

An integrated analysis-driven decision support solution for the design process

Key benefits

- ▶ Understand the cost impacts of design configuration & mission profile
- ▶ Concurrent risk identification and mitigation (Model-based)
- ▶ Technical validation for budget forecasts
- ▶ Structured / automated analysis workflows

Key features

- ▶ Integrated analyses to support trade studies
- ▶ Automated technical validation of trade studies
- ▶ Standardized function and failure data taxonomies

The Problem: The goal of any design process is a safe, reliable and cost effective system that performs its required functions. These outcomes are difficult to achieve with the rapidly increasing complexity of mission / safety critical systems, the 'new norm' of distributed design responsibility (geographically dispersed offices, functional segmentation within organisations, increasing design responsibility in the supply chain) and a significant disconnect between digital design tools (CAD, PLM) and traditionally manual (analogue) analysis tools and methods captured in Excel spreadsheets.

Solution:

An engineering based Decision Support Solution (DSS) that enables modelling, technical analysis and trade studies of alternate design configurations for Safety, Reliability and Cost of Ownership. The DSS should be simulation based and integrated with the Digital Twin / Thread to ensure concurrent, automated and objective risk identification and mitigation processes at each stage of the design process. All knowledge generated must be configuration controlled, extensible and effectively managed / transferred to internal and external stakeholders across the product lifecycle to enable continuous optimization of the ownership cost.



Solution Requirements:

Simulation model-based analysis with automation, standardized work-flows and data structures that can:

- ▶ Identify and analyze risks and factors that impact safety / availability / life-cycle cost
- ▶ Identify and validate the optimal maintenance approach for critical risks
- ▶ Analyze the impact of alternate usage cycles and operating environments
- ▶ Estimate maintenance requirements and budget for the solution
- ▶ Validate design decisions with automated analysis outputs to evidence safety / reliability / maintainability of the design

What does MADe offer as a DSS?

MADe optimizes the design decision process because it is:

- ▶ Cost Effective – tangible benefits to productivity of the analysis, engineering decision quality and total cost of ownership
- ▶ IT conformity – work with existing / proposed IT architecture, specifically CAD & PLM
- ▶ Reusability – model-based approach that is extensible, supports design variations
- ▶ Knowledge Capture – configuration management of the model and data across the analysis lifecycle, effective GUI based knowledge management capability

How MADe provides validation

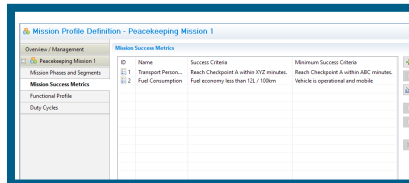
MADe uses a combined simulation model of the asset to compare alternate sustainment operating concepts. The model supports the following validation outcomes:

- ▶ Technical: reconcile functional capability with customer requirements
- ▶ Safety: evidence the safety case (FMECA / FTA / RBD / RCM)
- ▶ Budget: estimates are supported by engineering calculations analysis

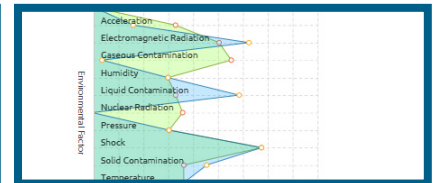
MADe Design Optimization Process

Define

How and where system will be used



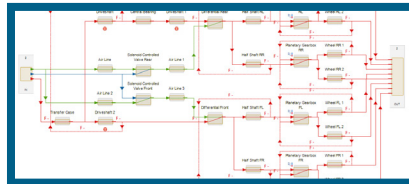
Mission Profile Definition



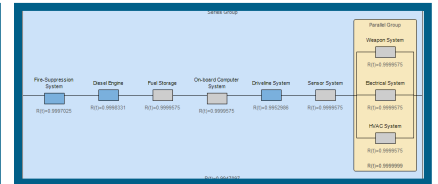
Environment Loading

Model

Identify potential failures and when they will occur



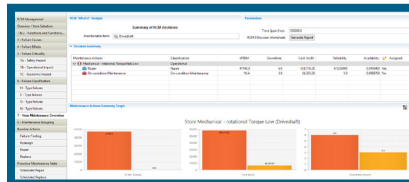
Functional / Failure Analysis



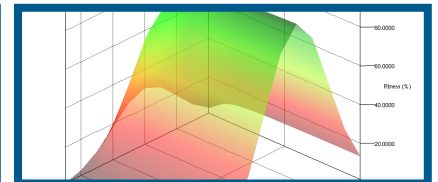
Reliability Analysis

Analyze / Mitigate

Identify optimal failure mitigation approach



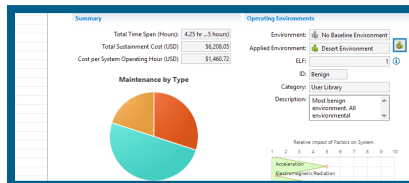
Reliability Centered Maintenance



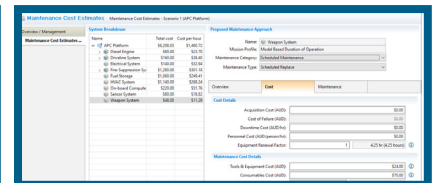
CBM Design

Calculate

Generate expected maintenance costs for the solution



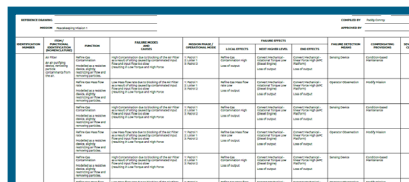
Maintenance Cost Estimate



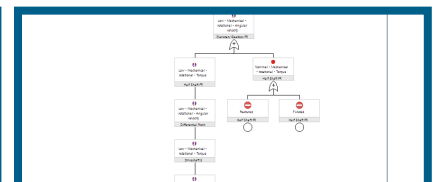
Maintenance Action Reports

Validate

Technical analyses



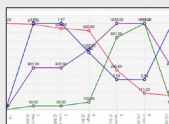
FMEA / FMECA



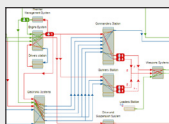
Fault Tree Analysis

MADe Functionality Overview

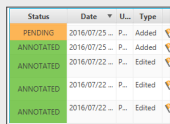
Modelling



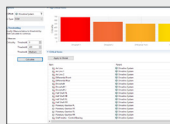
Use Cases



Functional Block Diagram



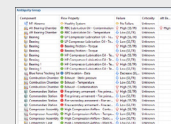
Data Quality Analysis



Critical Item Analysis



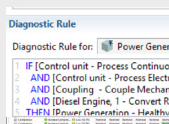
Sensor Set Design



Fault Detection and Isolation

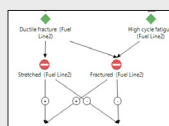


Diagnostics Optimisation

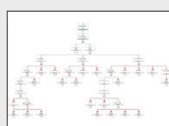


Model Based Diagnostic Rules

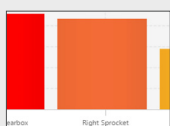
Safety and Reliability Assessment



Failure Diagram



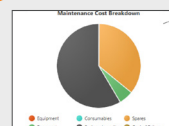
Fault Tree Analysis



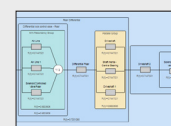
Criticality Analysis



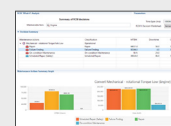
FMEA / FMECA



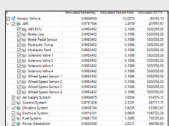
Maintenance Estimates



Reliability Block Diagram



RCM



Reliability Allocation

PHM

RAM