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Space Colonization
Exploration Strategies

Abstract

Strategies For Human Exploration Leading To Human Colonization of Space

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Enabling the commercial development of space is key to the future colonization of space and key to a viable space exploration program. Without commercial development following in the footsteps of exploration it is difficult to justify and maintain public interest in the efforts. NASA's exploration program has suffered from the lack of a good commercial economic strategy for decades. Only small advances in commercial space have moved forward, and only up to Earth orbit with the commercial satellite industry. A way to move beyond this phase is to begin the establishment of human commercial activities in space in partnership with the human exploration program.

In 2007 and 2008, the authors researched scenarios to make space exploration and commercial space development more feasible as part of their graduate work in the Space Architecture Program at the Sasakawa International Center for Space Architecture at the University of Houston, Houston, Texas. Through this research it became apparent that the problems facing future colonization are much larger than the technology being developed or the international missions that our space agencies are pursuing. These problems include a lack of commercial markets that industry can easily move into, space policy that addresses exploration but not commercial concerns, a lack of long-term strategy, budgeting and contracting methods from space agency procurements, and fundamental legal problems with current space treaties that appear counter-productive to commercial endeavors.

Based on past experience with the International Space Station (ISS) it is likely that current plans for human missions to the moon and Mars will evolve into international efforts. But that alone will not be enough to ensure permanent human colonization of space. In addition, a greater role for the commercial sector needs to be defined to establish a foot-hold that will make permanent outposts in space economically viable. But what is the commercial role, and how can it be formed and become economically viable? NASA already has goals established stating the commercial development need. NASA Strategic Goal 5 states: "Encourage the pursuit of appropriate partnerships with the emerging commercial space sector." The problem is that the commercial sector is not emerging fast enough, and cannot emerge without a market to move into, especially given that NASA is on a constant start-up, shut down, or change course mission with weak long-term strategies.

The exploration program can provide the foundation for commercial markets, but there are numerous barriers to overcome. There are key infrastructure elements that are needed in space that can help open new markets. Among those infrastructures are propellant depots, and a system of supply that will make reusable vehicles more feasible. Reusable systems will over time make new markets possible and bring down the cost for transportation services.

Other concerns that are preventing commercial organizations from investing in space development are legal issues proceeding from international treaties. Profitable organizations need to bring in more new resources and energy than they expend in their activities in order to grow and thrive. A commercial organization represents that excess new flow of resources and energy as profits. Commercial development of resources in space requires a large investment, and commercial organizations will not, and should not, commit a large up-front investment without some assurance that the resources they develop will accrue back to them. The current legal structure regarding resources in space is severely discouraging to commercial investment.

While the status of ownership of communications satellites and the benefit from any profits that are made from them is fairly well understood and respected under international law, the current international treaties about the ownership of any resources that might be developed on the Moon, or Mars, or any asteroids or meteorites leave the ownership of those resources in serious doubt. A corporation that actually manages to land on and develop any resources on the Moon, or Mars, or an asteroid, might find themselves immediately served with numerous lawsuits requiring them to turn over any income from those activities for the public good or to private entities that have otherwise claimed ownership. These unresolved issues are the result of treaties signed during the cold war with the best of intentions to try and head off major international strife, where it was agreed that no nation could claim sovereignty over any celestial body. Because ownership of real property usually descends to private ownership through the granting of ownership rights from the government that claims sovereignty over the land, there is some argument that no one can claim ownership over any celestial body or part thereof.

These issues are addressed in this paper with recommendations for space exploration, commercial development, and space policy that are needed to form a strategic plan for human expansion into space. In conclusion, the authors found that the current direction in space as carried out by our space agencies around the world is definitely needed, but is inadequate and incapable of resolving all of the issues that inhibit commercial space development. A bolder vision with strategic planning designed to grow infrastructures and set up a legal framework for commercial markets will go a long way toward enabling the future colonization of space.