SAP Intelligent Asset Management

SAP Asset Strategy and Performance Management

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Agenda

- Business Background and Drivers
- Solution Overview
- Summary
Business Background and Drivers
The Intelligent Enterprise
The Foundation of a Digital Supply Chain

The Intelligent Enterprise features 3 key components:

1. Intelligent Suite
2. Intelligent Technologies
3. Digital Platform
Digital Supply Chain
Enabling a Digitally Connected Product Lifecycle

Operator
Asset Intelligence
Enterprise Asset Management
Asset Performance Management
Asset Information Management

Manufacturer
Product Intelligence
R&D
Engineering
Manufacturing
The Physical Asset and the Digital Twin
Connect Digitally to Perfect Reality for Your Asset Management

Full digital representation of connected assets along their lifecycle delivering an embedded, collaborative and real-time set of next generation processes and systems
Intelligent Asset Management
Asset Central Foundation as One Common Data Set

Asset Central Foundation:
SAP’s digital twin for physical assets, is the foundation layer across the SAP portfolio.
Technology Enablers for Intelligent Asset Management

The Internet of Things
Provide sensor-enabled condition monitoring for real-time insights and new value-added services.

Big Data and analytics
Enable real-time analysis of data streaming from assets that are getting smarter and can communicate status and performance data.

Cloud computing
Reduce IT operations and maintenance effort while providing scalability to support changing business needs and growth.

Mobile solutions
Provide workers in the field with easy access to necessary information they would otherwise need to access in the office.

Augmented reality and virtual reality
Provide unmatched situational awareness and enhanced perception for better decision-making.

Artificial intelligence and machine learning
Bring unprecedented insights and automation of knowledge work across the enterprise.

Business networks
Simplify collaboration and sharing of information among asset management stakeholders and their equipment and service providers.

Real-time engineering simulation
Use physics-based digital twins for predictive engineering analysis in product development and operations.
Asset Strategy and Performance Management

Risk-based maintenance approach enables better decision making for maintenance planning and to reduce the probability of asset failure.

Adopt Reliability Centered Maintenance (RCM) processes, including Failure Modes and Effects Analysis (FMEA).

Manage performance to optimize return on assets across lifecycles. Monitor, review, and improve maintenance strategies.

Reduce bottlenecks, improve decision making, and prevent incidents using a holistic view of asset types and maintenance strategies.
SAP Asset Strategy and Performance Management
Determining the Correct Maintenance Strategy

**Asset Strategies:**
- Preventive
- On-Condition
- Predictive
- Failure Finding
- Run to Failure
- Modification

**Methodologies:**
- Risk & Criticality Analysis (RCA)
- Reliability Centered Maintenance (RCM)
- Failure Modes and Effects Analysis (FMEA)
- Structured Review (PM Review)
- Root Cause Analysis (RCA)
- …
Solution overview
SAP Asset Strategy and Performance Management helps companies achieve good asset management. It provides (Asset) Risk and Criticality Analysis and proven methodologies like RCM* and FMEA to develop recommended maintenance strategies e.g. preventive or corrective tasks actions.

*planned
SAP Asset Strategy and Performance Management
Solution Overview

- Identify Critical Assets
- Define Systems and Assets to Analyze
- Perform RCM/FMEA/PMR Analysis
- Develop Recommended Actions
- Implement Maintenance Strategies
- Monitor and Continually Re-evaluate
SAP Asset Central - Next-Generation Master Data Layer

Master Data Layer

Asset Classification
- Classes
- Subclasses

Asset Modelling
- Templates
- Models
- Attributes
- Indicators

Asset Representation
- Equipment
- Systems
- Locations
- Groups

Asset Information
- Instructions
- Alert Types / Rules
- Announcements
- Spare Parts
- Performance Improvement
- Notifications
- Documents
- Work Orders
- Failure Modes

Organization Representation
- Company Profile

New Innovations
SAP Asset Strategy and Performance Management Process: Define Asset Information and Scope

- Asset Classes & Subclasses are used to utilise Templates based on ISO standards and also assist in defining the asset model.
- An asset model represents a specific product or object identified by the manufacturer. The entire model information will be used as a template when creating a new equipment.
- Equipment in ASPM represents an individual maintainable object that requires asset strategy maintenance.
- Location in ASPM is used to structure Equipment in a hierarchical manner to support the analysis of the asset maintenance strategy.
- Group in ASPM is used to group multiple objects to support the assessment of Risk and Criticality and the FMEA analysis, e.g., a group of transformers in a certain location, a group of poles/towers & underground structures built from a certain capital project.
- System in ASPM is used to link or connect objects in a logical way for additional analysis purposes, e.g., the underground transmission system on a certain geographical zone.
- Risk and Critical Assessment and FMEA can be processed at any level above.
- Documents can be used to support store asset information, firmware, instructions and failures to support the entire ASPM process.
Global Standard – provided and kept up to date by SAP as the application provider. Based on industry standards e.g. ISO 14224, IEC 60076). This is the class and characteristics template.

Class: Transformer  
Subclass: Power Transformer  
Rated Power: (kW)  
Efficiency: %

Model Family & Model Information - provided by the manufacturer

Family: E23 – Voltage Transformer  
Model: E-23-8384 – Voltage Transformer, Oil Cooled  
Manufacturer: ACME Transformer Inc.  
No of phases: 3

Equipment Information – provided by Owner/Operator or by a Service Provider.

Equipment: Voltage Transformer, Oil Cooled TRFR-1000  
Site Data: Dusty Environment,  
Year Installed: 1997  
Service: Continuous
SAP Asset Strategy and Performance Management

Equipment: Features

Information
- Highlights
- Attributes
- Model Information
- Installation Information
- Life Cycle Information

Structure and Parts
- Structure
- Spare Parts

Documentation
- Documents
- Instructions
- Announcements

Monitoring
- Measuring Points
- Error Codes
- Improvement Cases

Time Line
Groups

- Models, Equipment and Locations can be arranged in Groups

- There are different types of groups e.g. assign equipment into different groups based on risk and criticality assessment.

- Objects that are grouped can be analyzed by population or age. You can filter by all kinds of objects (Equipment, Model, Subclass, Manufacturer etc.)

- An FMEA Assessment can be performed on a group
Location - Asset Hierarchies

- Flexible configuration of naming conventions for master data standardization
- Parent/child relationships for master data inheritance
The Document application stores and shares multiple documents across objects.
Asset Central Foundation
ERP Integration

Integration scenario ensures asset information is kept current between Asset Central (AC) and Enterprise Asset Management (EAM).

Integration between AC & EAM, covers both data and user experience improvements.

Integration provides Bi-directional synchronization of asset information for technical objects –
  - Equipment
  - Functional Location
  - Documents
  - Notifications
  - Work orders

Supported Releases – **S/4 HANA On Premise 1709 & above**, **ERP Enhancement package 6 & above.**

**Checkout the new integration** guide!
SAP Asset Strategy and Performance Management
Solution Overview

Identify Critical Assets
Define Systems and Assets to Analyze
Perform RCM/FMEA/PMR Analysis
Develop Recommended Actions
Implement Maintenance Strategies
Monitor and Continually Re-evaluate
# Risk and Criticality Assessment: Questions & Answers

## Matrix

### Dimensions (2)

<table>
<thead>
<tr>
<th>Question</th>
<th>Question Text</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔ What is Category of Failure Consequence?</td>
<td>What is Category of Failure Consequence?</td>
<td>Moderate</td>
</tr>
<tr>
<td>✔ What is the consequence to Operations?</td>
<td>What is the consequence of Failure to Operations?</td>
<td>XII</td>
</tr>
</tbody>
</table>

### Answers (4)

<table>
<thead>
<tr>
<th>Answers</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔️ Catastrophic</td>
<td>Failure resulting in death - system loss</td>
</tr>
<tr>
<td>✔️ Severe</td>
<td>Severe injury. Damage &lt; 100000 USD</td>
</tr>
<tr>
<td>✔️ Moderate</td>
<td>Minor injury or illness. Damage &lt; 250000 USD</td>
</tr>
<tr>
<td>✔️ Minor</td>
<td>Very minor injury. Damage &lt; 50000 USD</td>
</tr>
</tbody>
</table>

Note:
Risk & Criticality Assessment: Matrix

Matrix

Operations (2/2) Production (2/2) Environment (2/2) Safety (2/2)

Operations

What is Category of ... 3
What is the consequen... 3

What Category of Failure Consequence?

<table>
<thead>
<tr>
<th></th>
<th>Catastrophic</th>
<th>Severe</th>
<th>Moderate</th>
<th>Minor</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>1.00</td>
<td>2.00</td>
<td>3.00</td>
<td>4.00</td>
</tr>
<tr>
<td>VIII</td>
<td>2.00</td>
<td>4.00</td>
<td>6.00</td>
<td>8.00</td>
</tr>
<tr>
<td>XII</td>
<td>3.00</td>
<td>6.00</td>
<td>9.00</td>
<td>12.00</td>
</tr>
<tr>
<td>XVI</td>
<td>4.00</td>
<td>8.00</td>
<td>12.00</td>
<td>16.00</td>
</tr>
</tbody>
</table>
**Equipment List:** Showing Risk, Criticality, RPN and Recommended Action

**Use case:** Get list of all safety critical assets, select and create a group for follow-up activities
SAP Asset Strategy and Performance Management
Solution Overview

- Identify Critical Assets
- Define Systems and Assets to Analyze
- Implement Maintenance Strategies
- Monitor and Continually Re-evaluate
- Develop Recommended Actions
- Perform RCM/FMEA/PMR Analysis
Reliability Centered Maintenance (RCM) – a brief history

Efforts to understand non-structural aircraft components failure patterns led Stanley Nowlan and Howard Heap, both from United Airlines, to develop a new approach towards maintenance. They documented their methodology for developing failure consequence management policies in a report published by the U.S. Department of Defense in 1978.

Their process was called Reliability Centered Maintenance (RCM) and was based on a common-sense procedure with a decision diagram for creating Maintenance strategies to protect assets functions. RCM is defined as a process to determine what must be done to keep assets doing what their operators want them to do in their current operating context. Since its origins, RCM has been used in many industries, and in almost every industrialized country in the world. There have been many individual interpretations of Nowlan and Heap’s report leading to the creation of a variety of methods that differ widely from the original Process.

The purpose of the standard SAE JA1011, published in 1999, is to set out the criteria that any process must comply with in order to be called “RCM.” The twelve pages’ document, revised in August 2009, describes the minimum criteria for a process to be considered an RCM-compliant method. The standard provides the criteria to establish if a given process follows the creeds of RCM as originally proposed. It can also serve as a guide for organizations seeking RCM training, facilitation or consulting.

Document SAE JA1011, AUG 2009, establishes that for a Process be acknowledged as RCM it must follow the seven steps in the order shown below:

1. What are the functions and associated desired standards of performance of the asset in its present operating context (functions)?
2. In what ways can it fail to fulfill its functions (functional failures)?
3. What causes each functional failure (failure modes)?
4. What happens when each failure occurs (failure effects)?
5. In what way does each failure matter (failure consequences)?
6. What should be done to predict or prevent each failure (proactive tasks and task intervals)?
7. What should be done if a suitable proactive task cannot be found (default actions)?
Reliability Centered Maintenance (RCM**)
7 + 1 Leading Questions

- **Which Assets or Systems do I want to Analyze?**
  **Scope** – Boiler System

- **What are the desired functions and performance in it’s operating context?**
  **Functions** – Generate Steam at 60% Efficiency

- **In what ways does it fail to fulfil its functions?**
  **Functional Failures** – Operating below 60% Efficiency

- **What causes each functional failure?**
  **Failure Modes** – Scale Formation inside Boiler water Tubes

- **What happens when each failure occurs?**
  **Failure Effects** – For the same output more Fuel is consumed, adding to the fuel cost

- **In what way does each failure matter?**
  **Failure Consequences** – Production Impacted, 3 Hr Down time required for Repair

- **What can be done to predict or prevent each failure?**
  **Proactive Tasks & Task Intervals** – Regular Boiler Blow down to avoid Scale Deposit

- **What can be done if the failure cannot be predicted or prevented?**
  **Default Actions** – Take Shutdown of Boiler & Shift the load to other Boiler

*RCM2 and RCM3 are TM by Aladon
** Based on SAE JA1011 Evaluation Criteria for Reliability Centered Maintenance (RCM) Processes
**Failure Modes**

- The optimal maintenance strategy can be defined at the level of single failure mode.
- Failure Modes can be assigned to Models, Equipment, Locations, Spare Parts and Groups.
- They are based on a subclass and have different categories and types.
- RAMS Figures (Reliability, availability, maintainability and safety) and KPIs (MTTF, MTTR, MTBF).
FMEA Assessment

## Failure Mode

### Risk Priority Number (RPN = Severity x Occurrence x Detectability)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Cause</th>
<th>RPN</th>
<th>Effect</th>
<th>Detectability</th>
<th>Occurrence</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circuit Breaker</td>
<td>Cement Growth</td>
<td>20</td>
<td>Loss of Power</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Impurities in Raw Material</td>
<td>5</td>
<td>Outage</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relay Chatter</td>
<td>5</td>
<td>Outage</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
SAP Asset Strategy and Performance Management
Solution Overview

1. Identify Critical Assets
2. Define Systems and Assets to Analyze
3. Perform RCM/FMEA/PMR Analysis
4. Develop Recommended Actions
5. Implement Maintenance Strategies
6. Monitor and Continually Re-evaluate

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Instructions

- Instructions describe how to execute maintenance.
- There are different types of Instructions e.g. Breakdown, Installation, Operations, Planned Maintenance.
- Instructions can be assigned to Models, Equipment and Groups.
- Failure Modes can only be assigned to Breakdown Instructions.
- You can define the number of steps, duration, criticality, safety rules, tools and required spare parts.
- Additionally you can define preconditions, the steps themselves and post checks.
- You can add different documents. If you added an animated 3D file (.vds) the end user can view the sequences.
# Develop Recommended Actions

## Assign Preventive, Corrective or Placeholder Instructions

### Preventive Instructions

<table>
<thead>
<tr>
<th>Description</th>
<th>Activity</th>
<th>Estimated Cost (Colombian Peso)</th>
<th>Estimated Frequency (Months)</th>
<th>Risk Reduction (Colombian Peso)</th>
</tr>
</thead>
</table>

There is no data available.

### Select Instructions

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Instruction Type</th>
<th>Activity</th>
<th>Duration</th>
<th>Source</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote Control Calibration</td>
<td>Planned Maintenance</td>
<td>Adjust</td>
<td>1 Minutes</td>
<td>SAP Operator</td>
<td>Published</td>
</tr>
<tr>
<td>Disassembly bearing</td>
<td>Planned Maintenance</td>
<td>Repair</td>
<td></td>
<td>SAP Operator</td>
<td>Published</td>
</tr>
<tr>
<td>Replace Insulator</td>
<td>Planned Maintenance</td>
<td>Replace</td>
<td>3 Days</td>
<td>SAP Operator</td>
<td>Published</td>
</tr>
<tr>
<td>43000-MT Instruction</td>
<td>Planned Maintenance</td>
<td>Adjust</td>
<td>2 Hours</td>
<td>SAP Operator</td>
<td>In Revision</td>
</tr>
<tr>
<td>Oil Change</td>
<td>Planned Maintenance</td>
<td>Service</td>
<td>2 Hours</td>
<td>SAP Operator</td>
<td>Published</td>
</tr>
<tr>
<td>Oil Quality Tests</td>
<td>Planned Maintenance</td>
<td>Check</td>
<td>3 Hours</td>
<td>SAP Operator</td>
<td>Published</td>
</tr>
</tbody>
</table>
Develop Recommended Actions
Assign Preventive, Corrective or Placeholder Instructions

### Preventive Instruction

<table>
<thead>
<tr>
<th>Description</th>
<th>Activity</th>
<th>Estimated Cost (Colombian Peso)</th>
<th>Estimated Frequency (Months)</th>
<th>Risk Reduction (Colombian Peso)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote Control Calibration</td>
<td>Adjust</td>
<td>1000</td>
<td>0</td>
<td>500</td>
</tr>
<tr>
<td>L.OPER .43</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yearly inspection</td>
<td>Inspection</td>
<td>500</td>
<td>12</td>
<td>500</td>
</tr>
</tbody>
</table>

### Placeholder Instruction
Develop Recommended Actions
Publish Assessment
SAP Asset Strategy and Performance Management
Solution Overview

1. Identify Critical Assets
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Asset Central – ERP Integration

Asset data involved in the integration

- Equipment
- Functional Location
- Documents
- Notifications
- Work orders

- Equipment Header
- Functional Location Header
- Document Type Mapping
- Notification Header
- Work order Header

- Assignment Information
  - Plant, Organization data.
  - Object status, Class, Characteristics, and more...

Mapping configuration is mandatory
SAP Asset Strategy and Performance Management
Solution Overview

Monitor and Continually Re-evaluate
Define Systems and Assets to Analyze

Implement Maintenance Strategies
Identify Critical Assets

Develop Recommended Actions
Perform RCM/FMEA/PMR Analysis
Analytical Apps and BW Extractors for S/4HANA Asset Management

- Object Page
  - Find Technical object
  - Find Notifications
  - Find Orders and Operation
  - Find Task list and Operation
  - Find Documents
  - Find Class

- Overview Page
  - Maintenance Planning Overview
  - Scheduling Overview

- Analytics List Page
  - Breakdown Analysis
  - Damage Analysis
  - Actual Cost Analysis*

- BW extractors
  - Equipment*
  - Functional locations*
  - Maintenance order*
  - Maintenance order/Operation*
  - Maintenance notification*
  - Maintenance Notification Items*
  - Preventive Maintenance Item*

- CDS views for Strategic analysis
  - Location Analysis +
  - Damage Analysis +
  - Maintenance order Analysis +
  - Breakdown Analysis +

*S/4 Cloud 1811
+CDS views are prepared, SAC content not available
Analytical List Page
Actual Cost Analysis

The SAP Fiori app Actual Cost Analysis supports the Maintenance Planner in monitoring and evaluating actual costs resulting from current maintenance orders.

Value Proposition
- Easily identify the maintenance activities leading to the highest costs or parts of the asset that were particularly costly on inspections
- Evaluate actual maintenance costs stored in the Universal Journal Entry
- Seamless navigation within one page that combines transactional and analytical data using chart and table visualization

Capabilities
- Analyze the actual costs for materials and labor in maintenance
- Compare the total maintenance cost for unplanned, corrective and preventive maintenance activities
- Filters allow you to analyze critical costs in a fiscal year from different perspectives, such as the order type, the construction type, the location, the planner group or the manufacturer
Analytical List Page
Technical Object Breakdowns

- Analyze Breakdown and its impact on Reliability
- Evaluate effective time to repair and time between repair
- Evaluate Mean and Total time between repair as well time to repair
- Real time evaluation of statistical KPIs without storing aggregates
- Identify where the equipment was installed if the breakdown is identified after the equipment was dismantled.
- Identify equipment that fails often or long time to repair
- Identify location where equipment fails quite often
- Compare reliability of the equipment from different manufacturers
- Identify repair frequencies for a type or make of an equipment
Analytical List Page
Damage Analysis

Main KPIs
• Detailed failure mode analysis
• Number of damages recorded, related causes and activities
• Covers all the features covered by MCI5 / IW69

High-level innovation description
For malfunction report and activity reports, it is critical to record parts that were observed as damaged. Number of damages and corresponding causes could help in analyzing reliability of equipment.

Value Proposition
Increased reliability due to
• Identify failure modes of an equipment
• Identify parts that gets damaged and activities that are needed to repair or replace them
• Identifying main causes observed by technicians and plan preventive or inspections activities to avoid future unplanned breakdown.
• Identify parts that are over maintained and remove them from preventive activities.

Capabilities
• Analyze frequent offenders that create reliability issues for an equipment
• Identify relation between Failure mode, damages, causes and effect it has on operation of asset

Improvements over PMIS
• Calculation and aggregation is in real time with transactional data and not stored in S-structure.
• KPIs can be aggregated at equipment type, manufacturer, model or any other critical attributes.
• Much easy navigation that lets user drill down to notification or order and get better visibility for historical failures.
PdMS: Sensor Data for Rules & Alerts
Summary
SAP Asset Strategy and Performance Management helps companies achieve good asset management. It provides (Asset) Risk and Criticality Analysis and proven methodologies like RCM* and FMEA to develop recommended maintenance strategies e.g. preventive or corrective tasks actions.
How do I get further information?

SAP.com

SAP Help Portal

Roadmap
Thank you.

Contact information:

Ralph Müller
ralph.mueller@sap.com