

## **DESIGN REPORT and VERIFICATION PLAN (DRVP)**

**Due: Midnight, December 11, 2022**

At the conclusion of the conceptual design phase, trade studies have been completed at the system, subsystem, and major component levels. Before completing the preliminary design phase, design teams must ensure that there is adequate analysis to support the design decisions, a clear plan for the testing, analysis, inspection, or demonstration required to verify each requirement, and a thorough risk assessment with appropriate mitigation plans to ensure successful PDR completion. The content of the DRVP is as follows:

- Front Matter
  - Title page
  - Abstract
  - Table of contents
  - List of figures
  - List of tables
- Introduction and System Overview
  - Purpose and benefits
    - Describe the problem the team is addressing through this design effort
  - Goals and objectives
    - Describe the outcomes you intend to achieve and the actions that will lead to achieving the team's goals
  - Concept of system operations
    - Graphical depiction
  - Preview the document's major content areas and organization
- System Description
  - Definition
    - Describe the overall system configuration
  - Requirements
    - State the critical requirements and discuss their origin
  - Integration
    - Describe how your system interfaces with other systems and support equipment
    - Show integrations (mechanical, electrical, data, etc.) in a block diagram
  - Governing equations
    - Introduce equations needed for system analysis, define variables, and explain how the equations are used
  - Analysis/results
    - Explain what system-level analysis was done, why it was done, and what assumptions were made in enough detail that your work can be reproduced
    - Discuss the important results and remaining risks and mitigations.
  - System summary (see example below)
    - Summarize the system configuration
    - Include a table of the requirements, the performance your design will achieve based on your analysis, and if your design satisfies that requirement
  - System verification plans

- Describe the verification method in relationship to a core design requirement
  - Establish criteria or benchmarks to verify target requirements
  - Identify needed tools/hardware/software
  - Specify a location for testing
  - Describe methods or processes to record and document the test results
  - Provide graphics (as needed) to illustrate the tests to be implemented
  - Describe key stakeholders and responsibilities
  - Anticipate safety risks and describe risk-mitigation techniques.
- Budgets
  - Describe allocations down to subsystems
  - Discuss the current forecast versus the budget
  - Discuss the cost to-date for your team
- Subsystem X (repeat for each subsystem)
  - Definition
    - Describe the subsystem's role in achieving the system objectives
  - Requirements
    - Discuss how system level requirements were decomposed to the subsystem
  - Integration
    - Describe how the subsystem interfaces and is compatible with other subsystems
    - Show integrations (mechanical, electrical, data, etc.) in a block diagram
  - Governing equations
    - Introduce equations needed for subsystem analysis
    - Define variables and explain how the equations are used
  - Analysis/results
    - Explain what analysis was done, why it was done, and what assumptions were made in enough detail that your work can be reproduced
    - Discuss the important results and remaining risks and mitigations.
  - Subsystem verification plans
    - Describe the verification method in relationship to a core design requirement
    - Describe the verification method in relationship to a core design requirement
    - Establish criteria or benchmarks to verify target requirements
    - Identify needed tools/hardware/software
    - Specify a location for testing
    - Describe methods or processes to record and document the test results
    - Provide graphics to illustrate the tests to be implemented
    - Describe key stakeholders and responsibilities
    - Anticipate safety risks and describe risk-mitigation techniques.
  - Subsystem summary (see example below)
    - Summarize the subsystem configuration
    - Include a table of the requirements, the performance your design will achieve based on your analysis, and if your design satisfies that requirement
- Conclusion
  - Summarize your design
  - Discuss how your design satisfies the requirements and constraints
  - Discuss how your design achieves the primary and secondary objectives

- Review risks that must be addressed as you enter the preliminary design phase.
- Back Matter
  - Design team organization chart
  - Budget
    - Summarize the expected cost of the proposed project. This should be justified by allocating the overall cost to system and subsystems elements.
    - Show that the expected cost, including a management reserve, is no more than the available funds.
  - Schedule
    - Provide a Gantt chart depicting the major phases of your project over its complete lifecycle and how you will support the critical milestones of your internal and/or external customer(s).
  - Acknowledgements
  - References (document any information that didn't originate from the design team)

Example System/Subsystem Summary Table:

Requirement			Analysis Value	MOC	Meets Requirement
Number	Title	Value			
1.1	Total Mass	$\leq 10$ kg	10.45 kg		No
1.2	Endurance	$\geq 20$ minutes	27 minutes		Yes