Satellite Communications Class Project:
CubeSat Omnimapper

ECE 6390 – Summer 2015

Synopsis:

With the advent of low-cost CubeSat launches, it is now possible to establish a large constellation of low-cost, LEO satellites with basic communications and data collection services. A Silicon Valley venture capital firm has approached your small company about the possibility of designing, building, launching, and maintaining a system of CubeSats that photograph the entire surface of the earth every day. Dubbed the "Omnimapper Project", they would like for your group of savvy satellite engineers to provide a basic design and cost estimate for the satellite system for deployment. They have contacted multiple small companies and will select the most well-reasoned proposal that can deliver a daily photograph of the earth's surface with the highest pixels/day/cost.

Proposals will be competitively ranked according to which mission concept best illustrates the Omnimapper concept. Objective evaluation of these proposals will pay close attention to the technical correctness, professional presentation, and the key metric: recorded and relayed pixels per day per 10-year total cost (deployment and operation). Pixel resolution should be high enough to make out basic features on the ground (streets, trees, houses, small rivers).

Related article:
http://www.sciencemag.org/content/348/6231/172.full

Team-Member Assignments:

I will assign 6 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. The final project should address the following systems:

- Communication Systems – antennas, RF hardware, modulation, spectral usage, peak data output, bit rate, coding, network topology, number and specification for earth station relays, etc.

- Launch and Orbital Systems – number of satellites, orbital and constellation design, costs, cubesat units per satellite, etc.
- Power Systems – power source, peak power output, etc.
- Imaging – specification for camera system and optics, image compression, etc.
- 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 through e-mail, which I will place on the GT server. An externally hosted server for your website is also permissible, but must be "frozen" at the project deadline – extraordinary grade penalties if I detect changes. Projects must be submitted by noon on Friday, 24 July 2015. Late projects will not be accepted.

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 Correctness, Professional Content, Research/References, and Feasibility. 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 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.