

Geopolitical Context of Lunar Exploration and Settlement¹

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Introduction

Moon, Mars, asteroids, and other space locations have attracted international attention as possible targets of interest for peaceful and geopolitical competition in space. Strategically, however, the race for space dominance will be played out on the Moon first and soon. This competition has long-term implications for the future of liberty on Earth as well as for understanding the history and evolution of the solar system.

If non-democratic regimes, such as China or Russia, dominate exploration and settlement of the Moon, liberty will be at risk. Only the United States and its democratic partners can assure the elimination of this space-related risk to liberty. If we abandon leadership in accessing the resource, science and settlement potential of our nearest neighbor to the any other nation or group of nations, particularly a non-democratic regime, the ability for the United States and its allies to protect themselves and liberty for the world will be at great risk. To others would accrue the benefits – psychological, political, economic and scientific – that the United States harvested as a consequence of Apollo's success 40 years ago. This lesson has not been lost on our intellectual, ideological and economic competitors.

The investment of money and intellectual capital in going back to the Moon, permanently, brings with it, not merely geopolitical high ground and prestige of physically being there, but constitutes a deliberate pathway to economic advancement. We need such an effort to grow our economic and

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technological base. The dividends paid by a return to the Moon will be seen in growth of our intellectual and technical capability and in outpacing others who do not go or in competing on equal terms with those who do. More will result from our efforts than the obvious advantage that comes from having an Saturn-class heavy lifter. A myriad of discoveries are bound to accompany lunar exploration, including astronomical and physical science, in opening the potential of extraterrestrial resource utilization, in developing new energy resources, and in many other areas. At stake are more than mere spin-offs of technology. At stake is access to transformational discovery.

Growth or stagnation forms the crossroads decision facing our country. Protection of human liberty depends on the affirmative decision to grow. For growth to occur the intellectual system of America must be stressed and problems that appear intractable must be solved. For example, history ties the expansion of democracy to a people's access to energy to drive economic. Comparable transformations await in space.

Current Background

Between 2005 and 2008, the NASA Advisory Council continuously reviewed all aspects of the Constellation Program, NASA's effort to implement the Vision for Space Exploration put forth by then-President George W. Bush. The Council's conclusion can be summarized as follows: Constellation constitutes an extremely important, technically well-conceived, highly challenging, and grossly under-funded effort to return Americans to deep space, including eventual flights to Mars.

By lack of congressional and Bush Administration action, Constellation not only never received the Administration's promised funding; but the program nonetheless was required:

1) to continue the construction of the international space station, which was badly under-budgeted by NASA, the Office of Management and Budget, and ultimately the Congress, prior to Mike Griffin's tenure as NASA Administrator;

2) to accommodate numerous major cost over-runs in the Science programs, which are largely protected from major revision or cancellation by congressional interests;

3) to manage the Agency without hire and fire authority, which is particularly devastating to the essential hiring of young engineers; and

4) to absorb the legislative redirection and inflation-related costs of several Continuing Resolutions.

Whatever course is set by the new Administration, these four

fundamental budgetary restrictions to success must be eliminated or the risk of program failure and of loss of future missions and crews will reach unacceptable levels.

Future Course

In spite of the difficulties that have faced Constellation, history tells us that an aggressive program to return Americans to deep space, initially the Moon and then on to Mars, must form an essential component of national policy. The current course of United States in space appears to be to have no national capability to launch its astronauts, at all. Americans would find it unacceptable, as well as devastating to human liberty, if we abandon leadership in deep space to the Chinese, Europe, or any other nation or group of nations. Potentially equally devastating would be loss of access to the energy resources of the Moon as fossil fuels diminish on Earth. In the harsh light of history, it is frightening to contemplate the long-term, totally adverse consequences to the standing of the United States in modern civilization of a decision to abandon deep space. Space does not represent just another large-scale science arena that can be abandoned limited only to the science leadership consequences the United States has suffered in recent decades.

What, then, should be the focus of national space policy in order to maintain leadership in deep space? Some propose that we concentrate only on Mars. This would be naïve and self-defeating. The country is simply not technically ready to go to Mars at present, and it will be a long time until we are ready to do so. Returning to the Moon, however, provides the fastest path for humans to go to Mars. Without the experience of returning to the Moon, we will not have the engineering or physiological insight for many decades to either fly to Mars or land there. Without lunar water resources, radiation protection for the long voyage to Mars may not be possible. Without the development of lunar helium-3 fusion technology applied to interplanetary propulsion, we may not be able to reduce the transit time to Mars to an acceptable duration. Without lunar operational experience, including learning to operate outside of communications with Earth, we vastly increase the risk of early Martian flights. Without lunar oxygen and water, Earth launch payloads to Mars may be prohibitively large and expensive, not to mention the continued uncertainties about sustainable resources on Mars. Without lunar rocket fuel resources, that is, hydrogen, oxygen and/or methane, we may not be able to land on Mars because of complicating presence of just some atmosphere and not a lot. Indeed,

without returning to the Moon, future opportunities of leadership, including a much greater potential for international cooperation in scientific endeavors related to the Moon and beyond, cannot be realized.

Others suggest going to an asteroid. As important to human survival on Earth as asteroid diversion may someday be, just going there is hardly a stimulating policy initiative; and it is a capability that comes automatically with a return to the Moon. Suggestions also have been made for missions to **Lagrange** points – a mission which has aptly been referred to “as mission to nowhere - except for their potential as a location for observatories.

One should note that, between 1968 and 1973 during the Apollo Program, we had the rocket capability necessary to reach a comet or asteroid on an impact trajectory toward Earth, something the Space Shuttle would be incapable of doing. With the Apollo Saturn V, had it been necessary, we could have placed a propulsion source on such a body and altered its path so as to miss the Earth; a much better solution than to just blow it up. Former President George W. Bush began development of a Saturn V-class capability with the Constellation Program's Ares V rocket. The Ares V or an up-rated Saturn V, combined with a helium-3 fusion propulsion system, would be a giant step toward protecting the Earth in the future.

Implications

Returning to the Moon and to deep space constitutes the right course for the United States. Human exploration of space embodies basic instincts — the exercise of freedom, betterment of one's conditions, and curiosity about nature. These instincts have been manifested throughout history in desires for new homelands, trade and knowledge. For Americans particularly, such instincts lie at the very core of our unique and special society of immigrants.

Over the last 150,000 years or more, human exploration of Earth has yielded new homes, livelihoods, know how and resources as well as improved standards of living and increased family security. In historical times, governments (e.g., Portugal, England, Spain, and the United States) have directly and indirectly played a role in encouraging exploration efforts. Private groups and individuals often have taken additional initiatives to explore newly discovered or newly accessible lands and seas. Based on their specific historical experience, Americans can expect that the benefits sought and won in the past also will flow from their return to the Moon, future exploration of Mars, and the long reach beyond. To realize such benefits, however, Americans must regain its rapidly disappearing leadership role

human activities in deep space.

With a permanent resumption of the exploration of deep space, one thing is certain: Our efforts will be comparable to those of our ancestors as they migrated out of Africa and into a global habitat. Further, a permanent human presence away from Earth provides another opportunity for the expansion of free institutions, with all their attendant rewards, as humans face new situations and new individual and societal challenges.

Conclusion

The competitive international venue remains at the Moon. Returning there now meets the requirements for a U.S. space policy that maintains deep space leadership, as well as providing major new scientific returns and opportunities. Without a lunar focus, the nation's human space activity will consist of PowerPoint presentations about what might be done and not about what will be done. Properly conceived and implemented, however, returning to the Moon prepares the way for a new generation to go to Mars.

The current Constellation Program contains most of the technical elements necessary to implement a policy of deep space leadership, particularly development of a heavy-lift launch vehicle, the Ares V. In addition, Constellation includes a large upper stage for transfer to the Moon and other destinations, two well-conceived spacecraft for transport and landing of crews on the lunar surface (Orion and Altair), strong concepts for exploration and lunar surface systems, and enthusiastic engineers and managers to make it happen if adequately supported. The one major missing component of a coherent and sustaining architecture may be a well-developed concept for in-space refueling of spacecraft and upper rocket stages. On the other hand, the experience base for developing in-space refueling capabilities clearly exists based on a variety of past activities, including ISS construction.

If we continue to abandon leadership in deep space to other nations or group of nations, particularly a non-democratic regime, the ability for the United States and its allies to protect themselves and liberty for the world will be at great risk and potentially impossible. To others would accrue the benefits — psychological, political, technical, economic and scientific — that the United States harvested as a consequence of Apollo's success 40 years ago. This lesson has not been lost on our ideological and economic competitors.

American leadership absent from space? Is this the future we wish for our progeny?