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16.851 – Satellite Engineering
Due: Tuesday, September 23, 2003

Problem Set #2: Problem Definition

Subject: Orbit Maneuvering and Power

Motivation: Many of today's spacecraft use solar panels to power their various subsystems. There are a variety of factors that influence the size and type of solar panels to be used. Depending on the altitude and inclination of the spacecraft's orbit, the surface of the solar array may be eclipsed for some time. In addition, there are three types of solar cells (Gallium Arsenide, Indium Phosphide and Silicon) that provide varying amounts of power. The surface area of a solar array must be adjusted so that the power requirements of the spacecraft's subsystems can be fulfilled given these constraints.

Problem Statement: What is the surface area of a solar panel needed to produce enough power to fulfill the power requirements of a given spacecraft? How does this surface area vary given the spacecraft's altitude and inclination? How does this surface area vary given the type of the solar cells, i.e. Gallium Arsenide, Indium Phosphide or Silicon?

Approach: We will write a Matlab program to find solar array size needed to fulfill the power requirements for a spacecraft given a particular orbit. The program user will input the power needed as well as the altitude and inclination of the spacecraft's orbit. It is assumed that the orbit will be fixed throughout the lifetime of the spacecraft. Given the orbital parameters, the time the satellite is in eclipse and in daylight will be calculated. The program will then determine the size of the solar array for three different solar cell types: Gallium Arsenide, Indium Phosphide and Silicon. The results for the three solar cell types will be displayed in Matlab.