Space Systems Engineering and Architecture

January 2013 Field Exam Question

MIT Department of Aeronautics and Astronautics

Central to effective space systems engineering architecture is the understanding of how requirements flow down to concept selection, detailed design decisions, fundamental intra-disciplinary relationships, inter-disciplinary dependencies, and their impact on the overall systems behavior. This question examines one's grasp of such relationships and draws upon concepts taught in 16.851 and 16.842.

For **each** of the four numbered disciplines below,

1. Optics for Space-Based Apertures in UV-Optical-IR (UVOIR) bands
2. Angular Momentum Management through Attitude Control
3. Earth-Centered Orbital Dynamics
4. An additional discipline of your choice (that is taught in 16.851)

address the lettered issues below:

a. Write a physical relationship (i.e. equation) that is fundamental to that discipline, define the variables and their units, and describe how the input variables impact the output in both in physical and in mathematical terms.
b. Describe several elements of form (specific hardware and/or software components) that are used in practice to implement key functions (internal processes such as heat exchanging, signal amplifying etc…) associated with this discipline.
c. Identify several other disciplines (taught in 16.851) that have strong coupling to this discipline and describe the nature of this coupling and its impact on space system design. Distinguish between parametric coupling based on your answers in part a.) and physical coupling based on your answers in part b.)
d. Explain how changing the values assigned to the variables in the fundamental relationship described in part a.) impact overall system performance, risk and cost.

It is your choice if you want to answer this question generically or in the context of a particular mission scenario.