23rd IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Small Spacecraft for Deep-Space Exploration (8)

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SOLVING COMMUNICATIONS AND NAVIGATION REQUIREMENTS FOR SMALL LUNAR MISSIONS

Abstract

There is a growing need for space exploration to be performed at the lowest possible cost, and at the highest efficiency. The important supporting infrastructure of exploration can be performed by industry, therefore allowing agencies to focus their budgets in cutting edge technology development and science. One such infrastructure service that future lunar robotic and manned exploration missions will require, is reliable continuous communications and navigation both on the lunar surface and in lunar orbit. This will enable greater utilization of missions, reduction in mission costs, enable exploration of the far side of the moon and increase the safety of future manned missions. Nano satellites, and other small assets deployed in-situ, will, in particular, benefit from a provided communications service as it will allow their on-board systems to be minimized and data throughput to be maximized.

The proposed Lunar Communications Pathfinder Mission will demonstrate the technologies, operations and preliminary services that will be a first step towards a fully operational lunar communications and navigation system. The spacecraft will deliver a host of nano satellites to lunar orbit, where they will form the initial user base for the communications system. The communications element of the satellite will provide data relay services between a dedicated ground segment and multiple lunar assets. Users will be able to command and receive data from their lunar assets via an internet based interface removing the need to set up their own ground station. Opportunities to demonstrate critical technologies for exploration will be available, with current demonstration options under consideration including K-band systems, optical communications, navigation and alternative propulsion systems.

The system is being designed to be compatible with other planned lunar assets (space agencies and Google Lunar X-prize) with a view to offering back up or supplementary communications services. The Pathfinder Mission will provide a similar level of service to what would be expected in LEO, hence simpli-

fying the system requirements for nano to small satellites and therefore reduces the cost and complexity of performing lunar missions when compared with direct-to-earth communications. The system will also bringing lunar missions within budget levels of national agencies, universities consortia and small companies. This mission will provide a service that will be open to any customers with missions headed to cis-lunar space so that the progress of lunar science and exploration can be accelerated, leading to future lunar exploitation.