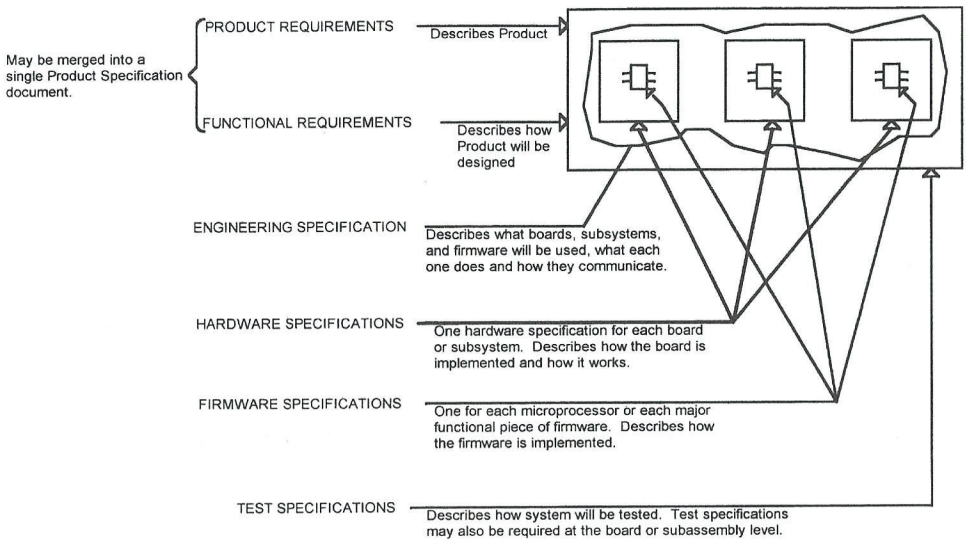

Figure 1.1
Design Documentation.

System evaluation

Hardware design

Firmware design

Integration

Verification (test)

These steps are not necessarily serial. For example, if there are separate hardware and software teams, the hardware and firmware design can proceed in parallel. The process is not always linear—system evaluation may reveal a problem with the selected processor, which means that step must be repeated. Last, the process is not always this well divided. The requirements definition and functionality description, for example, may be merged into a product specification or other customer-required documents.

Many companies require such product specifications early in the design process. I will not dwell on that here, as the requirements for this type of document are specific to the company or the customer for whom the product is intended. Commercial customers, to pick one example, have considerably different requirements than the Department of Defense. The design and documentation process begins with the next level of documentation below the product specification: the requirements definition.

Requirements Definition

The requirements definition (which, again, may actually be part of the product specifications), describes what the product is to do. In a very large company, the marketing department or a major customer may define the requirements. In a smaller company, the hardware and software engineers may sketch out the requirements definition. For a small, one-engineer project, the requirements may be the result of a momentary inspiration.

The requirements definition can take the form of a book—defining every interaction, interface, and error condition in the system—or a single-page list of what the finished product must do. In either case, the requirements definition must describe:

- What the system is to do
- What the real world I/O consists of
- What the operator interface is (if any)

In a small embedded control system, defining the requirements is crucial, as it prevents problems later when you find out that there is insufficient RAM or that the microprocessor you have chosen is too slow for the job. A simple example of this is the following system definition for a swimming pool pump timer. (Appendix A contains the complete requirements definition and specifications.)

System description: A swimming pool timer that cycles the alternating current (AC) pump motor on a swimming pool.

Power input: 9 to 12V DC from a wall-mount transformer.

Pump is a 1/2-hp, single-phase, AC motor, controlled by mechanical relay.

Provision is to be made for a switch closure input that inhibits pump operation if the water level is low.

User can set the length of time the pump is on and off. An override is available to permit turning off the pump when it is on for maintenance and turning on the pump when it is off so that chemicals can be added.

On/off/override time is to be adjustable in 30-minute increments from 1/2 hour to 23 hours.

A display will indicate the on/off condition of the pump, the time remaining, and whether the pump is in override mode. The display also will indicate the condition of the water-low monitor.

Minimum switches and knobs.

In addition to a list of requirements and functions like this, a system that is intended to be a commercial product might also include requirements for EMI/