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## **One Small Step for Mankind...Now for the Next Step!**

Haym Benaroya

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From time immemorial, humans have looked upwards at the sky with wonder and longing, only scarcely understanding their place in the universe that surrounds them. The Moon, being the dominant object in the sky, has been the centerpiece of folklore as well as scientific contemplation for as long as humans have inhabited the Earth. H.G. Wells, among many others, took us there using his words and our imagination long before 1969 when American astronauts landed on that body to become the first human Moonwalkers. This nation is now twenty-six years beyond Neil Armstrong's first steps on the Moon. One can only imagine what would have been had we vigorously proceeded from those first steps to lunar colonies and industries.

The role of space, and in particular the Moon, is very similar to that of the Western Frontier in the economic development of the United States, which would be a very different country if its western border was today at the Mississippi. If one is bold enough to extrapolate world development with that postulate, then a case can be made that another dominant power would have emerged during the 1800s, completely changing the history we know. Regardless of the specifics, without doubt, a much-diminished United States would have evolved. It may be that the world would have been dominated by one not-as-benevolent power under this scenario. It is upon such a juncture that we, the dominant space power, currently sit. Do we continue on our current path of

benign neglect, ignoring the trail blazed by our space pioneers of the sixties, and “stay East of the Mississippi”? Or do we take upon our shoulders the challenge and the promise of “going West”?

During the sixties and seventies, when many unmanned spacecraft landed on the Moon with their payloads, in addition to the American manned activities, much was learned about our nearest neighbor. Yet, even to this day, much remains open to speculation. What is certain, given the continuation of our civilization on Earth, is that humans (hopefully Americans) will again land on the Moon, this time with the goal of creating colonies for long-term scientific, technical, industrial, and recreational activities. In addition, the Lunar experience will provide us with the necessary understanding that is required for bolder forays into our Solar System and outward, the next likely outpost being Mars. With all this activity would come an economic boon of dimensions unseen this century. It is not hard to picture the evolution of a space-based economy that can dwarf Earth's economy within the lifetimes of our grandchildren, just as the American economy dwarfed those of Europe in a matter of a hundred years.

What would have been had the last quarter century seen continued expansion of our expeditions into low Earth orbit and into lunar space? One only has to look at today's studies and visionary plans to make an educated guess. From the mining of He-3 in abundant quantities in the lunar soil for eventual cheap fusion energy sources, to dual-use technologies which can serve both civilian space while being leveraged into the terrestrial economy, the potential of expanded space activities is to become a growth sector for our economy, not a sink as has been misunderstood and misrepresented. It will become the source of highly skilled and high paying jobs for the next century, the century of our children and grandchildren.

Lunar settlement and industrialization are a central component of an overall strategy to take space and make it an economic engine for our nation, creating new technologies, new markets, and new jobs. We no longer think of the nation's aircraft manufacturers as a drain on taxpayer resources; rather we view them as a major component in our GNP and one of our largest technological employers and exporters. There is no reason why space, and especially lunar settlement and

industrialization, cannot become the dominant component of our economy in the same time that it took to go from the Wright Brothers to the 747.

Our leaders must make the connection between lunar industrialization and taxpayer benefits during the initial development phases, when government must lead industry and the nation into space. In addition to science, economic benefits accrue from lunar manufacturing facilities for special products, materials, and propellants. We already see the economic benefits of the satellite communications industry. Next, we would like to benefit from manufacturing in low gravity and hard vacuum, from medical research and space medical facilities to entertainment and athletics, from extraterrestrial resources to space science. These are only a few of the industries that can develop into massive operations in the lunar and space environment. Just as with the development of the railroads and the opening of the American West, the colonization and industrialization of the Moon begins with modest national investment with the Federal Government continuing to fund R&D so that cheap access to space becomes available. At that point, government becomes a customer, with venture capital and industry doing what it does best, marshaling resources, technical talent, and logistics to build facilities, cities, and industries. This will be the beginning of the creation of an infrastructure on the Moon. An important strategic aspect here is that NASA activity be limited to space science and perhaps certain high-risk technology development such as propulsion, with the free enterprise system open to everything else.

Lunar industrialization is our nation's ticket to more rapid growth and job development. We should be clear, however, lunar and space industrialization will happen, whether or not the United States takes the lead. However, the benefits of such industrialization will mainly fall upon those with the courage and conviction to proceed; and they are not necessarily English-speaking peoples. We and our leaders need to have the courage to proceed.