Proposal for a Comparison of Reliability and Maintainability Activities across ESA, JAXA, and NASA

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Proposal

- The R&M taskforce proposes a comparative evaluation of the scope of R&M considerations (technical objectives and strategies) across the three agencies, and common tools, techniques, and standards used to implement those strategies.
- The task force proposes to consider the elements of the NASA R&M framework, as captured in the hierarchy of R&M considerations, to identify commonalities and differences in the way reliability and maintainability is addressed by the flight projects.
- In addition, the task force will consider lessons learned from past projects concerning international cooperation.

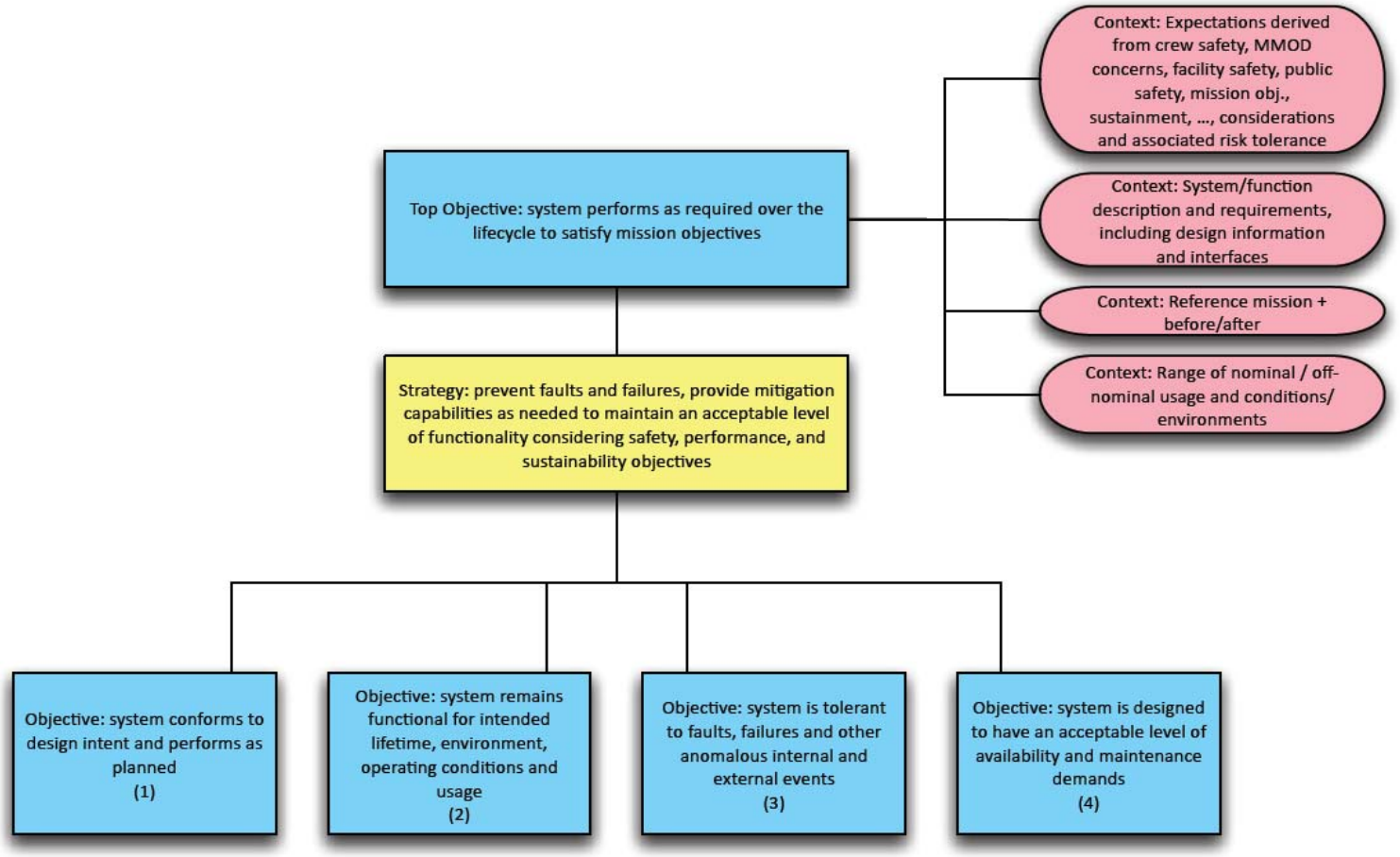
Objectives Based Hierarchy: Overview

- 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 R&M activities
  - Specifies the technical considerations to be addressed by projects
  - Basis for evaluation of plans, design, and assurance products

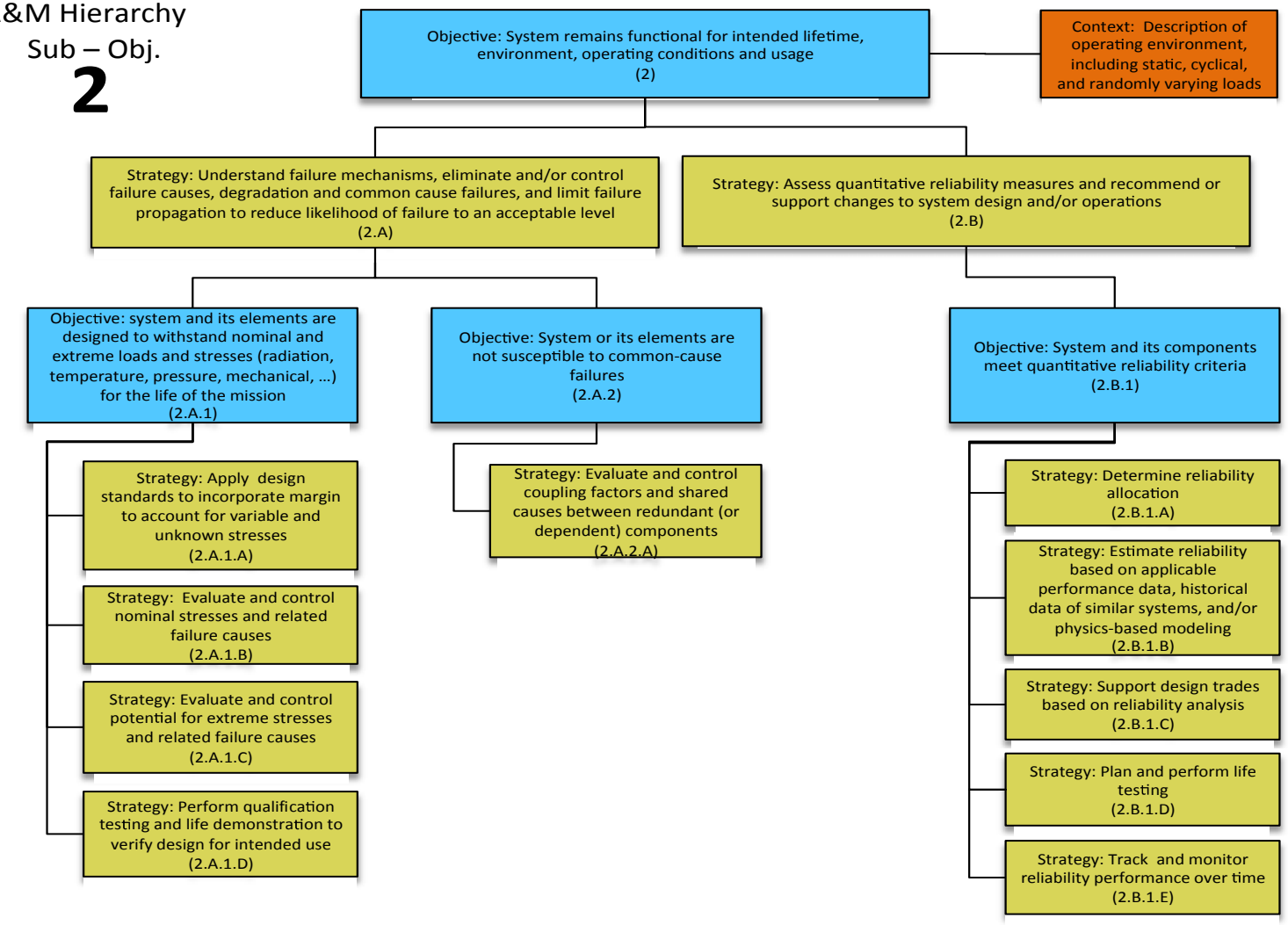
Decomposition of R&M Objectives

R&M Objectives Structure – Top-Level



Decomposition of R&M Objectives

R&M Hierarchy
Sub – Obj.
2



Analysis and Comparison

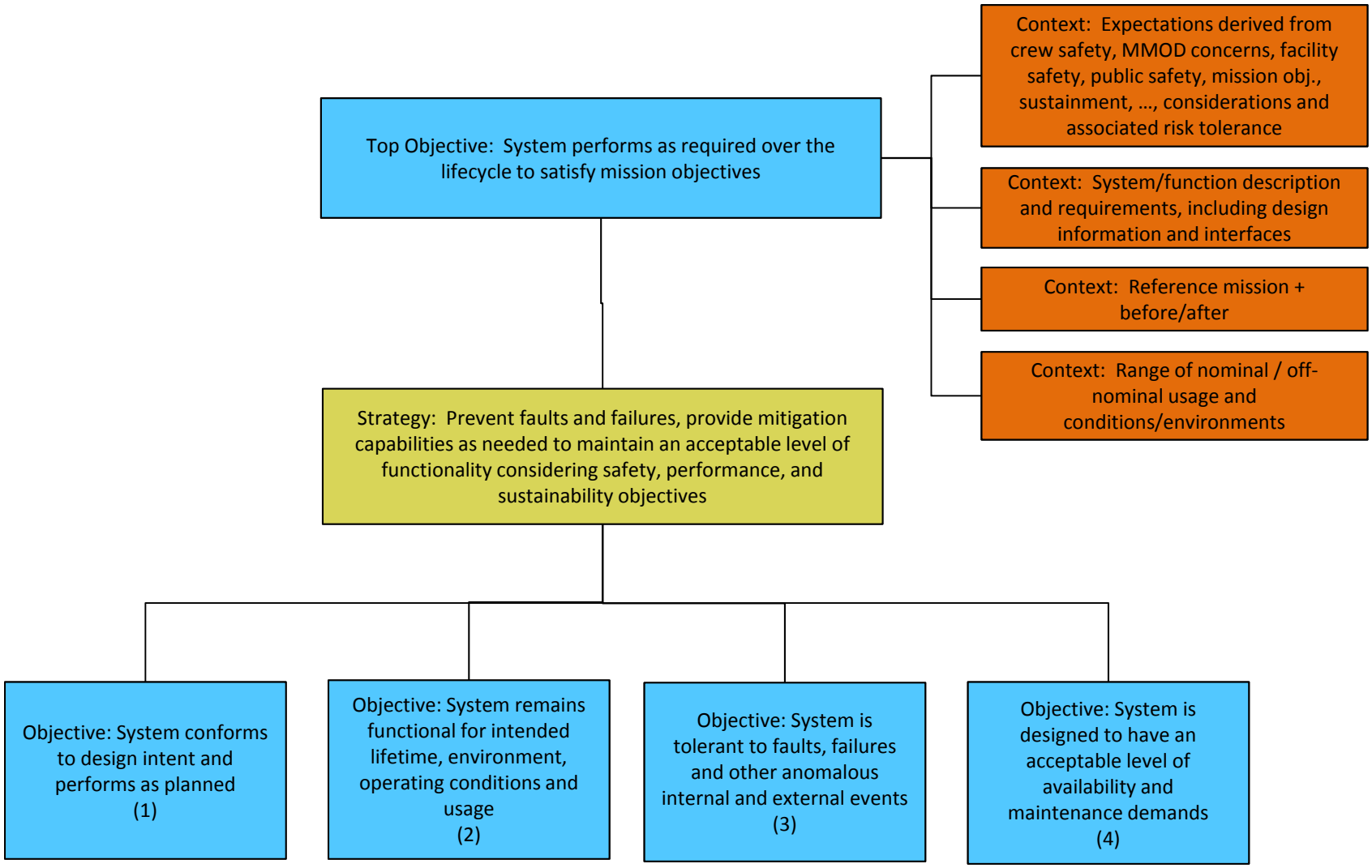
			Scope						
		Evidence	Human Space Flight	Class A	Class B	Class C	Class D	Research and Technology	Ground Based Systems
1.C	Strategy: Achieve high level of process reliability								
1.C.1	Objective: Built system and its components do not contain flaws/faults that reduce ability to withstand loads and stresses								
1.C.1.A	Strategy: Select appropriate quality components and materials	approved parts list, parts control and traceability, materials review, approved vendors list	Parts/materials control standards applicable to Human Space Flight	Parts/materials control standards applicable to individual mission class				Parts/materials control standards applicable to research and technology	Parts/materials control standards applicable to ground based systems, if they exist
1.C.1.B	Strategy: Perform process reliability reviews to ensure consistency of reliability design processes with interdependant engineering analyses	technical oversight & management, independant technical review, peer technical review, software process audits	High rigor review of all reliability design processes and engineering analyses			Selective review of reliability design processes and engineering analyses based on high risk drivers			For telemetry items, same scope as Class A/B. For other items, selective review as in Class C/D
1.C.1.C	Strategy: Establish and verify manufacturing processes and handling criteria	approved parts list, ground handling analysis, process variance analysis, process FMEA, ground handling test, process capability assessment	Parts control handling standards and manufacturing criteria applicable to Human Space Flight	Parts control handling standards and manufacturing criteria applicable to individual mission class				Parts control handling standards and manufacturing criteria applicable to research and technology	Parts control handling standards and manufacturing criteria applicable to ground based systems, if they exist
1.C.1.D	Strategy: Screening, proof testing and acceptance testing	Environmental Stress Screening, Inspection Criteria, Acceptance Test Plan	Test/Screen at full level of rigor (duration, number of cycles, acc. for ESS). Test/Screen will be tailored based on criticality				Test/Screen at decreased level of rigor than lower risk classes (box level). Test/Screen will be tailored based on criticality		Verify functionality of ground support equipment used for testing. Screen/proof testing of safety elements

Output

- The output of the comparison will be a report structured in accordance with the Provisions in Support of the Mutual Recognition of Safety & Mission Assurance Standards in Cooperative Programs.
- This report would address area 5.o Dependability Assurance with particular focus on Reliability and Maintainability, herein referred to as R&M.
- Completion of the report is targeted by the next trilateral SMA meeting.

R & M Heirarchy

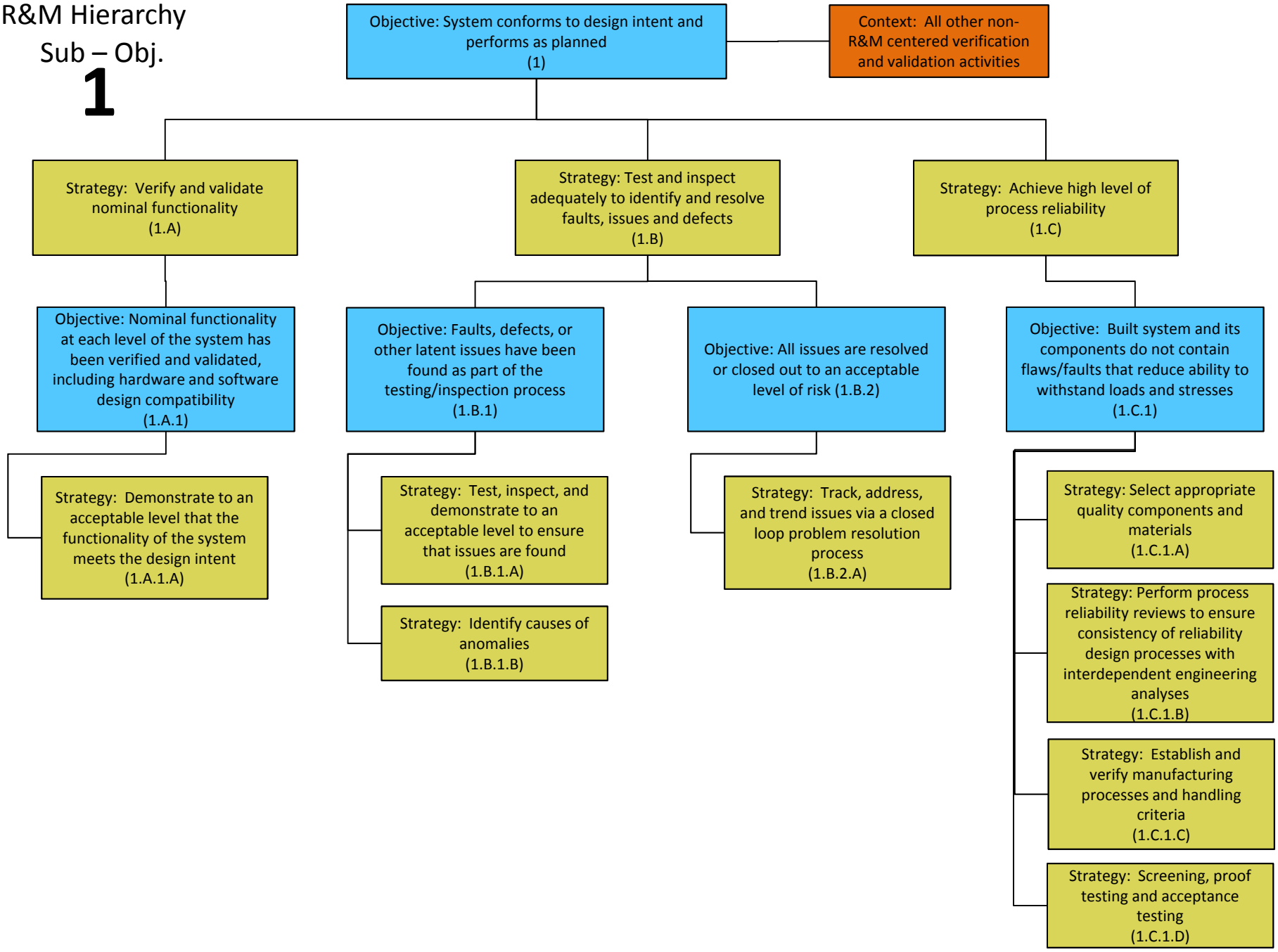
R&M Objectives Hierarchy – Top Level



R&M Hierarchy

Sub – Obj.

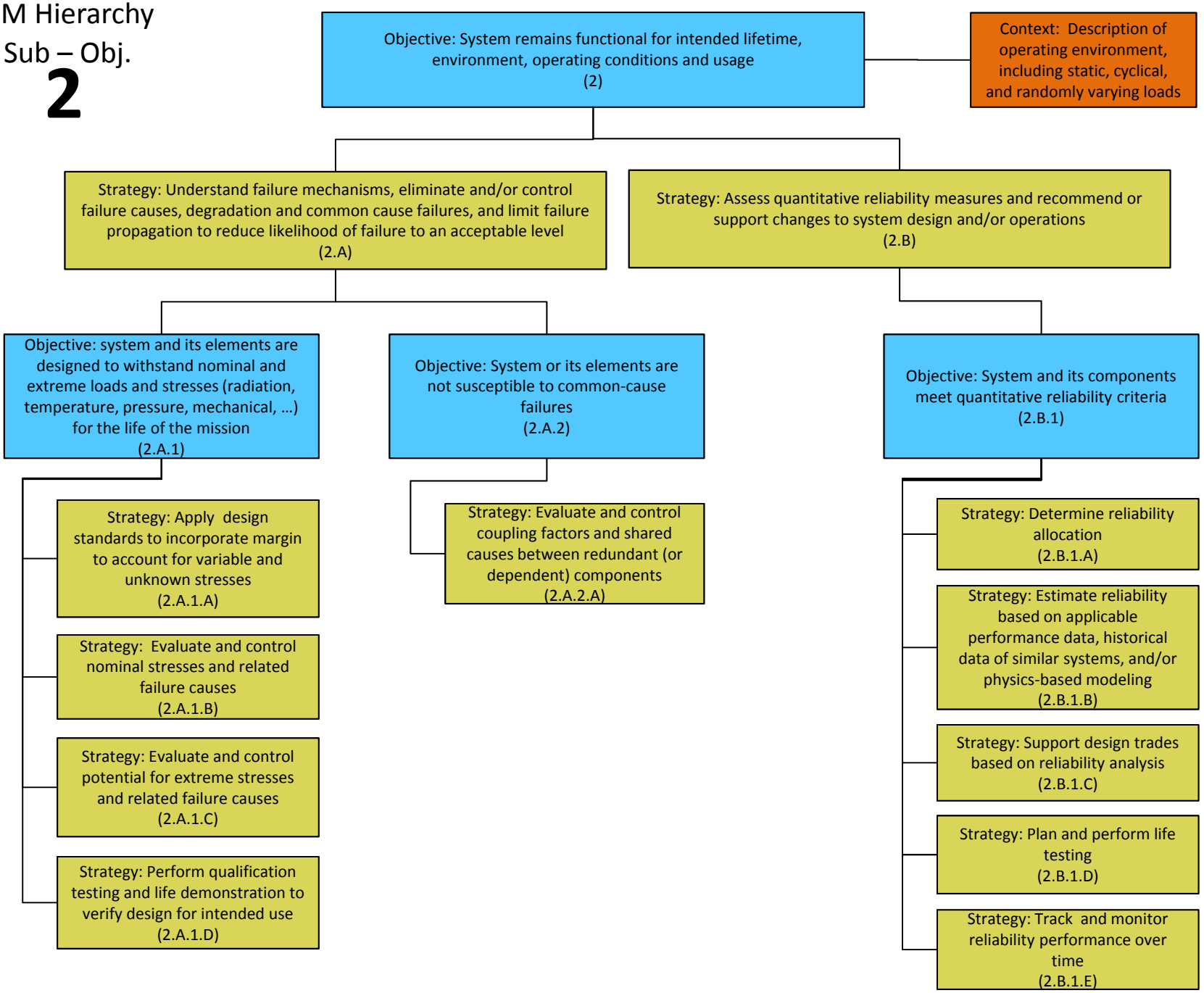
1



R&M Hierarchy

Sub – Obj.

2



R&M Hierarchy

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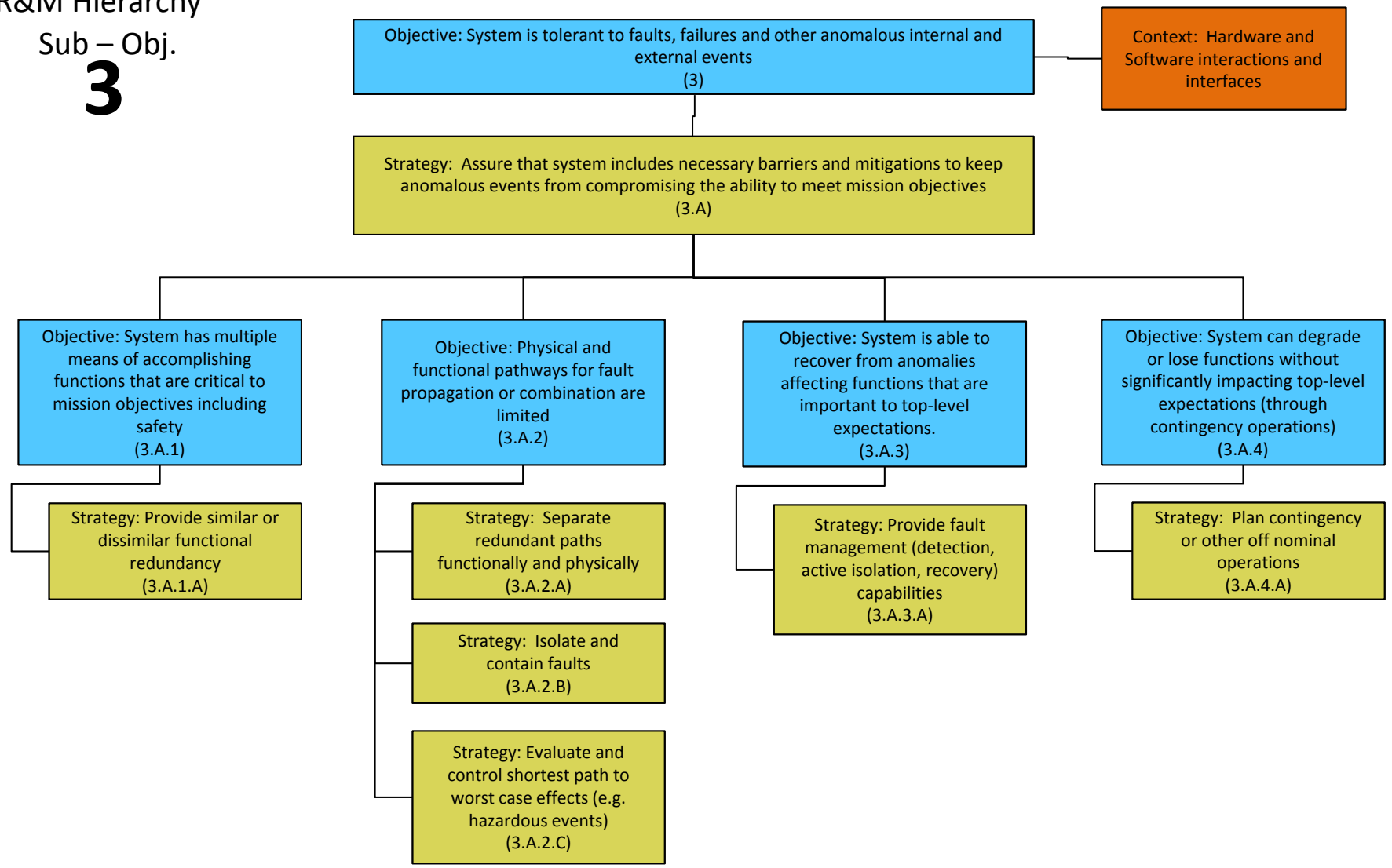
3



R&M Hierarchy

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