

Utilizing the MADe Modeling Tool



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Research Goals

Reliability Analyses (FMEA, FMECA, Reliability Predictions, FTA, CIL)

- Efficiently re-usable.
 - Library of common Spacecraft subsystems and components
- Develop standardized formats
- Relate to systems engineering models.
- Verify consistency.

Why use MADe?

- What is it?
 - A modeling tool that allows users to generate a variety of analyses across different engineering domains.
 - Currently has 3 modules (SRA, RAM, PHM).
- What can it do?
 - Design & Safety: FMEA, FMECA, FTA
 - Reliability & Availability Engineering: RBD Analysis
- Why is it useful to us?
 - Pre-formatted reports
 - One file vs Multiple files
 - Vast and available resources (palette, library)
 - Versatile.

Real Life Applications in Aerospace

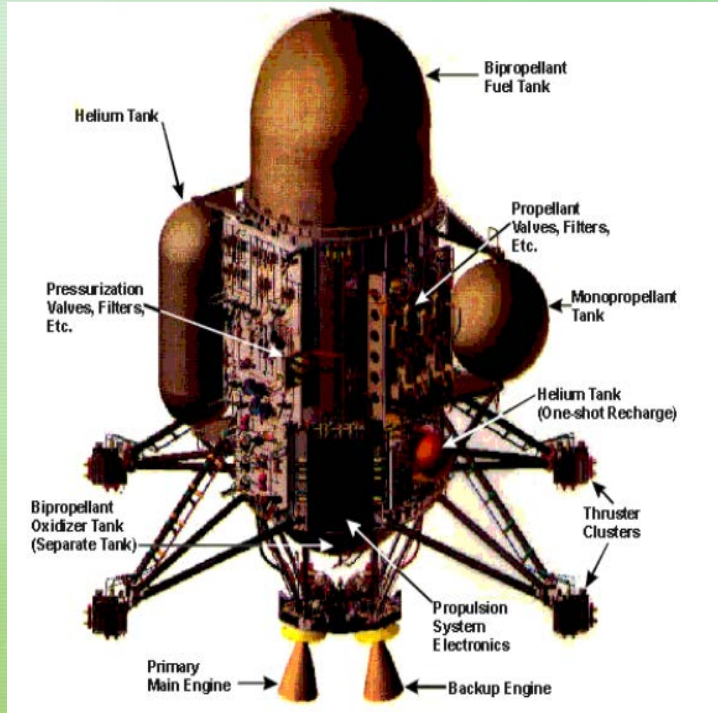


Figure 1: Propulsion System

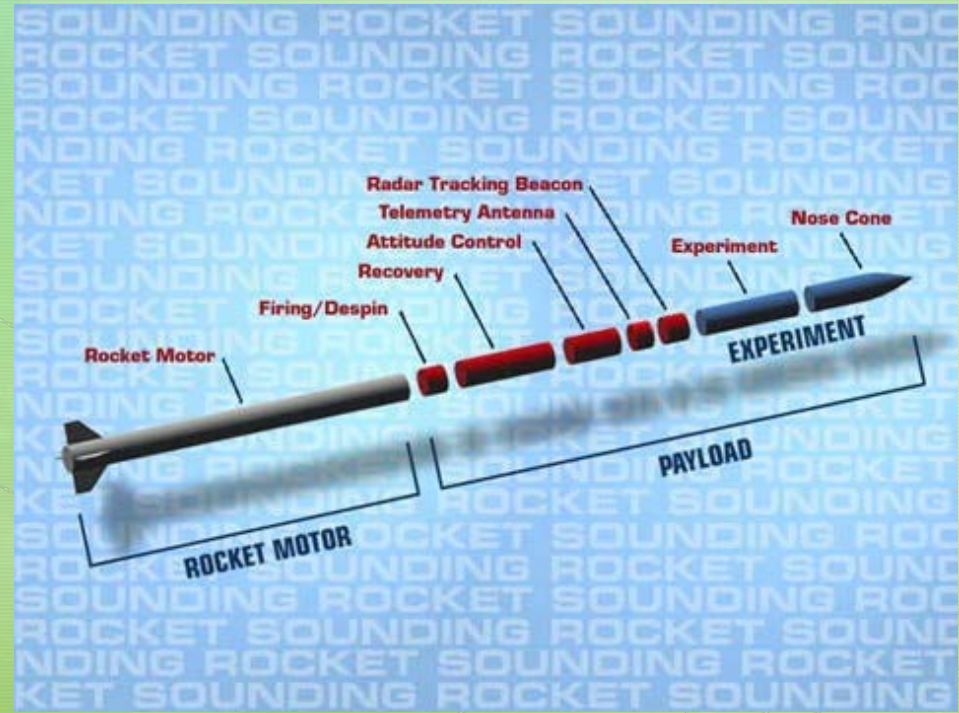


Figure 2: Sounding Rocket System

Models in MADE

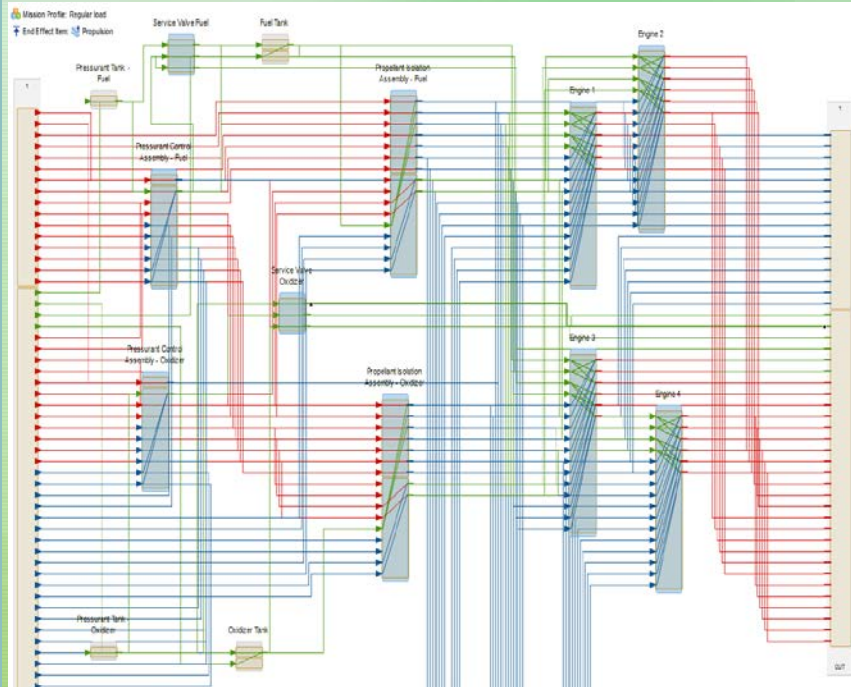


Figure 4: Propulsion System

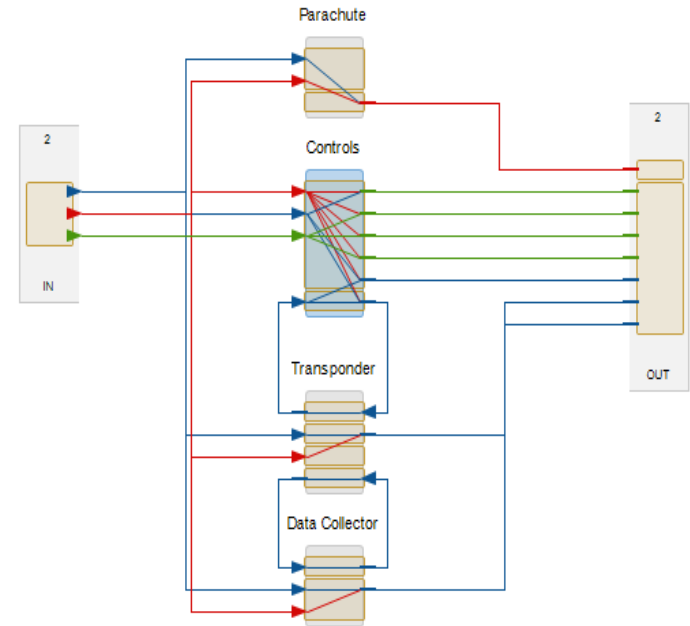


Figure 5: Payload Subsystem of Sounding Rocket System

Features of MADe

Figure 6:
Functional
Modeling for
Transponder
Component

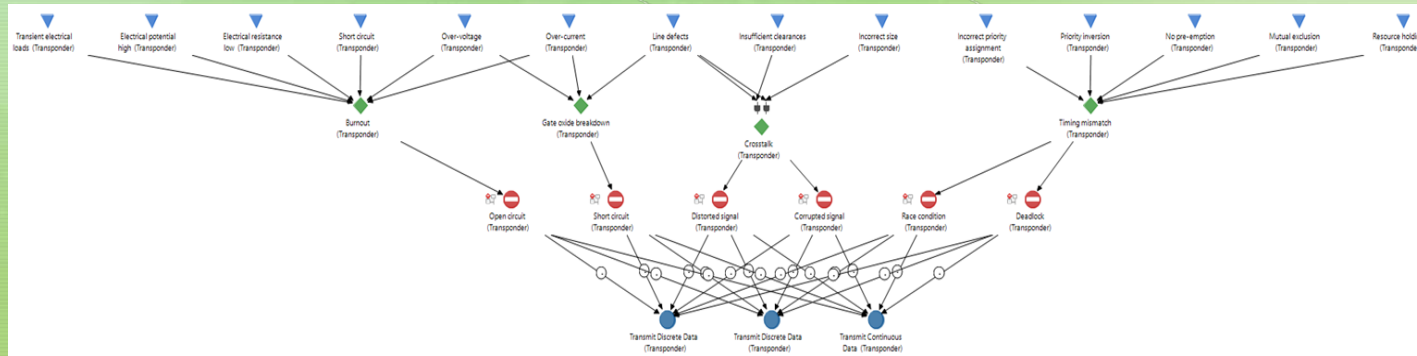
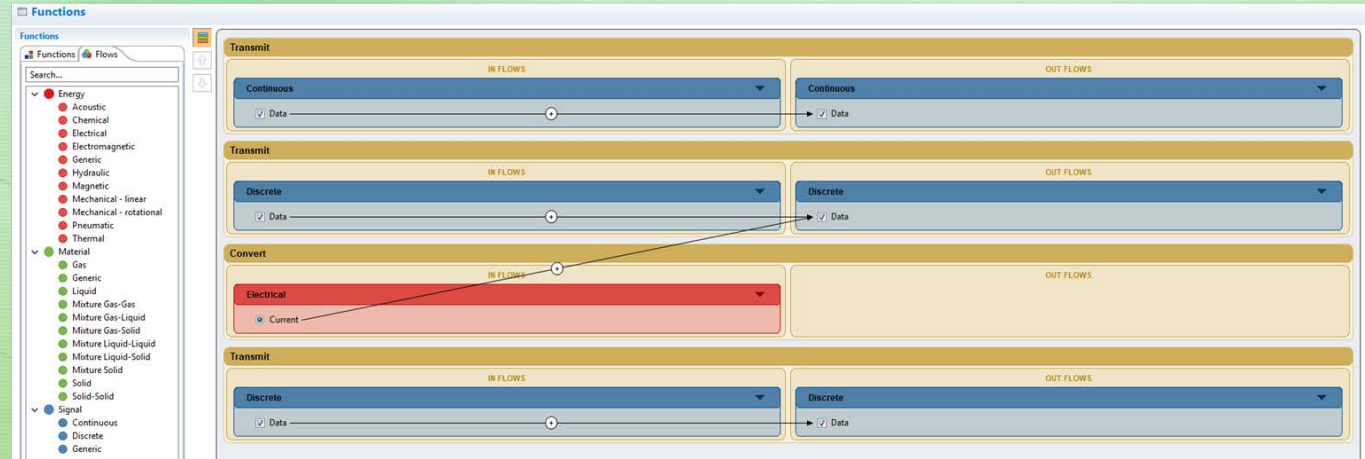


Figure 7: Failure
Diagram for
Transponder
Component

Features of MADe cont'd

Failure Conditions - Circuit breaking of the Transponder

Failure Conditions

Assign one or more Failure Conditions for Circuit breaking of the Transponder.

Compensating Provisions | Detection Methods | Failure Conditions

Name	Definition
<input type="checkbox"/> Degraded output	When an item produces an output flow but not of the required magnitude for ide...
<input checked="" type="checkbox"/> Failure to cease operation	When an item fails to cease functioning upon demand to do so.
<input checked="" type="checkbox"/> Failure to operate	When an item fails to function upon demand to do so.
<input checked="" type="checkbox"/> Intermittent operation	When an item functions normally and then fails to function at regular or irregular ...
<input type="checkbox"/> Loss of output	When an item fails to provide output during operation.
<input type="checkbox"/> Premature Operation	When an item functions earlier than it is prescribed to.
<input type="checkbox"/> Other	Any other conditions of failure.

Narrative

OK Cancel

Figure 8: Additional Information on Failure Diagram

Criticality & Reliability Editor

Relevant Selection

- Operating System
 - Control
 - Inhibit
 - Engines
 - Physical
 - Inhibit
 - Control
 - Data Collector
 - Transducers
 - Transponder
 - Continuous - Data
 - Transmit
 - Transmit
 - Failure Diagram

Function Fow Criticality

Selected Profile: Default Fuzzy Profile | Criticality Method: Fuzzy/FBN

Difficulty of Detection: 0.3

High

Occurrence: 1.5

Severity: 10.0

Low

Occurrence: 1.5

Severity: 10.0

Figure 9: Criticality & Reliability Editor

Challenges/Lessons Learned

- Navigation/Complexity Issues
- Continued development of Reliability Analyses in Aerospace.
- High importance in meeting regulation standards.
- Broaden the scope of describing and understanding component failures and faults due the library of failure causes and mechanisms.
- Modeling tool's vast potential.

References

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