Satellite Communications Class Project:
Exoplanet Mission

ECE 6390 – Fall 2010

Synopsis:

Since the discovery of exoplanets (planets beyond our solar system) at the end of the 20th century, scientists have dreamt of sending robotic probes to these distant worlds for observation. The distance is overwhelming, both from a travel and communications point of view. Under today's propulsion options, the space probe would take many centuries to arrive at an exoplanet, making any recovered information a gift to a distant and successive generation of human beings.

But what a gift! To this end, the *National Aeronautics and Space Administration* (NASA) recently awarded your university laboratory a small semester-long grant to perform a paper study design on the first potential mission to an exoplanet. You and your students must provide a design capable of sending high-resolution images back to earth from the nearest exoplanet-populated star system, Epsilon Eridani (10.5 light years away).

Team-Member Assignments:

I will assign 9 teams with 4-5 members each to constitute a "company". Once formed, the teams must elect a team-leader, choose a company name, and submit an 80 x 80 pixel icon for their web link. I expect everyone to contribute to the final design and documentation and will solicit internal rankings of team-member efforts.

System Components:

Due to the multiplicity of talents within each group and the "systems"-nature of the class, *all* aspects of the mission design should be explored in the final proposal. Communication systems should receive the most design focus, but the final project should address all of the following systems:

- Communication Systems – antennas, RF hardware, modulation, spectral usage, peak data output, bit rate, coding, etc.
- Propulsion System – engine type, trajectory, and voyage time
- Power Systems – power source, peak power output, estimated lifetime, etc.
- Resiliency of Electronics – Discuss strategies for space-hardening the electronics for the duration of the voyage. Identify the likely points of failure.
- Budget and Timeline – total research and development costs broken into materials, equipment, supplies, people costs, space resources, and other miscellaneous costs.

This list is not necessarily exhaustive. The level of detail for each system is left up to the groups. However, increased descriptions will enhance the competitiveness of your design. *Verbose* descriptions will degrade the competitiveness of your design.

Deliverables:

You must prepare a concise, well-written technical report detailing your team's mission design. The report should be in html-format with all files submitted in-class on a CD or through e-mail (e-mail submissions are strongly preferred; they must be ZIPped and are only possible for files less than 20 MB total). Projects must be submitted by noon on Friday, 10 December 2010. Late projects will not be accepted. In addition to the final project files, each group is required to upload a summary video to YouTube that provides an overview of the project design in less than 10 minutes.

Grading:

Your final proposal will be graded on the technical criteria listed above. Deductions from these base scores will then be made based on the following areas: Completeness, Technical Writing, Professional Content, Research/References, and Conciseness. Each team member may also receive a small, variable downward adjustment to their individual project scores based on internal rankings of contribution and effort.

Additionally, a portion of the project grade (30%) will be based on peer evaluations. The projects will be placed online and each member of the class will submit an evaluation for each project (other than their own). These individual evaluations will be held confidential; they will also count as a homework assignment. Thus, the projects will be posted online over the weekend and evaluations will be submitted electronically during exam week. Look online for the evaluation sheet.

Distance Learning Student Grading:

Distance-Learning students will perform the same project individually (no groups) with the following changes to the grading/submission scheme: 1) expectation of a much shorter PDF or DOC write-up on your proposed design is expected (no website required), 2) no video summary requirement, and 3) no peer-review component/requirement.