**Textbook Problem 5.2**

**Question**:

Identify the relationships between operational objectives and functional requirements for the case of a new commuter aircraft. Cite three operational objectives and the functional requirements that are needed to realize these objectives.

**Response**:

The relationships between operational objectives and functional requirements for a new commuter aircraft begin with operational objectives. This is the description of what the overall system must do. Once these are defined, they are then refined further to functional requirements. Some Operational objectives for this new aircraft may focus on the operational distribution or deployment of the system, mission profile/scenario, and performance related factors.

Operational objectives:

1. [OO-1] The system shall contain a communications system.

2. [OO-2] The system be able to fly between LAX and BOS without refueling.

3. [OO-3] ]The system shall be able to land in all major airports in the US.

Functional Requirements:

*For OO-1*:

a) [FR-1] The system shall use VHF radio for communications.

b) [FR-2] The system shall use FAA frequency and protocols for communication.

c) [FR-3] The system shall contain a digital receiver, antenna, transmitter, and signal processor.

*For OO-2*:

a) [FR-4] The system shall be contain a leak-free gasoline tank.

b) [FR-5] The system shall monitor the amount of gasoline left in the tank.

c) [FR-6] The system shall be refueled on the ground only.

d) [FR-7] The system shall accept fueling from standard ground-based fueling methods.

*For OO-3*:

a) [FR-9] The system shall contain landing gear.

b) [FR-10] The system shall contain brakes.

c) [FR-11] The system shall stop without causing degradation to aircraft body.

**Textbook Problem 5.4**

**Question**:

What is meant by “measures of effectiveness”? For the effectiveness analysis of a sport utility vehicle (SUV), list what you think would be the ten most important characteristics that should be exercised and measured in the analysis.

**Response**:

Measures of effectiveness (MOEs) are a set of criteria which describe the characteristics of the system response to its environment, which are critical to the operation of the system. In simpler terms, when evaluating and analysis the results of a simulation or data collected, measures of effectiveness are the success criteria to which the results are graded against.

In my opinion, the 10 most important characteristics for an SUV are:

1. Overall Size
2. Weight
3. Power
4. Number of passengers
5. Range on a full fuel tank
6. Miles per gallon (MPG)
7. In-car entertainment inputs
8. Environmental impact
9. Engine horsepower
10. Engine torque rating

**Textbook Problem 5.6**

**Question**:

Assume that you have a business in garden care equipment and are planning to develop one or two models of lawn tractors to serve suburban homeowners. Consider the needs of the majority of such potential customers and write at least six operational requirements that express these needs. Remember the qualities of good requirements as you do so. Also write a concept of operations for the lawn tractor. Draw a context diagram of the lawn tractor.

**Response**:

Operational Requirements for lawn tractor:

1. The system shall be able to operate for a minimum of 5 hours on one charge.
2. The system shall be steerable in all directions.
3. The system shall be able to start and stop on voice command from operator.
4. The system shall be powered by hydrogen or solar power.
5. The system shall be fit within the dimensions of the following area: 5’ long, 4’ wide, 5’ tall.
6. The system shall cut grass down to a minimum of 1.5” in height.

A Concept of Operations for the lawn tractor:

There exists a need for a new lawn tractor that harnesses the power of environmental energy in order to prevent (and reduce) atmospheric pollution. The primary operational constraint of the tractor is that it be environmentally safe with regards to external exhaust. The lawn tractor shall have multiple modes of manual operation, along with scanning capabilities to allow for a given area to be tended in an optimally minimized amount of time. The lawn tractor shall have the capability to start and cease operation based on voice commands. The lawn tractor shall be able to charge its internal battery, in real-time or in stand-by mode, via hydrogen or solar power. The lawn tractor shall be protected against environmental hazards, and all components (e.g. internal charge, mechanical parts, etc.) shall not degrade in performance through extended use. The lawn tractor shall have self-prognostics built that indicate and predict upcoming maintenance needs. The lawn tractor shall be housed in a docking station which serves as recharge station for the next use.

[See next page for Context Diagram]

A Context Diagram for the lawn tractor: