



# BENCHMARKING WORLD-CLASS MAINTENANCE

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# Benchmarking

- **Benchmarking**\* is the process of comparing one's business processes and performance metrics to industry bests and/or best practices from other industries.
- Dimensions typically measured are quality, time, and cost.
- Improvements from learning mean doing things better, faster, and cheaper.

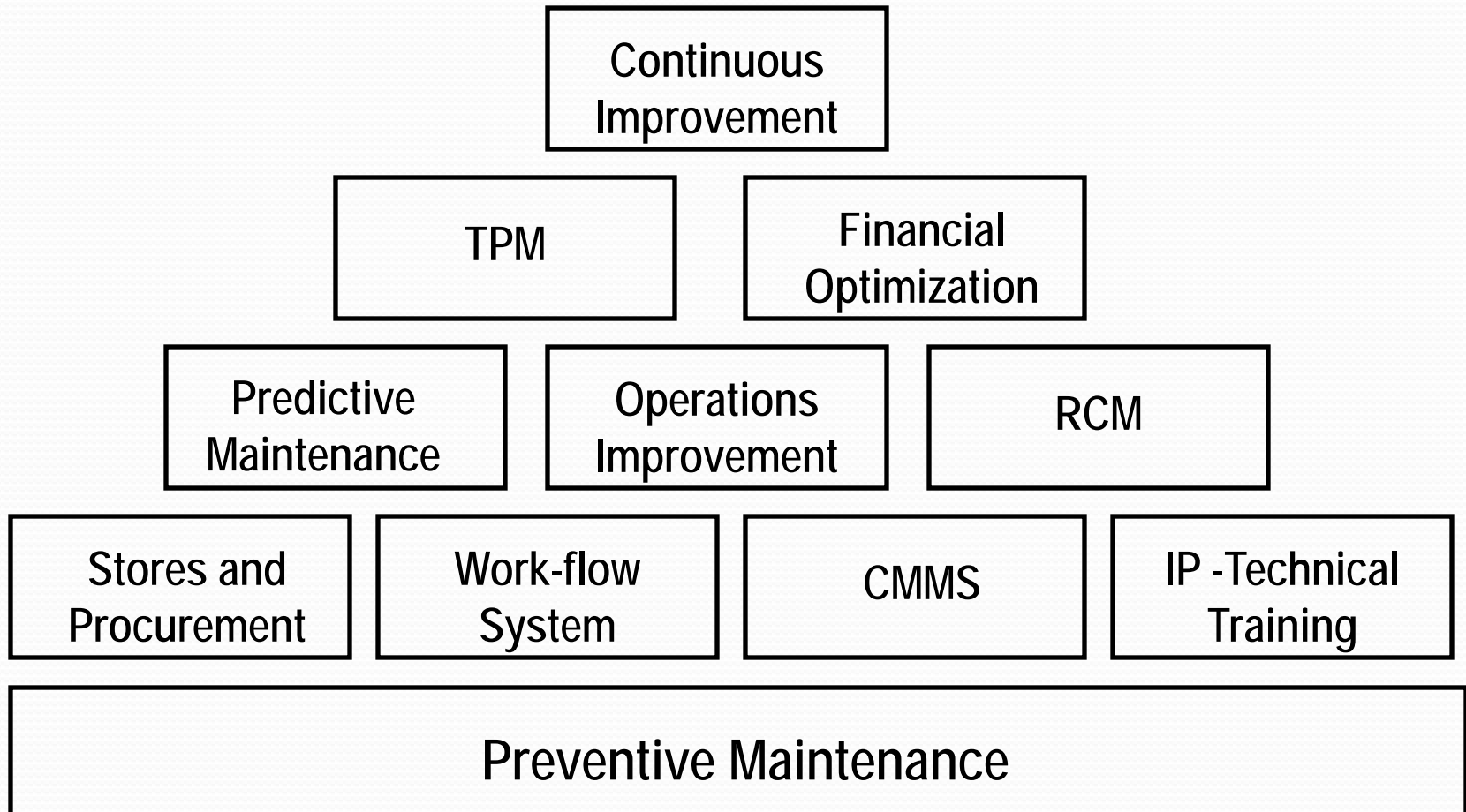
\* Wikipedia

# WHAT IS WORLD-CLASS MAINTENANCE?

1. The best “simply do the basics very well.”\*
2. The best also take a proactive approach to the management of maintenance.\*

\* Engineer’s Digest February 2001

# THE ASSET MANAGEMENT PYRAMID\*



\* Engineer's Digest February 2001

# World-Class Maintenance Best Practices

- **Planned Maintenance Work > 90%**
- **Breakdown/Crisis Work < 3%**
- **Maintenance Schedule Compliance > 90%**
- **Craftsmen per Planner = 15 to 20**
- **Maintenance Overtime < 5%**
- **Maintenance Direct Work > 65%**
- **MRO Inventory Turns > 3 per year**
- **Accurate CMMS Data**
- **Annual Maintenance Cost < 2.5% of ERC  
(Estimated Replacement Cost)**

# Characteristics of World-Class Maintenance Performance

- Clear Vision and Mission for Maintenance
- Proactive not Reactive
- Managed Costs
- Total Facility Understanding of & Participation in Maintenance
- Top Management Support

# World-Class Performance Work Management

- Planned Maintenance Work > 90%
- Breakdown/Crisis Work < 3%
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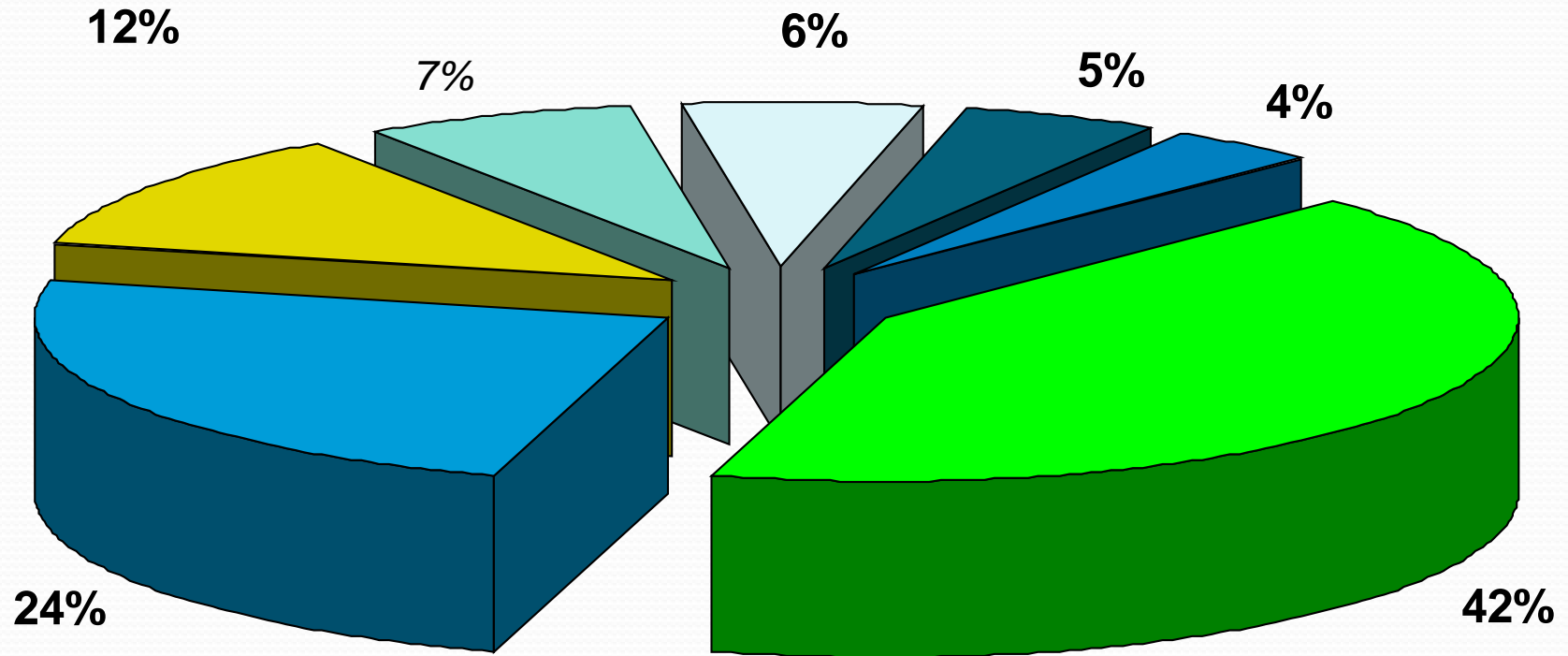
# World-Class Performance Personnel Management

- Man-hours Charged to Work Orders =100%
- Maintenance Call-in's per month < 2
- Maintenance Overtime < 5%
- Training Days per Employee Year > 15
- Maintenance Direct Work > 65%



# Maintenance *Labor Productivity*

U.S. Average Distribution of Maintenance Time



***Best Practices for Direct Work =65%***

■ Direct Work	■ Waiting	■ Unnecessary Breaks
■ Personal Breaks	■ Redo Work	■ Poor Communication
■ Late Starts/Early Quits		

# Supporting References

- Published studies show that in a **reactive** or emergency type of maintenance organization, craftworkers usually are **25-35 percent productive**. In organizations where **good planning and scheduling** disciplines are in use, however, productivity is much higher; it can often achieve levels of **60 percent or greater**- Terry Wireman, Engineers Digest
- Case studies indicate **37 to 70% gain in efficiency** in one to five (1 to 5) years after implementing **maintenance planning and scheduling** - Amoco Chemicals, Total Productive Manufacturing Manual

# World-Class Performance Material Management

- MRO Service Level  $> 95\%$
- Inventory Turns per Year  $> 3$
- Value of MRO % of ERV  $< 1\%$

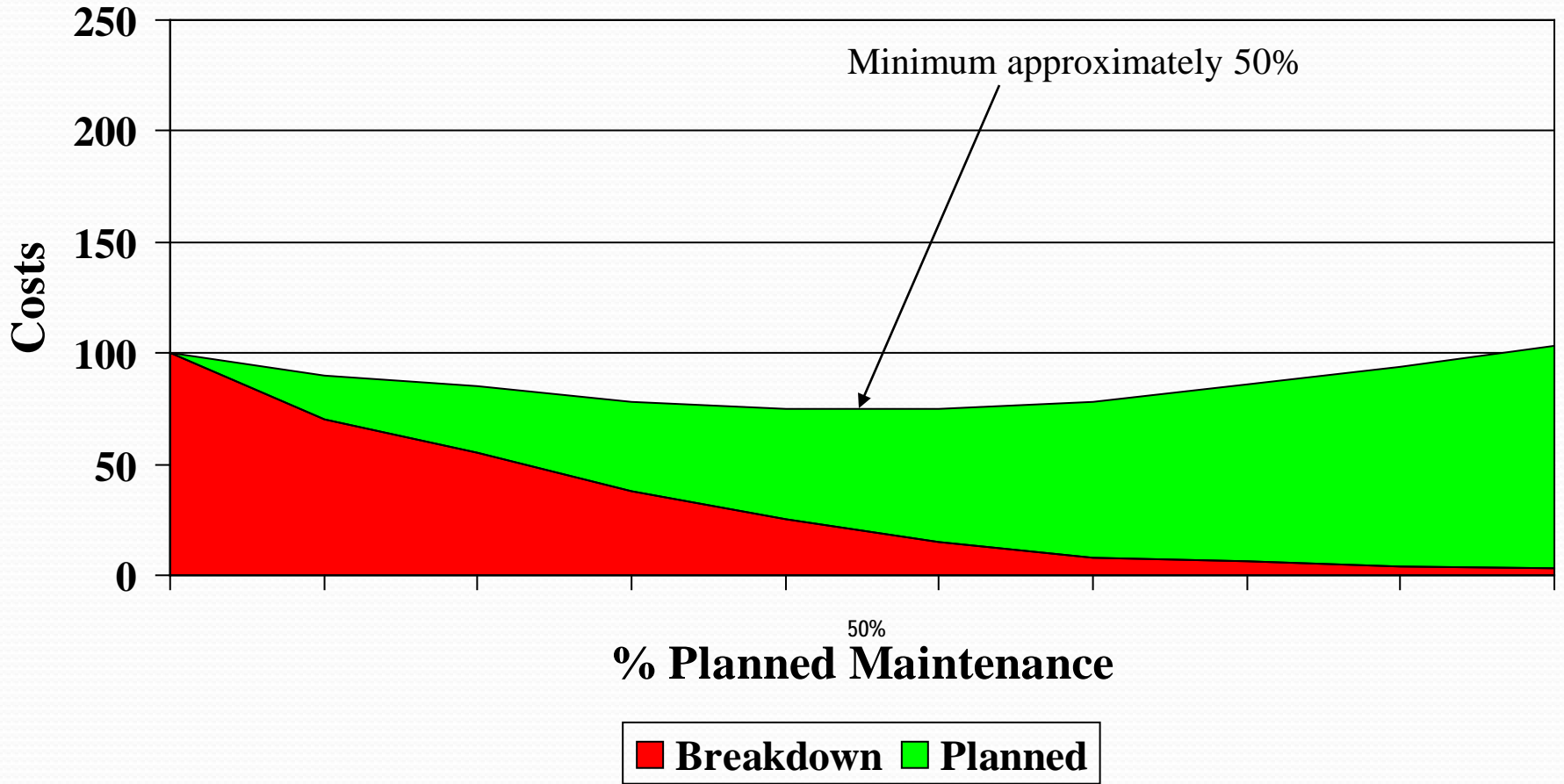
# World-Class Performance Cost Management

- Annual Maintenance Cost to Original Investment in Equipment < 3%
- Annual Maintenance Cost to Estimated Replacement Cost < 2.5%

# Direct Maintenance Costs

- **Maintenance Labor**
- **Maintenance Materials**
- **Maintenance Overhead**

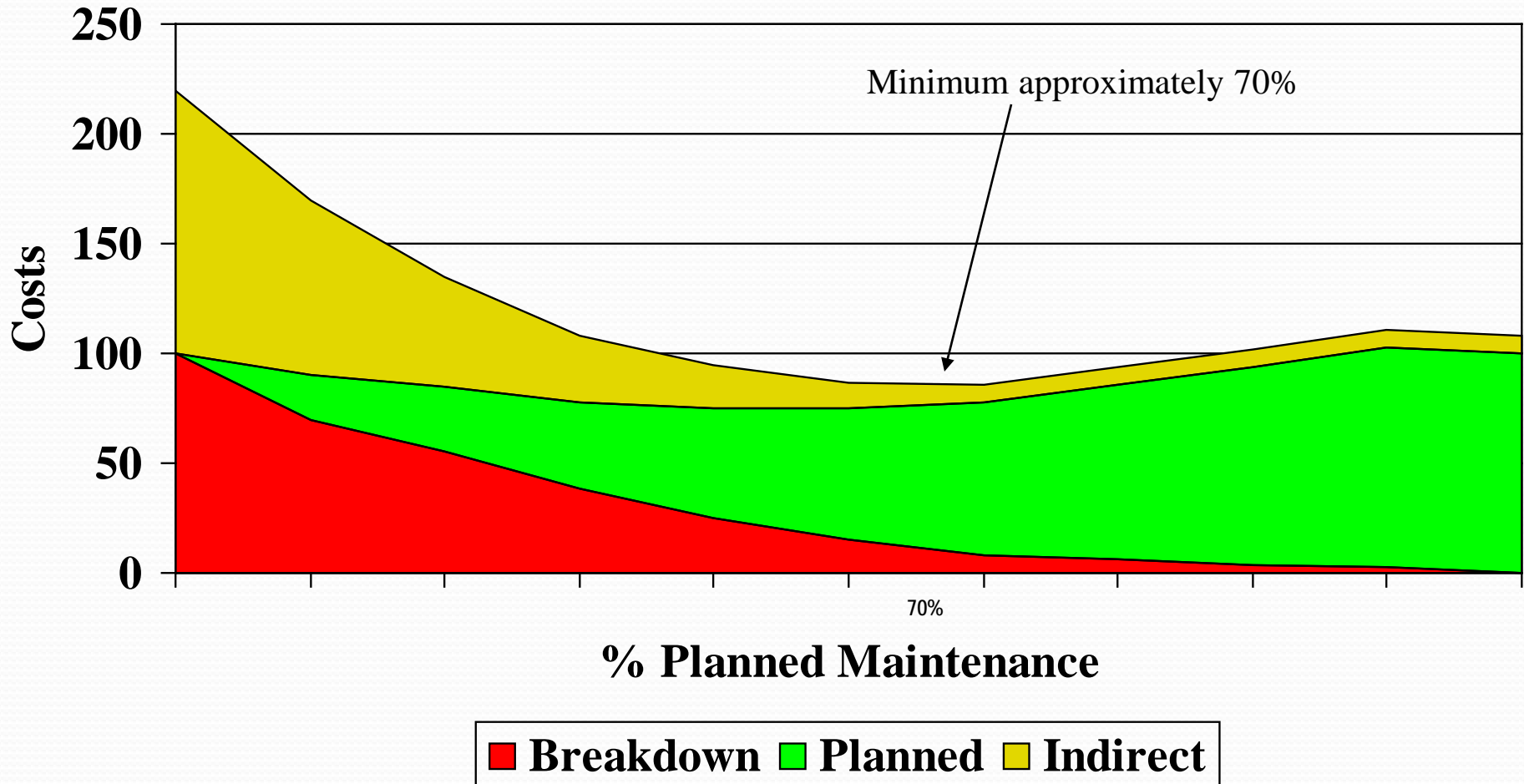
# DIRECT MAINTENANCE COST



# Indirect Maintenance Costs

- **Equipment Availability**
- **Lost Capacity**
- **Equipment Life Cycle Cost**
- **Production Overtime**
- **Idle Production Personnel**
- **Scrap and Rework**
- **Expedited Shipments**
- **Late Deliveries**
- **Lost Customers**

# TOTAL MAINTENANCE COST





# The Hidden Cost of Poor Maintenance

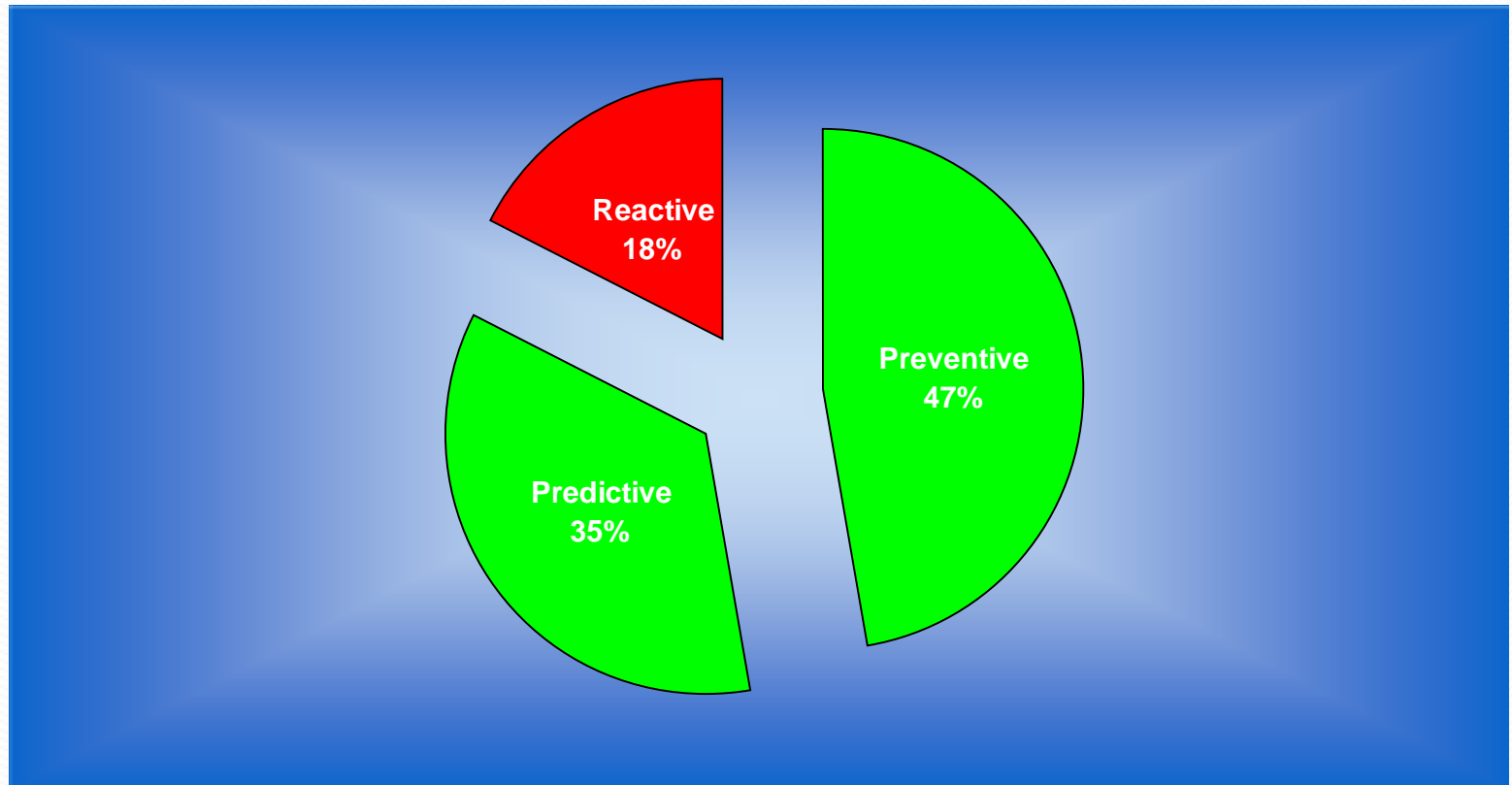


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# Levels of Maintenance

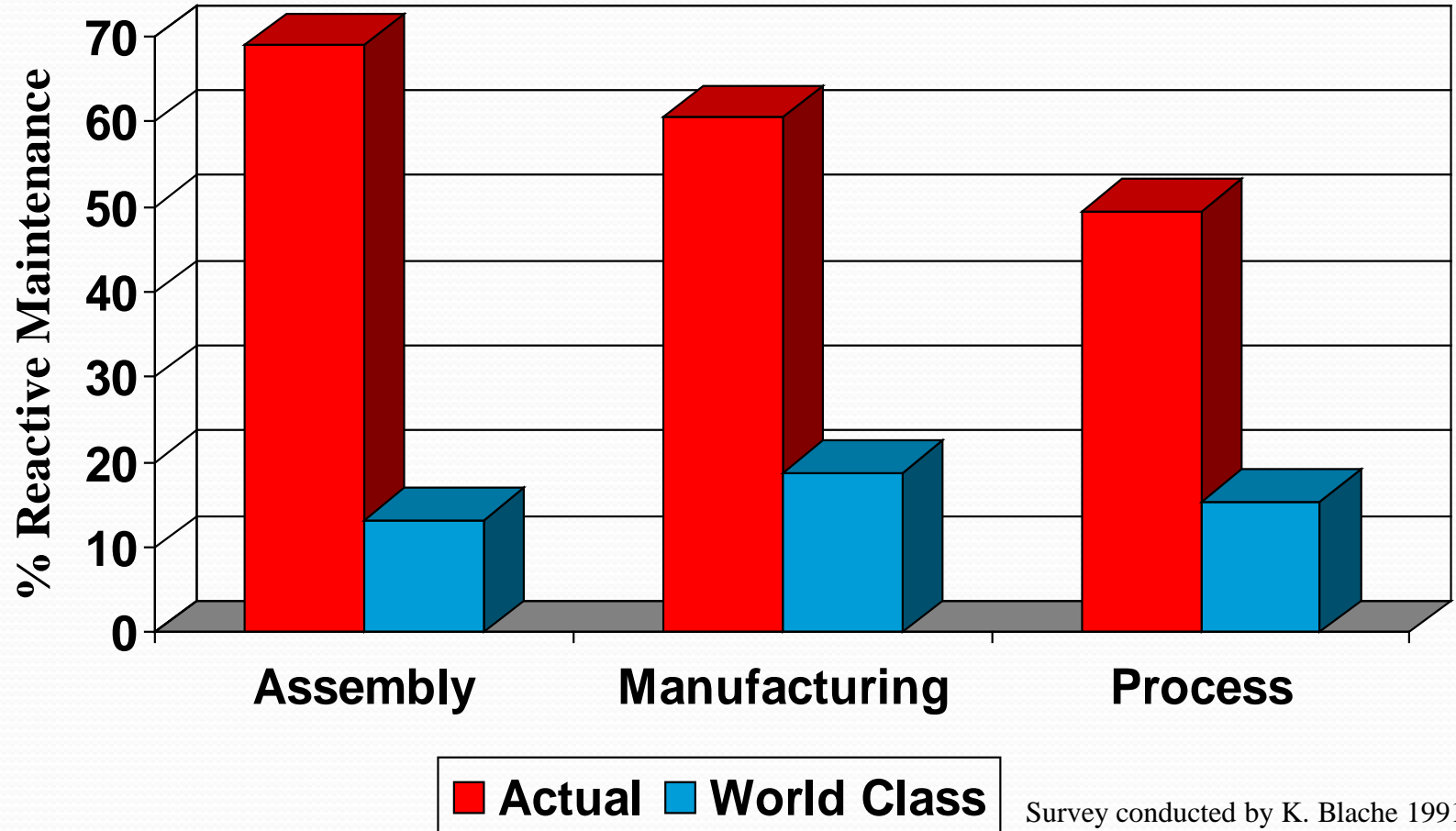


# PERCEIVED WORLD-CLASS



Survey conducted by K. Blache 1991

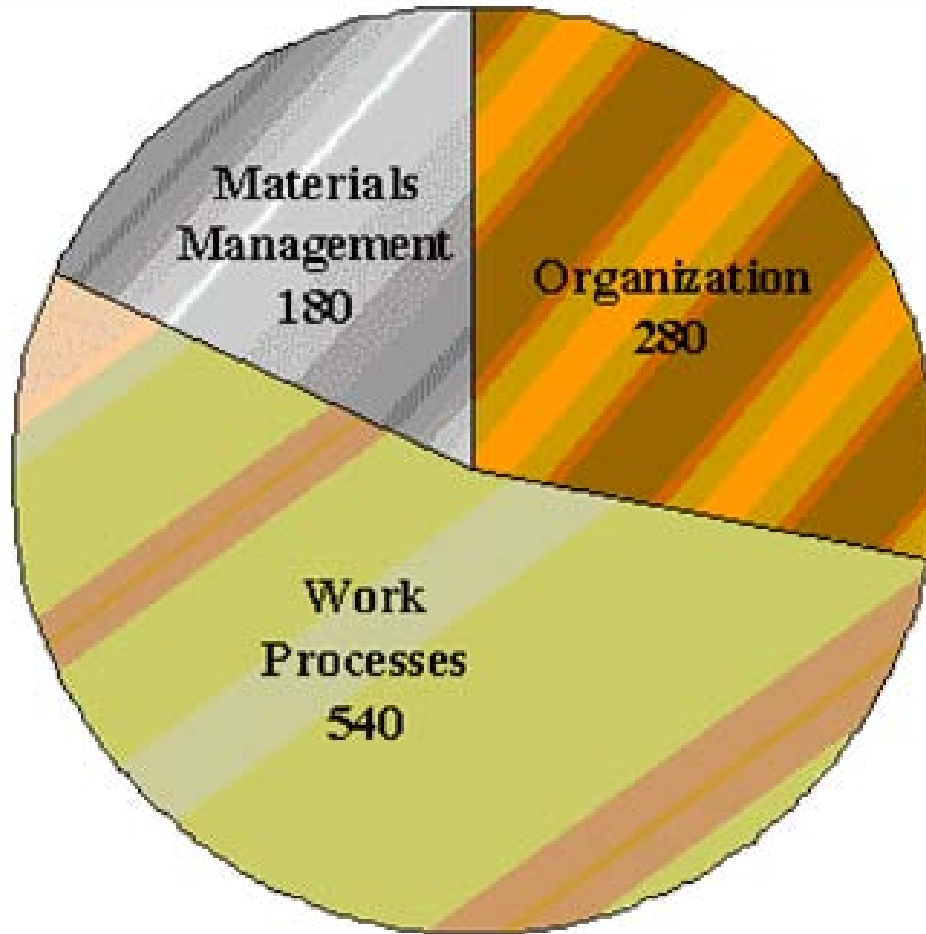
# REACTIVE MAINTENANCE



# North American Maintenance Excellence Award

- Won by Few Companies  
(Alcoa, Baldor Marion Dodge, Aera Energy LLC, A. K. Steel Corp.)
- Peer Evaluation
- 1000-Point Evaluation of Maintenance
- Primary Focus on Work Process  
(540 of 1000 points in this area)

# North American Maintenance Excellence Award Focus Areas



# North American Maintenance Excellence Award

## Work Process

- Reliability-based **Preventive & Predictive Maintenance**
- Outstanding Environment, Health & Safety Record
- Disciplined **Planning & Scheduling Process**
- Total Quality/Continuous Improvement Process
- Effective **Performance Measurement & Reporting**
- Fixed Asset/Project Management Process
- Facilities Maintenance Process

# Reduce Costs Through

## *Maintenance Benchmarking*

To determine your opportunity for improvement you need to know where you are today. Maintenance Benchmarking addresses the following areas:

- Organization
- Procedures
- Planning and Scheduling
- Planned Maintenance and Lubrication
- Equipment Records and CMMS
- MRO Inventory
- Training
- Maintenance Costs
- Maintenance Performance Measurement (KPI's)

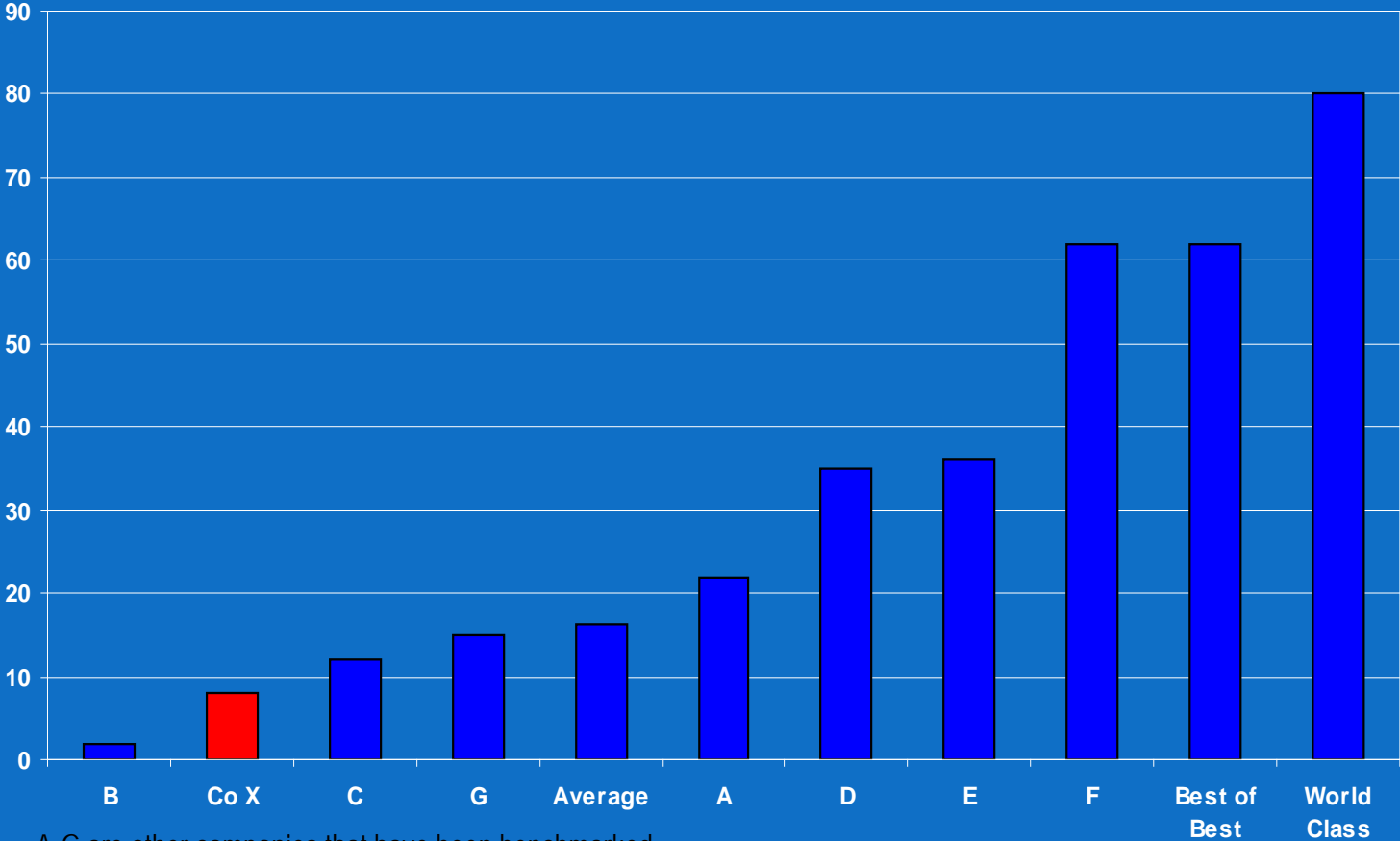


# Planning & Scheduling Benchmarking Topics

- Are maintenance activities planned?
- What percentage of maintenance time has been planned at least 24 hours in advance?
- Who plans and coordinates for labor, material, and equipment availability?
- Are estimates made for maintenance actions?
- What is the current backlog of work waiting to be done? (labor-hours)
- How are major upgrade/overhaul schedules determined?
- Is a flow chart of the planning and scheduling process available?
- Are operations and maintenance schedules coordinated?

# Company X

## Maintenance Benchmarking - Planning & Scheduling



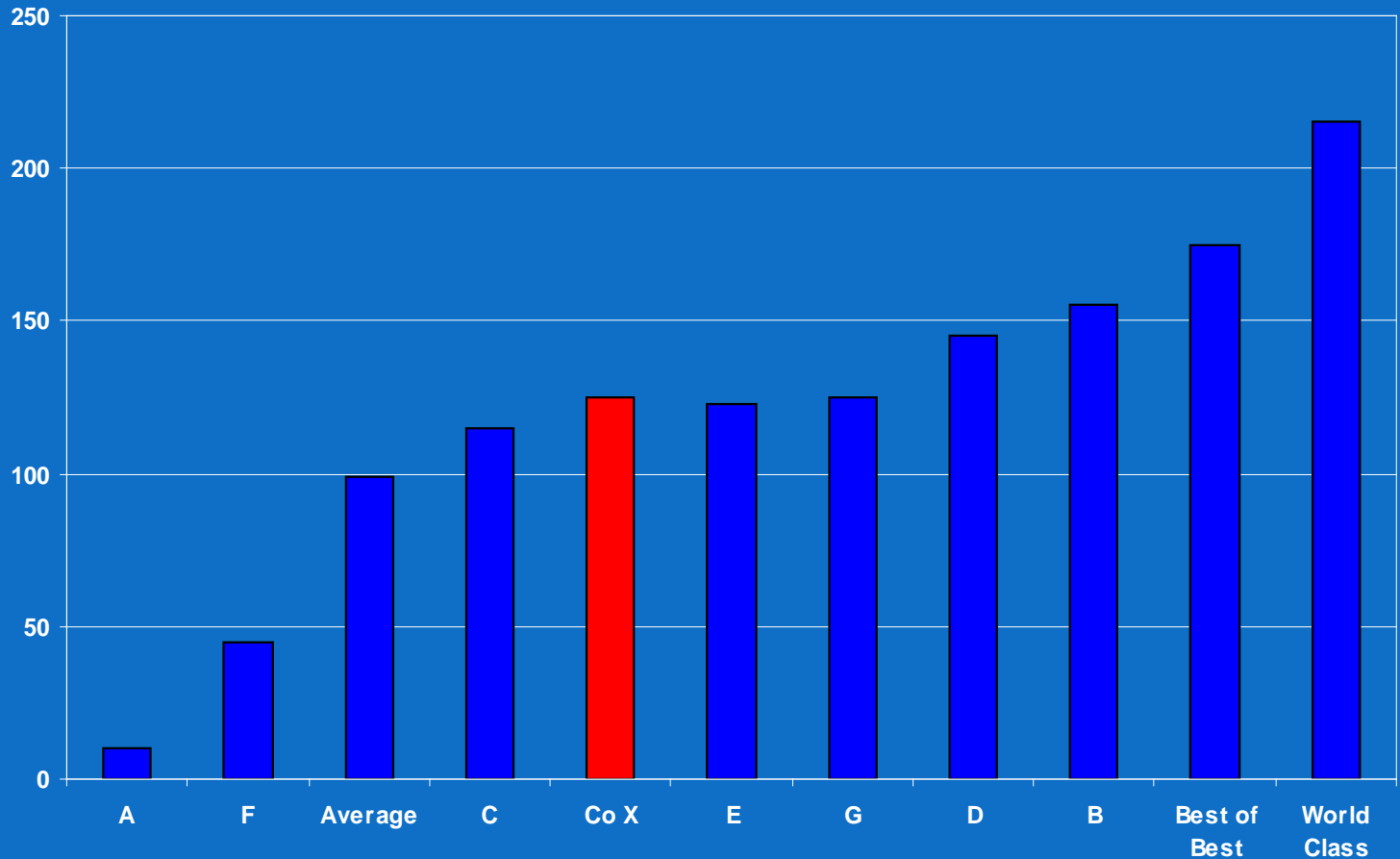
A-G are other companies that have been benchmarked

# Maintenance Cost Controls

## Benchmarking Topics

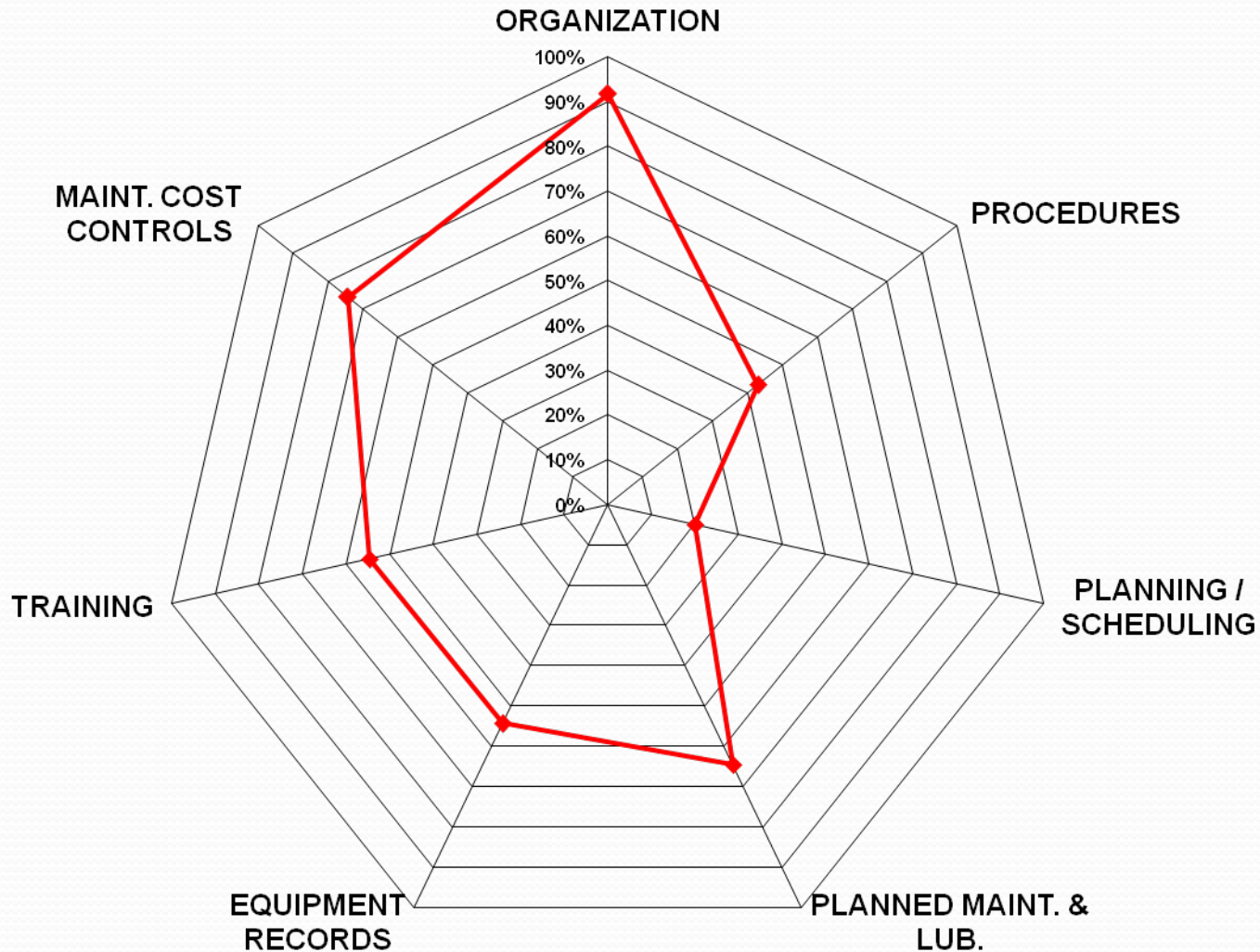
- Does the organization have a long-range (3-5 years) spending plan?
- Does the department have an annual budget?
- Are sub-accounts maintained for different types of maintenance activity?
- How are indirect maintenance costs accounted for?
- Are cost comparisons made of repetitive jobs?
- Does the organization have a maintenance cost reduction program?
- Is maintenance cost performance data shared with hourly employees?
- Are maintenance costs charged back to the requesting departments?
- Is there a capital equipment acquisition plan?

## Company X Maintenance Benchmarking - Maint. Cost Controls



A-G are other companies that have been benchmarked

# Sample Opportunity Graph



# Maintenance Management Functional Analysis

<b>Function</b>	<b>Comments</b>
Work Identification	PM work identified. Work lists, hot lists on Excel/DB common
Work Prioritization	Informal. Production needs are first. Work lists
Estimating	Some PM work. Informal. No audits.
Documentation	Some PM work. Lacks detail. Heavy use of checklists. No audits
Planning	Informal. Highly reactive. Hot lists. Delays not measured.
Scheduling	Informal. Supervisor and technicians. No measures of compliance. Due dates.
Work Execution	Informal. No sampling. Utilization unknown. No quality audits.
History	Informal. Personal files. Depends on individual effort. General accounting data.
Analysis	Informal. Yard Manager. Maintenance Manager memory.

# Peer Comparison

- Yard A maintained 29 overhead cranes for \$2,091 per crane
- Yard B maintained 38 cranes for the same period for \$1,539 per crane

**Differential between yards is 26%**

# “Six Big Losses” In Equipment Effectiveness

## Down Time:

1. Equipment failure - from breakdowns
2. Setup and adjustment - style change, etc.

## Speed Losses:

3. Idling and minor stoppages - due to abnormal operation of line components
4. Reduced speed - due to discrepancies between design and actual speed of equipment

## Defect:

5. Process defects - due to waste/quality defects
6. Reduced yield - from machine start-up to stable production



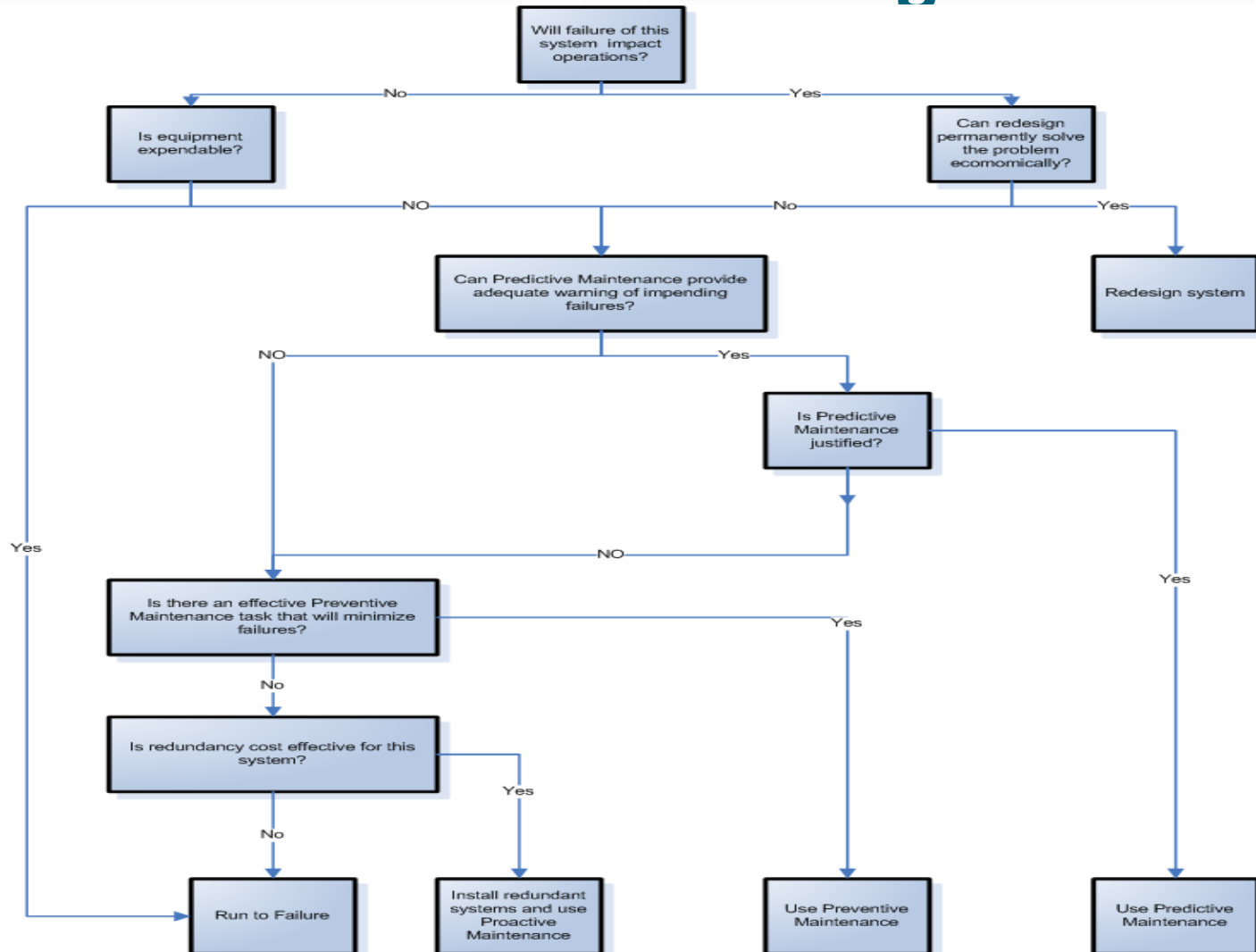
# Your Current Operation

- Do you have a mission and a strategy or do you respond to crises?
- Do you track performance indicators or measure success by *keeping it running*?
- Do you understand the economics of what you are doing or do you leave it to the *bean counters*?
- Are you a manager or a supplier of people?
- Do you feel responsible for individual development through innovative training?

# Your Current Operation

- Are you providing a “Technology” or a “Service”?
- Do you pro-actively manage by prevention or react to problems?
- Do you manage assets or repair equipment?
- Do you manage life cycle costing or accept the lowest cost solution?
- Do you do long-range planning or react to the squeaky wheel?
- Is there a maintenance strategy for every asset?

# Maintenance Strategies



Source: NASA Facilities RCM Guide

# World Class Maintenance Requirements

- Clear Vision and Mission for Maintenance
- Well Defined Equipment Strategies
- Top Management Support
- A Proactive NOT Reactive Approach
- Accurately Managed Costs
- Total Facility Participation
- Effective Maintenance Planning
- Strict Cost Control

# Elements Needed for Effective Maintenance

- Supervisory Control Routines
- Operator and Trades Training
- Management Training
- Methodology for Sharing Information

# Elements Needed for Effective Maintenance

- Agreement on Maintenance Structure, Procedures, & Formats (DES, PM, PdM, SOP, Planning, Staffing, etc.)
- Consistent and Accurate Equipment Histories
- Consistent MRO Procedures
- Implementation of Effective Maintenance Planning and Scheduling

# Elements Needed for Effective Maintenance

- Consistent Metrics to Evaluate Progress
- Consistent Application of Proven Techniques
- Commitment to *Make It Work*

# Charles Brooks Associates, Inc.

- Maintenance Benchmarking (MB)
- Controlled Maintenance (CM)
- Computerized Maintenance Managements Systems
- The Analytical Method of Training (AMT)
- Performance Excellence Process (PEP)
- High Performance Work Team Development
- New Technology Start-Up
- TEAM (Training, Engineering and Motivation)
- Supervisory Skills Development (SSD)