

Satellite Communications Class Project: **Win the Google Lunar X-PRIZE**

ECE 6390 – Fall 2007

Synopsis:

Space-tacular Ventures LLC – a for-profit financier of private space missions – has invited your company to participate in a competitive bid to win funding for new space missions. Your team has decided to submit a mission proposal based on winning the Google Lunar X-PRIZE. The field of applicants for this next round of funding is competitive, with 7 other private companies also competing for X-PRIZE funding.

The Google Lunar X-PRIZE awards a substantial prize to a private company who can land a operating rover on the moon. Specifications of the competition are listed below:

The \$30 million prize purse is segmented into a \$20 million Grand Prize, a \$5 million Second Prize, and \$5 million in bonus prizes. To win the Grand Prize, a team must successfully soft land a privately funded spacecraft on the Moon, rove on the lunar surface for a minimum of 500 meters, and transmit a specific set of video, images, and data back to the Earth.

The Grand Prize is \$20 million until December 31st 2012; thereafter it will drop to \$15 million until December 31st 2014 at which point the competition will be terminated unless extended by Google and the X PRIZE Foundation. To win the Second Prize, a team must land their spacecraft on the Moon, rove and transmit data back to Earth. Second place will be available until December 31st 2014 at which point the competition will be terminated unless extended by Google and the X PRIZE Foundation.

Bonus prizes will be won by successfully completing additional mission tasks such as roving longer distances (> 5,000 meters), imaging man made artifacts (e.g. Apollo hardware), discovering water ice, and/or surviving through a frigid lunar night (approximately 14.5 Earth days). The competing lunar spacecraft will be equipped with high-definition video and still cameras, and will send images and data to Earth, which the public will be able to view on the Google Lunar X PRIZE website.

[excerpted from Science Daily article, September 14, 2007]

For more information, browse to <http://www.googlelunarxprize.org>.

Team-Member Assignments:

I will assign 8 teams with 5 members each. 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 proposal and will solicit internal rankings of team-member assignments.

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, outage and reliability, etc.
- **Power Systems** – power source, peak power output, estimated lifetime, etc.
- **Propulsion Systems** – rocket type and weight, fuel estimates, landing site, soft-landing schemes, etc.
- **Rover Systems** – mechanics of rover motion, sensor systems, data requirements, space-hardening and certification of electronics, etc.
- **Orbital Mechanics** – path to the moon, travel duration, launch site, attitude controls, trajectory sensing and correction, etc.
- **Budget and Timeline** – total mission cost broken into materials, equipment, supplies, people costs, space resources, and other miscellaneous costs; include a small-company “overhead” of 50% for all personnel costs; milestones listed on a Gantt chart; estimated return on investment and profit (for your company and Space-tacular Ventures) from winning the X-prize.

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 proposal.

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 submissions are strongly preferred; they must be ZIPped and are only possible for files less than 10 MB total). Projects must be submitted by noon on 11 December 2007. Late projects will not be accepted.

Grading:

Your final proposal will be *competitively* graded on cost, functionality, and feasibility – as if I were making the final funding recommendation to Space-tacular Ventures. The proposals from the class teams will be ranked against one another and assigned a base score of $100\% - 3(n-1)$ where n is the integer ranking. Thus, first place will receive a base score of 100%, second place will receive 97%, third place will receive 94%, and so on. 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 will also receive a small, variable downward adjustment to their individual project scores based on internal rankings of contribution and effort. I will also offer +5% bonus points to superlative proposals in the following categories:

- 1) Best Technical Writing
- 2) Best Professional Presentation
- 3) Creative Use of the Web
- 4) Most Novel Engineering Design or Concept

Late projects will not be accepted. All projects will be posted on the web, unless the team members collectively object and notify me.