

## A Space Renaissance

By Madhu Thangavelu

### Abstract

We are entering a new Space renaissance. The US policy to return to the moon offers the opportunity to test and certify technology for extraterrestrial activity, as well as great potential for further exploration of possible human habitats. Developments and private investment in rocketry are encouraging and enabling economic space access. Consequently, we may be arriving at a critical inflection point; almost all our views of the world and our universe so far have come from Earth. What would it feel like to step out of our only home, and to look back at the Earth from another world? Those who have left the Earth tell us the experience cannot be put into words; it must be experienced directly. So, it appears that we are readier than ever to allow large numbers of people to experience the out-of-this-world experience that philosophers call the Overview Effect. Perhaps, as a result, we will become better neighbors, accepting of a new cosmopolitan worldview, and in the process, become better stewards of our only home, Mother Earth.

**Keywords:** Space renaissance, spaceflight, lining off Earth, Overview Effect, stewardship of the Earth.

We are entering a Renaissance era in human spaceflight. Just as the European masters brought forth a magical period of learning, discovery, invention, fine arts, and music five hundred years ago, with the advances in the science and technologies proliferating today, we expect a rejuvenation in human space activity in this dawn of the 21st century.

The Space Launch System heavy lift launcher and the Orion spacecraft, expressly designed for the purpose, are on track for test flights by Christmas 2018. The new US administration has moved swiftly to reinstate a newly constituted National Space Council, and in its first meeting on October 5, 2017, it directed NASA to conduct a 45-day study with the express aim of returning astronauts to our Moon within five years. On Monday December 11, the president signed the Space Policy Directive #1 to set us on this course. It is not by accident that the president had Apollo astronauts Buzz Aldrin and Sen. Harrison Schmitt by his side when he signed the directive. If we can hold to this five-year schedule and directive, we should have the new generation of 21st-century astronauts step on our Moon on July 20, 2022, to celebrate both the 50th anniversary of the last Apollo landing of December 1972 (Apollo 17) as well as reminding us all of when Apollo 11 landed, and humans took the first step on an extraterrestrial body on July 20, 1969.

This policy is not founded on exploration, science, and technology prowess alone. It is the consensus and culmination of thought leaders that the free world must lead such an effort. And since our Moon is the next logical platform after the International Space Station to fly the *e pluribus unum* banner high, the most suited and capable nations who cherish free speech and freedom of thought, movement, and expression should spearhead the endeavor. Outer Space offers an ultimate arena to express human

freedom, and we believe we should do it now, since the technologies exist today, both in the government agencies involved and within the newly homegrown, innovative, and agile private space sector that is champing at the bit to go.

Visions like those offered in the American Space Renaissance Act and the European Space Agency's Moon Village suggest that a new paradigm is emerging for space activity in general, and for human space activity in particular. A Space Renaissance of sorts is happening right now, especially in human space endeavor, and it appears to have many nations and many sectors, both governmental and private, eager to participate in projects. At the September 2017 International Astronautical Congress in Adelaide, NASA and the Russian Space Agency Roscosmos agreed to pursue a new project called the Deep Space Gateway to locate a crewed orbital station around our Moon. This act alone shows the ties that bind humanity, sans the prevailing thorns in the politics between rivals of the cold war past. With many promising space systems like the private SpaceX Falcon Heavy that has evolved from the Falcon 9 reusable launcher mated to the crew Dragon capsule and NASA's heavy lift Space Launch System coupled with the Orion capsule, being readied for launch in 2018 and 2019 respectively, it is clear that human space activity will now see a healthy catalyst in commercial space sector involvement. In fact, the Falcon Heavy maiden test flight on February 6, 2018 is the harbinger of truly economic space access, providing the much-needed catalyst our spaceflight program needs to spur on the development of human space activity, both on the domestic front and in the international arena.

The private space sector is poised to take advantage of new and emerging technologies like reusable boosters; advanced robotics; secure, wideband, delay and disruption-tolerant communications; agile and advanced manufacturing technologies, all essential to accelerate fielding the innovative and economically viable space systems needed to support crews on long missions away from home. Of special mention are the technological advances in the nuclear thermal power generation industry. For long, space activity and visions of space activity have been constrained by the paucity of power. The deregulation, or rather the ongoing re-regulation of the nuclear power industry, may bring forth new visions of spacecraft and extraterrestrial settlements based on the heritage that NASA pursued and successfully demonstrated decades ago. Long-duration missions, especially those proposals for space vehicles headed for destinations beyond our immediate, warm solar neighborhood would benefit greatly from a new generation of compact nuclear fission power plants. The long nights on our Moon would be a perfect setting to test and certify this technology for safe and sustainable extraterrestrial settlement activity.

Unlike robotic space missions, human space activity has proved to be difficult to budget in the past, with extremely narrow engineering and human factor tolerances that are critical to preserving crew safety. In a global economy that is fast evolving into a multipolar one, aided by the reach and penetration of innovative and agile communication system networks, highly disruptive and distributive technologies like Block Chain and cryptocurrencies like Bitcoin seem to be reshaping economic activity. Perhaps space policy and economics will also be affected positively by the democratic transparency and fluidity we see.

Many chapters in the history of modern science and technology may be viewed through the poignant discoveries made by the inventions of the microscope and the telescope. Indeed, the great classical philosophical debates and divides between the biological and life sciences and the physical sciences mark the beginnings of the modern era of scientific thought. While the microscope allows the life sciences to continue to probe deeper and deeper into the living organism, the telescope looks outward into the heavens, toward the beginning of time and space. The James Webb Space Telescope is being readied for launch, and it will soon enhance the revolution in astronomy that the Hubble space telescope started a quarter century ago. Good to recall that astronaut missions were crucial in servicing the Hubble and enhancing performance, time and again.

Armed with the scientific and space instrumentation tools we have today, space science has much to offer humanity, about the origins of our universe, our solar system, the evolution of our Sun, and the origin of life itself. Far from over, after the Apollo era that but scratched the surface, the scientific exploration of our Moon has not yet begun. Our dormant Moon holds an unperturbed record of solar activity over a billion-year span. Return to the Moon and careful extraction of material will bring hard data about solar activity that is of immediate benefit to humanity, as we try to understand and build reliable long-term climate change and solar behavior models that are crucial to preserving our biosphere and our species in particular. The recent discovery of breaches on lunar lava tube roofs called “skylights” would allow exciting exploration of their interiors, long considered for their potential to shelter us from the harsh lunar environment, and safely to locate permanent habitats, from where we could evolve advanced technologies for humanity’s expansion into the cosmos.

Information is the lifeblood of the progress of civilization. The flow and freedom of information are the hallmarks of democracy. Information enhances plurality and enriches the colors of diversity. The velocity of information today, aided by advances in information and communications technology, is vital to save lives in jeopardy, for folks caught in the vagaries of daily life and on the common defense fronts. Timely information allows for progressive education of the professional and the new generation alike, and it is the engine that drives new views and exciting innovations and inventions that make new dimensions in civilization possible. Human space activity is at the leading edge of such progressive activity, and it is one such arena of information-driven endeavor.

But we may be arriving at a critical inflection point; a confluence of philosophies of sorts. All our views of the world and our universe so far have been limited by looking out from Earth into our surroundings and peering into the universe from platform Earth. What would it feel like to step out of our only home, the blue planet we call Earth, and to look back at this magical marble floating in the dark and void emptiness of space; to turn our heads and look back from another world, albeit barren and desolate? What would looking into Earth from outside feel like? What would people on Earth feel, looking up at our Moon, the largest, brightest and most visible orb in our night skies, and knowing that people are living, working, and looking at us from there?

We already know that people who orbit the Earth or those who have visited our Moon tell us the experience cannot be put into words. Such a view must be experienced directly, they say, and it permanently changes our minds, our lives, and our worldview.

And so, it appears that through the mastery of human space technology, we are readier than ever before now to embark on a journey that would allow large numbers of people to experience the out-of-this-world experience that philosophers call the Overview Effect. We will use the stepping stool of information and the machines that make the technological sublime possible to relish and bask in the spiritual sublime offered by outer space. And in the process, we will become a more refined and sensitive species, appreciative of humanity's predicament on Earth, and we will refine our consciousness and become more aware of our place and purpose in the cosmos. Perhaps we will become better neighbors, accepting of a new cosmopolitan worldview, and in the process, become better stewards of our only home, Mother Earth.



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**About the Author:** Madhu Thangavelu conducts the ASTE527 Graduate Space Concept Synthesis Studio in the Department of Astronautical Engineering within the Viterbi School of Engineering, and he teaches Space Architecture in the School of Architecture at the University of Southern California. He holds degrees in both disciplines. He is also an adjunct faculty member of the International Space University based in Strasbourg, France, an institution that trains promising young space professionals for leadership in international space activities. Recently, he has been nominated as a director of the National Space Society.

**Editors' Notes:** Madhu Thangavelu blesses the Space community with his teaching, research supervision and his long-time support of the National Space Society's annual international Space conventions and activities. His graduate students at the University of Southern California consistently create Space technology designs that will contribute to the Space Renaissance that Madhu describes so well in this article. We thank Madhu for his frequent participation in Kepler Space Institute events and future planning. **Bob Krone and Gordon Arthur.**