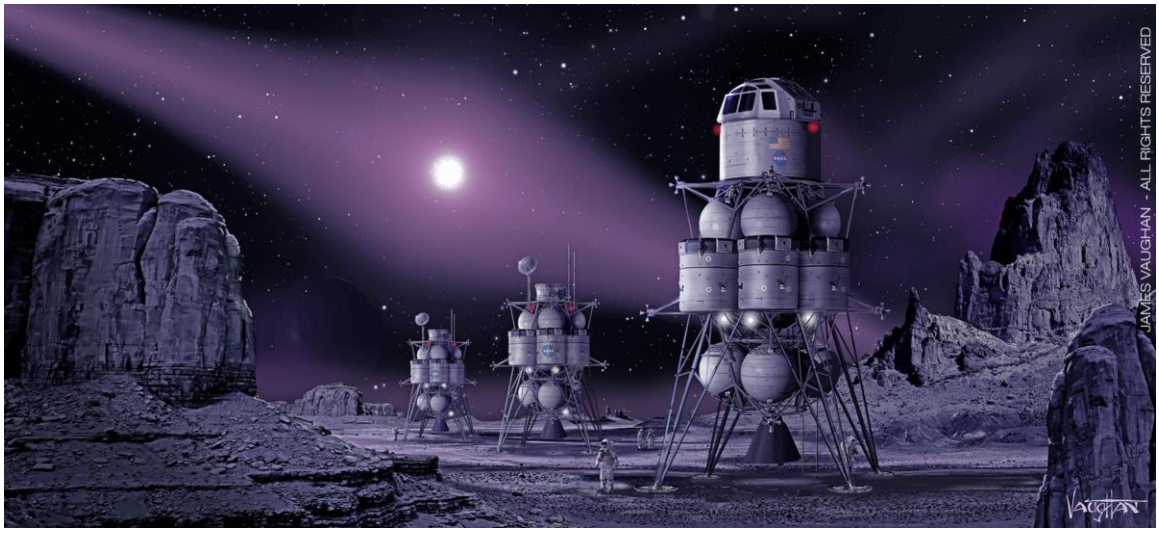
INTERNATIONAL INSTITUTE
OF SPACE COMMERCE

The Lunar Economic Action Plan: A Business Plan for the Moon.



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Forward

Since the dawn of humanity, we have been explorers. Our innate curiosity and desire for a better life have taken us away from our birthplace, over the next hill, across the oceans, and most recently, beyond the planet itself into space.

That exploration has historically happened in two discrete phases: discovery, and then settlement. Since Sputnik we have been sending probes and people to discover the universe around us, but with the International Space Station, we have now moved on to permanent settlement in Earth orbit. And the next logical destinations are the Moon, and then Mars.

As it was for our forebears, initial settlement pushes our technology, governments, businesses and individuals to their limits. The first moonbase will take far-thinking cooperation and tenacity on a global scale. To succeed, the work of groups like the International Institute of Space Commerce, as outlined here in LEAP, will be key.

An entire universe of opportunity awaits our decisive action, as we take our next permanent steps away from home.

Chris Hadfield, Astronaut (Ret.)

Introduction

The road to Mars and the exploration of space leads through the Moon. It is the next logical step in the human exploration of space. The return to the moon can best be accomplished by taking advantage of government and industry partnerships and international cooperation.

The vision of Alfred Lord Tennyson expressed in Locksley Hall in 1842 could well be fulfilled with such partnerships –

For I dipt into the future, far as human eye could see,
Saw the Vision of the world, and all the wonder that would be;

Saw the heavens fill with commerce, argosies of magic sails,
Pilots of the purple twilight dropping down with costly bales.

The Lunar Economic Action Plan (LEAP) of the Institute proposes that a private settlement on the Moon offers an opportunity for a return to the Moon and a lunar outpost that is both feasible and cost effective. It makes the case that technology is not the issue, but rather economics. It proposes an approach that leverages the strengths of both private industry and private capital and that supports and enhances both science and the exploration of the Moon. It is a return to the Moon that takes advantage of both new technologies and the new economics of the space age.

It is an approach that harnesses the energy and resources of commerce while supporting a platform and destination for the exploration of space. International cooperation, as demonstrated by the International Space Station, has proven to be of great benefit. And a lunar settlement that utilizes the capabilities of commerce and other countries could not only prove to be of similar benefit but could well provide the foundation for the human exploration of space well beyond the lunar surface.

George Abbey, Senior Fellow for Space Policy at the Baker Institute, Rice University

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Executive Summary

A private settlement on the Moon is surprisingly feasible and even cost effective, offering the best chance of success for a return to the Moon and by definition settlement beyond. Interestingly, technology is not the issue, but rather economics. By leveraging the strengths of private industry and private capital, via the use of Public Private Partnerships and Mega Funds, the provision of public science and exploration of the Moon can be both enhanced and ensured. Any return to the Moon takes advantage of both new technologies and the new economics of the space age. The Lunar Economic Action Plan (LEAP) was created to examine this possibility.

LEAP – The Lunar Economic Action Plan

Over the last twelve months, as the USA, Europe, China, and India, and many other governments around the world, are increasing their focus on a return to the Moon, the International Institute of Space Commerce (the Institute) asked a series of leading global experts in the space field, from governments, academia and industry alike, what role private industry and private investment could and should logically play in the return to the Moon with the establishment of a private settlement on the Moon.

The effort was entitled the 'Lunar Economic Action Plan' or 'LEAP' for short. Think of it as a Business Plan for the Moon.

Invited authors were asked to consider a private settlement from the aspect of business and commerce. Suggested potential topics and questions were as follows:

Think Finance. How would you fund such a venture? What jurisdiction(s) would you use and why? Access to capital markets? Debt or equity financing? IPO? Leverage Intellectual Property? Bonds for the construction of the settlement?

Think Macro Economics. How would you practically establish a working economy between the Moon and the Earth? Imagine a thriving lunar settlement, or settlements, with hundreds if not thousands or more people living and working in the Moon and interacting commercially and more with the Earth.

Think Media and Communications. How will those living and working there consume media, create media? How will they call home? How will this effect traditional communications markets and the development of low earth orbit economy? Imagine 24-hour communications with the Earth, broadcasting, media, and questions of censorship? Data centers on the Moon? How will they watch Netflix on the Moon?

Think Currency. What currency will they likely use (we imagine no one is going to take a printing press to the Moon)? How may this revolutionize the use of digital currencies back on Earth with the Moon as an economic proving ground? A living wage on the Moon? A barter economy?

Think Day-To-Day Life. What skill sets will be needed? What jobs? Civil Engineers, Doctors and Nurses, Construction, Teachers, Police, military, entrepreneurs, restaurant owners, insurance adjusters, customs officers, engineers, baristas, chefs, journalists, scientists, farmers, aquaculture specialists, janitors, plumbers, IT support and more? How will they manage payroll, investments, and pensions? Health care? Legal disputes?

Inputs were received from over 20 authors. The results were eye opening.

Image courtesy of Bryan Versteeg

Findings

Technology is not the issue: economics is the key. If conducted properly, the private settlement of the Moon and Solar System could see a multi billion, if not trillion, dollar expansion of the global economy.

As we fast approach near 50 years since the first Apollo landings on the Moon, technologies have advanced along with our understanding of the value and benefits of Lunar exploration. Indeed, the next steps on the Moon will take full advantage of the exponential revolution and digital renaissance. The use of robotics, CIS Lunar cycler architectures, and in-situ resources will be both logical and key to the success of any

settlements. LEAP was conducted on the premise that the technologies needed are already available, though of course their cost has radically reduced since the age of Apollo, and in this way improves the economics of any settlement.

Economics, not technology, is the key

Instead, the key to success of such future missions to the Moon lays with understanding the fundamental changes in the economics and funding of such missions via privatization and the leveraging of private capital for the global space industry since 1969 to best effect. Why should tax payers monies be invested in physical equipment or pressurized space when instead, following multiple successful examples to date in the space industry, it can be far better leveraged with government as a customer for private industry allowing both the growth of new tax paying industries leveraging private capital exponentially enhancing in the provision of services and science and far greater measured tax payer value?

GOGO to COCO

In this era of declining national budgets, increasing national debt, why wouldn't private capital logically be leveraged to enable the growth of the economic sphere of influence for a nation in space? Why should the taxpayer carry such a burden alone? The world's space agencies can utilize the dynamisms of private enterprise to make new resources available to themselves and their science communities building upon the changes in how space missions are funded working from the traditional Government Owned, Government Operated (GOGO) models of the Apollo era and the Government Owned, Contractor Operated (GOCO) models of the Space Shuttle program on through to the

more modern and efficient economic Contractor Owned, Contractor Operated (COCO) models of today with Government as a customer of services.

Leveraging the power of Public Private Partnerships

Just as Public Private Partnerships are driving new opportunities and new models of finance for the provision of public science in the space industry today, what more can they achieve in regards to the settlement of the Moon and beyond? Further, the establishment of a specific Space Mega Fund could allow for the successful investment in the new frontier by a range of governments, entities, and individuals offsetting risk through shared investment portfolios in multiple space sectors and service providers.

A private settlement on the Moon in support of public science in itself becomes an experiment in economics opening new avenues for both jurisdictional and regulatory experimentation as the frontier is literally pushed forwards in terms of spectrum, telecommunications, currencies, intellectual property, and more as people live on the Moon and as investments are made and realized, opening new avenues of growth for the global economy. Asking a simple question such as 'how will people watch Netflix on the Moon' opens a series of logic gates and regulatory decisions that will need to be made. The economics of the provision of public science subtly evolves to that of value creation for the economy of their national parent, a focus on property development and the creation of value in terms of both physical space and how well that space is regulated to enable commerce or not.

Up to the point of the establishment of a private settlement on the Moon the adage that '100% of the monies spent in space are not, they are in reality spent on Earth' holds

true. The value creation of the global space industry still drives economic activity here on Earth though jobs, investments, goods and services. The settlement on the Moon will become a logical extension of this economic equation or sphere of influence potentially boosting the home economy with new goods, services, and vitality that have been traditionally found from investment in invention and exploration. In essence the extension of the global economy to a new CIS Lunar sphere beyond the existing barrier of Geostationary Orbit.

Though interesting questions of both digital and physical quarantine will arise. It is not an automatic extension of the economic sphere. Questions as to the need for a focus on the different, yet real, regulatory requirements will arise. For example, from such global bodies such as the International Telecommunications Union to the World Trade Organization for the movement of goods and services coupled with access to global markets and the provision of spectrum. Regulation either enables or deters commerce. Despite its high technology, this is the same in terms of the space industry.

ITU Region 4?

For example, is a new ITU Region needed? Most likely given the need and use of spectrum both to provide a communications infrastructure to enable exploration and commerce on the Moon and to ensure that the use of that infrastructure compliments instead of disrupts the existing global communications infrastructure in space. The present ITU system is quite logically focused on Earth with three regions ensuring equitable access to spectrum in space for commerce, civil, and military use via the ITU's Radio Regulations. 'No spectrum, no satellite, no investment' is the mantra of the

global satellite communications industry, now valued at over $330 billion annually. Any communications from the Moon will have to work in harmony with the existing international and national regulatory processes and treaties enabling equitable use of spectrum in space. Communications on the Moon and in CIS Lunar space and beyond will have initially different needs. While the physics may be the same, the distances could enable more equitable re-use of existing spectrum without causing harmful interference to existing global networks. Yet, the present ITU Radio Regulations have no provisions to allow commercial spectrum use beyond Geostationary Orbit as there has simply been no need until now. Such provisions could be added and an ITU Region 4 for use of spectrum beyond geostationary orbit has logically been suggested.

A question of Jurisdiction

Further, will goods created, or services originated, on the Moon be treated for market access differently depending upon which jurisdiction their facility is operating? Of course as here the choice of the jurisdiction to work via in space, akin to the flagging of a ship on the High Seas, has proven key to success or failure of commerce in space tied more to access to enabling regulation and market access than arguably any other industry. Settlements will inherit the regulatory environments of their host jurisdictions. The more competitive or open to commerce their host jurisdiction is, the greater chance for success the settlement will have? Hence will goods and services be treated under existing WTO regulations for market access? What about the need to recognize and address the differences in such goods and services given the nature of the Moon? What of the question of quarantine, both physical and digital? The original Apollo astronauts faced both customs forms and quarantines when they returned. How

does such evolve to more modern needs and how do they relate to barriers to entry to markets, both physical and regulatory?

The Moon Treaty as a de-facto economic quarantine?

The question of a different type of quarantine has also arisen form the studies: that of a potentially self-imposed financial quarantine upon the citizens, companies, and economies of those nations who have chosen to sign and ratify the 1979 Moon Treaty. The Treaty's provisions preclude private investment. What might have been a consideration at the height of the Cold War in 1979 has perhaps changed in face of the realities of modern economics and necessities of capital flow needed to facilitate exploration and settlement? Spacefaring powers such as the United States, Russia, China and the United Kingdom and its Dependencies do not recognize the validity of the Moon Treaty, whereas nations such as France, Austria, Belgium, and India do. Does this preclude their companies, citizens, and economies from both investing in and participating in the settlement of space?

At what cost?

Given that the 2014 study from the National Space Society estimated a cost a US $5 billion for an initial settlement by 2022, upon examination the LEAP authors believe this figure has actually reduced in cost since then given the development and application of exponential technologies and changes in the launch services industry.

To put this in perspective, this mean a private settlement on the Moon could be

achieved for *less* than the cost to build Disneyland Shanghai or the new Apple campus in Palo Alto. There are many more similar examples.

The future looks to be an interesting place given the change in the economics of a settlement on the Moon, and even for the whole Solar System, providing investment and economic expansion for host economies here on Earth.

The work of the Lunar Economic Action Plan (LEAP) of the Institute has come to the conclusion that a private settlement on the Moon is surprisingly feasible and even cost effective, offering the best chance of success for a return to the Moon and by definition settlement beyond.

A list of the papers and authors can be found here www.iisc.im and in the following

List of Papers and Authors

1. *MOBIUS: An Evolutionary Strategy for Lunar Tourism*, **M. Lali, and Madhu Thangavelu**, University of Southern California http://iisc.im/portfolio-items/mobius-an-evolutionary-strategy-for-lunar-tourism/
2. *Moon or Mars: What is NASA's Next Logical Step*? **Allyson Reneau** **http://iisc.im/portfolio-items/moon-or-mars-what-is-nasas-next-logical-step/**
3. *LEAP Communications P*lan, **John Paffett**, http://iisc.im/2017/08/10/white-paper-published-leap-communications-architecture/
4. *Location, Location, Location on the Moon*, **Hoyt Davidson, http://iisc.im/portfolio-items/location-location-location-on-the-moon/**
5. *Using Lunar Resources to Create a Spacefaring System*, **Paul Spudis**, http://iisc.im/portfolio-items/using-lunar-resources-to-create-a-spacefaring-system/
6. *Jurisdictional Challenges And Their Potential Impact Upon Commerce Related To A Private Settlement On The Moon,* **Jay Honeycutt, Michael Potter, Christopher**

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7. *Justifying a Lunar Settlement*, **Jose Ocasio-Christian**, http://iisc.im/portfolio-items/justifying-a-lunar-settlement/
8. *Creating A Courageous 21st Century Space Policy*, **Dennis Wingo,** http://iisc.im/portfolio-items/creating-a-courageous-21st-century-space-policy/
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11. *Moon 2.0: Private Planetary Exploration and the New Lunar Economy*, **William Pomerantz**, Virgin Orbit, http://iisc.im/wp-content/uploads/2016/07/Moon-2.0-Pomerantz.pdf
12. *Innovative Models for the Private Financing of Space Science Missions*, **Jeffrey Nasonov, Norah Patten, Michael Potter, Christopher Stott** http://iisc.im/portfolio-items/innovative-models-for-private-financing-of-space-science-missions/
13. *A Return To The Lunar Surface,* **Blue Origin** Testimony before the US House of Representatives Sub Committee on Space, September 7th 2017. http://iisc.im/portfolio-items/blue-origin-testimony-on-a-return-to-the-lunar-surface/
14. *Project Horizon* (De-Classified), **US Army**, March 1959 http://iisc.im/portfolio-items/project-horizon/
15. *Low Cost Strategies for Lunar Settlement*, **National Space Society** http://www.nss.org/spacemovement/lunarsettlement.html

About the Institute

The International Institute of Space Commerce is the world's leading nonpartisan think-tank dedicated to the study of the business, economics, and commerce of space. It is also an Institute of the International Space University (ISU). The Institute's goal is to transform the global discussion on space commerce working to solve the issues it faces

today and tomorrow by driving forward the conversation with a marketplace of new ideas by providing this home for the exchange, discussion, and creation of new ideas in space commerce. Being international in its reach and a non partisan 'Think Tank' drawing upon new ideas and solutions to existing and future problems the space industry faces by drawing together experts from academia, government, the media, business, international and non- governmental organizations, most notably those from the ISU and its extended network of people and resources. www.iisc.im