

Today

Leadership Position (T-3) is when you have Exceeded your partner’s Performance.

This parity goal (T-2) Is the time to achieve A real time parity With the partner.

The parity goal is Focused on achieving The level of performance They are currently achieving T-1 is the time to Achieve this level of performance

Warfare

1) Become the Enemy
2) Think yourself in the enemy’s position

Miyamoto Musashi

Become the Enemy Think yourself in the enemy’s position
**Code of Conduct for Benchmarking**

- Keep it legal
- Be willing to give what you get
- Respect Confidentiality
- Keep information internal
- Use benchmarking contacts
- Don't refer without permission
- Be prepared from the start
- Understand expectations
- Act in accordance with expectations
- Be Honest
- Follow through with commitments

---

**Benchmarks**

**Too Fluid?**

A benchmark performance does not remain a standard for long.

*Continuous Improvement Must be the goal.*

---

**Competition**

Just as water retains no constant shape, so in warfare there are no constant conditions.

The same applies in business

---

**Benchmarking Checklist**

- Plan
- Search
- Observe
- Analyze
- Adapt
- Improve
CHECKLIST

This checklist is modified from a quality benchmarking checklist developed by Gregory Watson –
- Considered one of the original Benchmarking Gurus
- This list is modified to reflect maintenance parameters in a benchmarking project.

Plan
What is our maintenance mission?
What is our maintenance process?
How do we measure it?
How well is our maintenance performing today?
Who is the customer for maintenance?
What services does maintenance deliver?
What services do the customers for maintenance expect or require?
What is the performance goal?
How was this goal established?
How does our maintenance compare with our competitors?

Search
What companies do better with their maintenance?
Which company is considered to be the best at maintenance?
What can we learn from this company?
Who should we contact to determine if they are willing to participate in our benchmarking study?

Observe
What is their maintenance mission?
What are their performance goals?
How well does their maintenance Strategies perform over time and/or at multiple locations?
How do they measure maintenance performance?
What enables the performance of maintenance?
What factors could prevent us from adopting their maintenance policies and practices into our organization?
**Analyze**

- What is the nature of the performance gap?
- What is the magnitude of the performance gap?
- What characteristics distinguish their process as superior?
- What activities within our process are candidates for change?

**Adapt**

- How does the knowledge about their maintenance process enable us to change our maintenance process?
- Should we redefine or reset our performance measures based on this benchmark?
- What parts of their maintenance process would have to be changed or modified to be adapted into our business environment?

**Improve**

- What have we learned that would allow us to improve upon a "Superior" maintenance process?
- How can we implement these changes into our maintenance process?

**Traps to Benchmarking**

- The fear of being seen as copying
- The fear of losing competitive advantage by sharing information
- Arrogance
  - "We are the Best"
  - But, How do you know?
- Convenient Benchmarking
- Impatience
  - "Action without Planning"
  - "Industrial Tourism"
- Not doing it at all
Benchmarking Projects
7 step procedural review

- Expose management to the concepts of benchmarking
- Develop a project cost estimate
- Conduct the project in a way that insures its success – (planning)
- Ensure the project follows a disciplined process
- Report interim and final results to management
- Facilitate the changes recommended by the study
- Monitor the results of the implementation

Benchmarking Projects
7 step procedural review

- Expose management to the concepts of benchmarking
- Develop a project cost estimate
- Conduct the project in a way that insures its success – (planning)
- Ensure the project follows a disciplined process
- Report interim and final results to management
- Facilitate the changes recommended by the study
- Monitor the results of the implementation

BENCHMARKING...

It is necessary to explore the tangible and intangible factors that combine to produce a superior performance and to involve those people most directly concerned in the activity being examined.

SURVEY OVERVIEW

The following slides will provide an interesting comparison.
- The first slide is the Reliability Web Survey
- The second overlays the University database
  - 200 additional companies

SURVEY OVERVIEW

The following slides will provide an interesting comparison.
- The first slide is the Reliability Web Survey
- The second overlays the University database
  - 200 additional companies

RW Survey

Organization 40
Training
Work Order
Planning & Scheduling
C.I.
Fin Opt
Gen Prac
Reliability
PDM
CMMS/ EAM
Operations Inv.

RW Survey

Organization 40
Training
Work Order
Planning & Scheduling
C.I.
Fin Opt
Gen Prac
Reliability
PDM
CMMS/ EAM
Operations Inv.
**Reliability Web Survey**
- Very Strong in PDM
- University Database
  - Inventory Strong
  - General maintenance practices strong

**Waste Water Database**
- Followed General trends of University Database
- Slightly above average in basics
OBSERVATIONS FROM THE INTERNATIONAL SURVEY

The following observations are derived from analysis of the data collected during the Reliability Web Benchmarking Survey.

These results will reflect a blend of almost 50% US companies along with 50% of International respondents.

ORGANIZATIONS

Strengths
- Organizational Charts
- Roles & Responsibilities
- Supervisor Rations –
  - 80% less than 16:1
  - Majority at 8-12:1
- Planners
  - 64% used planners

Weaknesses
- Organization Effort and Attitude
  - 32% Above Average
  - 46% Average
  - 22% Below Average
- Planners
  - 37% with Acceptable Ratios
- Incentive Plan
  - 19% Were Tied to a plan

TRAINING

Strengths
- 47% use a mix of classroom and lab training for technicians
- 43% use a mix of in-house and contract training instructors

Weaknesses
- Only 19% of salaried supervisors have a career training program
- 70% do not train their planners
- 50% rate the skill of their technicians as fair or poor

WORK ORDER/ WORK FLOW

Strengths
- 63% close over 3/4ths of all work orders within 8 weeks of the original request
- 25% generate over ½ of all work orders from their preventive or predictive maintenance inspections

Weaknesses
- Only 30% report 100% of their labor hours to work orders
- Only 32% report 100% of their material issues to work orders
- Only 35% report 100% coverage of maintenance work by work orders
**PLANNING AND SCHEDULING**

**Strengths**
- 31% report less than 10% of all their plans experience a delay in work execution due to a poor plan
- 55% schedule maintenance weekly
- 45% have weekly maintenance/production schedule meetings
  - 30% daily

**Weaknesses**
- 99% did not include tools in their work order plans
- Only 34% tracked a backlog of work by craft
- Only 20% tracked their work by date needed by
- Almost ½ of all respondents checked less than 50% of the estimates versus actuals for work order planning and execution performance

---

**PREVENTIVE MAINTENANCE**

**Strengths**
- 84% have detailed inspection checklists
- 79% have detailed lubrication checklists
- 17% use operations personnel to perform their PM tasks

**Weaknesses**
- 66% include some form of PDM technique in their asset care program
- Over 50% fail to audit their PM program annually for coverage
- 57% Still use only time based PM’s

---

**INVENTORY AND PURCHASING**

**Strengths**
- 70% of the respondents allowed maintenance to specify spare parts and stocking levels
- 57% had aisle and bin locations for 90%+ of the inventory

**Weaknesses**
- Only 20% have an inventory service level of 95%+
- Over 20% of the respondents had less than 50% of all of their spare parts in the inventory system
- 1/3rd of all respondents tracked less than 70% of all material issues to a work order
CMMS/ EAM SYSTEMS

Strengths
- 53% of respondents have involved more than 90% of their organization in CMMS/ EAM Usage
- 33% used the data in the system to make cost based management decisions
- 29% used the data in the system to track progressive return on investment

Weaknesses
- Integration to:
  - Production Scheduling
  - Payroll/ Timekeeping
  - Financial/ Accounting
- Only 37% felt 3/4ths or more of their personnel were proficient using their system

MAINTENANCE REPORTING

Strengths
- 35% distribute 90% of their reports on a timely basis

Weaknesses
- While 51% reviewed equipment by downtime – only 24% examined equipment by Downtime Cost
- Only 44% examined PM as % of total Activities
- Less than 1/3 compared actuals to plan
- Only 40% had an inventory valuation report
- Only 14% had a Buyer performance report

LATEST ADDITIONS TO SURVEY
**PREDICTIVE MAINTENANCE**

**Strengths**
- 92% some form of Vibration Analysis
- 87% some form of thermography
- 92% some form of oil analysis
- 70% some form of ultrasonics

**Weaknesses**
- 59% have no connection between their PDM system and their CMMS/EAM

---

**RELIABILITY ENGINEERING**

**Strengths**
- 67% of the organizations are developing a reliability work culture

**Weaknesses**
- 56% of the organizations do not use RCM methodologies to adjust/refine their PM/PDM programs
- Over 50% of the companies say their work order system is inaccurate when it comes to tracking causes of failures
- 52% of the organizations have no measures to track the effectiveness of their reliability efforts

---

**MAINTENANCE – GENERAL PRACTICES**

**Strengths**
- 58% calculate and track equipment availability on the majority of the equipment
- 47% have a total organization focus on equipment reliability/availability
- 72% have some form of operator involvement in maintenance

**Weaknesses**
- 64% do not communicate the financial effects of equipment availability/reliability within the organization
- 17% do not have their equipment/process meeting regulatory requirements
- Over ½ are not conducting technical training for the organization

---

**FINANCIAL OPTIMIZATION**

**Strengths**
- 84% track downtime duration for their key assets
- 86% track downtime causes for their key assets
- 78% track maintenance costs for their key assets

**Weaknesses**
- 28% track all related impact costs (energy, quality, contracting)
- 22% examine all cost factors when making decisions concerning their assets
- Over 50% do not examine efficiency losses on the majority of their equipment
- 29% do not accurately track material costs
### Asset Care — Continuous Improvement

**Strengths**
- 58% management shows visible support for C.I. efforts
- 62% entire organization supports C.I. efforts
- 71% Management supports on-going training to improve employee skills

**Weaknesses**
- 46% do not track ROI on the C.I. efforts
- 63% do not link C.I. to reliability engineering
- 27% have poor relations between plant management and labor

### Maintenance Contracting

**Strengths**
- 78% have joint responsibilities for safety between the company and contractor
- Over 50% have the contracting system linked electronically with their CMMS/ EAM

**Weaknesses**
- Only 24% have an individual dedicated to the contracting process
- 28% have no electronic system to track contracts

### Document Management

**Strengths**
- 40% have their document management system interfaced with other systems
- 42% have established document control procedures

**Weaknesses**
- 59% have less than ½ of their drawings in the system
- 21% have poor version control procedures
- Only 44% allow maintenance technicians direct access to the system

### RW Survey

![RW Survey Diagram]
**BENCHMARKING SURVEY??**

- Why is this important?
- What does it mean to your company?

**BENCHMARKING AND CHANGE...**

- The gap between present and Best Practice promotes dissatisfaction and desire for change
- Seeing, understanding, and learning from Best Practice helps to identify what and how to change
- Witnessing Best Practice provides a realistic, achievable picture of the desired future

**CHANGE??**

- Why should "We have always done it this way" be a reason for continuing to do something?
- Annual objectives based on past performance plus or minus 10% are meaningless in a period of rapid change!!

**BENCHMARKING...**

- It is necessary to explore the tangible and intangible factors that combine to produce a superior performance and to involve those people most directly concerned in the activity being examined.
**BENCHMARK CAUTIONS**

- To fluid because world standards are rapidly improving
- To modest for corporate goals

**Benefiting from Benchmarking**

Provides a measure for the benchmarked process among the target organizations

Describes the organization’s gap in performance as compared to the measure

Identifies best practices and enablers that produced the results observed during the study

Sets performance goals for the process and identifies actions that can be taken to improve performance

**BENCHMARKS TOO FLUID?**

- A benchmark performance does not remain a standard for long
- Continuous improvement

**BENCHMARKS ARE GOOD FOR?**

- Finding process improvements
- Arousing people to the challenge
- Setting milestone targets
MAINTENANCE/ ASSET BENCHMARKS

- The following are a series of maintenance and asset benchmarks.
- These are not specific to an industry, but represent a cross-section of industries.
- These numbers should never be used as an end-goal, but are only presented as a general guideline.

## ASSET VALUE BASED BENCHMARKS

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Low Range</th>
<th>High Range</th>
<th>Best Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance Cost/ ERV</td>
<td>2%</td>
<td>5%</td>
<td>2%</td>
</tr>
<tr>
<td>Stores Investment/ ERV</td>
<td>.8%</td>
<td>1.2%</td>
<td>1%</td>
</tr>
<tr>
<td>ERV/ Maintenance Technician</td>
<td>$4M</td>
<td>$10M</td>
<td>$7M</td>
</tr>
</tbody>
</table>

Figure 12-1

## STAFFING BENCHMARKS

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Low Range</th>
<th>High Range</th>
<th>Best Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technicians to Supervisor</td>
<td>8:1</td>
<td>15:1</td>
<td>10:1</td>
</tr>
<tr>
<td>Technicians to Planner</td>
<td>15:1</td>
<td>25:1</td>
<td>20:1</td>
</tr>
<tr>
<td>ERV/ Maintenance Engineer</td>
<td>$50M</td>
<td>$250M</td>
<td>$100M</td>
</tr>
</tbody>
</table>

Figure 12-2

## MAINTENANCE COSTS COMPARED TO TOTAL COST OF SALES

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Low Range</th>
<th>High Range</th>
<th>Best Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Maintenance Costs/Sales Cost</td>
<td>1%</td>
<td>5%</td>
<td>2%</td>
</tr>
<tr>
<td>Maintenance Labor Costs/Sales Costs</td>
<td>.6%</td>
<td>2.5%</td>
<td>1%</td>
</tr>
<tr>
<td>Maintenance Stores Costs/Sales Costs</td>
<td>.4%</td>
<td>2.5%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Figure 12-3
### MAINTENANCE PERFORMANCE

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Low Range</th>
<th>High Range</th>
<th>Best Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Order Coverage</td>
<td>60%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Preventive Maintenance Compliance</td>
<td>65%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Maintenance Schedule Compliance</td>
<td>35%</td>
<td>95%</td>
<td>95%</td>
</tr>
</tbody>
</table>

Figure 12-4

### MAINTENANCE PERFORMANCE - 2

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Low Range</th>
<th>High Range</th>
<th>Best Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planned Maintenance Work</td>
<td>35%</td>
<td>95%</td>
<td>80+%</td>
</tr>
<tr>
<td>Operator Involvement in PM</td>
<td>10%</td>
<td>40%</td>
<td>Varies</td>
</tr>
<tr>
<td>Contractor Costs/Total Maintenance Costs</td>
<td>10%</td>
<td>100%</td>
<td>Varies</td>
</tr>
</tbody>
</table>

Figure 12-5

### MAINTENANCE PERFORMANCE -3

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Low Range</th>
<th>High Range</th>
<th>Best Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM/PDM Hours/Total Hours</td>
<td>20%</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>Reactive Hours/Total Hours</td>
<td>5%</td>
<td>50%</td>
<td>&lt;10%</td>
</tr>
<tr>
<td>Productivity Rates (Wrench Time)</td>
<td>20%</td>
<td>60%</td>
<td>60%</td>
</tr>
</tbody>
</table>

Figure 12-6

### EQUIPMENT PERFORMANCE

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Low Range</th>
<th>High Range</th>
<th>Best Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment Availability</td>
<td>65%</td>
<td>99.9%</td>
<td>Varies</td>
</tr>
<tr>
<td>Equipment Efficiency</td>
<td>75%</td>
<td>95%</td>
<td>95+%</td>
</tr>
<tr>
<td>Overall Equipment Effectiveness</td>
<td>&lt;20%</td>
<td>85+%</td>
<td>Varies</td>
</tr>
</tbody>
</table>

Figure 12-7
## MAINTENANCE STORES

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Low Range</th>
<th>High Range</th>
<th>Best Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spare Parts Inventory Turns</td>
<td>.5</td>
<td>1.4</td>
<td>Varies</td>
</tr>
<tr>
<td>Stores Service Level</td>
<td>80%</td>
<td>99%</td>
<td>95-97%</td>
</tr>
<tr>
<td>Value of stores transactions per $350K</td>
<td>$600K+</td>
<td></td>
<td>Varies</td>
</tr>
</tbody>
</table>

## TRAINING

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Low Range</th>
<th>High Range</th>
<th>Best Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training Expenditure per Employee</td>
<td>$607</td>
<td>$2000</td>
<td>Varies</td>
</tr>
<tr>
<td>Training as a Percentage of Payroll</td>
<td>1.65%</td>
<td>4.39%</td>
<td>Varies</td>
</tr>
<tr>
<td>Technology Training / Total Training Expense</td>
<td>&lt;20%</td>
<td>50+%</td>
<td>Varies</td>
</tr>
</tbody>
</table>

Figure 12-9

---

**RELIABILITYWEB BENCHMARKS**


For the chapter text for this workshop:

- [http://www.maintenancebenchmarking.com/best_practices_maintenance.htm](http://www.maintenancebenchmarking.com/best_practices_maintenance.htm)

On-Line Survey

---

P. Crosby “Let’s Talk Quality”

An extensive up front audit is a way people postpone doing something useful.
WILL YOU....

- Help your company achieve the benefits available by improving maintenance??
- Utilize Benchmarking as a tool for continuous improvement??
- Benchmark for the right reasons
  - Not tourism or ego gratification
- If so- then you will be increasing your company’s competitive position!!!

THANK YOU FOR VIEWING THIS I-PRESENTATION

- If you would like additional information about Benchmarking or would like to discuss how we can help your company’s benchmarking initiative, please contact us at:
  - twireman@vestapartners.com
  - (203) 517-0400

- Or visit our website at:
  - www.vestapartners.com