**Textbook Problem 6.1**

**Question**:

Explain why it is necessary to examine a number of alternative system concepts prior to defining a set of system performance requirements for the purpose of competitive system acquisition. What are the likely results of failing to examine a sufficient range of concepts?

**Response**:

It is important to examine alternate system concepts before defining system requirements because in a competitive environment, artificially eliminating solutions or going with a presupposed design can deter the ability to stay ahead of the competition.

In the Concept Exploration phase of the systems engineering lifecycle, the goal is to convert the operationally oriented view of the system from the Needs Analysis phase into functionally oriented structure, one that focuses on analysis of alternatives and performance requirements formulation and validation. Through the definition of multiple alternatives vs. the exploration of a single concept, a competitor can position themselves to further refine their operational requirements – this analysis, based on comparative evaluations of the operational effectiveness for each idea, will help establish realistic limits for the expected effectiveness given the operational situation. The added specificity to these operational requirements upfront will prove extremely effective when developing performance requirements. In addition, while it is certainly prudent to begin with a predecessor system, creativity and imagination is also encouraged in a competitive situation. Consideration of modified architectures, perhaps involving brand new technology, should be fully considered. Cognizance of these new ideas may bring light into other operational requirements or system limitations that were not previous explored – these opportunities should be taken advantage of, especially when fighting for a contact.

Failure to examine a sufficient range of alternative solutions may result in the competition getting an edge on ones solution because they have thoroughly examined the available trade space. The phrase “outside the box thinking” is the reality of staying competitive in major acquisition. If there are limitations or premature eliminations of alternative solutions, then critically creative ideas may easily go to waste. The contracting agency or the Customer has different criteria on which they base their decision for determining contractual awards. A trade space analysis on different concepts may very well be part of their gating criteria for further pursuit of the contract. In the end, ensuring that the best possible design is chosen, which will fully satisfy the Customer’s needs, is the key to success in a competition, keeping other factors like cost, performance, and risk in mind.

**Textbook Problem 6.5**

**Question**:

Derive the principal functions of a VCR by following the checklist shown in the subsection “Functional Exploration and Allocation.” How does each function relate to the operational requirements of a VCR?

**Response**:

The principal functions of a VCR are as follows, with each [#] mapping to the questions checklist in the “Functional Exploration and Allocation” section of the text:

* Accept remote control instructions from user 🡪 [1] – Signal I/O & Processing
* Control playback of tape (Play, Stop, Pause, Rewind, Fast Fwd) 🡪 [1] – Signal I/O & Processing
* Adjust playback of video tape (Tracking) 🡪 [1] – Signal I/O & Processing
* Display and process visual information from video tape 🡪 [2] – Data Storage
* Accept video tape in VCR mechanical housing 🡪 [3] – Mechanical Structures

In an effort to derive performance requirements from the current operational objectives in the Concept Exploration phase, it is necessary to identify functions that the system must carry out in order to meet the defined operational objectives. Functions are the basis for what the system will do, and are eventually translated to physical objects. Operational requirements relate to all functions, as the functions themselves are derived from these requirements.