ISPE Carolina-South Atlantic Chapter Reliability Excellence

Enterprise Asset Management Master Planning

Presented by:

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GenesisSolutions
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Enterprise Asset Management Master Planning

Enterprise Asset Management Overview
Enterprise Asset Management Overview

Defining EAM

**Enterprise Asset Management**

- *Whole life optimal management of the physical assets of an organization to maximize value*
- *Covers design, construction, commissioning, operations, maintenance and decommissioning/replacement of plant, equipment and facilities*
- *“Enterprise" refers to the management of the assets across departments, locations, facilities and business units*
- *Managing assets across the facility, organizations will improve utilization and performance*
Enterprise Asset Management Overview

Understanding Enterprise Asset Management

Balance Approach
\[ \text{LCC} = \text{Cost}_{\text{Acquisition}} + \text{Cost}_{\text{Ownership}} \]

Life Cycle Phases:
- Concept and Definition
- Design and Development
- Manufacturing
- Installation
- Operation and Maintenance
- Disposal

Asset Costs
- Maintenance and product support, warranty costs consequential costs
- Operating costs
- Increasing
- Minimum costs
- Total life cycle costs
- Acquisition costs
- Ownership costs
Enterprise Asset Management Overview

Critical Success Factors

- Standardized Workflow Processes
- Optimized CMMS Database Configuration
- Program Solutions (EAM MP, RCM, TPM)

 Genesis Solutions

A Fully Integrated Global EAM Service Provider
Enterprise Asset Management Overview

EAM Leverage Points

Developing sustainable Systems to support the People responsible for optimizing the Processes, utilizing the latest Technology and providing the necessary Governance to monitor all functions with key metrics to ensure success.
Enterprise Asset Management Overview

EAM Strategy Drivers

<table>
<thead>
<tr>
<th>Driver</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>15%</td>
</tr>
<tr>
<td>Knowledge Transfer</td>
<td>57%</td>
</tr>
<tr>
<td>Sharing Best Practices</td>
<td>62%</td>
</tr>
<tr>
<td>Corporate Social Responsibility</td>
<td>62%</td>
</tr>
<tr>
<td>Reduce Energy Costs</td>
<td>65%</td>
</tr>
<tr>
<td>Calibration for Quality or Yield</td>
<td>74%</td>
</tr>
<tr>
<td>Safety &amp; Risk Management</td>
<td>86%</td>
</tr>
<tr>
<td>Extend Asset Longevity</td>
<td>91%</td>
</tr>
<tr>
<td>Cost Control for labor &amp; Parts</td>
<td>92%</td>
</tr>
<tr>
<td>Improve uptime</td>
<td>95%</td>
</tr>
</tbody>
</table>

*ARC Advisory Group 2010 EAM and Field Service Mgt 09

65 Participants / 1,300 (+) Plants / 463,000 (+) Employees

A Fully Integrated Global EAM Service Provider
Enterprise Asset Management Master Planning

EAM Maturity Continuum

Levels of Asset Management Performance Progression
EAM Maturity Continuum

**Define**
- EAM Maturity Continuum
  *Define the progressive levels of Asset Management Performance*

**Measure**
- Current State Assessment
  *Measure where you are on the Maturity Continuum*

**Analyze**
- EAM Master Plan Development
  *Analyze your assessment and develop the path forward to achieve EAM Excellence*

**Improve**
- Implementation Models for EAM Excellence
  *Improve your success with proven EAM Master Plan Models*

**Control**
- EAM Excellence Governance Model
  *Control your improvements by measuring and sustaining success*
## EAM Maturity Continuum

### Maturity Continuum Progression

<table>
<thead>
<tr>
<th>Performance Measures</th>
<th>Reactive</th>
<th>Planned</th>
<th>Predictive</th>
<th>Reliability</th>
<th>Enterprise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fix it AFTER it fails</td>
<td>Fix it BEFORE it fails</td>
<td>Plan</td>
<td>Predict</td>
<td>Eliminate Defects</td>
<td>Improve &amp; sustain</td>
</tr>
<tr>
<td>Defer Maintenance</td>
<td>Overlapping Responsibilities</td>
<td>Plan</td>
<td>Schedule</td>
<td>Precision</td>
<td>Alignment (shared vision)</td>
</tr>
<tr>
<td>“Fire Fighting” Heroes</td>
<td>Role Based Training</td>
<td>Coordinate</td>
<td>Coordinate</td>
<td>Redesign</td>
<td>Integration (Supply, Operations, Engineering)</td>
</tr>
<tr>
<td>Limited Development</td>
<td>Defined Roles &amp; Responsibilities</td>
<td>Monitoring Technician</td>
<td>Improved</td>
<td>Improvement &amp; Value Focus</td>
<td>Differentiation (System Performance)</td>
</tr>
<tr>
<td>CMMS PM Management</td>
<td>Cross Trained / Bench Strength</td>
<td>Work Execution</td>
<td>Total Productive</td>
<td>Efforts</td>
<td>Alliances</td>
</tr>
<tr>
<td>Limited Utilization</td>
<td>Limited Performance Tracking</td>
<td>Electronic Document</td>
<td>Predictive Technologies</td>
<td>Continuous</td>
<td>Organizational Metrics</td>
</tr>
<tr>
<td>CMMS Planning &amp; Inventory Management</td>
<td>Tracking</td>
<td>Management Systems</td>
<td>Barcoding &amp; RFID</td>
<td>Improvement</td>
<td>Aligned</td>
</tr>
<tr>
<td>CMMS Scheduling &amp; Robust Reporting</td>
<td>Leading &amp; Lagging Indicators</td>
<td>Mobile Handheld Devices</td>
<td>Utilization</td>
<td>Efforts</td>
<td></td>
</tr>
<tr>
<td>CMMS Automated Work Generation</td>
<td>Continuous Improvement</td>
<td>Efforts</td>
<td>Efforts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMMS Life Cycle Cost Tracking</td>
<td>Efforts</td>
<td>Efforts</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Performance Measures
- Reactive
  - Fix it AFTER it fails
  - Defer Maintenance
- Planned
  - Fix it BEFORE it fails
  - Overlapping Responsibilities
  - Plan
  - Schedule
  - Coordinate
- Predictive
  - Predict
  - Plan
  - Schedule
  - Coordinate
- Reliability
  - Eliminate Defects
  - Improve Precision
  - Redesign
  - Value Focus
- Enterprise
  - Improve & sustain
  - Alignment (shared vision)
  - Integration (Supply, Operations, Engineering)
  - Differentiation (System Performance)
  - Alliances

### People
- “Fire Fighting” Heroes
- Overlapping Responsibilities
- Role Based Training
- Defined Roles & Responsibilities
- Cross Trained / Bench Strength

### Processes
- Limited Development
- Planning Materials & Inventory Management
- Kitting Materials & Scheduling Technicians
- Monitoring Technician Work Execution
- Total Productive Maintenance

### Systems
- CMMS PM Management
- CMMS Planning & Inventory Management
- CMMS Scheduling & Robust Reporting
- CMMS Automated Work Generation
- CMMS Life Cycle Cost Tracking

### Technology
- Limited Utilization
- Electronic Document Management Systems
- Predictive Technologies
- Mobile Handheld Devices
- Barcoding & RFID Utilization

### Governance
- Minimal Performance Tracking
- Lagging Indicators
- Leading & Lagging Indicators
- Continuous Improvement Efforts
- Organizational Metrics Aligned
EAM Maturity Continuum

Reactive State

- **Bad**
  - High CM/PM Ratio
  - Plan on the fly
  - Expediting Parts
  - Stock-Outs
  - Extended Outages
  - Hurry & fix it fast
  - No time to analyze failures
  - Impacting Production
  - Rework

- **Good**
  - Predict
  - Plan
  - Predictive Technologies
  - Mobile Handheld Devices
  - Barcoding & RFID Utilization

- **Enterprise**
  - Improve & sustain
  - Alignment (shared vision)
  - Integration (Supply, Operations, Engineering)
  - Differentiation (performance)

**People**
- "Fire Fighting" Heroes
- Limited Development

**Processes**
- CMMS PM Management
- Limited Development

**Systems**
- CMMS Planning & Inventory Management
- CMMS Scheduling & Robust Reporting
- CMMS Automated Work Generation
- CMMS Life Cycle Cost Tracking

**Technology**
- Electronic Document Management Systems
- Predictive Technologies
- Mobile Handheld Devices
- Barcoding & RFID Utilization

**Governance**
- Minimal Performance Tracking
- Lagging Indicators
- Leading & Lagging Indicators
- Continuous Improvement Efforts
- Organizational Metrics Aligned
EAM Maturity Continuum

Planned State

**People**
- "Fire Fighting" Heroes
- “Fire Fighting” Heroes
- Limited Development

**Processes**
- CMMS PM Management
- CMMS Planning & Inventory Management
- CMMS Scheduling & Robust Reporting
- CMMS Automated Work Generation
- CMMS Life Cycle Cost Tracking

**Systems**
- CMMS PM Management
- CMMS Planning & Inventory Management
- CMMS Scheduling & Robust Reporting
- CMMS Automated Work Generation
- CMMS Life Cycle Cost Tracking

**Technology**
- Limited Utilization
- Electronic Document Management Systems
- Predictive Technologies
- Mobile Handheld Devices
- Barcoding & RFID Utilization

**Governance**
- Minimal Performance Tracking
- Lagging Indicators
- Leading & Lagging Indicators
- Continuous Improvement Efforts
- Organizational Metrics Aligned

**Performance Measures**
- Fix it BEFORE it fails
- Predict
- Plan
- Improve Precision
- Improve
- Maintain
- Sustain

**Roles & Responsibilities**
- Overlapping Responsibilities
- Role Based Training Defined
- Cross Trained / Bench Strength

**Alignment**
- (shared vision)
- Integration (Supply, Operations, Engineering)
- Differentiation (System Performance)

**Fix it**
- BEFORE it fails
- AFTER it fails

**Improve & sustain**
- Alignment (shared vision)
- Integration (Supply, Operations, Engineering)
- Differentiation (System Performance)

**Bad**
- High CM/PM Ratio
- Plan on the fly
- Expediting Parts
- Stock Outs
- Extended Outages
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- No time to analyze failures
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- Rework

**Good**
- Planning
- Scheduling
- Material Reservations
- Material Planning
- Less Costly Repairs
- Less Operational Impact

**ROI**
- Inventory Optimization
- Labor Utilization
- Wrench Time
- Contractor Costs
- Availability/uptime
- Overtime

**Governance**
- Minimal Performance Tracking
- Lagging Indicators
- Leading & Lagging Indicators
- Continuous Improvement Efforts
- Organizational Metrics Aligned

**Reliability**
- Eliminate Defects
- Improve Precision
- Redesign
- Maintain
- Sustain

**Predictive**
- Fix it BEFORE it fails
- Predict
- Plan
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**Reactive**
- Fix it AFTER it fails
- Defer Maintenance
- No time to analyze failures
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**Enterprise**
- Improve & sustain
- Alignment (shared vision)
- Integration (Supply, Operations, Engineering)
- Differentiation (System Performance)
EAM Maturity Continuum

Predictive State

- Performance Measures
  - Fix it BEFORE it fails
  - Fix it AFTER it fails

- People
  - "Fire Fighting" Heroes
  - Limited Development

- Processes
  - CMMS PM Management
  - CMMS Planning & Inventory Management
  - CMMS Scheduling & Robust Reporting
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- Governance
  - Minimal Performance Tracking
  - Lagging Indicators
  - Leading & Lagging Indicators
  - Continuous Improvement Efforts
  - Organizational Metrics Aligned

- Reliability
  - Eliminate Defects
  - Improve Precision
  - Redesign
  - Validation
  - Evaluation

- ROI
  - Inventory Optimization
  - Labor Utilization
  - Wrench On Time
  - Contractor Costs
  - Availability/Uptime
  - Overtime

- Enterprise
  - Alignment (shared vision)
  - Integration (Supply, Operations, Engineering)
  - Differentiation (System Performance)

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  - Redesign
  - Validation
  - Evaluation

- ROI
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  - Labor Utilization
  - Wrench On Time
  - Contractor Costs
  - Availability/Uptime
  - Overtime

- Enterprise
  - Alignment (shared vision)
  - Integration (Supply, Operations, Engineering)
  - Differentiation (System Performance)
EAM Maturity Continuum

Reliability State

**Performance Measures**

- **Reactive**
  - Fix it AFTER it fails
  - Defer Maintenance
- **Planned**
  - Fix it BEFORE it fails
- **Predictive**
  - Predict Plan
- **Reliability**
  - Determine Defects
  - Improve Precision
  - Redesign
- **Enterprise**
  - Improve & sustain alignment
  - Integration (Supply, Operations, Engineering)
  - Differentiation (Technology, Systems, Processes)

**People**
- “Fire Fighting” Heroes
- Limited Utilization

**Processes**
- CMMS PM Management
- Limited Development

**Systems**
- CMMS PM Management
- CMMS Planning & Inventory Management

**Technology**
- Minimal Performance Tracking
- Barcoding & RFID Utilization

**Governance**
- Recording Assessment
- Indicators
- Improvement Efforts
- Aligned

**Bad**
- High CM/PM Ratio
- Plan on the fly
- Exempting Parts
- Stock-Outs
- Extended Outages
- Hurry and fix fast
- No time to analyze failures
- Impacting Production
- Rework

**Good**
- Planning
- Scheduling
- Material Reservations
- Material Planning
- Less Costly Repairs
- Less Operational Impact
- Trending & Data Analysis
- Non-Intrusive Maintenance Measurement
- Critically Driven
- Risk Based
- Design Changes
- KPI’s
- Root Cause Failure Analysis
- Quality Management
- Capital Engineering

**ROI**
- Inventory Optimization
- Labor Utilization
- Wrench On Time
- Contractor Costs
- Availability/uptime
- Overtime
- Capital Life Cycle
- COGS
- Right First Time Quality
- PM Optimization
- TPM

Fix it BEFORE it fails

Fix it AFTER it fails

Measure & fix

Don’t just fix it, improve it

Improve & sustain

Fix it AFTER it fails

Measure & fix

Don’t just fix it, improve it

Improve & sustain
EAM Maturity Continuum

Enterprise State

People
- "Fire Fighting" Heroes
- Complex "Overlapping" Responsibilities Role

Processes
- Limited Development
- Defined Based Training

Systems
- CMMS PM Management
- Limited Utilization

Technology
- Minimal Performance Tracking
- Overlapping Responsibilities

Governance
- Minimal Performance Tracking

Performance Measures
- Fix it BEFORE it fails
- Fix it AFTER it fails

Reacting
- Defer Maintenance

Predictive
- Predict
- Plan

Reliability
- Eliminate Defects
- Improve Precision
- Redesign

Continuous Improvement
- Organizational Metrics Aligned
- Electronic Document Management
- Predictive Technologies
- Mobile Handheld Devices
- Barcoding & RFID Utilization

Plan
- Planning
- Scheduling
- Risk Based
- Design Changes
- KPIs
- Root Cause Failure Analysis
- Quality Management
- Capital Engineering
- Center of Excellence
- Enterprise Reliability
- Content Sharing
- Network Supply Chain

ROI
- Inventory Optimization
- Labor Utilization
- Wrench On Time
- Contractor Costs
- Availability/upTime
- Overtime
- Capital Life
- COGS
- Right First Time Quality
- PM Optimization
- TPM
- Strategic Sourcing
- Depot Level Stocking

Alignment
- (Supply, Operations, Engineering)
- Differentiation

Performance Measures
- Lagging Indicators
- Leading Indicators
Enterprise Asset Management Master Planning

Current State Assessment

Where are you on the Maturity Continuum?
Current State Assessment

DMAIC Process Checklist - Measure

Define
EAM Maturity Continuum
Define the progressive levels of Asset Management Performance

Measure
Current State Assessment
Measure where you are on the Maturity Continuum

Analyze
EAM Master Plan Development
Analyze your assessment and develop the path forward to achieve EAM Excellence

Improve
Implementation Models for EAM Excellence
Improve your success with proven EAM Master Plan Models

Control
EAM Excellence Governance Model
Control your improvements by measuring and sustaining success
Current State Assessment

Assessment Approach

Data Collection
- CMMS data collection
- CMMS functional use
- Personnel interviews
- Personnel surveys
- Plant walk through
- Standard procedures review
- Technical document review

Data Analysis
- Data and information analysis
- Scorecard completion
- Report development
Current State Assessment

Seven Elements of EAM

- Organizational Readiness
- CMMS Functionality & Utilization
- Planning & Scheduling
- Work Management
- Inventory Management
- Metrics & Performance Improvement
- Maintenance & Reliability Strategy
Current State Assessment

EAM Hierarchy

Each of the 7 Elements of EAM has individual Components to ensure a detailed approach to assess your Current State
Current State Assessment
Assessment Component Examples

Organizational Readiness
• (OR-01) Key Reliability Staffing Roles and Responsibilities
• (OR-02) Asset Management Mission, Vision, and Values
• (OR-08) Collaborative Environment
• (OR-15) Senior Facility Leadership Involvement

CMMS Functionality & Utilization
• (CM-01) Asset Bill of Materials
• (CM-04) Asset Hierarchies and Subassemblies
• (CM-05) Master Asset List
• (CM-09) CMMS Workflow Process

Planning & Scheduling
• (PS-02) Planned Materials Purchasing, Reservation, and Availability
• (PS-03) Planned Outages
• (PS-04) Proactive Planning and Scheduling
• (PS-10) Work Order Prioritization

Work Management
• (WM-01) Proactive Maintenance Program Management
• (WM-02) Work History Tracking
• (WM-04) Work Execution Review
• (WM-06) Process Management System
Current State Assessment

Assessment Component Examples (cont.)

Inventory Management
• (IM-01) Item Master List
• (IM-03) Inventory Control
• (IM-04) Vendor Managed Inventory
• (IM-05) Cycle Counts

Metrics & Performance Improvement
• (MP-01) Key Performance Indicator Development and Alignment
• (MP-02) Key Performance Indicator Tracking and Reporting
• (MP-04) Manufacturing Performance Data Collection
• (MP-09) Overtime Tracking and Goals

Performance is scored for 76 EAM Components against criteria aligned to the five states of Enterprise Asset Management Maturity

Maintenance & Reliability Strategy
• (MS-01) Asset Criticality Ranking
• (MS-02) Condition Based Maintenance
• (MS-04) Critical Spares
• (MS-07) Preventive Maintenance Optimization

A Fully Integrated Global EAM Service Provider
Current State Assessment

Assessment Results - Example

[Graph showing assessment results for various categories such as Total Score, Organizational Readiness, CMMS Functionality & Utilization, Planning & Scheduling, Work Management, Inventory Management, Metrics & Performance Improvement, Maintenance & Reliability Strategy. Each category is assessed on a scale from 0 to 10, with scores highlighted in different colors for different levels of performance.]
Current State Assessment

Understanding Assessment Results

The Assessment is designed to support development of an EAM Master Plan, act as the gap analysis tool, and track performance going forward.

*Note that as performance improves, the chart becomes larger and more circular in shape.
## Current State Assessment

### Assessment Component Scoring

Components will have associated findings that detail the basis for the scores

<table>
<thead>
<tr>
<th>Component</th>
<th>Component Description</th>
<th>Score</th>
<th>Assessment Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR-01</td>
<td>Key Reliability Staffing Roles and Responsibilities</td>
<td>2.5</td>
<td>The four reliability organizations have functional roles for management, supervision, planning, scheduling, and analyzing but there are not clearly defined responsibilities with a tremendous amount of overlap in job duties. Job descriptions do not exist for all organizations and a review process did not appear to be present.</td>
</tr>
<tr>
<td>OR-02</td>
<td>Asset Management Mission, Vision, and Values</td>
<td>5.0</td>
<td>The mission, vision, and values for asset management have not been established but initial discussion has been initiated.</td>
</tr>
<tr>
<td>OR-03</td>
<td>Asset Management Council</td>
<td>5.5</td>
<td>There is no official forum in place to review organization asset management performance or path forward.</td>
</tr>
<tr>
<td>OR-04</td>
<td>Management of Change</td>
<td>2.0</td>
<td>There is no formal management of change process in place to effectively track asset changes or additions on PM's, job plans, and spare parts. There is a CAD drawing management of change process in place but the approval process has been communicated to be slow.</td>
</tr>
<tr>
<td>OR-05</td>
<td>Process Safety Management</td>
<td>7.5</td>
<td>A review of assets which impact process safety has been completed and those assets which qualify are governed under a comprehensive management program that integrates technologies, procedures, and practices.</td>
</tr>
<tr>
<td>OR-06</td>
<td>Housekeeping &amp; Organization</td>
<td>4.2</td>
<td>The manufacturing floors are well maintained and orderly. The is evidence of a 5S program in place although there wasn't consistent organization in the workspaces and storage areas.</td>
</tr>
</tbody>
</table>

*The findings are used during the development of your EAM Master Plan to define your Current State*
Current State Assessment

Typical Situation

Do any of these apply to you?

- You’ve invested money into a powerful CMMS and feel you have fundamental control of it, but you wonder if it is really helping you improve your business.
- Your spare part lists aren’t accurate or updated.
- You have what you think is a decent PM program but it has just sort of evolved and has not been rationalized or evaluated across other plants.
- A big chunk of your most experienced maintenance personnel are going to retire in the next 5-10 years.
- Planning and scheduling is not well defined and many of the key components are not taking place (i.e. Job Steps, Material Kitting). You’re not sure who is responsible for planning and who is responsible for scheduling in your organization.
- You’re not sure how well your inventory is managed. You don’t truly know what and how much you have on hand and if you have all critical spare parts.
Current State Assessment

Benefits to Understanding your Current State

**Measuring your Current State provides:**

• A clear understanding of the **strengths and weaknesses of your asset management program**

• A **recommended list of detailed actions** that when implemented will improve performance

• The **foundation for developing your EAM Master Plan**

• A **tool for conducting a periodic gap analysis** that supports your EAM Master Plan

• A **tool for tracking progress and performance** of your EAM Master Plan execution
Enterprise Asset Management Master Planning

EAM Master Plan Development

Developing the path forward to achieving EAM Excellence
EAM Master Plan Development

DMAIC Process Checklist - Analyze

- **Define**
  EAM Maturity Continuum
  Define the progressive levels of Asset Management Performance

- **Measure**
  Current State Assessment
  Measure where you are on the Maturity Continuum

- **Analyze**
  EAM Master Plan Development
  Analyze your assessment and develop the path forward to achieve EAM Excellence

- **Improve**
  Implementation Models for EAM Excellence
  Improve your success with proven EAM Master Plan Models

- **Control**
  EAM Excellence Governance Model
  Control your improvements by measuring and sustaining success
EAM Master Plan Development

Value Proposition

Facilities, Assets, & Critical Systems

Maintenance Program Mission & Vision

Alignment with Business Strategy

Where are we now?

EAM Master Plan

Where are we going?

Where are the “Areas of Opportunity”?

Current State
• Assessment Tool
• Benchmarking
• Gap Analysis

Closing the Gap
• Prioritization of Opportunities
• Criticality Analysis
• Predictive Maintenance Approach
• Organization Development
• Reliability Strategies
• Measurable Goals

Maintenance Excellence
• Only 5% of companies operate in this area
• 30% gain in production achievable
• 30% lower costs than competitors
**EAM Master Plan Development**

**Maturity Continuum Progression**

---

An EAM Master Plan is a documented implementation strategy to make incremental improvements on the Maturity Continuum.
EAM Master Plan Development

EAM Master Plan Fundamentals

Why is EAM Master Planning important to us?

• Improve asset effectiveness and life cycle management through higher Return on Assets

• Developing and implementing an EAM Master Plan is an essential strategy for maintaining competitiveness

• A master plan should address People, Process, Systems, Technology, and Governance

• The ability to implement a CMMS or leverage your current CMMS investment is a fundamental element of the master plan

• Master planning begins with defining and benchmarking your “Current State“ based upon a robust assessment tool

• The prioritized objectives leading to a Future State is the Road Map for your master plan
The Synergy of all EAM Elements working together is critical to your program’s success as the improvement of each Element directly impacts the success of the other Elements.
# EAM Master Plan Development

## EAM Master Plan - Example

<table>
<thead>
<tr>
<th>Asset Management Master Plan Implementation (Phase 1)</th>
<th>30 weeks</th>
<th>Mon 4/4/11</th>
<th>Fri 10/28/11</th>
<th>Resource</th>
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<tbody>
<tr>
<td>MRO Material &amp; Service Data Tracking</td>
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</tr>
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<td>Fri 9/2/11</td>
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</tr>
<tr>
<td>Inventory Standardization</td>
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<tr>
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<td>Internal / External</td>
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<td>Fri 8/26/11</td>
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<thead>
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<th>19 weeks</th>
<th>Mon 11/14/11</th>
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<td>Key Performance Indicators</td>
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<td>Fri 1/20/12</td>
<td>Internal / External</td>
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<tr>
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<td>Fri 1/13/12</td>
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<td>Organizational Structure / Roles &amp; Responsibilities</td>
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<td>Mon 12/2/11</td>
<td>Fri 2/10/12</td>
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<th>Mon 8/20/12</th>
<th>Resource</th>
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<td>Preventive Maintenance Optimization (3rd Quartile)</td>
<td>35 days</td>
<td>Tue 4/17/12</td>
<td>Mon 6/4/12</td>
<td>Internal</td>
</tr>
<tr>
<td>Preventive Maintenance Program Management</td>
<td>30 days</td>
<td>Tue 4/17/12</td>
<td>Mon 5/28/12</td>
<td>External</td>
</tr>
<tr>
<td>Asset Bill of Materials &amp; Critical Spare Part Identification (2nd Quartile)</td>
<td>65 days</td>
<td>Tue 4/17/12</td>
<td>Mon 7/16/12</td>
<td>Internal / External</td>
</tr>
<tr>
<td>Lubrication Program</td>
<td>90 days</td>
<td>Tue 4/17/12</td>
<td>Mon 8/20/12</td>
<td>Internal / External</td>
</tr>
<tr>
<td>Meter Reading &amp; DCS Utilization (1st Quartile)</td>
<td>85 days</td>
<td>Tue 4/17/12</td>
<td>Mon 8/13/12</td>
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<table>
<thead>
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<th>Asset Management Master Plan Implementation (Phase 4)</th>
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<tbody>
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<td>Preventive Maintenance Optimization (4th Quartile)</td>
<td>35 days</td>
<td>Tue 9/11/12</td>
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<td>Internal</td>
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<tr>
<td>Asset Bill of Materials &amp; Critical Spare Part Identification (3rd / 4th Quartile)</td>
<td>130 days</td>
<td>Tue 9/11/12</td>
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<td>Skills Training Matrix &amp; Apprenticeship Program</td>
<td>75 days</td>
<td>Tue 9/11/12</td>
<td>Mon 12/24/12</td>
<td>Internal / External</td>
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</table>
EAM Master Plan Development

EAM Master Plan Flowchart

Start

System Priority
Procedure

System Boundary
Procedure

Equipment
Numbering
Procedure

Equipment Class
Table

System Criticality
Rank Procedure

Asset
Hierarchy

Prioritize Systems

Identify System Boundaries

Number System Equipment

Enter Equipment Number

Assign EQ. Class

Set-up EQ. Hierarchy

Field Verify & Collect EQ. Data

Populate EQ. Notebook

All EQ. Numbered?

Yes

Perform Criticality Ranking

No

Select First/Next System

Develop Asset Hierarchy

System Critical?

Yes

Develop Task Procedure

RCM

No

RCM Analysis Procedure

Select Critical System

Define System Functions

Review Equip. Records

FMEA (RAG) Analysis

Evaluate Current Maint. Program

Prevention – Mitigation Analysis

Select Optimum Maintenance Strategy

Optimum Maint. Strategy Procedure

Equation Maintenance Strategy & Tactics
- PM Tasks
- Inspections
- Lubrication Plan
- Survey Routes
- Calibrations
- RCF/A / EIR
- Condition Based Maint.
- Re-Refurbish
- Replace/Redesign

RCF/A / EIR Procedure

Update PM Task Lists

P&S

Is EQ RTF Candidate?

No

Develop PM Tasks (as needed)

Implement - Genesis P&S Procedure

Create P&S Master Schedule

Define Maintenance Metrics

Implement Maint. Metrics

Monitor & Manage By Metrics

Periodic equip. refurbish/upgrade & update PM tasks

Yes

Document RTF Equipment

MRO

Spare Parts List to MM

Critical Spares Procedure

Assist Spare Parts with EQ. in Hierarchy

Critical Spares List To MM

Genesis Solutions
A Fully Integrated Global EAM Service Provider
EAM Master Plan Development

Enterprise Asset Management Pyramid

- EAM
- Metrics & Performance Improvement
- Work Management
- Planning & Scheduling
- Maintenance & Reliability Strategy
- Inventory Management
- Organizational Readiness
- CMMS Functionality & Utilization
Enterprise Asset Management Master Planning
Implementation Models for EAM Excellence

Proven EAM Models
Implementation Models for EAM Excellence

DMAIC Process Checklist - Improve

**Define**
EAM Maturity Continuum
*Define the progressive levels of Asset Management Performance*

**Measure**
Current State Assessment
*Measure where you are on the Maturity Continuum*

**Analyze**
EAM Master Plan Development
*Analyze your assessment and develop the path forward to achieve EAM Excellence*

**Improve**
Implementation Models for EAM Excellence
*Improve your success with proven EAM Master Plan Models*

**Control**
EAM Excellence Governance Model
*Control your improvements by measuring and sustaining success*
Implementation Models for EAM Excellence

Path Forward

1. Establish a Sense of Urgency
   - Build a case – use data to show reliability problems
   - Prioritize based on expected results

2. Create a Guiding Coalition
   - Get a sponsor with organizational “clout”
   - Identify the key stakeholders - Get them to work together like a team

3. Develop and Communicate a Vision and Strategy
   - Create an expected outcome – problem statement
   - Develop action plans – e.g. CAPAs from the FMEA or Optimized PMs

4. Empower Broad-Based Action
   - Remove barriers – use both power and influence
   - Encourage risk-taking

5. Generate Short-Term Wins
   - Plan to win
   - Create and visibly recognize those wins
   - Don’t let up
Implementation Models for EAM Excellence

EAM Master Plan Implementation Flowchart

- Make the Case for Change
- Define the “Current State”
- Analyze the Results
- Establish clear Goals for Future State
- Develop Plan w/Prioritization Strategy
- Gain Endorsement
- Implement EAM Master Plan
- Identify & Replicate Best Practices
- Measure & Communicate Progress
- Promote Learning to Sustain Improvements

Transformation Process
Implementation Models for EAM Excellence

Value Proposition - Understanding Cost Impact

Each Component of your EAM Master Plan will impact your bottom line, either directly or indirectly.
Implementation Models for EAM Excellence

EAM Excellence Value Proposition

To provide a **competitive advantage** by establishing and applying Best Practices to improve Facility and Asset Reliability, Operating Life, and Efficiency in the most cost effective manner possible.

\[
EN \ 15341: \quad E4 = \frac{\text{Total Maintenance Cost}}{\text{Product Transformation Cost}} \times 100 \% 
\]
Steering Committee embraces the TPM concept of Total Participation by including: Safety, Engineering & Maintenance, Finance, Operations, IT, and the Shop Floor.

Components:

- Charter (short, mid, & long term goals)
- Endorsements
- Training
- Pilot
- Communities of Practice
Implementation Models for EAM Excellence

Considerations for Resourcing Model

There are 3 Resourcing Models to consider when implementing an EAM Master Plan: **Internal**, **Hybrid**, and **Outsourced**.

- **Internal** - We have all the resources to “Run the Business” and “Improve the Business”.

- **Hybrid (Internal/Outsourced)** - We can’t dedicate all our resources; we have some SME gaps and don’t want to risk a false start.

- **Outsourced** - This is not our core expertise but we need to improve.
Enterprise Asset Management Master Planning

EAM Excellence Governance Model

Measuring and Sustaining Success
EAM Excellence Governance Model

DMAIC Process Checklist - Control

✔ Define
EAM Maturity Continuum
*Define the progressive levels of Asset Management Performance*

✔ Measure
Current State Assessment
*Measure where you are on the Maturity Continuum*

✔ Analyze
EAM Master Plan Development
*Analyze your assessment and develop the path forward to achieve EAM Excellence*

✔ Improve
Implementation Models for EAM Excellence
*Improve your success with proven EAM Master Plan Models*

Control
EAM Excellence Governance Model
*Control your improvements by measuring and sustaining success*
Management Controls & Reporting Systems (MCRS) is a key component of the EAM Master Plan Governance:

- We want to ensure we have a sustainable and evolving continuous improvement effort to advance incrementally across the EAM Maturity Continuum
- Treat the master plan as an Engineering Project with a Budget, Timeline, Resources, Deliverables, Accountability, and Project Management Team to ensure success
- We need to measure our improvement and track our implementation status versus the EAM Master Plan
- Establishing milestones and reviewing: Schedule, Budget, Resource Deployment
Steering Committee Components:

- Charter (Mission, Vision, Values)
- Senior Management endorsement (issue a support letter)
- Introductory EAM training to Steering Committee Members
- Establish activity objectives, goals, and policies/procedures
- Publish a 3 year EAM Master Plan
- Issue monthly and quarterly progress reports
- Publish pilot results, performance trends and Best Practices

Example of a EAM Excellence Vision statement:

“To provide a competitive advantage for ACME by establishing and utilizing Best Practices to improve Facility and Asset Reliability, Operating Life and Efficiencies in the most cost effective manner possible while enhancing Safety, Quality, and the Environment”
EAM Excellence Governance Model

Organization Support Structure

- Executive Sponsor
- Steering Committee
- Site Maintenance Council(s)
- Maintenance CoP Lead(s)
- Finance
Example of a Site Maintenance Council Charter:

• Collaboratively develop and implement strategies that support the Commercial Portfolio, Site Master Plan, Business Objectives, Annual and Long Term Capital Plan, and the Annual Budget Plan.

• Conduct monthly routine cross-functional meetings. Review, trend, and analyze: Key Performance Indicators for commercial results, Maintenance Excellence metrics, capital projects, and operating budget. Identify action items to ensure alignment with the Site and Operating Unit network strategy.

• Communicate on a routine basis, utilizing agendas, meeting minutes, and action items which are distributed among council membership and corporate sponsors.

• The Council communicates decisions across the organization, providing leadership and direction to operators and mechanics, resulting in focused strategies.
# EAM Excellence Governance Model

## Individual Site Scorecard Example

<table>
<thead>
<tr>
<th>Metric</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
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<th>JAN</th>
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<td>143</td>
<td>181</td>
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<td>J</td>
<td>F</td>
<td>M</td>
<td>A</td>
<td>M</td>
<td>J</td>
<td>J</td>
<td>A</td>
<td>S</td>
</tr>
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</tr>
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<td>23</td>
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<td>32</td>
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<td>19</td>
<td>20</td>
<td>17</td>
<td>12</td>
<td>13</td>
</tr>
</tbody>
</table>

**Maintenance Proactivity (PM/PM+CM)**

- **Red** = <65%
- **Yellow** = 65-75%
- **Green** = >75%

<table>
<thead>
<tr>
<th>Operating Site</th>
<th>Month</th>
<th>J</th>
<th>F</th>
<th>M</th>
<th>A</th>
<th>M</th>
<th>J</th>
<th>J</th>
<th>A</th>
<th>S</th>
<th>O</th>
<th>N</th>
<th>D</th>
<th>YTD</th>
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<tbody>
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<td>79%</td>
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<td>74%</td>
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<td>78%</td>
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<td>76%</td>
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<td>77%</td>
<td>86%</td>
<td>83%</td>
<td>78%</td>
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<td>84%</td>
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<td>83%</td>
<td>87%</td>
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<td>81%</td>
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<td>79%</td>
<td>58%</td>
<td>68%</td>
<td>61%</td>
<td>55%</td>
<td>60%</td>
<td>59%</td>
<td>65%</td>
<td>73%</td>
<td>64%</td>
</tr>
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</table>

**Maintenance Downtime (Hours)**

- **Red** = Deteriorating Trend
- **Yellow** = Static Trend
- **Green** = Improving Trend

<table>
<thead>
<tr>
<th>Operating Site</th>
<th>Month</th>
<th>J</th>
<th>F</th>
<th>M</th>
<th>A</th>
<th>M</th>
<th>J</th>
<th>J</th>
<th>A</th>
<th>S</th>
<th>O</th>
<th>N</th>
<th>D</th>
<th>YTD</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td>17</td>
<td>16</td>
<td>15</td>
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<td>15</td>
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<td>211</td>
<td>314</td>
<td>295</td>
<td>286</td>
<td>343</td>
<td>276</td>
<td>3869</td>
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</table>
EAM Excellence Governance Model

DMAIC Process Checklist Completion

**Define**

EAM Maturity Continuum
*Define the progressive levels of Asset Management Performance*

**Measure**

Current State Assessment
*Measure where you are on the Maturity Continuum*

**Analyze**

EAM Master Plan Development
*Analyze your assessment and develop the path forward to achieve EAM Excellence*

**Improve**

Implementation Models for EAM Excellence
*Improve your success with proven EAM Master Plan Models*

**Control**

EAM Excellence Governance Model
*Control your improvements by measuring and sustaining success*
Enterprise Asset Management Master Planning

Maximizing Return on Investment with EAM
Maximizing Return on Investment with EAM

Asset Management ROI Opportunities

<table>
<thead>
<tr>
<th>Performance Measures</th>
<th>Reactive</th>
<th>Planned</th>
<th>Predictive</th>
<th>Reliability</th>
<th>Enterprise</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fix it AFTER it fails</td>
<td>Fix it BEFORE it fails</td>
<td>Measure &amp; fix</td>
<td>Don’t just fix it, improve it</td>
<td>Enterprise Asset Management</td>
</tr>
<tr>
<td>Wrench Time</td>
<td>25%</td>
<td>35%</td>
<td>50%</td>
<td>60%</td>
<td>70%</td>
</tr>
<tr>
<td>OEE - Availability Factor</td>
<td>80%</td>
<td>84%</td>
<td>90%</td>
<td>95%</td>
<td>98%</td>
</tr>
<tr>
<td>Labor Cost Savings</td>
<td>35%</td>
<td>30%</td>
<td>20%</td>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td>Contractor Cost Savings</td>
<td>35%</td>
<td>30%</td>
<td>20%</td>
<td>10%</td>
<td>0%</td>
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<tr>
<td>Material Cost Savings</td>
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<td>10%</td>
<td>5%</td>
<td>0%</td>
</tr>
<tr>
<td>Inventory Carrying Cost Savings</td>
<td>20%</td>
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<td>10%</td>
<td>5%</td>
<td>0%</td>
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<tr>
<td>Safety Improvement</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Quality Improvement</td>
<td></td>
<td></td>
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</table>
Maximizing Return on Investment with EAM

EAM Benefits

- Increased Production Capacity
  - Reduced Downtime
  - Improved Efficiency
- Reduced Maintenance Costs
  - Planned Labor
  - Planned Material

ROI
Maximizing Return on Investment with EAM

Impact of Reliability on OEE

- Containing and Controlling Loss Moves the bar

- Finding the Hidden Factory...

- Everything we do must move the line

- Theoretical Max

- Current Capacity OEE

- Lost Time

- Lost Speed

- Lost Units

- Availability A

- Performance P

- Quality Q

1. Breakdowns
2. Setup
3. Idle/Minor Stop
4. Reduced Rate
5. Scrap/Rework
6. Startup Loss

A Fully Integrated Global EAM Service Provider
Maximizing Return on Investment with EAM

Planning and Scheduling Efficiency

Typical Job Planned On-the-Run

Same job if Effectively Planned & Scheduled

Typical Maintenance Craftsman’s Day

Planned & Scheduled vs. On The Run

<table>
<thead>
<tr>
<th>Activity/Step</th>
<th>Reactive WITHOUT Planning &amp; Scheduling</th>
<th>Proactive with Planning &amp; Scheduling</th>
</tr>
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<tbody>
<tr>
<td>Receiving instructions</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>Obtaining Tools and materials</td>
<td>12%</td>
<td>5%</td>
</tr>
<tr>
<td>Travel to and from job (both with and w/o tools and materials)</td>
<td>15%</td>
<td>10%</td>
</tr>
<tr>
<td>Coordination Delays</td>
<td>8%</td>
<td>3%</td>
</tr>
<tr>
<td>Idle at job site</td>
<td>5%</td>
<td>2%</td>
</tr>
<tr>
<td>Late starts and early quits</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td>Authorized breaks and relief</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Excess personal time (extra breaks, phone calls, smoke breaks, slow return from lunch and breaks, etc.)</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td>Sub-Total</td>
<td>65%</td>
<td>35%</td>
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<tr>
<td>Direct actual work accomplished (as a % if whole day)</td>
<td>35%</td>
<td>65%</td>
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Maximizing Return on Investment with EAM

Wrench Time Improvement

Maintenance Practice - Planning and Scheduling

<table>
<thead>
<tr>
<th>Without Planning and Scheduling</th>
<th>With Planning and Scheduling</th>
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</thead>
<tbody>
<tr>
<td>Planner / Scheduler</td>
<td>1</td>
</tr>
<tr>
<td>Total Craftspeople</td>
<td>11</td>
</tr>
<tr>
<td>Direct Work percentage</td>
<td>65%</td>
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<tr>
<td>Equivalent Full Time Workers</td>
<td>4.2</td>
</tr>
<tr>
<td></td>
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</tbody>
</table>
Maximizing Return on Investment with EAM

Potential Failure to Functional Failure (P-F Curve)
Maximizing Return on Investment with EAM

PM Optimization Standard Outcome

PM Optimization - Task Evaluation / Recommendation

- **DELETE** (Non-Value Added)
- **REASSIGN** (Operator Care / Lubrication Route)
- **REPLACE** (Implementation of PdM)
- **REVISION** (Upgrade or Improve)
- **KEEP** (No Modifications Required)
Maximizing Return on Investment with EAM

Labor Mix Best Practice

- **35%** PrM Results
- **15%** PM Inspection
- **15%** PM Results (Proactively Identified)
- **15%** PdM Inspection
- **15%** Planned Reactive
- **5%** Emergency Reactive

**REACTIVE MAINTENANCE (20%)**
- Emergency Reactive
- Planned Reactive (NOT Proactively Identified)

**PROACTIVE MAINTENANCE (80%)**
Enterprise Asset Management Master Planning

Question & Answer Session

Questions?