Requirements and Specifications   Quick Review

Aerospace Needs, Microelectronics, and the Quest for Reliability:

Many projects fail or have overruns because the requirements or specifications are poorly written.

After analysis of several errors and failures in Aerospace projects:

"NASA later concluded that software errors were less likely caused by poor coding practices than by errors in specifications, which in the case of the Shuttle would have affected the fifth computer as well."

Requirements and Specifications   Quick Review

One **Requirement** is a statement of one thing a product must do or a quality it must have. **Requirement Specifications** or **Documents** are collections of the set of all **requirements** that are to be imposed on the design and verification of the product.

From my experience in system and product design, the Requirements should be divided into General, Detailed and Functional Requirements. For embedded systems, the Detailed and Functional Requirements describe the role of the sensors and imputs, microcontrollers and processing, and outputs for a product. (Other names may be used but the divisions are useful.)

General Requirements
The general *specificatio*ns of the operation of a product that must be met by the end product. These specifications should define the characteristics of the product as experienced by the end user. Examples might include such topics as number of users, power consumption, size, weight, and speed. Numerical values should be assigned to a requirement whenever possible. The Acceptance Testing should verify that the product meets the General Requirements.

Detailed Requirements
1. Description of purpose and general operation including a physical description.
2. In normal operation for input and output
       Number and type of inputs (i.e. analog inputs, digital inputs, etc.-What do they represent? Range and resolution of values (i.e. 0-600volts, +- .01 volts)
       Frequency range (if required)
           Such values determine the following:
       Samples per second per channel for analog inputs or data rates for digital data
       For outputs, what will the user see (or hear)? How does the user control the product- keyboard, touch screen, etc.
3. Other conditions
       Response to over-range or errors of input values- What happens when something goes

wrong?
Alarm conditions (if necessary)
"Hard real-time" timing constraints (if any) and overall timing diagram
4. Acceptance Testing Protocol
What will satisfy the "user" that the product performs as described?
5. Special Requirements
Power/safety/environmental considerations

Functional Specifications
1. **Block diagram** and description of software (SW) and hardware (HW) modules used to meet the Detailed Requirements
2. **Description of the interfaces** between modules – type of data exchanged, data rates, error conditions, etc.
3. Timing diagram for critical parts of system
4. More detailed description of the output data or signals
5. For the software modules and data, estimate the storage requirements.
5. Details of the User interface with the product

PROJECT REPORTS - OUTLINE AND REQUIREMENTS (Continued)

Detailed Design (Hardware and Software)
1. Flow charts, circuit diagrams, etc that describe how the product will be made.
2. Define all the I/O drivers and interrupt service routines. How will these routines be tested?
3. How will the integrated system (HW and SW) be tested?