16.851 - SATELLITE ENGINEERING MEMORANDUM

TO: 16.851 FACULTY

FROM: STUDENTS

SUBJECT: PROBLEM SET #3 QUESTION DEFINITION

DATE: 10/6/2003

Subject: Space Environment and Attitude Control Systems

Motivation:

The near-Earth space and atmospheric environments strongly influence the performance and lifetime of operational space systems. A study of the interaction between environmental disturbances, mission objectives, and selection and sizing of ACS actuators will help us understand some of the considerations needed when designing spacecraft systems for harsh environments. Our goal is to design a tool that helps size ACS actuators for a satellite mission given specific mission objectives and environmental disturbances. Such a tool will be valuable when sizing ACS components next semester.

Problem Statement:

How does the space environment affect the kind and sizes of ACS actuators? How does the size of the actuators vary given the different kinds of environmental disturbances?

Approach:

We will write a Matlab program to find the kind and sizes of ACS actuators needed for a satellite mission given environmental disturbances and mission objectives. A literature search will allow us to improve on the approximations given in SMAD. The program user will input the values for the mission objectives and environmental disturbances. The program will then calculate the kinds and sizes of ACS actuators needed for the space mission. The results of the type and size of ACS actuators needed will be outputted.

1. Determine type and range of environmental disturbances to include
2. Determine type and range of mission objectives
3. Determine relevant spacecraft characteristics such as mass and moments of inertia
4. Map mission objectives to types of actuators
5. Use values of environmental disturbances and values of mission objectives to determine size and weight of actuators.