

Homework #4: Requirements

A. Reference attached spreadsheet

B. Reference attached spreadsheet

C. Written Responses

1. Good and Bad Requirements

Good Requirement: “The LunarGEM spacecraft shall comply with NASA-STD-5017, Design and Development Requirements for Mechanisms.”

Explanation: This requirement is “SMART” – references a specific standard; can be measured by that standard; because the document referenced is a formal NASA standard, it must be achievable; the standard referenced is relevant to the element spacecraft. In the original format, this requirement was not traceable; however, after reviewing and reorganizing the requirements into a more coherent structure, this requirement was traceable.

Bad Requirement: “Spacecraft assembly shall be performed in a class-100,000 clean room.”

Explanation: This requirement specifies HOW to do something, not WHAT is supposed to be done.

Rewritten: “The spacecraft shall be assembled in an environment free of foreign objects and dust particles.”

2. **Verifiable Requirement:** “LunarGEM shall be operational in the entire range of temperatures encountered the Moon’s surface.”

Verification Method: Verification methods for this requirement include analysis of the individual materials, followed by a test of all the components together placed under the entire range of temperatures.

3. **Non-verifiable Requirement:** “The spacecraft contractor shall define adequate safety margins to be incorporated into the design.”

Explanation: This requirement cannot be verified because the word “adequate” in this context is subjective and not quantifiable.

4. Good and Bad Rationale

Good Rationale: “Rationale: Small ΔV corrections will be necessary to maintain the desired trajectory to the moon.”

Explanation: This rationale explains why the requirement (1.1.3.2) is needed, what assumptions were made, and what design effort drove the requirement.

Bad Rationale: “Rationale: Temperature variations could result in failure of electronics and other critical systems.”

Explanation: This rationale does not completely explain why the requirement (3.2.2) is needed. A better way to state this rationale may be “Unless designed for, temperature variations could result in failure of electronics and other critical systems.”

5. **Requirement that should not be a requirement:** “Lunar seismic vehicles shall separate from the OTV after lunar orbit insertion and descend to the surface of the moon.”

Explanation: This requirement should not be a requirement because it describes how the lunar seismic vehicles get to the surface of the moon (the solution) as opposed to what the lunar seismic vehicles need to do (the actual requirement). A better written requirement would be, “The lunar seismic vehicles shall descend to the surface of the moon such that _____ tolerances are met.”

D. **Rewritten Requirements Document** (reference attachment)

E. **Product Breakdown Structure** (reference attachment)