SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (D3)
Systems and Infrastructures to Implement Future Building Blocks in Space Exploration and Development (2)

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INFRASTRUCTURE BASED EXPLORATION - AN AFFORDABLE PATH TO SUSTAINABLE SPACE DEVELOPMENT

Abstract

Since the dawn of the space age more than 50 years ago space exploration has been accomplished utilizing dedicated systems. The rockets that were used could only travel to low earth orbit and were expended at the end of the mission. The capsules that we used to send astronauts to orbit and eventually to the moon were all dedicated to a single purpose and a single mission. As we enter our next half century of exploration it is time to reexamine the way that we explore and incorporate the hard won lessons learned from the past into our new approach. Infrastructure based exploration leverages commercially developed, reusable systems to address the concepts of affordability and sustainability.

The Obama administration has adopted the "flexible path" model for human exploration that was highlighted by the Augustine Committee in their 2009 report. This model focuses on capabilities that need to be developed that will enable missions to multiple destinations; the Moon, near earth asteroids, Phobos or Demos or even to the surface of Mars. To complement this approach NASA is also supporting a number of commercial space transportation initiatives to delivery cargo and eventually crew to the International Space Station (ISS) including the Commercial Orbital Transportation Services (COTS) program and Commercial Crew Development (CCDev) program. In addition NASA is also supporting several of the Google Lunar X Prize contestants with the $30 million Innovative Lunar Demonstration Data (ILDD) program.

NASA has also recently completed a set of conceptual studies of orbital propellant storage and transfer that could lead to the development of orbital propellant depots as well as studies of reusable solar electric transfer vehicles. In addition, Bigelow Aerospace has invested hundreds of millions of dollars to develop and demonstrate expandable commercial orbital habitats.

This paper will examine the exploration architectural options that become possible if these space systems become available later in the decade. Several notional build sequences will be explored that make use of various elements that enable a wide variety of human exploration missions beyond LEO including to EM L1/2, Lunar surface tele-operations and crewed missions, asteroid missions and even robotic Mars missions. Finally the International Lunar Research Park concept that is being developed by the State of Hawaii will be presented as a possible near term exploration strategy.