

Module 1: General Introduction to RAMS Analyses: the five W's

1.1. What are RAMS analyses?

1.2. Why should they be performed?

1.3. Who should perform them?

1.4. Where are they included within a project?

1.5. When should they be done?

1.6. How can a RAMS analysis be performed?

- ❖ Safety analysis
- ❖ FMECA analysis
- ❖ FTA analysis
- ❖ Reliability analysis
- ❖ Transport analysis
- ❖ Maintenance analysis
- ❖ Spare analysis

Module 2: RAMS theory: availability model

2.1. Definitions

- ❖ System Failure
- ❖ System availability and downtime
- ❖ Failure rate
- ❖ MTBF (Mean Time Between Failures)
- ❖ MTTR (Mean Time to Repair)

2.2. Parameters and configurations

2.3. Reliability Mathematical Models

- ❖ Basic equations
- ❖ System reliability models
 - ❖ Serial configuration
 - ❖ Parallel configuration
 - ❖ m out of n configuration
 - ❖ Stand-by redundancy

2.4. Examples

Module 3: Application to telescopes and astronomical instruments

3.1. General RAMS assumptions

3.2. Relation to "Concept of Operations" and "Maintenance" documents

3.3. Typical subsystems to analyze in an astronomical observatory

3.4. Impact of RAMS analyses in special cases

- ❖ Robotic telescopes
- ❖ Remote, isolated sites or with extreme conditions
- ❖ Giant telescopes. ELT case

3.5. Examples

- ❖ MEGARA instrument
- ❖ TSPM telescope

Module 4: Reference RAMS standards and related literature

❖ Organizations

❖ RAMS-related standards and literature

- ❖ ESA Standards: ECSS
- ❖ ISO Standards
- ❖ IEC Standards
- ❖ Literature: NASA Handbook for Systems Engineering
- ❖ Reliability prediction: MIL-HDBK-217 and its progeny

Appendix: Templates and Bibliography

Templates

- ❖ FMECA template
- ❖ Reliability budget template

Bibliography consulted

Course Overview

This course intends to introduce the fundamentals of the RAMS (Reliability, Availability, Maintainability, Safety) analyses as part of the System Engineering activities within any project and, in particular, within the scientific projects linked to astronomical instrumentation and telescopes.

To whom this course is addressed

This course is aimed at Systems Engineers who wish to acquire the fundamentals to perform basic RAMS analyses, specifically for engineering astronomical projects. Also, Project managers and engineers in the different technical disciplines, who will learn what inputs are required from them to carry out the project RAMS analyses and the deliverables resulting from them.

Background needed

None specific. General engineering, physical and mathematical concepts are welcome.

At the end of this course, attendees will

Understand what RAMS analyses are and its importance within a project.

Be able to perform, in a systematic and structured way, a preliminary failure analyses, simple reliability calculations, maintainability and safety analyses.

Learn how this concepts are applied in a practical way to the field of astronomical instrumentation.

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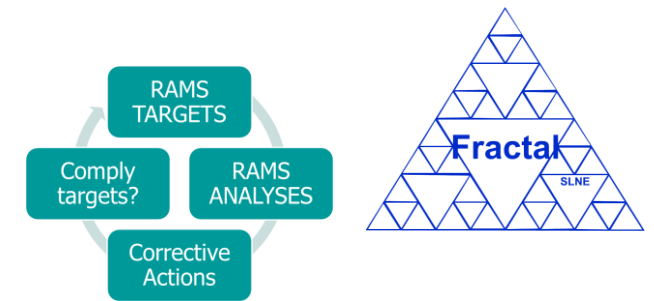
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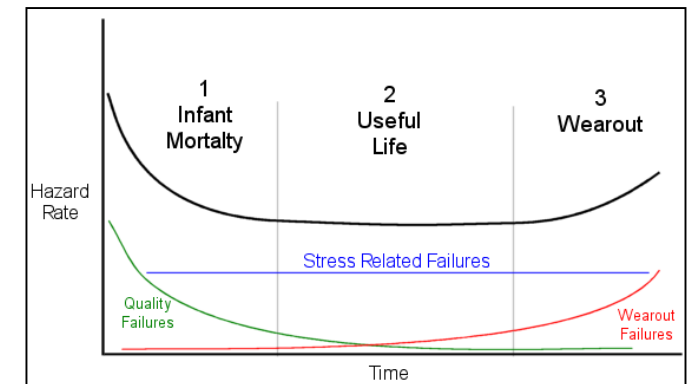
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Introduction to RAMS analyses for telescopes and astronomical instruments



Training



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