

Demonstrate Airworthiness using integrated engineering analysis

Key benefits

- ▶ Model based simulation
- ▶ Integrated analysis
- ▶ Automation of failure identification / mitigation
- ▶ Traceability of risk identification / mitigation
- ▶ GUI based knowledge capture / transfer / management

Key features

- ▶ Comprehensive failure concept taxonomy
- ▶ Consistency of failure concept descriptions
- ▶ Graphical representation of failure progression

The Problem: Aircraft certification for Airworthiness is an important milestone. However the accuracy and legibility of the records are not always linked or derived from the engineering analyses used for the aircraft design and maintenance planning – which can have significant technical and schedule consequences across the product lifecycle.

The Solution: The MADe software is an integrated analysis solution that generates the artefacts required for Airworthiness certification. Analysis generated concurrently with design leads to improvements in the certification process. MADe automatically tracks the source of all parameters used in an analysis to provides a means of assessing the quality of data used to support engineering decisions and analysis.



Which analyses are generated by MADe?

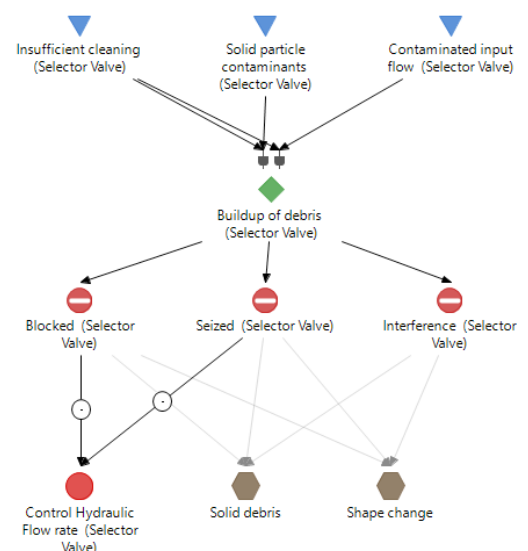
Engineering analyses are generated on-demand from the model of the system built during design. A key benefit is that the artefacts used to improve and validate the design can also be leveraged to document and demonstrate Airworthiness

- ▶ Mission Profile – identifying the typical use-cases and operation of the design
- ▶ FMECA – identifying the failures and how they progress through the system
- ▶ FTA – performing root cause analysis to find the initiating cause of any failure
- ▶ RCM – determining the maintenance plan required to support the platform in operation

How is Annotations used to demonstrate analysis quality?

The ability to generate analyses is important, as is the ability to document, trace and demonstrate the quality and integrity of the model used to generate the analyses. Annotations demonstrate quality by documenting:

- ▶ Justification – List each decision/parameter and the reasoning to support the change or decision
- ▶ Configuration Management – who made the decision and when it was made
- ▶ Data source and quality - the integrity of the data including the quality of the data source



Physical failure modelling utilizing the Failure Concepts taxonomy

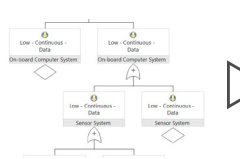
How MADE supports Airworthiness

Generate Engineering Analyses


FMEA

FAILURE MODES AND CAUSES	I OF
High Contamination due to blocking of the Air Filter as a result of siltling caused by contaminated input Flow and input Flow too slow (resulting in Low Torque and high Force)	1: P 2: LI 3: P
Low Mass Flow rate due to blocking of the Air Filter as a result of siltling caused by contaminated input Flow and input Flow too slow	1: P 2: LI 3: P

FTA



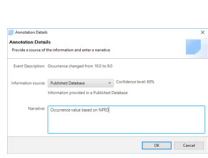
RCM Analysis



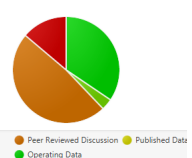
- 1) FMEA is generated based on the model
- 2) FTA can be generated from the FTA that provides cut-sets of failures
- 3) RCM analysis can be used to generate appropriate maintenance plan in response to the system

Demonstrate Analysis Quality

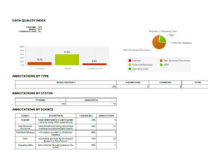
Annotate Decisions



Review Model Quality



Document Annotations



- 1) Each parameter used is tracked and annotated
- 2) Model or Analysis quality assessment (confidence level)
- 3) Reports generated to document quality of the analyses

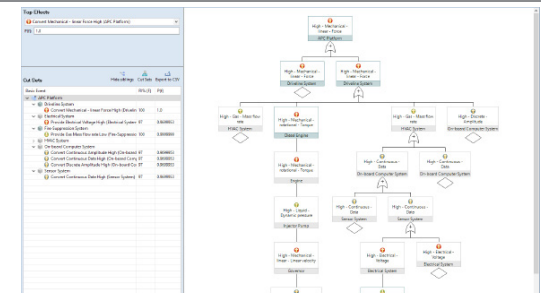
Key Airworthiness Analyses

FMEA/FMECA

IDENTIFICATION NUMBER	FUNCTIONAL DESCRIPTION (NOMENCLATURE)	FUNCTION	FAILURE MODES AND CAUSES	MISSION PHASE / OPERATIONAL MODE	LOGICAL EFFECTS	SEVERITY
	Air Filter	Prevent gas contamination	High contamination due to blocking of the air filter as a result of siltling caused by contaminated input Flow and input Flow too slow (resulting in Low Torque and high Force)	1: Panel 1 2: Cabin 1 3: Panel 2	Correct trajectory Operational Temp Blow Engine Loss of output	
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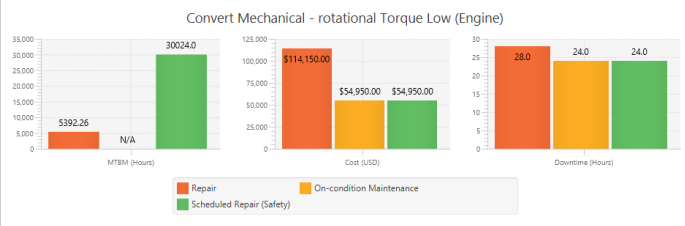
FMEA/FMECA leverage the functional and physical model to track failures

Fault Tree Analysis



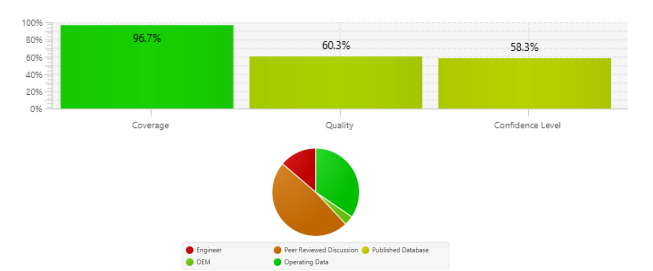
Root cause analysis from failure cause to end-effect in the FTA

Classic RCM/Maintenance Plan



Classic RCM to provide a maintenance plan in response to system failures

Annotations/Analysis Quality



An Model Quality Index and report to support any generated analyses