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Strategies & Architectures as the Framework for Future Building Blocks in Space Exploration and  
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BUILDING A SUSTAINABLE LUNAR ARCHITECTURE – A PROPOSED APPROACH

**Abstract**

A future lunar architecture, if it is to be truly sustainable, should be conceived with the entire space ecosystem in mind, that is, in addition to the NASA exploration missions, the trade space should include commercial activities in low Earth orbit (LEO) and geosynchronous Earth orbit (GEO), other government agency needs, space science missions, and the activities and capabilities of other nations in space. A capability for long-term exploration and utilization of the Moon is more likely to be affordable and sustainable if it is built upon a foundation shared with multiple commercial and government users and if it employs multiple service providers. The lunar architecture and concept of operations should be crafted to use elements that are common across as many space enterprises as possible, rather than creating customized, single-purpose vehicles, capabilities, and facilities only for NASA lunar missions.

In the space architecture to be described in the paper, strategically selected staging points, initially in LEO and later also in the lunar vicinity, yield a sustainable transportation system that encourages the participation of multiple, competing providers to support a broad range of users.

Reusable orbit transfer vehicles have not emerged to date, perhaps because they require an infrastructure investment that no single user has been able to justify. However, the space policy directive to establish “long-term exploration and utilization” of the Moon combined with existing and emerging commercial and government activities in Earth orbit might provide the economic rationale needed to realize this vision.

The goal is to establish an infrastructure that will continue to be used by NASA and others even as NASA’s needs evolve in the future. In this proposed approach an additional staging point, in the lunar vicinity, would be established as soon as, but not until, the level of activity at the Moon made it necessary and economically viable. Ultimately a lunar staging point will be essential to supporting vigorous, long-term lunar exploration and utilization but that outcome can best be achieved by building from a foundation that begins in LEO.