

A Vision for Spaceflight Reliability: NASA's Objectives Based Strategy

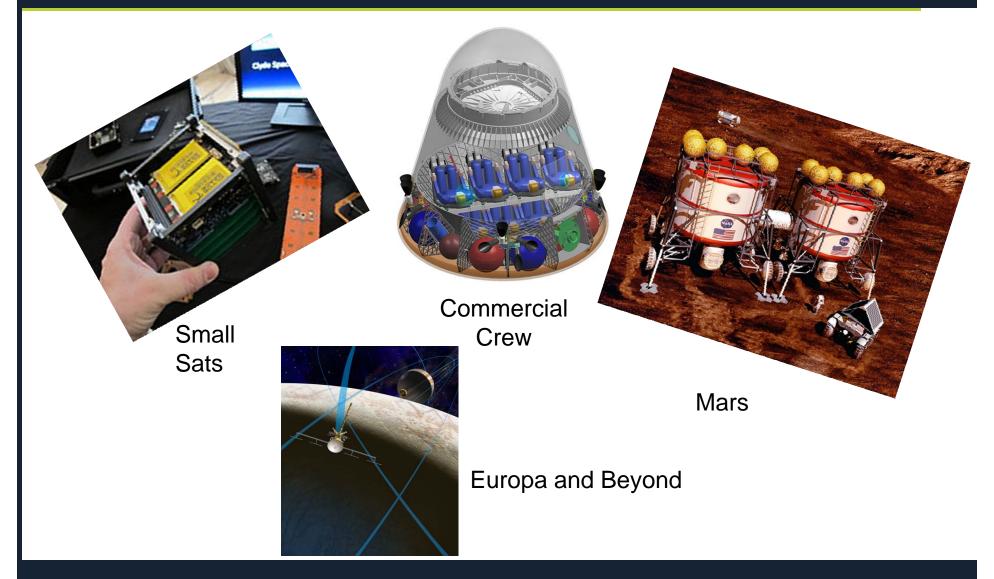
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NASA Challenges

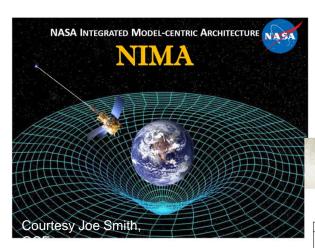






MBSE





Our products may need to be different in a model based environment

NASA OCE direction *will* enable model centric capability 4 Pillars of SysML – ABS Example

1. Structure

strass activations@enuence liseruence Diagrams

2. Behavior sd ABS_ActivationSequence [Sequence Diagram] bdd [Package] Structure [ABS Structure Hierarchy], stm TireTraction [State Diagram] **FMFA** act PreventLockup [Activity Diagram] Library:: Electronic Anti-Lock Library:: Contr | ibd [Block] Anti-Lock Controller [Basic] Hazard Decisions should not Analysis be made without our definition insight and oversight req [Package] Stopping Distance ld = "10.2" Text = "The vehicle shall Text = "The braking system shall stop from 60 miles per hou prevent wheel lockup under all e4 : Distance Equation within 150 ft on a clean dry braking conditions. e3: Velocity Equation Reliability uirements Copyright © 2006-2009 by Object Management Group Models

Safety Requirements and Quality Demands



Mission Assurance Challenges



- NASA's Mission Assurance faces challenges
 - Changing missions
 - Changing acquisition models
 - Changing engineering practices
 - Changing technology
- We must reconsider our practices to stay relevant
 - Don't necessarily hang on to 'proven' practices
 - Consider the intent behind R&M methods and techniques



"Subset of Considerations"



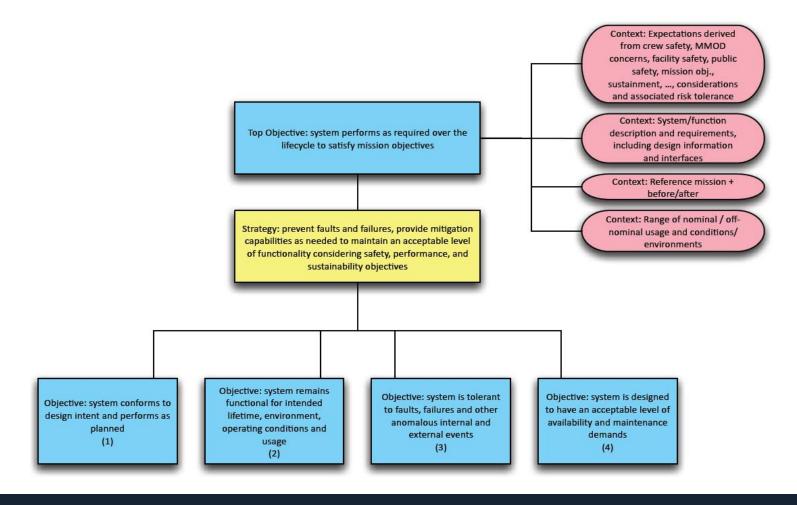
- Focus on the what:
 - Emphasize R&M objectives and related strategies
 - Leave choice of methods and techniques to implementing organizations
 - Allow for innovation and adaptation to new engineering practices



Decomposition of R&M Objectives

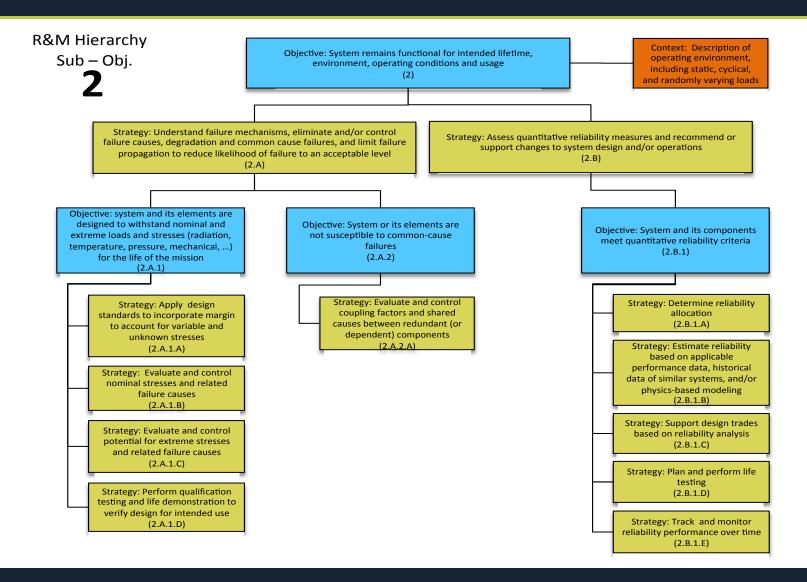


R&M Objectives Structure – Top-Level











Laying the Foundation



- Logically decompose top-level R&M objective
 - Use elements of the Goal Structuring Notation
 - Structure shows why strategies are to be applied
- Structure forms basis for a proposed R&M standard
 - Specifies the technical considerations to be addressed by projects
 - Forms basis for evaluation of plans, design, and assurance products



Summary



- Changes in missions, acquisition/engineering practices, and technology challenge proven R&M practices
- Define R&M objectives and strategies to enable adaptation and innovation
- Logically decompose the top-level R&M objective to identify the elements of an R&M argument



Final Thoughts



- MBSE is not the rationale for the proposed approach, but is considered to help devise R&M tools and methods within MBSE contexts.
- Community will have to work towards open standards for documenting R&M arguments and evidence
 - As part of broader assurance framework
 - Enable infrastructure of MBSE-compatible R&M tools

