

NDS SELF-AUDIT FOR ORGANIZATIONS MANAGING PHYSICAL ASSETS

PREFACE

NDS EAM Best Practice Self-Audit

NDS has developed this audit to enable organizations who maintain physical assets to audit their current management systems and processes against physical asset management best practice.

The audit is designed to make you aware of the current possibilities in physical asset management and gives brief explanations on rationale behind each segment of the audit.

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Introduction

The document provides a self-audit for organizations to assess where they stand in terms of physical asset management best practice. Although specific requirements may differ from industry to industry, many principles and practices are common to any organization that is involved with physical assets.

The underlying model used by NDS is to drive maximum value from the maintenance or asset care function for the organization. Maintenance should preserve the required function of the organization's physical assets with resource usage minimized over the asset life-cycle.

Our model focuses on the two factors that drive the value of the maintenance or asset care function to the organization.

Factor 1 Effectiveness

What exactly do we mean by this? This factor means that we must be doing the right maintenance at the right time. We must derive the optimal set of maintenance tasks and their timing/initiators (i.e specify the optimal maintenance program) for our assets in their current operating context.

We can be very efficient at doing the wrong things and the result will be horrible.

Factor 2 Efficiency

Efficiency can be defined simply as output over input.

In this context output can be measured at several levels. Output of the maintenance function is ultimately measured by success at preserving asset function however that success is defined (availability, reliability etc) We can also analyze efficiency at a lower level e.g. how efficiently can we execute the optimized maintenance program as referred to above.

Under "efficiency" we are concerned with improving process efficiencies in the maintenance or asset care process. NDS segments these out into maintenance processes, logistics processes and information processes.

Our approach to analyzing **Maintenance Efficiency** is structured into three main elements – as shown below. These elements focus on maximizing productivity of the maintainer/service person:

Process Efficiency (addressed through integrated EAM business process functionality [and supporting technologies for areas such as Crew Scheduling; Turnaround/Project Management etc])

Information Accessibility – Technical, Transaction and Performance Data (addressed through EDMS, Portals, GIS Integration and Data Warehousing)

Logistics Availability/Optimization (addressed through EAM/ERP business systems and supporting technologies).

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Who Are We?

Before you tackle the survey you may be curious as to who we are and what credentials do we have to produce such a self-audit document. New Dimension Solutions (www.nd-solutions.com) is a professional services practice focused on best practice in Enterprise Asset Management and Reliability. A one page profile on NDS, our services and track record is included at the end of the survey.

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2. Effectiveness and Efficiency
3. Business Objectives Drive Systems Priorities
4. **Effectiveness**
 - a. Managing the Failure Mode
 - b. Reliability-Centered Maintenance
 - c. Other MSF's
 - d. A Closed-Loop Approach
5. **Efficiency**
 - a. Strategize and Prioritize the Approach
 - b. EAM Systems Overview
 - c. Technical Configuration
 - d. Functional Hierarchy
 - e. Maintenance Plans
 - f. Planning and Scheduling
 - g. Maintenance Events
 - h. MRO Materials Management
 - i. Material Item Identification/Descriptors
 - ii. IPC Approach
 - iii. Bills of Materials
 - iv. MRO Materials Stock-holding
 - v. Sorting out an existing situation
 - i. Managing Predictive Tasks and Technology
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 - k. Shutdowns-Outages
 - l. KPIs and Data Warehousing
 - m. Rotables Tracking
 - n. User access to Systems and Information
 - o. Life-cycle Costing
 - p. Maintenance Budgeting
 - q. Electronic Document Management and Asset Content Management
 - r. Automated Workflow
 - s. Initiating Actions Based on Asset Condition
6. **Design-Build Phase of New Assets**



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1 Defined Objectives for Maintenance Function

It has been said that the fastest way to get nowhere is not to know where you are going. In this light the initial section here focuses on objectives of the maintenance function.

- 1 Does the maintenance department have clearly defined business objectives which are measurable, achievable and under maintenance control?

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- 2 Are these objectives clearly understood throughout the maintenance organization?

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- 3 Are the overall objectives broken down into specific objectives for each manager?

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- 4 Is progress against objective published frequently in an easily visible manner?

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2 Effectiveness

2.1 MAINTENANCE PROGRAMS DEVELOPMENT/OPTIMIZATION

1. Does your organization have **formal and systematic processes/methods** in place at the organization to facilitate development of maintenance programs (i.e. to select maintenance tasks) for the organization's assets (equipment)? [Check appropriate box]

| Not at all | Sporadic effort | On certain critical assets | Comprehensive program |
|------------|-----------------|----------------------------|-----------------------|
| 0 | 1 | 3 | 10 |



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2. Are you familiar with any formalized techniques or methodologies (defined here as **“Maintenance Strategy Formulation” techniques**) for developing optimized maintenance programs (i.e. performing maintenance task selection) for physical assets [Check appropriate boxes]

| Technique /methodology | Not familiar with | Heard of it | Some knowledge of the concepts | Deep working knowledge |
|---|-------------------|-------------|--------------------------------|------------------------|
| Reliability-Centered Maintenance (RCM) | | | | |
| Total Productive Maintenance (TPM) | | | | |
| PM Optimization | | | | |
| Root Cause Analysis | | | | |
| 6 Sigma (6σ) | | | | |
| HAZOP | | | | |
| Use Original Equipment Manufacturer (OEM) program | | | | |
| Other 1 | | | | |
| Other 2 | | | | |
| Other 3 | | | | |

3. What Maintenance Strategy Formulation techniques are used to develop maintenance programs (i.e. to select maintenance tasks) for **critical physical assets** at your organization? [Complete approx. % in appropriate boxes]

| Technique /methodology | % of Critical Assets |
|---|----------------------|
| Reliability- Centered Maintenance (RCM) | |
| Total Productive Maintenance (TPM) | |
| PM Optimization | |
| Root Cause Analysis | |
| 6 Sigma (6σ) | |
| HAZOP | |
| Use Original Equipment Manufacturer (OEM) program | |
| Other 1 | |
| Other 2 | |
| Other 3 | |



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4. What Maintenance Strategy Formulation techniques are used to develop maintenance programs (i.e. to select maintenance tasks) for *non-critical* physical assets? [Complete approx. % in appropriate boxes]

| Technique /methodology | % of Non-Critical Assets |
|---|--------------------------|
| Reliability- Centered Maintenance (RCM) | |
| Total Productive Maintenance (TPM) | |
| PM Optimization | |
| Root Cause Analysis | |
| 6 Sigma (6σ) | |
| HAZOP | |
| Use Original Equipment Manufacturer (OEM) program | |
| Other 1 | |
| Other 2 | |
| Other 3 | |



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5. Are any formalized “Maintenance Strategy Formulation” techniques or reliability optimization methodologies applied in the *Design-Build phase of new assets* (plants/facilities) or when modifying existing assets?

| None | Design engineers and draughtsman try to consider reliability and maintainability during design | Maintenance staff perform some formalized reliability review of proposed design | Full RCM process is incorporated as part of the life-cycle of new asset design /development /construction |
|------|--|---|---|
| | | | |

6. Has a formalized “*Criticality Analysis*” (formal process to prioritize asset importance) been determined for the technical systems /assets in the organization facilities? [Check appropriate box]

| No | Some Areas of Plant or Some Facilities | Most Areas of Most Facilities | All Assets at All Facilities |
|----|--|-------------------------------|------------------------------|
| | | | |

7. Are asset (equipment) failures and performance shortfalls reviewed to identify *cause* and to then develop appropriate *failure management policies* (such as adjustments to the maintenance program, training, redesign revised Standard Operating procedures)? [Check appropriate box]

| None | Some | For critical equipment | All |
|------|------|------------------------|-----|
| | | | |

8. Are asset (equipment) maintenance programs *reviewed* on a regular basis? [Check appropriate box]

| None | Some | For critical equipment | All |
|------|------|------------------------|-----|
| | | | |

9. Are *responsibilities* assigned to *specific functions/people* in the organization organization to develop the Predictive(PdM) and Preventive (PM) aspects of asset (equipment) maintenance programs? [Check appropriate box]

| None | Some | For critical equipment | All |
|------|------|------------------------|-----|
| | | | |



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10. Are the process steps used to develop the maintenance program formally **documented**? [Check appropriate box]

| None | Some | For critical equipment | All |
|------|------|------------------------|-----|
| | | | |

11. Does the organization have **senior management commitment** [CEO, Operations Manager, Director Level) towards reliability improvement initiatives? [Check appropriate box]

| No | Management awareness | Developing commitment | Strong senior management commitment |
|----|----------------------|-----------------------|-------------------------------------|
| | | | |

12. Does the organization have any **formalized strategic program** in place to improve Reliability of the organization’s physical assets? [Check appropriate box]

| No | Initial discussions and plans to commence such a program | Starting a formal program to improve asset reliability | Established program to improve asset reliability in place |
|----|--|--|---|
| | | | |

13. Does the organization have a **“Reliability Engineering Group”** or **“Reliability Group”** in place? [Check appropriate box]

| No | Part-time role for engineer | Reliability Officer | Reliability Department |
|----|-----------------------------|---------------------|------------------------|
| | | | |

14. Does the organization have a formalized approach to **“Risk Management”** i.e. what levels of risk are acceptable in terms of safety, environmental and operational consequences?

| No | Informal | In process of formulating risk management policy | Formalized comprehensive risk management policy in place |
|----|----------|--|--|
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15. Does the organization use external/ internal **benchmarking** and **networking** with other utilities to keep up-to-date on new initiatives and industry standards/performance levels/benchmarks? [Check appropriate box]

| No | Some | Belong to some organizations | Formal Initiative to benchmark and work with other interested companies on reliability initiatives |
|----|------|------------------------------|--|
| | | | |

16. Are **performance metrics** defined for the outputs of asset (equipment) maintenance programs? [e.g. Reliability, Availability, Maintenance Cost, Work Backlog etc] [Check appropriate box]

| No | Some | Periodic initiatives | Formal managed program using CMMS/EAM system |
|----|------|----------------------|--|
| | | | |

17. Are there **training plans** in place on any “formalized maintenance strategy formulation techniques” used by the organization for those employees who develop asset (equipment) maintenance programs? [Check appropriate box]

| No | Occasional | Recommended | Part of structured development program and skills required for the job |
|----|------------|-------------|--|
| | | | |

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Efficiency

Core EAM/CMMS System

Does your organization have a EAM/CMMS system implemented?

Maintenance Planning and Scheduling

Maintenance planning can be defined as ***the preparatory work required to make a work order (work package) ready to execute***. Typically in a best practice environment today “planning” of maintenance work packages will include the following items and is normally performed in the EAM or CMMS system.

- the scope of work
- required labor resources and estimated amount of time required
- required material items and quantity
- required tools
- specified procedures and technical information
- access to drawings, diagrams as required

Planning may be performed for one-off tasks (e.g. modifications) or for tasks which may be performed on multiple occasions. In the latter case the planning for the work package is normally stored in the EAM/CMMS system as a standard or base-line in some form of planning library for re-use, either linked to an asset ID or asset type ID.

Scheduling may be defined as positioning the planned work package into a specific timeslot on the maintenance calendar, and adjustment of this time allocation as the scheduling picture changes with actual completions, deviations from the planned times etc . For example we have a work package to replace a valve. This work package is planned by a maintenance planner and then scheduled to occur on Friday at 7:00 am.

Does your organization have maintenance planners?

What ratio exists between planners and maintainers?

Are the planners focused on planning as defined above or are they allocated numerous other duties such as materials expediting, data input into EAM system etc

Does your organization have a real understanding of planning as defined above or are the terms planning and scheduling used synonymously?

Does your company have a substantial library of planned work-packages on the EAM system or are most work packages planned from scratch?

What percentage of work that is scheduled in advance (i.e. not breakdown work) is planned?

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Is maintenance work (excluding breakdowns) scheduled in the EAM system to be performed on a specific day of a specific week or is work scheduled outside of the system by maintenance supervisors?

Does your organization have an effective work request system in place, where work can be requested by any authorized person in the operations or maintenance organization?

Are materials requirements created once a work order is scheduled in the EAM system (i.e. reservation created for stock items and requisitions created for non-stock items)?

Is work scheduled according to rough-cut capacity planning by skill-set in the EAM system (e.g. 500 hours of mechanical work is scheduled against an availability of 500 hours in a particular week)

If work is scheduled according to capacity, what percentage of capacity is scheduled?

Asset Configuration

Asset systems may be decomposed in a variety of ways. Typically assets will be broken into functional systems, and then down to functional units. Functional units may be further decomposed into line-replaceable items or identification of specific components. Different systems handle this in different ways and with different terminology. Some systems may offer the capability for multiple asset hierarchies based on different attributes (e.g. function, location, power source etc). In transmission and distribution environments it may be important to link assets in networks.

An asset database gives a record of the physical assets present in an asset system or that should be present according to the overall asset design specification. Coding the assets enables identification of specific assets to enable problems to be located, work to be directed to the right asset, costs and performance to be tracked and aggregated.

The asset code indicates the existence of an asset in the design. At any point in time a specific asset may be installed at that code or position (much like a person in an organizational chart). In certain environments (e.g. aviation) the specific asset in place at any time may require tracking via a serial number for regulatory or warranty purposes.

Is an asset database created in the EAM system?

Is this asset configuration in the EAM database accurate to the real-world asset configuration?

Are the real-world asset positions identified with clear tags or plates in a standard manner?

Is there any linkage between the asset hierarchy and the function hierarchy mentioned in Section?

Are the assets categorized in a consistent logical manner?

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Is the key technical data on each asset linked to the asset ID in the system?

Is there a formalized process in place to update the system asset configuration when the real-world configuration is changed in any manner?

Is the system web-enabled?

Is the asset hierarchy and technical data visible and easily accessible to the maintainers?

Document Management System

Given the goal of increasing wrench-time to improve efficiency, one critical area for improving maintenance productivity is in the availability of technical information. This information may be CAD drawings, geographical location information, technical settings, detailed task procedures, operating instructions, manuals explaining how an asset works, illustrated parts catalogs and exploded diagrams, regulated updates and revisions etc. These documents are now virtually all supplied electronically if requested but many legacy documents may be in hard-copy format. Undoubtedly best practice in this area is to have these documents in electronic format, and to link them via the EAM system to the appropriate objects in the EAM system e.g. to the Asset ID, the Material ID, the Task List (planned work package) etc.

Does your organization have an electronic document management system (or does your EAM system provide this functionality) which enables the indexing of documents and defines their network location?

Does your organization have a program in place to make such technical information accessible to the maintainers of your assets?

MRO Materials Management

MRO materials require specific handling to fully support maintainers in a world-class organization.

Areas for best practice improvement include:

- Materials identification
- MRO Materials Stockholding
- Duplicate Elimination
- Obsolete Parts Elimination
- Quality Control on Incoming Spares
- Proper Storage and Fixed Interval tasks for Stored Items

We will firstly tackle material identification as a key issue. How does the maintainer identify the material item that he requires? There are several ways to do this. These include:

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Illustrated parts catalogs or exploded diagram approach (e.g Auto parts)

In this approach an annotated picture of the asset is made available to the maintainer (ideally electronically) enabling the maintainer to visually identify the part he needs in the picture and from there via the annotation to cross reference to the manufacturers part number. There are software products on the market now which will enable the hot-spotting of the IPC or exploded diagrams to enable their electronic display where clicking of the annotated part will enable the maintainer to jump directly to the material item number in the EAM system.

Standardized material descriptors

Classification of materials in the EAM system

Materials Identification