PHM Technology
Decisions better made

MADE 3.8.8

Release Notes

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This release introduces significant upgrades and enhancements across multiple modules, particularly bolstering R&M and Safety analysis capabilities. Reliability-Centered Maintenance (RCM) has been overhauled to better reflect industry practices and improve user experience. Dedicated Hazard Analysis features were added to align with and support MIL-STD-882E System Safety processes, with a new hazard modelling capability via Hazard Diagrams and a Hazard Path Analysis.

API Enhancements export/import functionality for various components are extended and improved, including control measures and failure concepts, with better traceability. Additional updates include improvements to Fault Tree Analysis and Functional Hazard Assessment (FHA), delivering a more customizable and streamlined experience across the platform.

Key Features include:

- **Model-based Reliability-Centered Maintenance (RCM)**
  - » Enhanced RCM Analysis with two workflow streams: model-based analysis and FMECA/FMEA import analysis.
  - » Introduced a new RCM Analysis Overview page and contributor management features.
  - » Added display of reliability and availability metrics across RCM sections.
  - » Enhanced the RCM Summary tab with detailed effectiveness metrics.
  - » Introduced Significant Item Search and advanced filtering for Maintainable Items.
  - » Added Mission Context tab for defining operating profiles for significant items.
  - » Implemented Functional Failure Analysis (FFA) and FMEA import capabilities.
  - » Enhanced customization and workflow support for RCM processes.
  - » Introduced trade studies functionality to compare tasks against cost/availability metrics.
  - » Added reporting capabilities for RCM analysis and audits.
- **Hazards Implementation**
  - » Added hazard modelling through Hazard Diagrams and introduced hazard taxonomy.
  - » Enhanced connectivity between hazard concepts (HS, IM, TTO).
  - » Integrated failure diagrams and allowed control measures customization.
  - » Introduced Hazard Path Analysis and criticality strategies for evaluation.
  - » Added export capabilities for Hazard Path Analysis results.
- **API Enhancements**
  - » Enhanced export/import functionality, including Control Measures, diagnostic analysis, and Failure Concepts.
  - » Improved export options with better traceability and resource management.
- **Fault Tree Analysis Enhancements**
- **Functional Hazard Assessment (FHA) Enhancements**
- **Zentitle Enhancements**
- **Bug Fixes / Customer Requests**

Model-based Reliability-Centered Maintenance (RCM):

User Profiles and Collaboration

- Enhanced Classic RCM Analysis to include two distinct methodologies: model-based RCM using system data and RCM through FMECA/FMEA import, offering flexibility in performing analyses.
- Introduced a new RCM Analysis Overview page to manage RCM analyses, enabling users to create, edit, or delete analyses and view key details.
- Allows creation of analysis versions when the FMEA source is updated.
- Implemented contributor management functionality, allowing users to define and manage contributor profiles, assign roles, and edit contributor details within an RCM analysis.

SF and MSI Identification

- Introduced Significant Item Search functionality to help users identify and prioritize critical Maintainable Items for RCM analysis based on meaningful parameters such as reliability, availability, and criticality.
- Added a Significant Item Search tab as a supporting detail page under the RCM Analysis tab, enabling users to filter and select items within defined thresholds of criticality for inclusion in RCM analysis.
- Implemented filtering options for Maintainable Items, including, item criticality categories (e.g., critical, safety, mission-critical).
- Added search result management tools, allowing users to review filtered items, add selected items as Maintainable Items to the RCM analysis, and remove items as needed.
- Automated Maintainable Item list updates to ensure synchronization with the main RCM analysis page whenever items are added or removed from the search results.
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Mission/ Operating Context and Performance Standards

- Added a Mission Context tab to define and display the functional profile and operating context for Maintainable Significant Items (MSIs), providing essential details for RCM analysis initiation.
- Introduced a Functional Profile sub-tab to present a detailed, read-only functional profile synchronized with Mission Profile Definition (MPD).
- Enhanced operational metrics display to include narrative fields for Operating Context and Performance Standards.
- Implemented a time profile graph to visualize duty cycles of MSIs across mission phases, highlighting segments with active duty cycles and their total duration.
- Enabled seamless synchronization between Mission Context and MPD.
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FFA and FMEA

- Introduced Functional Failure Analysis (FFA) capabilities to support the generation and management of Failure Mode and Effects Analysis (FMEA) as part of the RCM process, ensuring a reference for maintenance teams.
- Added a wizard for creating RCM analyses, allowing users to specify analysis details (e.g., name, description) and select the desired RCM methodology, including model-based or FMEA-based approaches.
- Enabled FMEA data import functionality, allowing users to upload FMEA datasets directly from Excel spreadsheets, streamlining integration with external sources.

- Implemented robust data structures and interfaces to store and manage imported FMEA data, ensuring accessibility and usability throughout the RCM analysis process.

Methodology, Task Evaluation, and Selection

- Added the ability to customize RCM workflows, including decision-making questions and task types, to meet program-specific requirements. Customized workflows can now be saved for future reuse, while standardized workflows are available for quick implementation.
- Introduced a pre-defined workflow to guide users in determining the failure effect category for system components, ensuring consistent classification across analyses.
- Implemented workflows for task decision-making and evaluation, enabling users to define detailed task characteristics such as type, action, and occurrence using task type worksheets.
- Developed a structured process to assess the technical feasibility of selected tasks based on predefined criteria and supporting metrics. This includes options for defining maintenance grouping strategies, special triggering mechanisms, and approving tasks for inclusion in the RCM plan.

Trade Studies and Summaries

- Introduced trade studies functionality within MBRCM to enable the comparison of individual evaluated tasks against cost and availability metrics.
- Added the capability to calculate and display delta metrics, allowing users to compare the current RCM analysis with open projects. This feature helps identify improvements in cost, availability, and other key metrics resulting from RCM implementation.
- Enhanced MBRCM to support key performance indicators (KPIs) for measuring RCM success, such as reduced breakdowns, increased uptime, and cost savings. Eligible metrics for trade studies include Maintenance Type, Cost, Downtime, MTBM, MTTF, Reliability, and Availability, ensuring comprehensive evaluation criteria.
- Enabled users to conduct trade studies for all strategies associated with a selected model item and identify the most effective ones based on performance metrics.
- Added reliability and availability metrics display across various RCM sections, providing insights into baseline, adjusted, and delta metrics for failure modes, functions, items, and systems.
- Upgraded the RCM Summary tab to showcase detailed worksheet effectiveness metrics and summaries for baseline, adjusted, and delta values of critical reliability parameters, ensuring a comprehensive overview of RCM outcomes.

Analysis Export

- Added ability to customize analysis outcome table summaries to visualize data as required
- Added ability to export analysis tables to generic format (Excel and CSV)

Auditing and Traceability

- Added a new “RCM Audit” tab, providing users with a detailed view of changes made throughout the RCM analysis process. The new detail page contains a table, capturing key changes chronologically, and offers search and filter capabilities to locate events based on contributor.
- Implemented functionality to allow users to narrate and edit changes made to the RCM analysis.

Guides, Workflows, and Help Material

- Enhanced the RCM workflow with comprehensive tooltips and guidance text to assist users throughout the analysis process.
- Developed extensive help documentation for RCM workflows. This documentation includes detailed guidance and descriptions of each step in the RCM process, as well as feature-specific workflows.

Status and Tracking

- Implemented a dashboard to display the current status of each RCM analysis.

Integrated Model Interactions

- Implemented the ability to update and synchronize key system model parameters with existing RCM analyses at manageable workflow milestones.
- Established functionality to apply relevant maintenance tasks and strategies derived from the RCM analysis directly to the system model.

Hazards Implementation:

- Added ability to model hazards through Hazard Diagrams featuring three core hazard concepts: Hazard Sources (HS), Initiating Mechanisms (IM), and Target/Threat Outcomes (TTO).
- Introduced Hazard Taxonomy for HSs, IMs, and TTOs, allowing users to reference predefined categories when building hazard diagrams.
- Enhanced connectivity between hazard concepts: HS connect to IM, IM connect to TTO.
- Enabled integration with Failure Diagrams, allowing Faults, Failure Conditions, and Functional Failures to appear in hazard diagrams for modelling of failure-to-hazard progression.
- Added functionality to connect failure diagram concepts (e.g., Faults, Failure Conditions) directly to Hazard Sources.
- Added flexibility to edit Hazard Taxonomy names and narrative fields for tailored application-specific use.
- Introduced Criticality Attributes for hazard concepts based on MIL-STD-882E. Probability (1-10) and Software Control (0-10) attributes for all hazard and connected failure concepts, scaled qualitatively. Severity (1-10) attribute exclusive to TTOs to capture hazard severity.
- Added capability for users to edit criticality parameters.
- Integrated existing Control Measures Taxonomy into hazard diagrams, enabling selection of predefined control measures for all hazard and failure concepts.
- Customization to add new control measures if needed.
- Revising criticality parameters to reflect the effect of control measures using a Barrier Matrix.
- Introduced Hazard Path Analysis to evaluate hazards at both the item and system levels. Automatically generates Hazard Paths based on user-entered data, displaying key attributes.

- Implemented options for Path Criticality Strategies. Users can define strategies (e.g., Earliest, Latest, Highest, Lowest, Average) to determine how criticality parameters are calculated for hazard paths.
- Enabled Column Preferences for Hazard Path Analysis, allowing users to display only the required fields.
- Added capability to export Hazard Path Analysis Results in .csv format for external reporting.

API Enhancements:

- Introduced the ability to export Control Measures.
- Enhanced the optimization of function resources export to better capture detailed information.
- Added a date stamp to all export resources, providing users with a reliable reference.
- Enabled analysis exports to include reference to the parent system for improved traceability.
- Added the ability to export multiple resources simultaneously.
- Incorporated ambiguity groups into the diagnostic analysis export.
- Introduced the ability to import Functional Hazard Assessment (FHA) data, including attributes for Functions, Functional Failures, and Failure Conditions.
- Added the ability to import Mission Profile Definition (MPD) attributes.
- Enabled the import of Failure Concepts, along with their associated attributes and connections.
- Enhanced the Propagation Table export to include diagnostic groups, failure mode IDs, and the coverage metric.
- Updated the FMECA export to now include failure mode IDs.

Fault Tree Analysis Enhancements:

- Improved clipboard operations for individual events, enabling easier copy-paste functionality.
- Added a warning notification for large calculation times.
- Introduced the ability to create folders and organize Fault Tree analyses.
- Enforced unique naming for FTA analyses: duplicate names are prevented.

Functional Hazard Assessment (FHA) Enhancements:

- Implemented synchronization between FHA and Failure Diagrams: Failure Condition names updated in FHA will now automatically reflect in linked Failure Diagrams.
- Enhanced FHA linking and unlinking capabilities by adding tooltips and user prompts for better clarity.

Criticality Analysis Enhancements:

- Renamed the “Criticality” section in item properties to “Criticality Flag” to align with the terminology used in the Criticality Editor.
- Added the Criticality Flag options to the Advanced Properties window.

Reliability Block Diagrams (RBD) Enhancements:

- Implemented a new Reliability Block Diagram (RBD) View that displays a hierarchical breakdown of the RBD structure, and the equations generated/used in calculations for each RBD group, component, or subsystem.
- Introduced the ability to lock the RBD structure during or after Reliability Allocation (RA) creation.

Monte Carlo Analysis Enhancements:

- Increased the iteration limit for Monte Carlo simulations.

Technical Budgeting Enhancements:

- Updated Technical Budgeting Analysis charts to display the percentage split between components in the chart legend.

Diagnostic Analysis Enhancements:

- Introduced the ability to generate reports directly from the Diagnostic Analysis section.

Zentitle Enhancements:

- Introduced a new license activation process, including support for offline activation with key considerations addressed.
- Enhanced the implementation of Zentitle to support seamless sequential license check-out and check-in functionality.

Modelling and Project Upgrades:

- Introduced Autosave capability with features including automatic save-all functionality (no prompt), a toggle to enable/disable autosave (default: off), configurable autosave frequency and conditions. Additionally, the ability to save the current editor only has been removed.

Bugs Fixes and Performance Improvements

- Addressed an issue in 3.8.7 SP1 where copy-pasting failure diagrams to new components, or copy-pasting components containing failure diagrams will sometimes prevent updated criticality parameters from being read by FMECAs. This fix will eliminate the issue in existing models.
- Various bug-fixes
- Performance improvements to project and file management.
- Performance improvements to various analysis workflows.

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