

## **Jamestown on the Moon LLC**

**April 26<sup>th</sup> 2005**

**From: Klaus P. Heiss, Jamestown on the Moon LLC**

**To whom it may concern**

**A ROBUST IMPLEMENTATION OF THE PRESIDENT'S SPACE VISION:**

**A Lunar Condominium Development Company ("LCD")**

**For establishing**

**A FIRST SUSTAINED HUMAN SETTLEMENT OUTSIDE EARTH**

**on the Moon by 2015 and operate initially**

**"A CONDOMINIUM OF OBSERVATORIES"**

**To test and demonstrate**

**ENABLING SPACE EXPLORATION TECHNOLOGIES AND APPLICATIONS**

**for the Moon and Destinations beyond  
with private and international participation.**



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### Introduction.

The purpose of this Policy paper is to outline a Robust Implementation of the President's Space Initiative with specific technology RDT&E Goals for the 2015 – 2030 period, concentrating on the Moon as a testbed for exploration missions beyond the Moon thereafter.

This policy statement combines the expertise of two Technical Committees, the Space Colonization TC and the "In-Situ" Resources Utilization TC. Other TCs may join in this Policy Assessment and Recommendation for AIAA.

A clear, robust and historic goal for the President's Space Initiative is identified: the establishment of the First Permanent Human Settlement Outside Earth, on the Moon – starting in 2015 and fully operational by 2015 for decades beyond.

**The central theme of this paper is the need for a Private Company Approach for implementing the President's Space Exploration Initiative by proceeding first to the Moon.** In this we follow the examples of Comsat/Intelsat

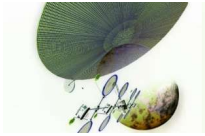
In commemoration of the first sustained English settlement in the Americas in 1607 we propose to name this settlement "**Jamestown**" and the Base "**Columbia**" for the astronauts of Columbia's last flight in January/February 2003.

### 1. Background.

In 1959 Wernher von Braun outlined a vision for the US Space program for the 1960's, culminating in the establishment of a permanent Lunar Base comprising twelve (12) astronauts. In May 1961 President Kennedy took the first step by directing NASA to land Man on the Moon and bring him back safely by the end of the decade, for a total effort that stayed below \$100 billion and accomplished the task in less than eight years.

At the time of the first landing of man on the Moon in July 1969 the Space Task Force outlined a similar goal for the US for the 1970's, including the deployment and operation of four large astronomy facilities for the 1970's. This unanimous recommendation was deconstructed, nearly terminating the quest for Human Space flight into the Solar System.

The assessment by Tom Paine in the mid-1980's and the Synthesis Group under Tom Stafford in the early 1990's came to the same conclusion, with the added vision of then proceeding on toward Mars and other destinations. 35 years after the first landing of man on the Moon we have spent in excess of \$500 billion and yet have not proceeded beyond



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Low Earth Orbit.

On January 14<sup>th</sup> 2004 President Bush committed the United States once more to resuming our quest for Human Space exploration, starting first and foremost with the Moon and, after mastering the myriad problems and challenges of Human Space flight and exploration, to then proceed beyond.

This vision of decades passed has to be realized with a robust implementation of the Space Initiative as stated by the President to give content and scope to NASA, other Government agencies, the U.S. Congress and, most important, the people and future generations of the United States and all those who will join us in this historic quest.

This journey, interrupted after a few missions of the first Humans to the Moon in the 1960's and early 1970's has, finally, to be continued by establishing the first Human settlement outside Earth on the Moon – this time to stay.

If such a goal were not given, NASA and the nation may meander another 35 years in Space and spend \$500 billion or more without any results to show for, other than periodic exercises limited to low Earth orbit.

### 2. **Statement of the Opportunities.**

With the renewed attention to **Space Exploration and the role of humans in Space** questions of the uses of the Moon and other bodies of the Solar system have come to the forefront: is human Space flight but a romantic quest of childhood dreams or are there key opportunities to be opened and explored for the benefit of mankind – on Earth or in Space.

**Economic laws** – which apply in Space as well as on Earth – will limit beneficial uses of Space for Earth to the immediate vicinity of Earth in the solar system, the Moon. These 'constraints' will limit the uses for Earth to essentially observations, communications and energy – all **commodities with 'low mass' and 'speed of light'** transmission.

The revolutionary concept of a '**condominium' of observation facilities** is proposed for observations of the universe, the Sun and the Earth – providing a stable, nearly limitless aperture across the electromagnetic spectrum with huge advantages in reliability, costs and assurance of continuity of observations. Similarly, **communications, navigation, command and control of civil and scientific activities** on the Moon and for Cis- and Translunar space will change fundamentally.



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Beyond these uses, the ‘tapping’ of the vast (Solar, Nuclear) **energy resources** available on the Moon promises fundamental changes in Space operations, Space transportation and potentially clean energy supplies across all regions of Earth. E.g. with 1 GWe supply on the Moon a new age of **‘fuel-less’ space transportation** across Cis- and Translunar space is enabled, ultimately allowing speeds of up to one third the speed of light for missions to nearby solar systems.

Last and not least, with such assured energy supplies, all the **lunar resources** can be tapped for the establishment of Closed Ecological Life Support Systems (CELSS) leading to the **first settlement independent of Earth** – a most historic step for mankind to assuring its survival and expansion into Space.

These broad, challenging and exciting opportunities and perspectives on beneficial uses of the Moon and Cis-lunar Space to benefit Earth require a robust Research, Development, Testing and Evaluation (“RDT&E”) effort across the board of aerospace technologies, but also all other fields of endeavor in engineering, technology, the sciences and the humanities. When set along the lines outlined herein we believe this renewed commitment will give a new, forceful impetus to the young generation to pursue these difficult and demanding tasks of innovation and enterprise.

Once we have learned how to walk and work on the Moon and from the Moon in Cis-lunar Space we then can set out to voyages beyond and extend humanity throughout the Solar system and some day beyond.



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### 3. Recommendations

In response to the President's Space Exploration Initiative and to give substance to the President's explicit statement of January 14<sup>th</sup>, 2004 to NASA and the nation;

In recognition of the aspirations and hopes of current and future generations of the United States and Mankind;

In commemoration of all those who died in pursuit of Human Space exploration in generations past and the crew on Columbia's last flight in particular;

Aware of the historical context of the opportunity of the United States to continue beyond the first steps of man on the moon taken in the 1960's and 70's and advance Human exploration and settlement of Space beyond Earth;

Faced with the critical need to decide on the next generation Space Transportation System derived from the unique US technology base of reusable engines, rockets and Spacecraft (the Space Shuttle System);

Deeply troubled by 35 years of indecision, delay and, yes, retreat from the journey of mankind into Space, in 1969 (Post-Apollo Space Task Force), in 1986 (Tom Paine Space Commission) and in 1992 (The Synthesis Group/Stafford Report), each one turned down because of unrealistic aspirations or recommendations beyond logical next steps on the Moon and from the Moon;

Mindful of the historically overarching quest to establish settlements and civilizations outside and ultimately independent of Earth;

Cognizant of the core quest of Space Enterprise to the young generation to aspire to a career in the sciences, technology, exploration and utilization;

To reconcile and focus the diverse constituent interests of the Science, Technology, Applications and Exploration objectives of NASA and the Space community by opening and enabling thereby opportunities on and beyond the Moon throughout Cis-lunar Space and the Solar system we recommend to

**ESTABLISH A FIRST SUSTAINED HUMAN PRESENCE ON THE MOON  
[AT THE POLES] OF TWELVE ASTRONAUTS BY 2015**

**TO DEPLOY AND OPERATE A CONDOMINIUM OF OBSERVATORIES  
THROUGH 2030 AND BEYOND**



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Key to the implementation of the Space Vision as originally announced by the President – **with 2015 as the cornerstone date for the return of the United States to the Moon** – this time to stay – is the mobilization of the private and Non-USG sectors and funds to supplement the “projected” NASA budget profiles as shown in the various “Roadmaps” in the ongoing internal assessments by the agency (Sections II and III below).

With NASA tasked to provide the requisite enabling **Space Transportation Infrastructure to and from the Moon by 2015** we may avoid committing the historic mistake of Emperor Zu Deh of 1423 when under the advice of his scientific and financial advisers China decided to burn their ships of exploration when returning from their global quest started in 1421 under the motto “Why should we spend all these funds to visit the barbarians – let them spend these funds if they want to visit us – the center of the universe and heavenly kingdom”. The barbarians did and the rest is history. China for one will not repeat that mistake.

In the meantime **we have and are burning our ships of space enterprise**: the family of Apollo launch technologies, the Space Shuttle, indeed even everyday launch systems and propulsion technologies, returning to “V2” derivative expendable systems conceived in the 1920’s and 30’s.

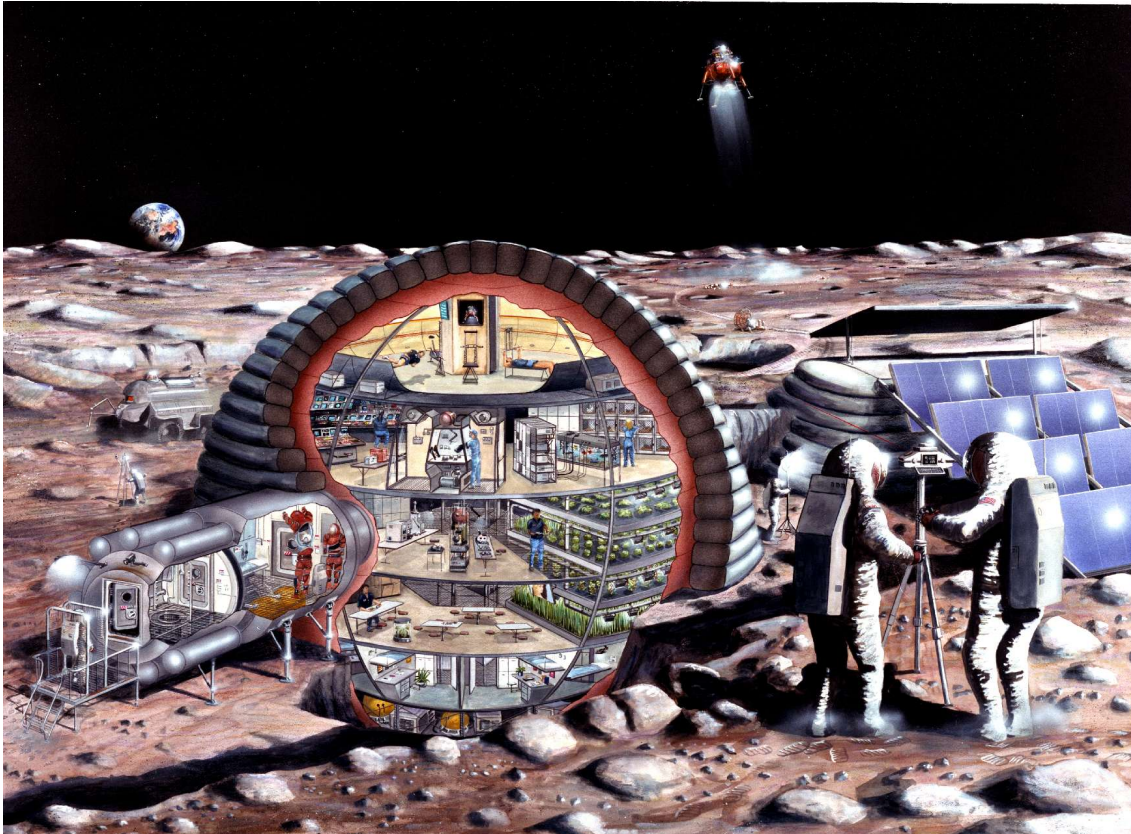
Lest the Nation agree on a Robust Implementation of the President’s Space Initiative NOW, the next generation of “Ships of Space Enterprise” will hoist different flags as they bypass us in Space in the decades ahead.



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### I. OBJECTIVES AND MILESTONES FOR THE FIRST OPERATIONS PERIOD (2015-2030):

**DEPLOY A SUSTAINED BASE ON THE MOON – AT CENTER, NORTH OR SOUTH POLES – BY 2015 WITH TWELVE OR MORE ASTRONAUTS (see Figure 1)<sup>1,2</sup> for the following tasks:**



**Figure 1 – Closed Ecological Life Support Systems (CELSS)**

- a. **A Testbed for HUMAN HEALTH ISSUES OF LONG TERM SPACE FLIGHT, including TELE-MEDICINE, in a 1/6<sup>th</sup> g environment to enable Human Space flight to Mars and destinations beyond, of two years or more duration. to assess ‘in situ’ the myriad of issues raised in the “Safe Passage” report of 2001. This Base will provide a unique Human Health Research Facility, providing important, enabling data of Human body responses to a 1/6<sup>th</sup> g environment, as against the one g (Earth) and “zero” g (ISS) environments to-date. To such purpose a two-year**

<sup>1</sup> High Frontier, “Columbia: A Permanent Lunar Base” Final Report to NASA Office of Space Flight, December 17<sup>th</sup>, 2003; see also extensive bibliography therein and in particular

<sup>2</sup> Mendell, W.W. Editor, *Lunar Bases and Space Activities of the 21<sup>st</sup> Century*, Lunar and Planetary Institute, Houston, Texas, 1985.



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baseline “on station” rotation schedule is proposed for the astronauts in the 2015 to 2030 decade.<sup>3</sup>

**2030 YEAR GOAL: ASSURED TWO YEAR DURATION SPACE FLIGHT MISSIONS IN TRANSLUNAR SPACE;**

**b. Deployment of a CONDOMINIUM OF LARGE OBSERVATORIES: for Astronomy, Earth and Climate (Sun-Earth) Observations, including vast distributed aperture instruments and "on board" data processing, management, servicing, repairs and updating of facilities (see Figure 2A and 2B for 1990's and 2003 concepts).<sup>4</sup>**

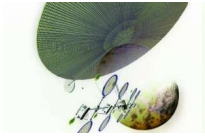


**Figure 2A: Condominium of Observatories on the Moon - Astronomy**

**2030 YEAR GOALS: HUBBLE/CHANDRA/COMPTON CLASS FACILITIES  
2015, LARGE DISTRIBUTED APERTURE SYSTEMS: 1 KM – 2015, 100 KM**

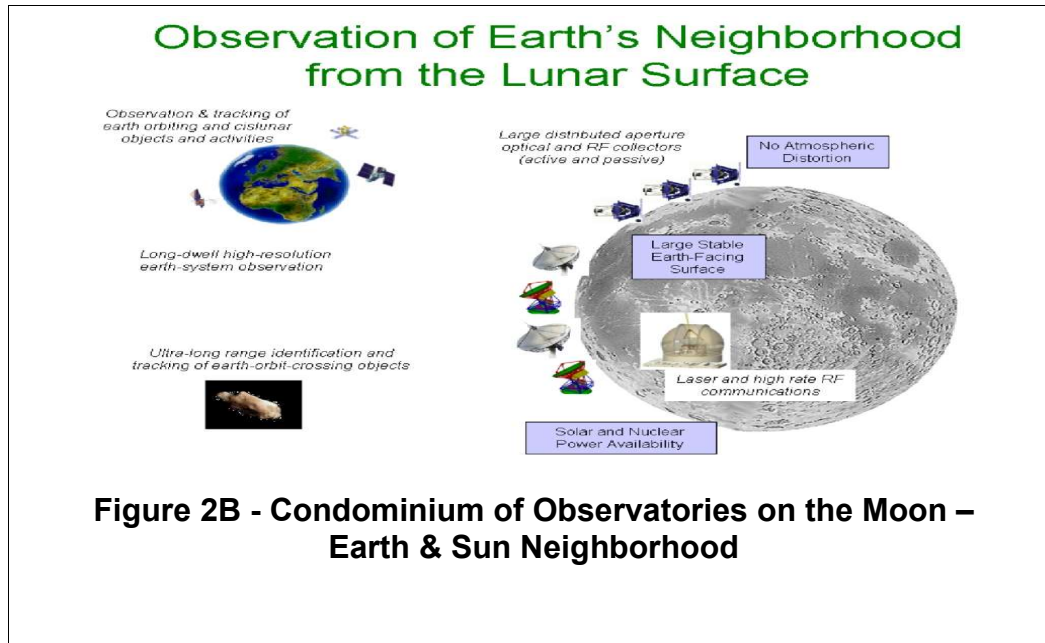
<sup>3</sup> Committee on Creating a Vision for Space Medicine during Travel beyond Earth Orbit, Board on Health Sciences Policy, Institute of Medicine: *Safe Passage – Astronaut Care for Exploration Missions*, John R. Ball and Charles H. Evans, Jr. *Editors*

<sup>4</sup> See among others: **1969 Space Task Force Lunar Astronomy Recommendations**, July 20<sup>th</sup>, 1969.



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– 2025, 1,000 KM + 2030;



In support of these “co-joint” core goals for the next decade(s) a variety of specific technology areas need sustained RDT&E efforts:

c.A Testbed for (CLOSED) ECOLOGICAL/BIOLOGICAL LIFE SUPPORT SYSTEMS (ELSS - CELSS) for sustaining the twelve astronaut base to decrease the outside (terrestrial) support needed, leading ultimately to resource autonomy and independence.<sup>5</sup>

**2030 YEAR GOAL: ELSS MODULE FOR 12 PEOPLE BY 2015, CELSS MODULES FOR 24 PEOPLE BY 2030;**

d.A Testbed for “In Situ” RESOURCES UTILIZATION, PRODUCTION AND PROCESSING with the objective to maximize lunar production capabilities / minimizing the need for terrestrial supplies and ‘on site to tap the myriad resources of other Moons, Asteroids, Planets; (Figure 3)

**TEN YEAR GOALS: 2015 – 100 MT, 2030 - 1,000 MT of varied output;**

e.A Testbed for ROBOTICS AND TELE-OPERATIONS in support of the various lunar activities and technology demonstration tasks for later extensions and applications on Earth, throughout Cis-Lunar Space, Mars

<sup>5</sup> High Frontier, “Columbia: A Permanent Lunar Base” *op.cit.* Chapter 1 and Chapter 4.

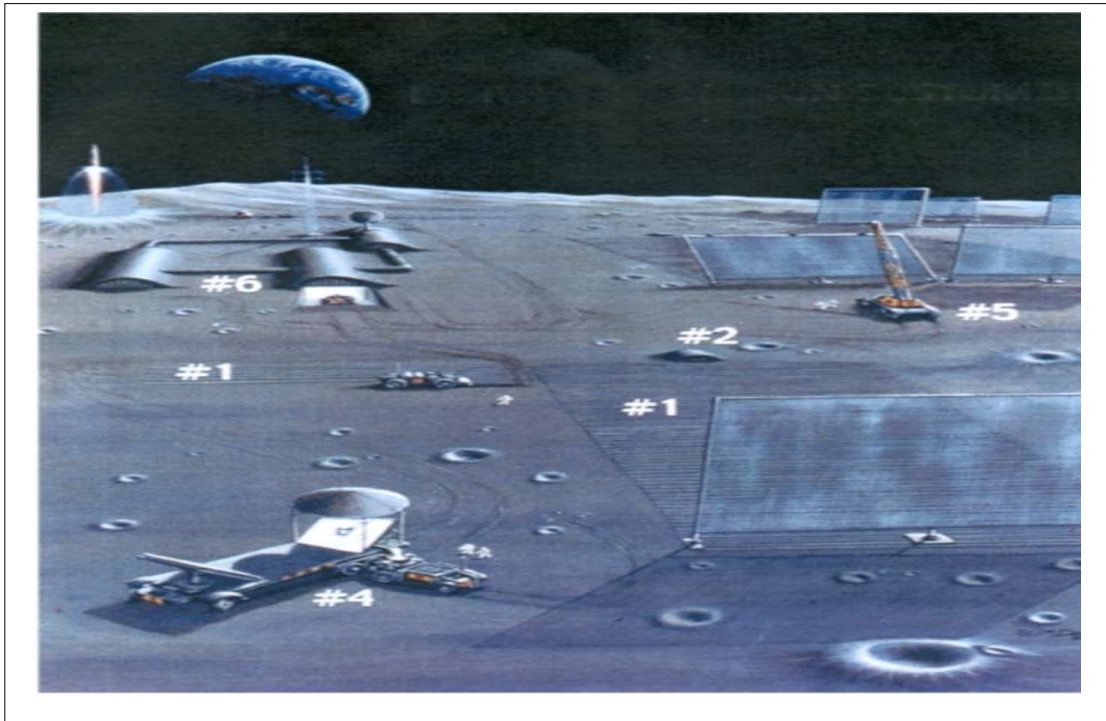


## Jamestown on the Moon LLC and Solar system exploration<sup>6</sup> (Figure 3)

**TEN YEAR GOALS: Demonstrations in the context of the 10 Year Technology Goals stated herein;**

**f.A Testbed for “in situ” ENERGY PRODUCTION, STORAGE and DISTRIBUTION TECHNOLOGIES, including**

- i. **NUCLEAR (Prometheus, other ‘conventional fission reactors)’<sup>7</sup>**
- ii. **SOLAR POWER plants<sup>8,9</sup> (Figure 3)**



**Figure 3 – Energy Distribution via Large Space Reflectors: #1 Solar Arrays, #2 Microwave Transmitters, #3 Reflectors; All made from Lunar soils by Production Equipment #4, #5 and #6 [Criswell]**

- iii. **<sup>3</sup>HE CLEAN FUSION<sup>10</sup> and**
- iv. **other novel energy concepts and processes.**

<sup>6</sup> Lee Morin, M.D., Ph.D., et. Al, **Concepts for Initial Robotic Lunar Resource Development**, Memorandum, 2005

<sup>7</sup> **150 to 200 KWe**; see also the NERVA program of the late 1960's and early 1970's (Harry Finger et.al.) that demonstrated 4 MWe

<sup>8</sup> Glaser P., Davidson C. and Csigi, K., **Solar Power Satellites**. 1998 Wiley-Praxis 654 pp and

<sup>9</sup> Criswell, David R., “**The Initial Lunar Supply Base**,” in *Space Resources and Space Settlements*, eds. J. Billington, W. Galbreath, and B. O’Leary, pp. 207-224, NASASP-428 and testimony by David Criswell to the U.S. Senate, November 2003

<sup>10</sup> Lunar Energy Enterprise Task Force, *Report of NASA Lunar Energy Enterprise Case Study Task Force*, NASA Technical Memorandum 101652, July 1989, 171 p.



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**2030 YEAR GOALS: 2015 – 1 MWE, 2025 – 10 MWE, 2030 – 1 GWE;**

**g.A Testbed for novel SPACE TRANSPORTATION technologies, including “in situ” FUELS PRODUCTION and storage, “FUEL-LESS” TRANSPORTATION concepts such as Electromagnetic Propulsion, Lunar Elevators, microwave and laser assisted propulsion. Specific RDT&E programs are warranted for each of these new Space Transportation technologies.**

**E.g. the deployment of a prototype Lunar Elevator from L1 to the lunar surface may be one of the most revolutionary breakthrough technologies, changing all of Cis-lunar and Trans-lunar applications, amongst them massive Solar Power Satellites.**

**Similarly, these same technologies (fuel-less transportation) can be used to establish a trans-lunar surface transportation infrastructure, e.g. a network of suspended cable “highways”, minimizing issues of Lunar dust and topography.**

**2030 YEAR GOALS: O/H 100 MT 2015, EMP 2025, SPACE ELEVATOR TO L1 2030<sup>11,12</sup>;**

**h.An ASTEROID and NEAR EARTH OBJECTS OBSERVATIONS and COUNTERMEASURES center, including a comprehensive threat assessment through inventory and analyses of Lunar crater topography, age distribution and astro-biological aspects. Combined with the energy goals stated above (Solar, Nuclear) and distributed aperture arrays, first practical means to intercept and deflect these periodic threats to all of Earth may be researched, developed, tested and evaluated.**

**2030 YEAR GOALS: HIGH RESOLUTION INVENTORY OF NEOS AND EXPERIMENTAL TESTING OF COUNTERMEASURES ON ACTUAL CELESTIAL OBJECTS FROM THE MOON.**

**i.Establishment of a DIGITAL HUMAN KNOWLEDGE ARCHIVE AND LIBRARY “ALEXANDRIA” to safeguard mankind’s historic, cultural and knowledge base against catastrophic loss such as occurred with the destruction of the Library of Alexandria first by the Romans in the turmoil**

<sup>11</sup> Pearson, J., "Anchored Lunar Satellites for Cislunar Transportation and Communication," *Journal of Astronautical Sciences*, Vol. 26, No. 1, pp. 39-62, 1979 and Pearson J., "Achievable Space Elevators for Space Transportation and Starship Acceleration," *NASA Conference Publication 10059*, Vision-21: Space Travel for the Next Millennium, April 3-4, 1990.

<sup>12</sup> Artsutanov Y., *Into Space without Rockets: A New Idea for Space Launch*, AFSC Foreign Technology Division Report ADA084597, Air Force Systems Command, Wright-Patterson AFB, 1969 (first published in Russian on July 31, 1960).



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of establishing the Augustan Empire and later in the seventh century AD with the Muslim conquests.<sup>13</sup>

**2030 YEAR GOALS: STORE ON THE MOON AND MAKE AVAILBLE WORLDWIDE US LIBRARY OF CONGRESS 2015-2030; LIVE CHAMBER ORCHESTRA PERFORMANCE ON THE MOON – 2020; DIGITAL 1:1 DISPLAY OF THE SISTINE CHAPEL AROUND THE MOON BASE.**

**j. Define and implement the next generation RE-USABLE SPACE TRANSPORTATION SYSTEM for all of Cis-lunar Space Operations and beyond meeting the above robust goals. The basic logistic needs are outlined in the 2004 AIAA Space Logistics Technical Committee Position Paper on Recommended Government Actions<sup>14</sup>**

**To-date NASA has shied away from a robust definition of these requirements and a realistic definition of the RDT&E so desperately overdue to assure US pre-eminence in Space<sup>15</sup>.**

In addition to the development of these requisite new Space Transportation capabilities **PRECURSOR MISSIONS** are suggested/required in preparation for the 2015 deployment of a permanent Lunar Base, amongst them:

- **2007+ ANALOG SIMULATION TESTBEDS / RDT&E** for each of the Technology Areas listed for the initial decade of Moon Base operations above, including
  - i. A 1:1 Scale Moon Base Habitat & CELLS Simulation, jointly with robust ISS tests and evaluations in zero g;**
  - ii. A 1:1 Scale Simulation Model of the Condominium of Observatories to test deployment and operations issues;**
  - iii. A Robotic ISRU Mining and Production Testbed, including RDT&E on nano technology applications, e.g. nano- carbon fibers for Lunar Elevator applications;**
  - iv. A Tele-Medicine Testbed in conjunction with the Moon Base Habitat and CELSS Simulation under (i);**
  - v. Solar Power (LSP & SPS) 1 GWe Construction, Deployment, Storage and Transmission (“Beaming”) Testbed(s);**
  - vi. RDT&E on <sup>3</sup>He Fusion Reactor Concept;**
  - vii. Testbeds for various “FUEL-LESS” SPACE TRANSPORTATION**

<sup>13</sup> First proposed to the **AIAA Policy Committee in 1979**, Norm Augustine Chairman.

<sup>14</sup> AIAA Space Logistics Technical Committee, **Recommended Government Actions to Address Critical U.S. Space Logistics Needs**, AIAA Position Paper, May 2004

<sup>15</sup> Snead, James Michael: “Architecting Rapid Growth in Space Logistics Capabilities”, AIAA 2004-4068, 40<sup>th</sup> AIAA/ASME/SAE/ASEE Joint Propulsion Conference, July 11-14 2004 Fort Lauderdale



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**Technologies, including Electromagnetic Propulsion, Solar-, Laser- and Plasma Sails, Lunar Elevator Concepts;**

**viii. Digitalization of the Library of Congress-Human Heritage Lunar Archives “Alexandria”.**

Each of these RDT&E/Testbed topics offer unique opportunities for private sector and other Non-USG inflow of funds through PPMs, JEAs, other joint ventures and agreements.

- **2007+ A HUMANITIES ON THE MOON education and cultural outreach program.** After all, it is the core mission of the US Space program to extend humanity beyond Earth and low Earth orbit into Space, not only in terms of science and technology, but vastly more important in extending the Human spirit and all its accomplishments into Space, with the Moon as the first sojourn on this voyage.
- **2008 Remote Sensing missions for site exploration and evaluation** including sub-meter stereo panchromatic and multi-spectral resolution for topographic mapping of potential Base sites;
- **2012 - Precursor Robotic Site preparation and pre-deployment missions on the Moon;**
- **2012 + Deployment of 'global' seismic detectors on the Moon** to determine internal geologic structure of the Moon making use of the periodic impact of meteorites and/or sounding experiments using explosives (analogous to oil and gas industry reservoir evaluations).
- **2015 - First Human Moon Base mission** to the prospective Base Site of **seven days** duration, with site evaluation, prospecting and preparation tasks, including deployment and checkout of robotic systems;
- **2015 – 2020 Increasingly long duration missions to the Base site(s)** with detailed Base preparation, deployment and expansion tasks for the 2020 full operation of a permanent Base.

It shall be NASA's task to test, rate and bear the risk in developing manned and unmanned system for an **“Interstate Space Highway and Ports Infrastructure” (Space Transportation and Base Startup)**, which shall be managed through a commercially operated company (the Lunar Condominium Development Company, “LCD”), with a statutory right of access and use of that infrastructure at additive (marginal) costs by all who participate in funding technology, projects and risks in accomplishing this historic goal:



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### **Jamestown Base: the First Sustained Human Habitat outside Earth on the Moon by 2015.**

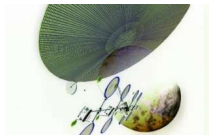
This “ComSat” Type entity shall have build in a sunset provision as to any monopoly, with the 2020 to 2030 transition period “deregulating” the initial monopoly. This was the case with the Jamestown Company as well, being dissolved in the 1620's after having placed the first English settlement on the American continent.

The “**Additive Cost Access and Use Rights**” (synonyms: “Incremental Costs”, “Marginal Costs”) are critical to stimulating and availing ourselves of the resources and innovation potential of industry, the private and international markets.

To stimulate private and “next generation” innovative thinking various prices shall be posted for “**Open Source**” design of components meeting (USG) defined standards and interfaces for such open source competition to which industry, the private and international partners can build to at their own risk and reward.

**We are wasting valuable time: every day that passes without such renewed dedication to built on the unique US technology base and leadership will contribute to the wasting of Human resources and know-how built at tremendous cost and effort over decades past.**

**This decision should not be left to the lethargy of inter-agency “processes” mired in the problems of the present, nor to “aerospace industry” surveys that reflect comfort with the status quo, rather than the requirements and mandates of our future in Space.**



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### II. CRITICAL: EARLY PRIVATE AND INTERNATIONAL PARTICIPATION - A LUNAR CONDOMINIUM DEVELOPMENT COMPANY (“LCD”).

The overriding economic success to-date in Space is communications and the profound revolution Space communications have wrought worldwide: the breakup of ATT, deregulation and competition, breakup of totalitarian empires. Had Space communications become a Government monopoly – or worse – set aside for exclusive military use, the world today would be unrecognizable to us, a world infinitely poorer and totalitarian.

To open Space to enterprise, markets and ultimately sustained autonomous, self-supporting activities a similar institutional innovation is required to assure early industrial, private and international market involvement, in analogy to the East India Company of ages past and of Comsat/Intelsat of the Space Age:

For each of the Technology Testbeds (a.k.a. “Spirals”) listed above, early industry involvement/participation on each of the technology areas shall be mandatory to maximize industry/private inputs and risk taking as well as early, “pre-operations” transfer of technologies and know-how to terrestrial applications and uses. To such purpose the necessary statutory basis already existing under the 1958 Space Act as well as possible enabling amendments thereto shall be enacted to allow NASA to become a reliable partner on long term Space Exploration and Economic Development activities.

It is proposed that the US Government establish – *ab initio* - as part of this new Space Initiative a **LUNAR CONDOMINIUM DEVELOPMENT COMPANY – (“THE JAMESTOWN GROUP”?)** to participate and ultimately take on self-sustained operations of the First Human Settlement outside Earth – on the Moon. International participation shall be assured in analogy to Intelsat through the LCD GROUP International.

**THE ROLE OF THE LCD GROUP** is to bring about substantial private sector and through THE LCD GROUP International overseas participation on all of the technology components listed for the Jamestown Settlement leading up to 2015 and ultimately full operation of such facilities after 2030. Each of these Components offers Private Sector Opportunities:

- NASA/THE LCD GROUP develops/provides “additive cost” access rights to any and all infrastructure components
- NASA/USG indemnifies for 2005 through 2030 period. The users will pay an insurance premium to THE LCD GROUP for such and related insurance issues;
- NASA/THE LCD GROUP enters into long term co-operation/procurement contracts (services, hardware, RDT&E)

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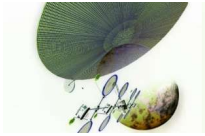
- PRIVATE SECTOR PARTNERS have exclusive rights to any intellectual/other property rights
- NASA/THE LCD GROUP will phase out where Private sector can take over
- TIME HORIZON: 2005 – 2030

During 2005 NASA SHOULD ESTABLISH AN OFF-SITE ENTITY IMMEDIATELY (see also institutional and statutory recommendations below) to define and explore the potential ventures and opportunities for private sector participation by exploring Pro Forma Private Placement Memoranda describing

- the **technologies, potential applications in Space** and in myriad applications thereof on Earth;
- the **NASA activities** scheduled thereto in terms of **funding and RDT&E facilities**, including long term procurement of goods and services from the PPM group;
- the **pro forma financial commitments** expected/promised/explored by industry and the private sector;
- the **exclusive rights** by PPM Groups to all technology, know-how, design and other intellectual property rights by the PPM groups;
- **exclusive LCD GROUP Logo marketing rights** in Space and on Earth for the goods and services of the LCD GROUP PPM group(s);
- the **expected revenue flows from Lunar and terrestrial applications** thereof to the PPM group;
- the technological and financial **risks and uncertainties**;
- **legal terms and conditions** and **additive cost access rights** to the NASA/US Government Space infrastructure for certified THE LCD GROUP PPM group members in the pursuit of their perceived opportunities, In particular this includes access and use of the Space Transportation Systems and facilities infrastructure of USG;
- **“Rules of the Road”** based on the 1958 Space Act as well as the LCD GROUP Company enactment statute by Congress under a
- **“Declaration of Space Rights”** constitution defining free market rules and approaches to the exploration and development of Space based on US constitutional principles and history.

Just one example of the myriad terrestrial applications of the technology paths (“spirals”) required in the exploration and development of Lunar, Cis-lunar and Trans-lunar applications is outlined in Figure 4, for Solar Satellite Systems applications outlined by Peter Glaser in 1989:

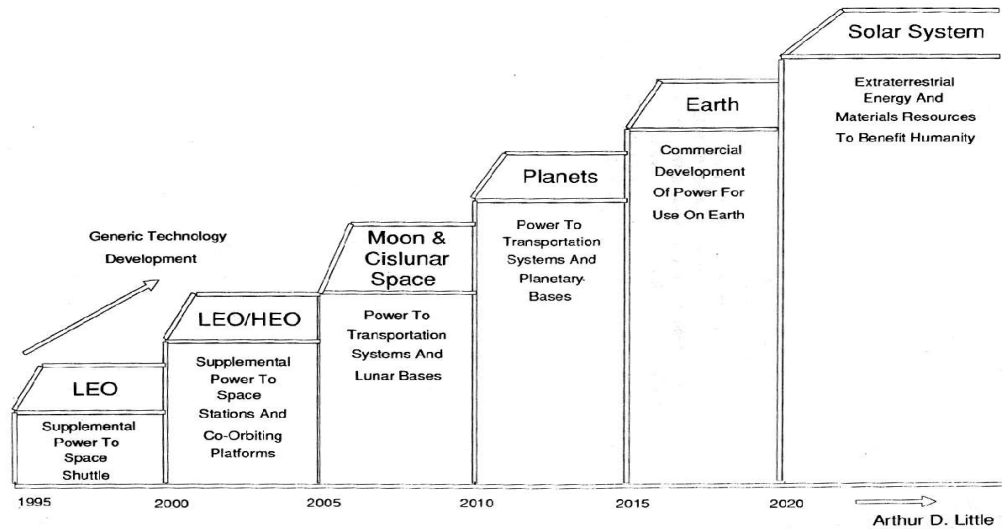
**THE ROLE OF THE LCD GROUP INTERNATIONAL** is identical to THE LCD GROUP Company, now geared to maximizing and structuring international co-



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operation and participation under identical rules as for domestic partners (“PPMs”) – as long as the international participation is deemed fair and reasonable as to the commitment of funds/risks to each of the technology areas listed above.

**Figure 4 - Power Beaming Growth Path**



Most important, THE LCD GROUP INTERNATIONAL shall endeavor on its own to provide a **SPACE TRANSPORTATION “BACK UP” CAPABILITY to US Space Transportation capabilities, so as to provide “real” launch insurance to allow continuity of operations.** A flow diagram of various institutional relations is shown in Figure 5:

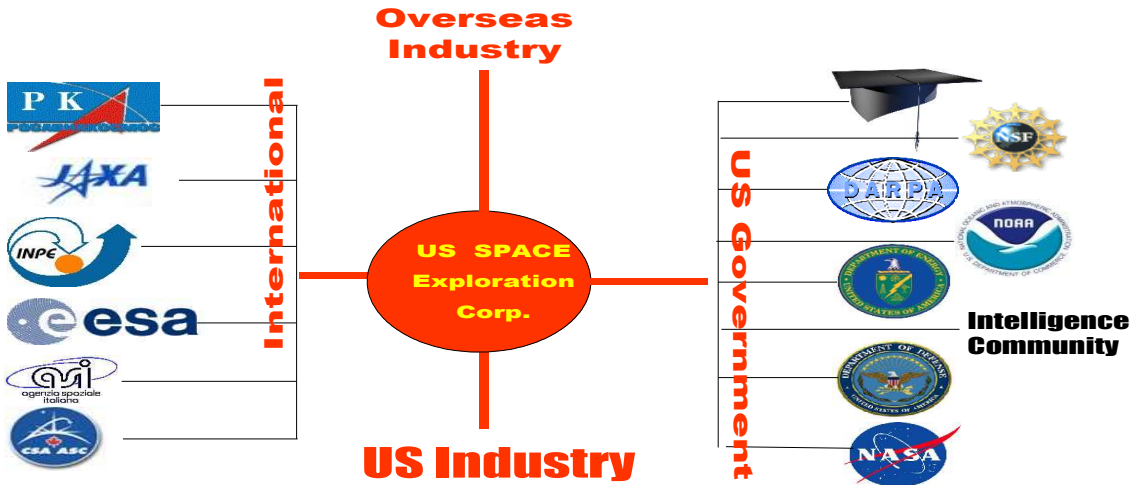
Fundamental to THE LCD GROUP INTERNATIONAL partnerships is an acceptance of the same Rules of the Road and “Declaration of Space Rights” as for the US LCD GROUP PPMs.



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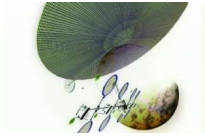
### III. INSTITUTIONAL AND STATUTORY REORGANIZATION OF US SPACE EFFORT.

In light of the above and cognizant of the bureaucratic and government-dependent industrial lethargy and obstructionism to redirection or innovation the immediate (“off-site”) institutional reorganization of the US civilian Space effort is recommended as follows:



**Figure 5 - US Lunar Condominium Development: Industry – Government – International Partnerships in implementing a Moonbase of Observatories**

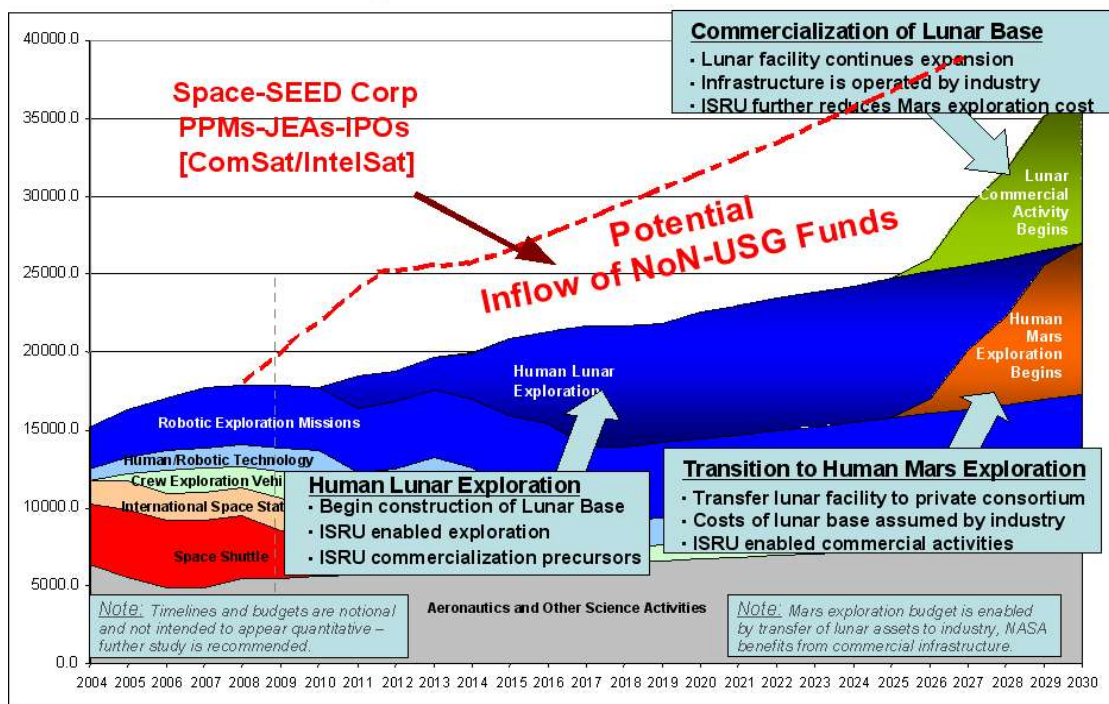
1. All Space Exploration and Space Transportation related NASA be immediately transferred into a **US LUNAR CONDOMINIUM DEVELOPMENT ENTITY “IN FORMATION”** (“LCD i.f.”), initially as part of the NASA structure until statutory formation of this “ComSat” of Space Exploration.
2. The **BUDGETARY AUTHORITY TRANSFERS** should include all of Space Exploration, Space Transportation, Space Observations (including Space Astronomy Observatories) and Applied Space Sciences (including life sciences).
3. The remaining NASA will be restructured and reinvigorated along the **N.A.C.A. MODEL OF FEDERAL RESEARCH LABORATORIES** (in place until the advent of NASA in 1958) dedicated to government/industry aeronautics and astronautics research and technology developments (RDT&E), with lead technology competences assigned to the various regional centers.
4. The Budgetary commitments to LCD i.f. shall be the currently posited **NASA “wedge” funding projected through 2010** and thereafter the



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Federal funding for Human Space Exploration and Development activities to LCD shall be phased out over a 20 year period (through 2030). The “commitments” by NASA (US Government) to LCD shall be the provision of funding for the basic **INFRASTRUCTURE** of Space Exploration and Development. Principally the **next generation** (Shuttle derivative) **Space Transportation System** for large scale/structures Cis- and Trans-lunar activities as well as the “ports” such as the initial Moon Base and the **TEN YEAR TECHNOLOGY GOALS** (2015 to 2030) outlined above (see Figure 6).

### Industry can Increase Total Investment in Exploration Infrastructure



5. **ALL ADDITIONAL FUNDING** raised by LCD Entity i.f. shall indeed be “in addition to” so as to incentivise and maximize the resources dedicated to the early and sustained development of the potential of the Moon, Cis-lunar Space and explorations beyond in the context of free markets and enterprise, the very foundations of the US “Common Wealth”.

**Attachments:**  
**Rules of the Road**  
**Declaration of Space Rights**



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### **RULES OF THE ROAD** **DECLARATION OF PRINCIPLES AND PROPERTY RIGHTS** **(Legal, Institutional, Space Property and Enterprise Issues)**

***“Wherever possible the private sector [should] be given the task of providing specified services or products in Space, and be free to determine the most cost-effective ways to satisfy those requirements . . .***

***“***

**Pioneering the Space Frontier**  
**Report of the National Commission on Space, p. 11**  
**Chaired by Thomas O. Paine**  
**May 1986**

The most challenging – and in some ways the most important – part of our renewed journey into Space will be a clear, simple statement of principles that guide U.S. and worldwide policy as to the role of enterprise, risk taking, costs and rewards when pursuing ventures in Space, be these of nations or of private enterprise, of explorers or merchants, of innovators or service providers.

Over the decades an impressive regime of international cooperation in Space exploration and the uses of Space has developed – some through explicit statutory provisions and international agreements, some by explicit or tacit understandings, some by deliberate non-specificity. In some cases, these practical steps have helped to give appropriate guidance for Space activities. In other cases, various agreements are unenforceable and have little to do with developing a regime that supports the desired role of entrepreneurs, private enterprise and innovative Space exploration.

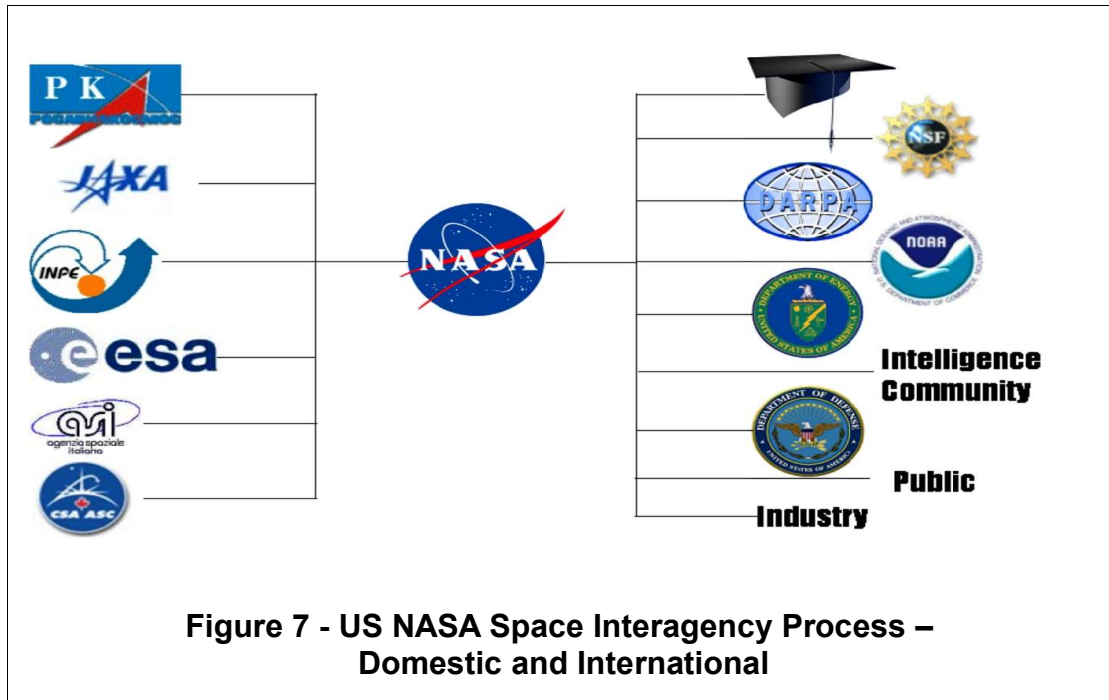
Space activities have proceeded under defense, civil and industrial sponsorship and direction. The policies have been dominated by defense and civil considerations, rather than the private sector, as reflected by the makeup of the space interagency process summarized in Figure 7. But recently private industry has begun to play a much more significant – and in some cases, a dominant – role in funding the design, deployment and operation of space systems – because that course is profitable. This trend should be encouraged in the proposed effort for NASA to establish a Lunar habitat within a decade, with incentives for entrepreneurs and private enterprise.

Thus, the policies of the past – both the international ‘understandings’ and the



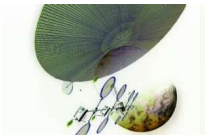
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inter-agency practices – need to be reviewed and updated to reflect that new reality. Such a serious updating should conform to the basic principles that have traditionally guided U.S. spirit and practice in exploring new frontiers, including the ideas embodied in the U.S. Constitution.



In formulating such new ‘rules of the road’ for renewed Space enterprise, it is instructive to consider some of the most remarkable passages in human thought, written by a refugee from National Socialism, a guest of British hospitality in London in 1942. Of particular note are the concluding remarks by Friedrich Hayek in his "The Road to Serfdom," written in exile in London on the foundation of free societies. These remarks addressed to his host country, England, on the inherent dangers of totalitarianism, whether national or socialistic or both, are timeless and should be heeded as various U.S. authorities consider the policy issues of Space enterprise today. (pp.177f):<sup>16</sup>

<sup>16</sup> Europeans, including **Hayek**, all too easily overlook that these same ideals were the foundation of the 18th century American revolution and the VIRGINIA DECLARATION OF RIGHTS of 1775 in particular, **drafted by Messrs. Mason and Lee and recognizing the Pursuit of Property Rights** specifically, adopted by Mr. Jefferson a year later in drafting the Declaration of Independence and ultimately included in the U.S. Constitution. The spiritual roots of these ideas can be traced, beyond John Locke, well back to scholastic thought, including the idea of the social contract foundation of all Government powers and the role (preference) of private property over common property. (**Thomas Aquinas, Duns Scotus, and Marsilius of Padua - who would extend the social contract foundation even to matters of theology (c.1270 - 1342)**).



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*"The purpose of this book has not been to sketch a detailed programme of a desirable future order of society. If with regard to international affairs we have gone a little beyond its essentially critical task, it was because in this field we may soon be called upon to create a framework within which future growth may have to proceed for a long time to come. A great deal will depend on how we use the opportunity we shall then have. But whatever we do, it can only be the beginning of a new, long, and arduous process in which we all hope we shall gradually create a world very different from that which we knew during the last quarter of a century. It is at least doubtful whether at this stage a detailed blueprint of a desirable internal order of society would be of much use - or whether anyone is competent to furnish it. The important thing now is that we shall come to agree on certain principles and free ourselves from some of the errors that have governed us in the recent past. However distasteful such an admission may be, we must recognize that we had before this war once again reached a stage where it is more important to clear away the obstacles with which human folly has encumbered our path and to release the creative energy of individuals than to devise further machinery for 'guiding' and 'directing' them - to create conditions favorable to progress rather than to 'plan progress'. The first need is to free ourselves of that worst form of contemporary obscurantism that tries to persuade us that what we have done in the recent past was all either wise or inevitable. We shall not grow wiser before we learn that much that we have done was very foolish.*

*"If we are to build a better world we must have the courage to make a new start - even if that means some 'reculer pour mieux sauter'. It is not those who believe in inevitable tendencies who show this courage, not those who preach a 'New Order' which is no more than a projection of these tendencies of the last forty years, and who can think of nothing better than to imitate Hitler. It is indeed those who cry loudest for the New Order who are most completely under the sway of the ideas which have created this war and most of the evils from which we suffer. The young are right if they have little confidence in the ideas that rule most of their elders. But they are mistaken or misled when they believe that these are still the liberal ideas of the nineteenth century, which in fact the young generation hardly knows. Though we neither can wish, nor possess the power, to go back to the reality of the nineteenth century, we have the opportunity to realize its ideals - and they were not mean. We have little right to feel in this respect superior to our grandfathers; and we should never forget that it is we, the twentieth century, and not they, who have made a mess of things. If they had not yet fully learned what was necessary to create the world they wanted, the experience we have since gained ought to have equipped us better for the task. If in the first attempt*



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*to create a world of free men we have failed, we must try again. The guiding principle, that a policy of freedom for the individual is the only truly progressive policy, remains as true to-day as it was in the nineteenth century."*

Had England only listened to Hayek! Let us not fail in Space, where the stakes, one may dare say, are much larger.

The need to revisit, reformulate and innovate U.S. Space Policy to conform to new opportunities and capabilities is a paramount requirement, not only for the U.S. but for all free market nations worldwide. This is necessary to assure substantial, productive and profitable (i.e. beneficial) uses of the vast investments made to-date by various governments, often with no regard nor incentive as to any practical uses.

What comes to mind is not dissimilar to the situation in the Colonies over 200 years ago. With the opening of the vast new territories West of the Appalachians, who and how should one decide on property and property rights – some abstract entity in distant London or the people who dared to go out and open up these new spaces for civilization? What is needed is an application of these same principles of homesteading and property rights that guided our forefathers then: the **Principles of the U.S. Constitution applied to a Declaration of Independence to and in Outer Space.**

A new Space Doctrine is needed along with any decision to establish the first permanent outpost on the Moon, assuring thereby the High Frontier for Space Enterprise. Critical amongst these principles – which should be established as a matter of statutory rights – are the indicated in the following proposed draft “Statement of Principles of Space Enterprise.”

Obviously this draft Declaration can be improved upon, but the core principles expressed herein have to be part of any such new Declaration – without which Space enterprise for sure will be destined to fail: we might as well burn our Space ships – just as the Chinese bureaucracy did in 1423 and let the ‘barbarians of Space’ visit us.

Absent such a Declaration of Rights: why should we have spent our precious resources to go West into the new territories; why would we have set out for Oregon and the Pacific? Indeed, why now risk our treasure on Space Exploration and Enterprise?

Hopefully, the United States will not repeat the mistake of the Chinese World Empire of the 15<sup>th</sup> century – and leave the ‘new territories’ to others to explore and develop.



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### PROPOSED DRAFT STATEMENT OF PRINCIPLES FOR SPACE ENTERPRISE

#### A Declaration of US Space Property Rights and Independence (Williamsburg, Virginia)

Whereas the United States has been founded on a set of well understood principles fundamental to the pursuit of property [Virginia Declaration of Rights, 1775] and freedom of man and

Whereas these principles have served the United States and the community of free nations well over centuries past

Whereas, in addition, the very discovery and development of these United States and the Americas were founded on the principles of the freedom of the seas, including the freedom to appropriate land and resources unclaimed or unused by others

The United States hereby declare:

**(1) FREEDOM OF NAVIGATION** – The new "Sea of Space" shall be open for anyone to navigate in and to undertake whatever enterprise in analogy to the freedom of the seas; the United States shall not agree to or be party to any treaty, policy, regulation or understanding that limits this freedom in whatever form; the United States sees no difference between the Open Seas of Earth and the 'Open Seas' of Space and hence no new principles have to be invented or agreed to that would limit such freedom of navigation and enterprise - for whatever purpose.

**(2) THE RIGHT TO PRIVATE PROPERTY** – Private property is fundamental to the pursuit of enterprise, investment, exploration and freedom of man, be it on Earth or in Space; the United States shall not agree to or be party to any treaty, policy, regulation or understanding that limits any proprietary rights of land, resources, services, data or other economic and intellectual goods in Space or derived from Space. In particular, the United States want to re-affirm that nothing in the 'Outer Space Treaty' prohibits or contradicts full private property rights by any citizen of Earth, nor any and all uses of such property for whatever private or public gain. This all the more so as 'private property' is the foundation of all free societies and has existed throughout known history at least since the inception of agriculture 5,000 or more years ago. On the other side 'national property rights' are a rather recent artifact promoted by the French revolution, giving rise to 'nationalism' and 'socialism' with a concurrent notion that such 'nations' are free to steal or infringe on any such private property. The devastating consequences



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of these artifacts, when combined, were seen in the 20<sup>th</sup> century. Specific provisions in the Constitution of the United States prohibit any 'taking' of such private property by government(s) without due compensation, nor can the United States be any party to a treaty or agreement that directly or indirectly were to agree to such a 'taking'.

Again, the United States see no difference between activities of free man on Earth and in Space for whatever purpose, and in particular reaffirms the right to private property of any and all means in the pursuit of exploration, science and commerce to be inalienable and fundamental to such freedom.

To the extent that the United States de-facto or unwittingly may have been a party to different understandings and treaties, these shall henceforth be declared null and void to the extent that they infringe on such property rights.

**(3) SPACE HOMESTEADING RIGHTS** – To foster the early and broadest possible exploration of Space and use of its vast resources the United States hereby proclaim Space Homesteading rights whereby - in analogy to the principles that opened the vast reaches of the United States to development for the benefit of their people and world markets.

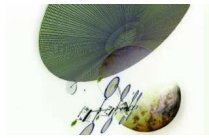
The United States will recognize the appropriation of any surface and underlying mineral and resource rights by anyone on the Moon or on any other Celestial body, with the size of homesteading rights to be determined for each of these bodies separately. Asteroids and Space debris can be appropriated in *toto*.

Such Homesteading rights are granted to any person that takes physical possession of such surface or object, himself or through ventures financed by him at his risk and benefit. Property rights have to be exercised through use within 99 years or revert to unclaimed Space status.

Lands and resources claimed as private property in Space under the Homesteading principle by US persons shall be subject to the rights and obligations of the United States constitution.

**(4) LOW COST ACCESS TO SPACE FOR PRIVATE ENTERPRISE** – Based on the principle that Government is formed to serve the individual, his rights, pursuit of freedom and property, the United States Government will henceforth make available at additive costs any facilities, services, hardware and intellectual Government rights in the pursuit of private U.S. Space enterprise.

By 'additive costs' are meant the costs added by each specific private activity to Government Space program, project or facility costs, and proven by Government to have been added by those specific activities to any one annual government



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budget appropriation. Similar access will be granted to any other free market nation that grants similar rights and access to its facilities and which participates in significant co-operative programs in Space with the United States.

**(5) COMPETITION** – Earth and Space are best served by open competition of ideas and enterprise in free markets, so that the best may succeed. Consonant with this premise the people of the United States will pursue their goals and interests in Space as they see fit: ‘anticipatory’ regulations, license requirements, laws and other provisions that stifle enterprise in open markets serve no purpose.

Nor is the exploration and use of Space served by 'co-ordinated' or co-operative programs for the sake of co-operation, if such programs deterred or stifled competition and enterprise by any nation and its people. After all, Spain and Portugal did not set out jointly to open the world for Europe. And the Soviet Union did not set out jointly with the United States to launch the first satellite or the first man into Space. Nor did President Kennedy set out to put man on the Moon and return him to Earth by the end of the 1960's jointly with the Soviet Union. Duplication - if any - is a low price to pay for enterprise and freedom in Space.

**(6) EXERCISE OF RIGHTS AND CLAIMS** – Consonant with the positive principles of international law, the United States shall claim and recognize property rights in Space only to the extent that such rights are vested in persons that control or provide services, resources, land or goods anywhere in Space. The United States will not recognize any claims or rights based on abstract, theoretical notions of others that would infringe in any way on free enterprise by the United States or any other Space faring nation or person of mankind, or other civilizations yet to be encountered.

***We cannot foresee the ingenuity that companies, established or entrepreneurial, will bring to the building of new industries in the 21<sup>st</sup> century based on the Highway to Space. Nor can we know the individuals whose names will rank with Douglas, Boeing, Sikorsky, and the other pioneers of the aeronautical industry. But looking back for analogies, we know that one of America's heroes, Charles Lindberg, practiced the skills of piloting in heavy weather, prior to his Atlantic crossing, by flying the U.S. mail.***

### ***Pioneering the Space Frontier***

Report of the National Commission on Space  
Dr. Thomas O. Paine, Chairman, 1986, p. 21