PHASE 2 ~ CONCEPTUAL DESIGN
Deliverable 5 ~ Functions and Requirements

INSTRUCTIONS. Write a product functions and requirements document for your design project system. Your functions and requirements are due electronically and you should add it to your design history file as well. Your document should have the filename convention Team-*yournumber*_del5_functions_and_requirements.

Purpose

The functions and requirements document is the bridge from the stakeholders' perspective to engineering terms to ensure that the stakeholders' needs are met. It describes what the system is to do (i.e., functions), how well it is to perform (i.e., performance requirements), and under what conditions (i.e., non-functional and performance requirements). This document does not define how the system is to be built.

Critical Information

Start at the "finish line" to gauge how many functions and requirements to write and/or how much detail to have in the document. The following should be asked when starting at the top level of the system:

- What are all the functions needed in order to satisfy the stakeholder that the system is doing what it is expected to do?
- How well does the system need to perform the required functions?
- Under what conditions does the system need to operate?

Each of these tests for the system or the sub-systems will need a set of functions and requirements. Other factors are the amount of commercial off-the-shelf (COTS) products used. Functions and requirements of COTS products should be reviewed to determine if they will meet the stakeholders' needs.

In general, the functions and requirements document should answer the following questions:

- Is there a definition of all the major system functions?
- With each function of the system, is there a set of requirements that describes: what the function does, who is assigned to do it, and under what conditions (e.g. environmental, reliability, and availability).
- Are all terms, definitions, and acronyms defined?
- Are all supporting documents such as Needs Assessment (i.e., Deliverable #4) and others referenced?
- Does each requirement have a traceable link to a higher level requirement of a stakeholder-specified need?
- Is each requirement concise, verifiable, clear, feasible, necessary, unambiguous, and technology independent?

- Are all technology dependent requirements identified as constraints?
- Does each requirement have a method of verification defined?

Format of the Functions and Requirements

The functions and requirements document should include the following sections:

1. TITLE PAGE
    - SYSTEM FUNCTIONS AND REQUIREMENTS FOR THE (insert name of project) AND (insert names of stakeholders and their affiliations)
    - Date that the document was formally approved by stakeholders
    - The organization responsible for preparing the document
    - Revision version and date issued

2. SCOPE OF SYSTEM OR SUB-SYSTEM. This sections contains a full identification of the system:
    - Provides a system overview and briefly states the purpose of the system
    - Describes the general nature of the system
    - Summarizes the history of system development, operation, and maintenance
    - Identifies the project stakeholders, users, and support organizations
    - Identifies current and planned operating sites

3. REFERENCED DOCUMENTS (*optional*). This optional section is a place to list any supporting documentation used and identifies all needed standards, policies, laws, concept exploration documents and other reference material that supports the functions and requirements.

4. FUNCTIONS AND REQUIREMENTS. This section is the *heart of the document*. It contains the following:
    - Functions: *what the system shall do*
    - Performance requirements: *how well it should perform*
    - Interface requirements: *definition of the interfaces*
    - Data requirements: *data elements and definitions of the system*
    - Non-Functional requirements: *reliability, safety, environmental, etc.*
    - Enabling requirements: *production, development, testing, training, support, deployment, and disposal*
    - Constraints: *technology, design, tools, and/or standards*

5. VERIFICATION METHODS. This section contains one of the following methods of verification for each requirement in the above section:
    - *Demonstration* verification is for a requirement that the system can demonstrate without external test equipment
    - *Test* verification is for a requirement that needs some external piece of test equipment (e.g., logic analyzer, volt meter, etc.)
    - *Analyze* verification is for a requirement that is met indirectly through a logical conclusion or mathematical analysis of a result (e.g.,

algorithms: the designer may need to show that the requirement is met through the analysis of count or calculations in software)

- *Inspection* verification is for a requirement that needs a visual comparison (e.g., quality of welding may be done through a visual comparison against an in-house standard)

6. TRACEABILITY MATRIX. This is a table that traces low-level functions and requirements to high-level functions and requirements and, at the top level, it should trace to the results of the Needs Assessment document (i.e., Deliverable #4).

7. GLOSSARY (*optional*). This optional section may be used for terms, acronyms, definitions, etc.