MEMORANDUM

To: Professor David W. Miller
Colonel John E. Keesee
cc: Marilyn Good
From: Students
Date: 2003-11-05
Subject: 16.851 Satellite Engineering: Problem Set 5 Question
Subsystems: human factors, structures, and cost

Motivation

Throughout history, people have been fascinated with exploring outer space. Until recently, only astronauts have had the privilege of being able to experience life in outer space. However, in 2001, the first space tourist, Dennis Tito, traveled to the International Space Station onboard a Russian Soyuz rocket.

The travels of Dennis Tito are just the beginning for space tourism. A new space tourism industry would be an entirely new commercial use of space and a huge potential new market. Space tourism may encourage other private investment in the use of space, which may in turn support significant future space exploration.

Problem Statement

Design a concept for a space hotel orbiting Earth. Create a CAD model of the hotel to visualize the concept. The space hotel should provide all the amenities required by a tourist. These amenities should include gravity, power, food, water, and waste removal.

Design a MATLAB module to size the hotel structure as well as estimate the requirements for supporting human life. The user will set the number of hotel guests. This input will be the driving factor for the concept design. Based on the design concept for the hotel, estimate the costs involved in launching, assembling, and operating the hotel. The module will minimize cost with respect to the number of guests and the type of structure.

Approach

First create a conceptual design of the space hotel. List the advantages and disadvantages of the design options considered and explain why one a final design concept was chosen. Create a CAD model of the hotel and make the model as detailed as possible in the time allowed to complete the assignment.

As the hotel will most likely be modular in design, determine how many launches are required to insert all hotel structural components into orbit. Show that the hotel modules fit within the launch vehicle fairing which will be used to launch the hotel into orbit.
Determine how artificial gravity will be created on the hotel. Also, determine the other needs of the human guests of the hotel. These needs will include electricity, food, water, waste removal, and crew.

Develop cost models to estimate the cost for launch, assembly, and operation of the hotel. Provide a reasonable basis for the derivation of the cost models used. Based on the estimated costs, estimate a cost per night per guest to stay at the space hotel.