

## **Session 2**

**The Role of Private Actors:  
Commercial Development of the  
Outer Space Resources, including  
Those of the Moon and Other  
Celestial Bodies: Economic and  
Legal Implications**

## DISCUSSION PAPER:

# The Role of Private Actors: Commercial Development of the Outer Space Resources, Including Those of the Moon and other Celestial Bodies: Economic and Legal Implications

by

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### I. Introduction: Economic Potential of Natural Resources on the Moon, Mars, and Other Celestial Bodies

With the prospect of space missions to the Moon and other celestial bodies becoming more and more a reality, the issue of finding ways to sustain such missions from an energy standpoint and define an adequate legal framework for the exploration and use of the resources available on the Moon and other celestial bodies is increasingly gaining the interest of policymakers and space industry representatives all over the world.

This section addresses the following *Discussion Question*: Are current initiatives to explore and possibly extract natural resources available on the Moon, Mars and other celestial bodies becoming economically (and technically) feasible so that they will materialize in the near future or is it too early to consider them?

Natural resources discovered on the Moon include oxygen from the lunar soil, water from the ice poles and numerous volatile gases which can be used to supply fuel and construction materials, priceless resources for future Lunar permanent bases and space missions.<sup>1</sup> Perhaps the most valuable resource on the Moon is Helium-3, a fuel that can be used in nuclear fusion. Helium-3 is considered by some experts as an ideal fuel because it is powerful and has the advantage of generating very little radioactive by-product.<sup>2</sup> While scarcely

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<sup>1</sup> National Aeronautics and Space Administration, Johnson Space Center, "Mining and Manufacturing on the Moon", online: NASA website <<http://aerospacescholars.jsc.nasa.gov/HAS/cirr/em/6/6.cfm>> (date accessed: 28 May 2006).

<sup>2</sup> Former NASA Astronaut Harrison Schmitt, in his book "Return to the Moon: Exploration, Enterprise, and Energy in the Human Settlement of Space" (New York, NY: Copernicus Books in association with Praxis Publishing, LTD, 2006) makes a strong argument for industrial use of the Moon based on the utility of Helium-3 fusion.

available on the Earth, Helium-3 is plentiful on the Moon.<sup>3</sup> Experts argue that this rare isotope could be extracted and transported to the Earth using existing terrestrial mining technology.<sup>4</sup>

Planet Mars also appears to host valuable resources. Recently, NASA's rovers Spirit and Opportunity discovered traces of jarosite and goethite, so-called "water-signature" minerals which may be the strongest to date proof of the existence of Martian water.<sup>5</sup> In addition, the discovery of relatively high concentrations of methane on Mars is another element that tends to suggest that there may be Martian life forms buried underground.<sup>6</sup> Scientists are optimistic that more groundbreaking discoveries are awaiting on Mars.<sup>7</sup> However, the cost of exploring Mars appears to be heavily controversial. One estimate, repeated by the media, puts a price tag of \$1 trillion for a mission that would use the Moon as a stop-over.<sup>8</sup> This estimate was challenged by others as being a "completely inaccurate reading of historical data and deeply flawed mathematics."<sup>9</sup> Even NASA officials called the price tag of \$1 trillion "preposterous"<sup>10</sup>, without

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<sup>3</sup> It is estimated that Helium-3 on the Moon is sufficient to accommodate Earth's energy needs for at least 1,000 years. National Aeronautics and Space Administration, Johnson Space Center, "Mining and Manufacturing on the Moon", online: NASA website <<http://aerospacescholars.jsc.nasa.gov/HAS/cirr/em/6/6.cfm>> (date accessed: 28 May 2006).

<sup>4</sup> See for example, Harrison H. Schmitt, "Mining the Moon", Popular Mechanics (12 October 2004), online: Popular Mechanics website <<http://www.popularmechanics.com/science/space/1283056.html?page=4&c=y>> (date accessed: 28 May 2006).

<sup>5</sup> NASA, Press Release "Mars Rovers Spot Water-Clue Mineral, Frost, Clouds" (13 December 2004), online: NASA Mars Exploration Rover Mission website <[http://marsrovers.nasa.gov/newsroom/press\\_releases/20041213a.htm](http://marsrovers.nasa.gov/newsroom/press_releases/20041213a.htm)> (date accessed: 6 June 2006); Space Daily, "NASA: Spirit Finds New proof of Martian Water" (14 December 2004), online: Space Daily website <<http://www.space.com/2004/041214030507.ph5iamy1.html>> (date accessed: 6 June 2006).

<sup>6</sup> Space Daily, "The Martian Methane Surprise" (7 December 2004), online: Space Daily website <<http://www.spacedaily.com/news/mars-life-04y.html>> (date accessed: 6 June 2006).

<sup>7</sup> NASA, Press Release 04-385, "Reports Detail Rover Discoveries of Wet Martian History" (2 December 2004), online: NASA News website <[http://www.nasa.gov/home/hqnews/2004/dec/HQ\\_04385\\_MER\\_science.html](http://www.nasa.gov/home/hqnews/2004/dec/HQ_04385_MER_science.html)> (date accessed: 6 June 2006), citing Dr. Michael Meyer, chief scientist for Mars Exploration at NASA Headquarters, Washington, DC.

<sup>8</sup> Gregg Easterbrook, "Bush's Goofy Mars Proposal: Red Scare", The New Republic Online (2 February 2004), online <<http://www.tnr.com/doc.mhtml?i=20040202&s=easterbrook020204>> (date accessed: 31 May 2006).

<sup>9</sup> Dwayne Day, "Whispers in the echo chamber: Why the Media Says the Space Plan Costs a trillion Dollars" The Space Review (22 March 2004), online: The Space Review <<http://www.thespace.com/article/119/1>> (date accessed: 1 June 2006).

<sup>10</sup> NASA Administrator Sean O'Keefe during a press conference on 21 January 2004, cited in Dwayne Day, "Whispers in the echo chamber: Why the Media Says the Space Plan Costs a trillion

providing however a more precise estimate.<sup>11</sup>

Scientists believe that asteroids contain rare elements and water as well.<sup>12</sup> Some argue that mining the asteroids would involve lower costs than retrieving lunar resources and the quality of asteroidal material (such as free metal – iron-nickel and volatiles – water, carbon and others) is generally deemed superior to lunar material.<sup>13</sup> The technology to be applied in mining and basic processing of asteroidal material is likely to be soon available.<sup>14</sup> The cost of mining asteroids could be drastically reduced (to under \$100 per pound) by using space tethers to Low Earth Orbit (LEO).<sup>15</sup>

It is undeniable that the use of such space resources can contribute significantly to the exploration of outer space by providing new energy sources and reducing the need for the use of Earth's sources. Future large scale activities in space will most likely require raw materials obtained from in-space sources rather than from Earth in order to compensate for the high cost of Earth launches.<sup>16</sup> Therefore, we can anticipate a future market for such resources of precious and earthily-rare minerals from the Moon and other celestial bodies, including near Earth asteroids.<sup>17</sup> Some experts advise that this market will only take off when cheaper

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Dollars" The Space Review (22 March 2004), online: The Space Review <  
[http://www.thespacereview.com/  
article/119/1](http://www.thespacereview.com/article/119/1)> (date accessed: 1 June 2006).

<sup>11</sup> Humorist Dave Barry summarized the debate around the cost of a mission to Mars. "The Bush administration says the Mars mission can be accomplished for only 143.8 zillion dollars, but critics claim that the true cost is likely to be much more like 687 fillion dillion dollars. (These numbers are imaginary, but trust me, they're as accurate as any other cost estimates you see about the Mars mission.)" Dave Barry, "NASA: Mars mission for mere zillions: Four-stage mission to fourth planet includes resupply at local Walmart", online: Polytechnic Online <  
[http://www.poly.rpi.edu/  
article\\_view.php3?view=2842&part=1](http://www.poly.rpi.edu/article_view.php3?view=2842&part=1)> (date accessed: 3 June 2006).

<sup>12</sup> Harrison H. Schmitt, "Mining the Moon", Popular Mechanics (12 October 2004), online: Popular Mechanics website <  
[http://www.popularmechanics.com/science/space/1283056.html?page=4&  
c=y](http://www.popularmechanics.com/science/space/1283056.html?page=4&c=y)> (date accessed: 28 May 2006).

<sup>13</sup> "Asteroidal vs. Lunar Materials Utilization", online: website  
<<http://www.permanent.com/ep-a-v-l.htm>> (date accessed: 26 May 2006).

<sup>14</sup> "Asteroidal vs. Lunar Materials Utilization", online: website  
<<http://www.permanent.com/ep-a-v-l.htm>> (date accessed: 26 May 2006).

<sup>15</sup> Mining Asteroids, online: <<http://miningasteroids.com/>> (date accessed: 28 May 2006).

<sup>16</sup> M J Sonter, "The Technical and Economic Feasibility of Mining the Near-Earth Asteroids", Paper presented at the 49<sup>th</sup> IAF Congress (Sept 28 - Oct 2, 1998, Melbourne, Australia), online: Space Future <  
[http://www.spacefuture.com/archive/the\\_technical\\_and\\_economic\\_feasibility\\_of\\_mining\\_  
the\\_near\\_earth\\_asteroids.shtml](http://www.spacefuture.com/archive/the_technical_and_economic_feasibility_of_mining_the_near_earth_asteroids.shtml)> (date accessed: 28 May 2006).

<sup>17</sup> A study done in 1998 estimated that the size and rate of development of this future in-orbit

launch technology will be available and space tourism will constitute the driving factor for space development. However, others suggest that space resources can be used to make permanent bases and fuel missions in a much less expensive way than having similar materials launched from Earth.<sup>18</sup> Thus, the idea of mining natural resources from outer space will be transformed into reality much sooner than expected.

In fact, in recent years, the exploration of natural resources on the Moon, Mars and other celestial bodies received considerable and growing attention from space faring nations. For example, in February 2004 NASA released its "Vision for US Space Exploration"<sup>19</sup> based on President George W. Bush's new space exploration policy, "A Renewed Spirit of Discovery: The President's Vision for US Space Exploration."<sup>20</sup> The new policy makes the human return to the Moon by the year 2020 a priority for its space missions as precursors for human exploration of Mars and other destinations.<sup>21</sup> The main rationale is that a permanent lunar base on the Moon could lead to the development and testing of new sustainable exploration approaches, such as, among others, space resources utilization.<sup>22</sup>

On the other hand, Russia has announced more definite plans to mine the isotope Helium-3 on the Moon by 2020.<sup>23</sup> The project will involve building a permanent base on the Moon by 2015 and establishing a heavy-cargo transport

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market for materials could exceed 1000 tons per year by 2010, with a subsequent exponential growth to tens of thousands of tons per year once large-scale space activities commence. M J Sonter, "The Technical and Economic Feasibility of Mining the Near-Earth Asteroids", Paper presented at the 49<sup>th</sup> IAF Congress (Sept 28 - Oct 2, 1998, Melbourne, Australia), online: Space Future < <http://www.spacefuture.com/archive/>> (date accessed: 28 May 2006).

<sup>18</sup> "Don't Wait for Cheap Earth Launch", online: website < <http://www.permanent.com/ep-cheap.htm>> (date accessed: 29 May 2006).

<sup>19</sup> National Aeronautics and Space Administration, "The Vision for Space Exploration" (February 2004), online: NASA website < [http://www.nasa.gov/pdf/55583main\\_vision\\_space\\_exploration2.pdf](http://www.nasa.gov/pdf/55583main_vision_space_exploration2.pdf)> (date accessed: 24 May 2006).

<sup>20</sup> White House, "A Renewed Spirit of Discovery: The President's Vision for US Space Exploration", online: White House's website < <http://www.whitehouse.gov/space/background.html>> (date accessed: 24 May 2006).

<sup>21</sup> *Ibid.*

<sup>22</sup> *Ibid.* President Bush advocated spending a total of \$12 billion over five years on the plan.

<sup>23</sup> Space Daily, "Russia Plans Mine on the Moon by 2020" (25 January 2006), online: Space Daily website < [http://www.spacedaily.com/reports/Russia\\_Plans\\_Mine\\_On\\_The\\_Moon\\_By\\_2020.html](http://www.spacedaily.com/reports/Russia_Plans_Mine_On_The_Moon_By_2020.html)> (date accessed: 6 June 2006).

link that would allow industrial-scale delivery of this rare isotope.<sup>24</sup>

The European Space Agency (ESA) has undertaken steps to explore the Moon, as well, by launching on 27 September 2003 the spacecraft Smart 1, which entered lunar orbit on 15 November 2004 carrying a set of miniaturised instruments which it will use to study the chemical composition of the lunar surface.<sup>25</sup> China has also expressed its intentions to explore the Moon and is allegedly considering the prospect of lunar mining;<sup>26</sup> however, Chinese officials denied media reports that China's exploration plan of the Moon is aimed at exploring Helium-3 resources for potential mining.<sup>27</sup> Japan is planning the launching of two robot exploration missions, LUNAR-A and Selene, to explore the Moon later this year or next year.<sup>28</sup> In addition, the Japanese Space Agency (JAXA) is planning a long-term space program that would include constructing a research base on the Moon starting around 2025.<sup>29</sup>

Indian Space Research Organization (ISRO) has planned to undertake an unmanned mission to the Moon (*Chandrayaan-1*) starting in 2006-07. This mission will involve placing of a 525-kg spacecraft around the lunar orbit, with the purpose of collecting data which will allow for the chemical mapping of the entire lunar surface.<sup>30</sup> The new ISRO space program reflects the views of the scientific community in India which advocates the need to seriously pursue the mining of Helium.<sup>31</sup>

The next section address possible scenarios of carrying out such activities in terms of potential players involved.

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<sup>24</sup> K.S.Parthasarathy, "Mining the Moon", The Tribune (Chandigarh, India), Online Edition (3 February 2006), online: The Tribune < <http://www.tribuneindia.com/2006/20060203/science.htm#1>> (date accessed: 6 June 2006).

<sup>25</sup> "Europe Goes to the Moon" (16 November 2004), EurActiv.com website < <http://www.euractiv.com/en/science/europe-goes-moon/article-132324>> (date accessed: 6 June 2006).

<sup>26</sup> Walter Derzko, "Mining the Moon; Will China Become the New Saudi Arabia of the 21st Century?" (2 November 2005), online: Smart Economy website < [http://smarteconomy.typepad.com/smart\\_economy/2005/11/mining\\_the\\_moon.html](http://smarteconomy.typepad.com/smart_economy/2005/11/mining_the_moon.html)> (date accessed: 6 June 2006).

<sup>27</sup> Hu Hao, Director of the Chinese Lunar Exploration Project, quoted in People's Daily Online, "China's lunar exploration is not for Helium-3" (5 November 2004).

<sup>28</sup> "Japan Investigates the Moon", Space Today Online (2005) <<http://www.spacetoday.org/Japan/Japan/Moon.html>> (date accessed: 6 June 2006).

<sup>29</sup> *Ibid.* citing the Japanese daily newspaper *Mainichi Shimbun* (28 February 2005).

<sup>30</sup> Radhakrishna Rao, "India Aims for the Moon" The-South-Asian.com (September 2004), online: the-south-asian.com < [http://www.the-south-asian.com/Sep2004/indias\\_moon\\_mission.htm](http://www.the-south-asian.com/Sep2004/indias_moon_mission.htm)> (date accessed: 6 June 2006).

<sup>31</sup> *Ibid.*

## **II. Developing the Field of Space Resource Exploration, Extraction and Use**

Various challenges arising out of government budgetary constraints, increased societal needs for resources, and the quest for major technological advances raise the question of what would be the best scenario to efficiently conduct the exploration and use of space resources.

### **A. Changing Role of the Main Players in the Space Industry**

From the beginning of the Space Age, States have been the main players in the space arena. They heavily invested public funds in the new capital-intensive ventures and carried out, as State activities, space explorations and operations primarily for the purposes of national prestige as well as security and strategic competition with other politically rival States. Such rationale and the role of States are still true to a large extent. However, during the 70's and 80's the world witnessed the emergence of an unprecedented global occurrence; i.e. the creation of new space players in the form of intergovernmental operational organizations, like INTELSAT, INMARSAT, INTERSPUTNIK, EUMETSAT, EUTELSAT, and ARABSAT. These bodies were established by States, under their respective international treaties and were accorded their own international legal personalities, for the purposes of carrying on specific space operations. While States continue carrying out their space activities mainly as a public good, these organizations were designed to exploit space technology, in a business-like manner, for meeting the earthly needs of people, primarily for telecommunication purposes.

In the 90s, the global space sector welcomed the entry of the third group of space actors; i.e. private enterprises. In fact, private companies have generally been involved in the space arena from the dawn of the Space Age, but their role had been primarily to serve as contractors and sub-contractors for States. However, the new role which the private sector started playing relates to the commercial exploitation of space applications. This transformation in private sector's role in the space field has essentially been caused or strongly influenced by the global politico-economic trends towards privatization, commercialization, deregulation, and globalization of almost all human activities. Presently, private companies are carrying out, as their own operations, commercial services for telecommunication, earth observation, launch of space payloads, navigation, etc. The followings are a few statistics and information about some recent developments that show the order of magnitude of the global space sector and the extent of the role played by various actors in this arena:

Space industry has become a major area of global economic activity. In 2005, for example, the global economic impact of space industry has been estimated to be

around \$209 billion and it accounts for half a million jobs in the US alone.<sup>32</sup> According to the International Space Business Council Report on the *2005 State of the Space Industry*, the total world revenue of the space industry (composed of both the governmental and commercial activities) reached \$103 billion in 2004 and could exceed \$158 billion in 2010.<sup>33</sup> The Report further shows that:

“\* More than \$18 billion is spent annually on the development of space systems.

\* US Defense spending on space has grown from around \$15 billion in 2000 to more than \$22 billion today and is forecast to reach \$28 billion by 2010.

\* India and China have joined the US, Europe, Russia, and Japan as having fully independent capabilities.”<sup>34</sup>

The biggest segment of commercial space industry is telecommunication services, which are constantly expanding and transforming.<sup>35</sup> Experts forecast massive market growth for wireless TV enabled telephone to reach \$30 billion in the near future.<sup>36</sup> Same is true about the world-wide market for satellite digital radio that could increase to 22 millions units by 2009.<sup>37</sup> Similarly, the market for

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<sup>32</sup> Louis A. Arana-Barradas, “Civilian Sector Biggest Space Customer,” San Antonio TX (SPX) (20 February 2006) online: Space Daily website <[http://www.spacedaily.com/reports/Civilian\\_Sector\\_Biggest\\_Space\\_Customer.html](http://www.spacedaily.com/reports/Civilian_Sector_Biggest_Space_Customer.html)> (date accessed: 22 February 2006). Also see General Lance W. Lord (Commander of Air Force Space Command), “Space Capabilities Integral to Economic Livelihood Central To Defense Structure,” Colorado Springs CO (SPX) (Feb 23, 2006), online:

<[http://www.spacewar.com/reports/Space\\_Capabilities\\_Integral\\_To\\_Economic\\_Livelihood\\_Central\\_To\\_Defense\\_Structure.html](http://www.spacewar.com/reports/Space_Capabilities_Integral_To_Economic_Livelihood_Central_To_Defense_Structure.html)> (date accessed: 28 February 2006).

<sup>33</sup> “Space & Satellite Market Surpasses \$103B, To Reach \$158B By 2010,” Bethesda MD (SPX) (Aug 10, 2005), online <<http://www.spacedaily.com/news/industry-05zg.html>> (date accessed: 10 August 2005).

<sup>34</sup> *Ibid.*

<sup>35</sup> “The Latest Trends in the Satellite Communications Industry,” Dublin, Ireland (SPX) (May 09, 2006), online <[http://www.spacemart.com/reports/The\\_Latest\\_Trends\\_In\\_The\\_Satellite\\_Communications\\_Industry.html](http://www.spacemart.com/reports/The_Latest_Trends_In_The_Satellite_Communications_Industry.html)> (date accessed: 17 May 2006). Also see, Futron *industry report*, “The Transformation of the Satellite Services Industry,” Bethesda MD (SPX) (Jan 24, 2005) online: <<http://www.spacedaily.com/news/satellite-biz-05i.html>> (date accessed: 8 July 2005).

<sup>36</sup> Gene Koprowski, “Wireless World 30 Billion in TV Phones”, Chicago IL (UPI) (Feb 19, 2006) online: <[http://www.spacedaily.com/reports/Wireless\\_World\\_30\\_Billion\\_In\\_TV\\_Phones.html](http://www.spacedaily.com/reports/Wireless_World_30_Billion_In_TV_Phones.html)> (date accessed: 22 February 2006). Also see, Gene Koprowski, “Wireless World: Satellite Phones on the Rise,” Chicago IL (UPI) (Aug 20, 2004) online <<http://www.spacedaily.com/news/satellite-biz-04zzzzzt.html>> (date accessed: 26 August 2004).

<sup>37</sup> “Worldwide Market for Digital Radio To Increase To 22M Units By 2009: R&M,” Dublin, Ireland (SPX) (Jan 16, 2006), online:

civil and commercial remote sensing satellites, according to a May 2006 forecast study, will see the “deliveries of approximately 139 imaging satellites worth \$16.3 billion over the next 10 years.”<sup>38</sup> Space products and services are put to innovative uses by multinational companies in the implementation of their new practice called corporate sustainable development (CSD).<sup>39</sup>

There is a dramatic shift going on in the space industry. While commercial space products and services are being increasingly utilized by the armed forces,<sup>40</sup> at the same time commercial enterprises have also become “the biggest user” of military space assets.<sup>41</sup> For example, the American military GPS system is very important to civilian population as it has been “estimated that 18,000 people worldwide were saved with the help of satellite-aided search and rescue - with 5,000 of those in the United States.”<sup>42</sup> GPS has also become a lucrative business for the civilian sector. The implication of this new relationship of interdependence, according to General Lance W. Lord - the head of the US Air Force Space Command, is that “Removing space capabilities from our [American military] way of life would not only cripple our combat forces, but it would have catastrophic

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<[http://www.spacedaily.com/news/Market\\_For\\_Digital\\_Radio\\_To\\_Increase\\_To\\_22M\\_Units\\_By\\_2009.html](http://www.spacedaily.com/news/Market_For_Digital_Radio_To_Increase_To_22M_Units_By_2009.html)> (date accessed: 21 January 2006).

<sup>38</sup> “Commercial Remote Sensing Satellite Market Stabilizing”, Newtown CN (SPX) (May 30, 2006), online <[http://www.spacedaily.com/reports/Commercial\\_Remote\\_Sensing\\_Satellite\\_Market\\_Stabilizing.html](http://www.spacedaily.com/reports/Commercial_Remote_Sensing_Satellite_Market_Stabilizing.html)> (date accessed: 30 May 2006).

<sup>39</sup> “Satellites Support Businesses Working for Sustainable Development,” Paris, France (ESA) (Feb 06, 2006), online

<[http://www.spacedaily.com/reports/Satellites\\_Support\\_Businesses\\_Working\\_For\\_Sustainable\\_Development.html](http://www.spacedaily.com/reports/Satellites_Support_Businesses_Working_For_Sustainable_Development.html)> (date accessed: 08 February 2006). Multinational companies use “satellite data to incorporate CSD practices across a wide variety of industrial sectors, including energy, civil engineering, offshore and onshore oil and gas operations, forestry and forest products, pulp and paper, aluminum and cement production. Corporate sustainable development - also referred to as corporate social responsibility - now sits at the heart of many business practices, and Earth observations from space offer the potential to provide a global and cost-effective way to measure progress toward the sustainability of business activities,” *Ibid.*

<sup>40</sup> “Government and Military Remain Key To Commercial Satellite Revenues,” Cambridge MS (SPX) (May 29, 2006), online:

<[http://www.spacemart.com/reports/Government\\_and\\_Military\\_Remain\\_Key\\_To\\_Commercial\\_Satellite\\_Revenues.html](http://www.spacemart.com/reports/Government_and_Military_Remain_Key_To_Commercial_Satellite_Revenues.html)> (date accessed: 29 May 2006).

<sup>41</sup> Louis A. Arana-Barradas, “Civilian Sector Biggest Space Customer,” San Antonio TX (SPX) (Feb 20, 2006), online: <[http://www.spacedaily.com/reports/Civilian\\_Sector\\_Biggest\\_Space\\_Customer.html](http://www.spacedaily.com/reports/Civilian_Sector_Biggest_Space_Customer.html)> (date accessed: 22 February 2006). Also see General Lance W. Lord (Commander of Air Force Space Command), “Space Capabilities Integral to Economic Livelihood Central To Defense Structure,” Colorado Springs CO (SPX) (Feb 23, 2006), online:

<[http://www.spacewar.com/reports/Space\\_Capabilities\\_Integral\\_To\\_Economic\\_Livelihood\\_Central\\_To\\_Defense\\_Structure.html](http://www.spacewar.com/reports/Space_Capabilities_Integral_To_Economic_Livelihood_Central_To_Defense_Structure.html)> (date accessed: 28 February 2006).

<sup>42</sup> *Ibid.*

consequences on our entire economy.”<sup>43</sup>

The scope and nature of space activities of private sector is constantly changing. Private enterprises are no more confining their activities to the commercial exploitation of space applications. They have embarked upon the domain hitherto almost exclusively dominated by governments; i.e. research and development of new space technologies and their applications, not only for earthly-based commercial operations but also for space explorations. Perhaps the most conspicuous example in this regard is that of the recent design, construction and successful testing of SpaceShipOne vehicle by a small private company called Scaled Composites, for sub-orbital (and eventually orbital) travel by ordinary human beings.<sup>44</sup> Also, funded entirely by private capital, SpaceX is developing its launch vehicle Falcon-1 for travel between the Earth and the Moon.<sup>45</sup>

## **B. Potential Scenarios for Undertaking Activities of Exploration, Extraction and Use of Space Resources**

As noted above, space activities were initially the exclusive domain of governments. In the last decades, however, the trend of increased involvement of the private sector in space applications is changing the economic and political landscape of space activities and raises questions about the role that governments and commercial ventures could play in the exploration and use of outer space resources. Some argue that governments should be exclusively responsible for carrying out space activities concerning the exploration and use of space resources; other consider that the private sector should be allowed to take over the area (with or without initial support from the government); while others suggest models involving public-private partnerships as the best way to balance the public obligation to provide safe services and finding the most cost-effective means for achieving this objective.

### *1. Government's Possible Involvement*

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<sup>43</sup> *Ibid.*

<sup>44</sup> “SpaceShipOne Wins Big Prize, Opens New Frontier of Private Space Travel,” Mojave CA (AFP) (Oct 04, 2004), online: <<http://www.spacedaily.com/news/xprize-04zh.html>> (date accessed: 12 October 2004).

<sup>45</sup> For details, visit SpaceX’s website at <<http://www.spacex.com/>>. Also see Frederic Garlan, “Despite Risks and Pitfalls Entrepreneurs Explore the Final Frontier,” Paris (AFP) (Feb 07, 2006), online <[http://www.spacedaily.com/reports/Despite\\_Risks\\_And\\_Pitfalls\\_Entrepreneurs\\_Explore\\_The\\_Final\\_Frontier.html](http://www.spacedaily.com/reports/Despite_Risks_And_Pitfalls_Entrepreneurs_Explore_The_Final_Frontier.html)> (date accessed: 08 February 2006); “Falcon 1 Lost In First Launch Attempt,” Washington DC (SPX) (Mar 24, 2006), online <[http://www.spacedaily.com/reports/Falcon\\_1\\_Lost\\_In\\_First\\_Launch\\_Attempt.html](http://www.spacedaily.com/reports/Falcon_1_Lost_In_First_Launch_Attempt.html)> (date accessed: 02 April 2006).

Nowadays, due to significant budgetary constraints, governments seem to have difficulties in making space exploration a spending priority. Even in United States, where the government made recently a strong case for its efforts to return to the Moon and Mars, the budgetary realities show the sacrifices required in order to allocate money to such project, i.e. it had to postpone or eliminate several projects deemed important by various sectors, such as a robotic mission to the icy moons of Jupiter, in particular Europa, thought to contain a subsurface sea of liquid water (making it a potential candidate for harboring alien life).<sup>46</sup>

In addition, it appears unlikely that taxpayers would be in favor of funding a large scale lunar or Mars mission that does not give direct economic payback.<sup>47</sup> The need to spare taxpayer money from being spent for Moon and Mars missions was vehemently pointed out by a recent press release by Citizens Against Government Waste (CAGW), a nonprofit organization in the US.<sup>48</sup> According to this group's President, Tom Schatz, "Mankind's future in space no longer depends on politicized bureaucracies and tax-funded boondoggles. The success of SpaceShipOne, startup space companies, and the advent of space tourism have opened the door to an exciting future of private enterprise in space. Such endeavors are economical, realistic, and more likely to yield tangible benefits for mankind and taxpayers." The group challenges the usefulness of a US House of Representatives appropriation for NASA's budget for 2006 fiscal year of \$16.5 billion including \$3.1 billion for the Moon/Mars initiative. The CAGW points out that the International Space Station (ISS) is "expected to be finished in 2010, 16 years behind schedule, \$92 billion over budget, with perhaps one-eighth of the capability that engineers had hoped." This group finds a worrisome trend of wasteful government spending in the space arena: "The ISS is a glaring link in a continuous chain of space projects that are either abandoned, end in disaster, or deliver far less than promised."<sup>49</sup>

Thus, in an era when governments are much more cost-conscious in order to reduce government deficits while not increasing the taxes, more reliance on the private sector for funding new projects is to be expected. As noted above, worldwide there is an increasing trend towards relying on private investors rather

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<sup>46</sup> Space Daily, "NASA Budget Shuts Out Icy Moon Mission" (8 February 2006), online: Space Daily website < [http://www.spacedaily.com/reports/NASA\\_Budget\\_Shuts\\_Out\\_Icy\\_Moons\\_Mission.html](http://www.spacedaily.com/reports/NASA_Budget_Shuts_Out_Icy_Moons_Mission.html) > (date accessed: 3 June 2006).

<sup>47</sup> "Asteroidal vs. Lunar Materials Utilization", online: website <<http://www.permanent.com/ep-a-v-l.htm>> (date accessed: 26 May 2006).

<sup>48</sup> Citizens Against Government Waste (CAGW), "Moon, Mars Missions Not a Priority for Taxpayers" (16 June 2005), online: Citizens Against Government Waste website < <http://www.cagw.org/site/News2?page=NewsArticle&id=8992> > (date accessed: 27 May 2006).

<sup>49</sup> *Ibid.*

than government for development in space.<sup>50</sup>

## 2. *Private Sector's Involvement*

Many experts argue that when private money become involved, the values become cost and efficiency, and thus commercialization of this area of space applications should be encouraged.<sup>51</sup> President Bush's "The Vision for Space Exploration" called for a larger role of private industry in space exploration.<sup>52</sup> The Commission on Implementation of United States Space Exploration Policy,<sup>53</sup> established in order to formulate recommendations for implementing this new vision for space exploration, released a report<sup>54</sup> which stresses, *inter alia*, the need to transform NASA's relationship with the private sector in order to reflect the new space exploration vision. The goal is to ensure a large presence of private industry in space operations by allowing private companies to assume the primary role of providing services to NASA and giving preference in operational activities to competitively awarded contracts with private and non-profit organizations.<sup>55</sup> In this context, "NASA's role must be limited to only those areas where there is irrefutable demonstration that only government can perform the proposed activity."<sup>56</sup> In addition, the report recommends that "Congress increase the potential for commercial opportunities related to the national space exploration vision by providing incentives for entrepreneurial investment in space, by creating significant monetary prizes for the accomplishment of space missions and/or technology developments and by assuring appropriate property rights for those who seek to develop space resources and infrastructure."<sup>57</sup>

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<sup>50</sup> "Overview of Economic and Political Issues", website <<http://www.permanent.com/ep-overv.htm>> (date accessed: 29 May 2006).

<sup>51</sup> "Asteroidal vs. Lunar Materials Utilization", online: website <<http://www.permanent.com/ep-a-v-l.htm>> (date accessed: 26 May 2006).

<sup>52</sup> Report of the President's Commission on Implementation of United States: Space Exploration Policy A Journey to Inspire, Innovate, and Discover, (Date Released: Wednesday, June 16, 2004), available online: <<http://www.marstoday.com/viewsr.html?pid=13136>> (date accessed: 25 January 2006).

<sup>53</sup> White House, Executive Order: President's Commission on Implementation of United States Space Exploration Policy (30 January 2004), online: White House's website <<http://www.whitehouse.gov/news/releases/2004/01/20040130-7.html>> (date accessed: 24 May 2006).

<sup>54</sup> Report of the President's Commission on Implementation of United States Space Exploration Policy. A Journey to Inspire, Innovate, and Discover (June 2004), online: SpaceRef.com <<http://www.space.ref.com/news/viewsr.html?pid=13136>> (date accessed: 25 May 2006).

<sup>55</sup> *Ibid.*

<sup>56</sup> *Ibid.*

<sup>57</sup> *Ibid.* (*emphasis added*).

In view of such governmental policy, a private company, Lunar Transportation System (LTS), has undertaken to “design, build, ground test, flight test, and operate its Earth-Moon transportation system.”<sup>58</sup> Although initially the US government would be the major customer, it is expected that private sector customers will soon require LTS services.<sup>59</sup> Explorations of the Moon and other celestial bodies and their natural resources are, undoubtedly, on the serious operational strategies of private enterprises and the success of “private” projects like the one mentioned above, serves as a stimulus to these entities.<sup>60</sup>

In order for the private sector to find the area of exploration and use of natural resources appealing from a business perspective, several requirements must be met:

- (1) There must be a market for the products
- (2) There must be a reasonable payback time (it is estimated that the private sector will not invest much into technologies or products whose payback exceeds 5 years, especially if the front end cost is large or the risk is perceived as high)<sup>61</sup>
- (3) Reasonable access to the resources (launch and transportation costs)
- (4) Readily available technology for extraction and processing of natural resources in outer space
- (5) Manageable risks (adequate insurance)
- (6) Legal protection of property right (real property and intellectual property).

Regarding the market for the products, as showed in the first section of this paper, it appears that at least for some resources, such as Helium-3, there will be

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<sup>58</sup> Online <<http://www.lunartransportationsystems.com/>> (date accessed: 25 January 2006); Also see, “Lunar Transportation Systems - A New Private Commercial Space Venture”, Bellevue WA (SPX) (Feb 02, 2005), online: <<http://www.spacedaily.com/news/rocketscience-05d.html>> (date accessed: 08 January 2006).

<sup>59</sup> Lunar Transportation System, online: <<http://www.lunartransportationsystems.com/>> (date accessed: 6 June 2006). Lunar Transportation Systems’ website introduces its “concept to create the equivalent of a two-way highway to the Moon as part of NASA’s new space exploration plans.”

<sup>60</sup> “First ‘Private’ Lunar Mission Succeeded Despite NASA Roadblocks,” Tucson AZ (SPX) (Apr 04, 2005), online <<http://www.space-travel.com/news/lunar-05p.html>> (date accessed: 18 April 2005); “New Book Reveals That Private Lunar Mission Succeeded Despite NASA Roadblocks,” PRESS RELEASE Date Released: April 2, 2005, online <<http://www.moontoday.net/news/viewpr.html?pid=16541>> (date accessed: 25 January 2006).

<sup>61</sup> “Overview of Economic and Political Issues”, website <<http://www.permanent.com/ep-overv.htm>> (date accessed: 29 May 2006).

immediate customers. Although usually space projects undertaken by private sector utilization of resources are characterized by high front-end investment, long payback time, and a high risk, relative to most other non-space business ventures, in the case of space resources utilization it is estimated that the initial quantity of resource required until payback, breakeven and then decent profits of investment would be less than what was required in the case of the building a major transcontinental pipeline and approximately the same as for a large offshore oil exploration and production project.<sup>62</sup> Also, the payback time is estimated to be shorter than in the case of other projects performed by private sector.

Many observers see the costs of getting to the Moon, Mars and other celestial bodies and of returning to Earth as so high that would render the commercial exploitation of outer space resources as economically unfeasible at the present time.<sup>63</sup> Others however have pointed out that such costs should not halt commercial initiatives because:

- (a) the cost of space resource utilization is not too high even using today's launching costs (it is comparable to large offshore oil and gas projects) and the actual launching cost will not be the main cost item in the project budget;<sup>64</sup>
- (b) the high cost of Earth launch drives up the market price and profitability of space resources (if the Earth launch costs come down, the price of products and services from space resources will come down, and so will the profit).<sup>65</sup>
- (c) There is no reasonable expectation that Earth launch vehicle projects currently under development will dramatically reduce the cost of launching from Earth. On the other hand, cost reductions will occur as a result of more private ventures entering into the market.<sup>66</sup>
- (d) As noted above, space resources utilization is estimated to have a shorter payback time than many projects of the same amount

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<sup>62</sup> "Overview of Economic and Political Issues", website <<http://www.permanent.com/ep-overv.htm>> (date accessed: 29 May 2006).

<sup>63</sup> Stephen Doyle, "Legal Aspects of Space Commercialization" in Nandasiri Jasentuliyana ed., *Space Law. Development and Scope* (Westport, CT: Praeger, 1992) 127 at 138.

<sup>64</sup> "Don't Wait for Cheap Earth Launch", online: website <<http://www.permanent.com/ep-cheap.htm>> (date accessed: 29 May 2006).

<sup>65</sup> "Don't Wait for Cheap Earth Launch", online: website <<http://www.permanent.com/ep-cheap.htm>> (date accessed: 29 May 2006).

<sup>66</sup> "Don't Wait for Cheap Earth Launch", online: website <<http://www.permanent.com/ep-cheap.htm>> (date accessed: 29 May 2006).

of investment on Earth, at current Earth launch costs.<sup>67</sup>

To give a concrete example, the total estimated cost for commencing lunar operations for extraction of Helium 3 would be about \$15 billion.<sup>68</sup> This cost would cover the rocket development, launching, and starting lunar operations. At a projected value of \$40,000 per ounce, 22 pounds of Helium-3 are estimated to be worth approximately \$141 million.<sup>69</sup> This figure made former NASA astronaut Harrison H. Schmitt to enthusiastically state: "With such tremendous business potential, the entrepreneurial private sector should support a return to the moon, this time to stay. For an investment of less than \$15 billion--about the same as was required for the 1970s Trans Alaska Pipeline--private enterprise could make permanent habitation on the moon the next chapter in human history."<sup>70</sup>

One element that plays perhaps a major role in the future of commercialization of exploration and use of space resources is the issue of protection of property rights. A strong private property regime can encourage commercialization and colonization of outer space. A communitarian property system will inhibit economic development and leave exploration and colonization in the realm of governments, who cannot always afford to undertake such activities.<sup>71</sup> Experts anticipate an integrated system of lunar and asteroid mining, habitation in outer space and solar power generation. In such scenario, the right to maintain a

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<sup>67</sup> "Overview of Economic and Political Issues", website <<http://www.permanent.com/ep-overv.htm>> (date accessed: 29 May 2006).

<sup>68</sup> Harrison H. Schmitt, "Mining the Moon", Popular Mechanics (12 October 2004), online: Popular Mechanics website <<http://www.popularmechanics.com/science/space/1283056.html?page=4&c=y>> (date accessed: 28 May 2006).

<sup>69</sup> Some estimates suggest that an investment capital of approximately \$6 billion would be required to develop and construct the first Helium-3 fusion plant. Harrison H. Schmitt, "Mining the Moon", Popular Mechanics (12 October 2004), online: Popular Mechanics website <<http://www.popularmechanics.com/science/space/1283056.html?page=4&c=y>> (date accessed: 28 May 2006). Currently it is estimated that it costs approximately \$15,000 to transport 1 kilogram from Earth to the Moon, but it is expected that the cost to drop in the near future to \$2,000/kg round trip from the Earth to the Moon. Sam Dirkin, "A Lunar Vision at \$2,000/kg", The Space Review (6 December 2004), online: the Space Review website <<http://www.thespacereview.com/article/284/1>> (date accessed: 28 May 2006).

<sup>70</sup> Harrison H. Schmitt, "Mining the Moon", Popular Mechanics (12 October 2004), online: Popular Mechanics website <<http://www.popularmechanics.com/science/space/1283056.html?page=4&c=y>> (date accessed: 28 May 2006).

<sup>71</sup> Sam Dinkin, "Property Rights and Space Commercialization", The Space Review (10 May 2004), online: The Space Review website <<http://www.thespacereview.com/article/141/1>> (date accessed: 28 May 2006).

facility in a given location relative to another space object or the right to exploit a given mineral deposit on a celestial body may lead to conflicts. The institution of real property appears would be an efficient method of allocating limited resources, such as materials and location.<sup>72</sup> According to Wayne White: “A regime of real property rights would provide legal and political certainty. Investors and settlers could predict the outcome of a conflict with greater certainty by analogizing to terrestrial property law. Settlers and developers would also be reassured, knowing that other nations would respect their right to remain at a given location.”<sup>73</sup>

Rights such as mineral rights, spectrum rights, rights of way, orbital slots, intellectual property and title deeds are seen by many as essential factors in accomplishing an optimal development in this area of space application.<sup>74</sup> No private company will likely invest in lunar or asteroid prospecting and mining until private property rights are guaranteed; investors need to be protected against unlawful interference from others.<sup>75</sup> Such risks are illustrated by an example provided by Sam Dinkin: “Imagine a rocket engineer who has an excellent design for an inexpensive Mars base that will use in situ resources such as local water deposits. The rocket engineer proposes to send scouts to look for that water. The rocket engineer puts this proposal into a business plan and goes to potential funders. The funders may say that the engineering is sound, but still no funding comes. Investors do not have sufficient assurance that water found in the scouting expedition will be available when the time comes to build the base. Other Mars missions may extract the water in the intervening time and not pay any compensation to the prospector.”<sup>76</sup>

The provisions of international space law addressing the issue of property rights in outer space are discussed below. To summarize this sub-section, however, one

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<sup>72</sup> Wayne White, “Real Property Rights in Outer Space” (1997), Proceedings, 40th Colloquium on the Law of Outer Space, at.370 (IISL 1998). Published by American Institute of Aeronautics and Astronautics, online: < [http://www.spacefuture.com/archive/real\\_property\\_rights\\_in\\_outer\\_space.shtml](http://www.spacefuture.com/archive/real_property_rights_in_outer_space.shtml)> (date accessed: 28 May 2006).

<sup>73</sup> Wayne White, “Real Property Rights in Outer Space” (1997), Proceedings, 40th Colloquium on the Law of Outer Space, at 370 (IISL 1998). Published by American Institute of Aeronautics and Astronautics, online: < [http://www.spacefuture.com/archive/real\\_property\\_rights\\_in\\_outer\\_space.shtml](http://www.spacefuture.com/archive/real_property_rights_in_outer_space.shtml)> (date accessed: 28 May 2006).

<sup>74</sup> Sam Dinkin, “Don’t Wait for Property Rights”, The Space Review (12 July 2004), online: The Space Review online < <http://www.thespacereview.com/article/179/1>> (date accessed: 28 May 2006).

<sup>75</sup> “Legal History and Issues”, online: website < <http://www.permanent.com/ep-legal.htm>> (date accessed: 29 May 2006).

<sup>76</sup> Dinkin, “Property Rights and Space Commercialization”, The Space Review (10 May 2004), online: The Space Review website <<http://www.thespacereview.com/article/141/1>> (date accessed: 28 May 2006).

can anticipate that the discussion over the need for a regime providing for property rights is likely to become increasingly debated as space develops.<sup>77</sup> As mentioned above, in the US the report published by the Commission on Implementation of United States Space Exploration Policy recommends, *inter alia*, that “Congress increase the potential for commercial opportunities related to the national space exploration vision by (...) *assuring appropriate property rights for those who seek to develop space resources and infrastructure.*”

Another issue under debate is whether the government should get involved in assisting large scale development of the space field by the private sector and what are the ways in which governments can get involved.

### 3. *Possible Government Incentives to Promote Private Involvement in the Exploration and Use of Space Resources*

Given the perceived difficulties that confront private companies from starting large scale development of space applications related to natural resources from the Moon, Mars and other celestial bodies, it is suggested that, at least in the initial stage, governments could assist the private sector in several ways. It is expected that the private sector will take over once the difficulties of covering the start-up costs and building initial infrastructure are overcome.

#### (a) Funding Basic Research and Development (R&D)

Especially in those areas where R&D costs are high, the payback times are long and the perceived risk is high, governments could provide funding for such Research and Development.<sup>78</sup> The results of this government-funded R&D should be made available to all competing private companies, thus ensuring a basis for fair competition.<sup>79</sup>

#### (b) Funding Deployment of Initial Infrastructure

Some argue that governments should fund the initial infrastructure, such as, for

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<sup>77</sup> Wayne White, “Real Property Rights in Outer Space” (1997), Proceedings, 40th Colloquium on the Law of Outer Space, at.370 (IISL 1998). Published by American Institute of Aeronautics and Astronautics, online: < [http://www.spacefuture.com/archive/real\\_property\\_rights\\_in\\_outer\\_space.shtml](http://www.spacefuture.com/archive/real_property_rights_in_outer_space.shtml)> (date accessed: 28 May 2006).

<sup>78</sup> “How the Government Can Help the Private Sector”, website < <http://www.permanent.com/ep-ghelp.htm>> (date accessed: 23 May 2006).

<sup>79</sup> “Private Sector History and Issues”, online: website < <http://www.permanent.com/ep-pvt.htm>>(date accessed: 26 May 2006).

example, a space station and interorbital vehicles.<sup>80</sup> The services provided by such infrastructure should be auctioned to the highest bidder; however, the private sector should be allowed to provide additional services. Once the private sector starts providing the same services, the government should let the private sector take over that market.<sup>81</sup>

#### (c) Providing a Guaranteed Market/Initial Customer

Some argue that the government should not fund any development but simply to guarantee a minimum market for the products resulting from the extraction and use of space resources. The private sector needs to be sure that if they produce, for example, fuel propellants or radiation shielding from lunar materials, these products not only will be marketable, but that there is an immediate customer for them and there is a guaranteed price for products and services from space materials.<sup>82</sup> Governments could guarantee that it would buy a certain quantity of such products at a certain price in case no other customer made a similar offer. Obviously, if a private customer offers a higher price, the government is relieved of the obligation to buy the products.<sup>83</sup>

#### (d) Providing Government-Sponsored Insurance

Since space based activities are high risk the insurance costs to cover such endeavors are also very high.<sup>84</sup> Buying sufficient insurance is, in many instances, the main obstacle for startup companies to get into space business. Governments could cover partially the insurance associated with carrying out exploration and extraction of resources on the Moon or other celestial bodies.<sup>85</sup> Thus the start-up costs and the risk for interested private companies would be significantly reduced.

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<sup>80</sup> "How the Government Can Help the Private Sector", website < <http://www.permanent.com/ep-ghelp.htm>> (date accessed: 23 May 2006).

<sup>81</sup> "Private Sector History and Issues", online: website < <http://www.permanent.com/ep-pvt.htm>>(date accessed: 26 May 2006).

<sup>82</sup> "Private Sector History and Issues", online: website < <http://www.permanent.com/ep-pvt.htm>>(date accessed: 26 May 2006).

<sup>83</sup> "How the Government Can Help the Private Sector", website < <http://www.permanent.com/ep-ghelp.htm>> (date accessed: 23 May 2006).

<sup>84</sup> For example, insurance for satellite and rocket launches accounts sometimes for a third of the total cost.

<sup>85</sup> "How the Government Can Help the Private Sector", website < <http://www.permanent.com/ep-ghelp.htm>> (date accessed: 23 May 2006).

(e) Enacting Legislation Providing the Necessary Regulatory Framework for Promotion and Liberalization of Commercial Space Activities

Governments should adopt laws and regulations that would clarify issues of private property and intellectual property related to exploration and use of space resources in light of that State's international responsibilities. Also, a proper regulatory framework needs to address issues of public interest and safety. Steve Doyle summarized the role of governments: "The function of governments is to protect the public interest by licensing or otherwise regulating the use of resources and ensuring that commercial operations are safe and environmentally acceptable."<sup>86</sup>

(e) Granting Tax Incentives and Loans at Preferred Interest Rates

Following the same rationale as above, it has been suggested that governments should provide interested private companies with tax incentives and loans at lower interest rates than high risk loans.

(f) Sponsorship of Development of Appropriate Technology and Systems Development

Such initiative is undertaken in the US where NASA's Centennial Challenge program co-sponsors with the X PRIZE Foundation a competition offering \$2 million to the private company that designs a Lunar Lander Analog. This challenge aims to stimulate the development of the kinds of "rockets and landing systems that NASA needs to return to the Moon, while also accelerating the development of the private sub-orbital space flight industry."<sup>87</sup>

4. *Public - Private Partnership (PPP) Model*

The concept of Public-Private Partnership is generally defined as "partnerships between the public sector and the private sector (industry), for the purpose of

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<sup>86</sup> Stephen Doyle, "Legal Aspects of Space Commercialization" in Nandasiri Jasentuliyana ed., *Space Law. Development and Scope* (Westport, CT: Praeger, 1992) 127 at 128.

<sup>87</sup> Shana Dale, Deputy Administrator, NASA, quoted by Space Daily, "NASA Announces Lunar Lander Analog Competition Agreement" (8 May 2006), online: Space Daily website < [http://www.spacedaily.com/reports/NASA\\_Announces\\_Lunar\\_Lander\\_Analog\\_Competition\\_Agreement.html](http://www.spacedaily.com/reports/NASA_Announces_Lunar_Lander_Analog_Competition_Agreement.html) > (date accessed: 29 May 2006). On 4 October 2004, the Ansari X PRIZE showed that offering such an award for ground breaking research and development is an effective impetus for technological growth.

delivering a project or a service traditionally provided by the public sector.”<sup>88</sup> In most instances, the public sector contracts for infrastructure development and deployment as well as for management and operations where risks are allocated between the public and private sector.<sup>89</sup> The procurement of a service under a PPP opens a wide range of options for public entities that do not have the skills to carry out a particular project or have budgetary constraints.

PPPs are likely to generate substantial benefits for customers and taxpayers if the appropriate allocation of responsibilities between the private customer and the public contractor is achieved. In terms of risk allocation, the controlling principle for PPPs is that a risk should be transferred to the party best able to manage (or control) it.<sup>90</sup> Typically, the private sector assumes the design, development and construction risks, the operational and maintenance risks, the performance risks and inflation risks as well as other financial risks. On the other hand, the market risks and residual value risks (dependent on the duration of the contract and the nature of the assets) is shared between the private and public sector, while policy and legislative risks are allocated to the public sector.<sup>91</sup>

In the space sector there are at least two examples of PPPs: the Skynet 5 project (undertaken in the United Kingdom) and the Galileo concession. In the former instance, the British Ministry of Defense chose the PPP model in order to conceive a military satellite communications system destined to replace the MoD’s Skynet 4 satellites. It was estimated that the PPP model would save the UK government £500 m over the life-time of the contract.<sup>92</sup> Under the 15-year concession contract, a private company delivers core military satellite communications to the UK armed forces, having also the permission to commercialize spare capacity to third parties. The arrangement involves taking over the ownership and operation of the existing Skynet 4 infrastructure and incorporating two new Skynet 5 satellites and the associated ground segment. Full service availability is expected by 2008.<sup>93</sup>

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<sup>88</sup> Xavier Bertran and Alexis Vidal “The Implementation of a Public-Private Partnership for Galileo” (The Proceedings of the 18th International Technical Meeting of the Satellite Division of The Institute of Navigation, 13-16 September 2005, Long Beach, CA) online: Online Journal of Space Communications website  
<[http://72.14.207.104/search?q=cache:7OIS3VoY2ikJ:satjournal.tcom.ohiou.edu/issue9/PDF/Implement\\_Public-Private.pdf+the+implementation+of+a+public+private+partnership+for+galileo&hl=en&gl=ca&ct=clnk&cd=1](http://72.14.207.104/search?q=cache:7OIS3VoY2ikJ:satjournal.tcom.ohiou.edu/issue9/PDF/Implement_Public-Private.pdf+the+implementation+of+a+public+private+partnership+for+galileo&hl=en&gl=ca&ct=clnk&cd=1)> (date accessed: 8 June 2006) at 390-399.

<sup>89</sup> *Ibid.* at 391.

<sup>90</sup> *Ibid.* at 395.

<sup>91</sup> *Ibid.*

<sup>92</sup> *Ibid.* at 393.

<sup>93</sup> *Ibid.*

The Galileo project started in 1998 when the European Commission announced plans to develop a European Global Navigation Satellite System (GNSS) in coordination with the European Space Agency. For the deployment and operation of Galileo a 20-year PPP scheme was selected as the most cost-effective way to meet the public sector's objectives while attracting private investment. In this particular PPP scheme, the public sector represented by the European Commission and the European Space Agency are responsible for the Definition and Development & In-Orbit Validation phases (which will include the launch and testing of 4 satellites). The Deployment and Operation phases are managed under a PPP with a private Galileo concessionaire, who must complete the 30-satellite constellation, the afferent ground segment and provide the users with Galileo services. The involvement of private finance is expected to reduce the need for public contribution over the 20-year concession period.<sup>94</sup>

According to some observers, PPP projects are a way to provide win-win situations for both the public and the private sector.<sup>95</sup> However, not all countries have the required legal framework to allow for implementing PPP models.

So, it appears that there may just not be one "critical path" to achieve commercialization of resource utilization in outer space. In any event, it is clear that private companies are becoming active players in the global space industry. It is not idealistic to predict that their role in the space sector would only expand because of many reasons, but the shortage of public funds and inherent inefficiencies of government operations and undertakings seem to be the most important ones. Private actors on the global level will carry out space activities for the earth-oriented human needs as well as space explorations and exploitation of resources of outer space, the Moon and other celestial bodies. It is, however, important to keep in mind that the role of State might not diminish but would change from the developers and operators of space systems to the regulators of space activities. To expand and flourish, the private entities need minimum interference from the government. However, unfortunately, primarily due to the dual purpose character of space technology and operations, the State

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<sup>94</sup> Xavier Bertran and Alexis Vidal "The Implementation of a Public-Private Partnership for Galileo" (The Proceedings of the 18th International Technical Meeting of the Satellite Division of The Institute of Navigation, 13-16 September 2005, Long Beach, CA) at 390-399 online: Online Journal of Space Communications website <[http://72.14.207.104/search?q=cache:7OIS3VoY2ikJ:satjournal.tcom.ohiou.edu/issue9/PDF/Implement\\_PublicPrivate.pdf+the+implementation+of+a+public+private+partnership+for+galileo&hl=en&gl=ca&ct=clnk&cd=1](http://72.14.207.104/search?q=cache:7OIS3VoY2ikJ:satjournal.tcom.ohiou.edu/issue9/PDF/Implement_PublicPrivate.pdf+the+implementation+of+a+public+private+partnership+for+galileo&hl=en&gl=ca&ct=clnk&cd=1)> (date accessed: 8 June 2006) at 394.

<sup>95</sup> *Ibid.* at 398.

control over private companies would not seem to reduce significantly.

We will next assess the applicable international space regulatory regime to determine to what extent it serves as a roadblock or stimulus for the space activities of private companies. We will also outline some important steps that governments need to take to stimulate and sustain space activities of private actors. However, it must be kept in mind that this is an inventory of important issues relevant to the participation of private entities in the exploration and exploitation of natural resources of the Moon and other celestial bodies. We do not intend to provide answers to all questions but to raise them so that they may be discussed in depth by others appropriately.

## **B. Legal Implications of and Regulatory Issues Relating to Participation by Private Entities**

Primarily due to the physical nature of outer space (including the Moon and other celestial bodies), international community has been creating international legal regime of outer space primarily through the United Nations' Committee on the Peaceful Uses of Outer Space (COPUOS). The most fundamental agreement within this regime is the 1967 Outer Space Treaty that has been ratified or signed by 125 States.<sup>96</sup> Some of the provisions of this Treaty have been further elaborated in four separate agreements.<sup>97</sup> In addition to the general application of a few other important treaties,<sup>98</sup> these five agreements are the nucleus of current international legal regime governing the exploration, use and

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<sup>96</sup> *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies* (hereinafter referred to as the Outer Space Treaty); opened for signature on 27 January 1967, entered into force on 10 October 1967; 98 ratifications and 27 signatures, 610 UNTS 205.

<sup>97</sup> *The Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space*, opened for signature on 22 April 1968, entered into force on 3 December 1968; 88 ratifications, 25 signatures, and 1 acceptance of rights and obligations, 672 UNTS 119. *The Convention on International Liability for Damage Caused by Space Objects*, opened for signature on 29 March 1972, entered into force on 1 September 1972; 82 ratifications, 25 signatures, and 2 acceptances of rights and obligations, 961 UNTS 187. *The Convention on Registration of Objects Launched into Outer Space*, opened for signature on 14 January 1975, entered into force on 15 September 1976; 45 ratifications, 4 signatures, and 2 acceptances of rights and obligations, 1023 UNTS 15. *The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies* (hereinafter referred to as the "Moon Agreement"), opened for signature on 18 December 1979, entered into force on 11 July 1984; 12 ratifications and 5 signatures, 1363 UNTS 3.

<sup>98</sup> For example, the *Charter of the United Nations*, 26 June 1945 (191 ratifications); *Constitution and Convention of the International Telecommunication Union with Annex*, 1994 (as amended in Marrakesh in 2004) and *ITU Radio Regulations*, Edition of 2004 (189 ratifications); *Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water*, 5 August 1963 (125 ratifications and 10 signatures), 480 UNTS 43.

exploitation of outer space, the Moon and other celestial bodies and their natural resources. As noted earlier, during the 60's, 70's when the foundations of this international regime were laid, States were the only players in the space arena. Therefore, this legal framework was perceptibly adopted largely and essentially from the perspective of States. However, the emergence of private entities as new players with growing importance gives rise to legal implications and poses challenges that were unknown earlier. In this part we will analyze the current international regime with a view to critically determine the relevance and viability of its principles and rules pertinent to the activities of private entities in the exploration, use and exploitation of natural resources of the Moon and other celestial bodies.

We should keep in mind, however, that irrespective of the increasing significance of the private entities in the space sector, States remain almost exclusively the subjects of international law. Peter Malanczuk correctly asserts that, "even much more than in general international law, there is no doubt that states are still the primary and predominant actors in space law. Legally speaking, this is a clear consequence of the fact that it is states which create space law in the form of treaties, custom or other international instruments and which provide for rights and duties of other entities. States also create international organizations active in outer space and regulate supervise and license private operators within their national jurisdiction who must conform to the international treaty obligations which states have accepted."<sup>99</sup> There should be no doubt that, at least in the near future, States would remain the main actors in the creation and implementation of law respecting space activities, including those that relate to the exploration, use and exploitation of the Moon and other celestial bodies and their natural resources. In other words, the scope, nature and extent of participation by private entities in space are, and would be, determined by the respective States according to their national policies and regulatory mechanisms.

## 1. GOVERNMENT REGULATION OF PRIVATE SPACE ENTITIES

It has been noted that current advocates for space commercialization focus almost exclusively on technological and economic aspects of resource exploration and use, and not sufficiently on the legal environment, especially under the international law.<sup>100</sup> In our view, the following legal principles must be taken into account while considering exploration, use and exploitation of outer space

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<sup>99</sup> Peter Malanczuk, "Actors: States, International Organisations, Private Entities", in Gabriel Lafferranderie and Daphne Crowther (eds.), *Outlook on Space Law over the Next 30 Years* (The Hague: Kluwer Law International, 1997) 23 at 30.

<sup>100</sup> Sam Dinkin, "Property Rights and Space Commercialization", *The Space Review* (10 May 2004), online: *The Space Review* website <<http://www.thespacereview.com/article/141/1>> (date accessed: 28 May 2006).

resources.

**(a) Freedom of exploration and use**

Article I (2) of the Outer Space Treaty recognizes the freedom of exploration and use of outer space by all States.<sup>101</sup> Similarly, Article 6 (1) of the Moon Agreement reiterates that the “freedom of scientific investigation on the moon (and other celestial bodies) by all States Parties” to the Agreement. It should be noted that the right of such freedom can be exercised by States alone but they can exercise their right either by undertaking space activities on their own, or by authorising their private entities or by participating in inter-governmental organisations. In other words, under international space law, private entities do not enjoy the right of freedom of exploration and use of outer space, the Moon and other celestial bodies, but they can be granted a privilege, under applicable national laws, by their respective States to undertake such activities.

Moreover, the freedom to explore and use the Moon and other celestial bodies by States, and consequently by their private entities, is not absolute and must be exercised only within the limitations prescribed by law; i.e. *inter alia* “without discrimination of any kind,” “on a basis of equality,” and “in accordance with international law.” It is the responsibility of an appropriate State to ensure that activities of its private entities are in accordance with applicable international law, including the provisions of the Outer Space Treaty (and the Moon Agreement, if applicable).

**(b) State responsibility**

Unlike the rules of general international law under which a State can be held responsible only if there is a “genuine link” between that State and the activity concerned,<sup>102</sup> Article VI of the Outer Space Treaty imposes comprehensive international responsibility on the concerned States Party to the Treaty to ensure that the activities of its private entities would remain in accordance with the provisions of the Treaty and international law. For carrying out this responsibility, an ‘appropriate’ State is obligated to exercise “continuous supervision” of its private entities engaged in space activities. Under Article VI, there is a possibility of existence of multiple ‘appropriate’ States. An ‘appropriate’ may be the State of registration of the spacecraft as determined

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<sup>101</sup> “Outer space, including the Moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies.”

<sup>102</sup> See, United Nations, *Report of the International Law Commission*, Fifty-third session (23 April-1 June and 2 July-10 August 2001), General Assembly, Official Records, Fifty-sixth session, Supplement No. 10 (A/56/10), United Nations, New York, 2001, Chapter IV: State Responsibility.

under the Registration Convention.<sup>103</sup> With the expanded space activities, particularly by private entities from various States working together, confusion about the ‘appropriate’ State will increase and thus must be resolved, preferably through an additional protocol to the Outer Space Treaty.

(c) *Liability for damage*

Under Article VII of the Outer Space Treaty, each launching State<sup>104</sup> is internationally liable for damage to another State or to its natural or juridical persons caused by a space object or its component parts. This principle has been expanded under the 1972 Liability Convention, according to which a “launching State shall be absolutely liable to pay compensation for damage caused by its space object on the surface of the Earth or to aircraft in flight.”<sup>105</sup> The Outer space Treaty and the Liability Convention may seem to impose burden on a space-faring nation, however, no State has suffered any serious financial losses as result of any accident. On the other hand, undertaking of such liability by the launching State is a good support to its private entities engaged in space activities.

It may be noted that space and nuclear activities are similarly hazardous in nature, and thus their liability regimes are comparable too. The 1963 Vienna Convention on Civil Liability for Nuclear Damage imposes absolute liability not only on the operator of a concerned nuclear plant but also on the State of installation of the nuclear facility.<sup>106</sup> The US is not party to any international

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<sup>103</sup> Article II of the Registration Convention obliges the launching State to “register the [launched] space object by means of an entry in an appropriate registry which it shall maintain.” And Article VIII of the Outer Space Treaty entitles the State “on whose registry an object launched into outer space is carried [to] retain jurisdiction and control over such object.”

<sup>104</sup> According to Article VII of the Outer Space Treaty, a launching State is a State “that launches or procures the launching of an object into outer space, including the Moon and other celestial bodies, and each State Party from whose territory or facility an object is launched.”

<sup>105</sup> *The Liability Convention*, supra note 97, Article II.

<sup>106</sup> Article VII of the 1963 *Vienna Convention on Civil Liability for Nuclear Damage*. As of May 13, 2005, there are 33 States Parties and 14 Signatories to the Convention. The Convention has been amended and strengthened in 1997 by a Protocol to Amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage and Convention on Supplementary Compensation for Nuclear Damage. Available online <<http://www.iaea.org/Publications/Documents/Conventions/liability.html>> (date accessed: 25 January 2006). Under the Convention, term “Installation State”, in relation to a nuclear installation, means the “Contracting Party within whose territory that installation is situated or, if it is not situated within the territory of any State, the Contracting Party by which or under the authority of which the nuclear installation is operated”: Article I (d), *Ibid*. Under Article VII (1) of the Convention: “The operator shall be required to maintain insurance or other financial security covering his liability for nuclear damage in such amount, of such type and in such terms as the Installation State shall specify. The Installation State shall ensure the payment of claims for

nuclear accident liability treaty. However, the 1957 US Price Anderson Act,<sup>107</sup> which has been renewed up to 2025, provides for \$10 billion in compensation for absolute liability. It “requires individual operators to be responsible for two layers of insurance cover. The first layer is where each nuclear site is required to purchase US\$ 300 million cover from private insurers. The second layer is jointly provided by all US reactor operators. It is funded through retrospective payments if required of up to \$96 million per reactor collected in annual installments of \$15 million (and adjusted with inflation). Combined, the total provision comes to over \$10 billion paid for by the utilities. (The Dept. of Energy also provides \$10 billion for its nuclear activities.) Beyond this cover and irrespective of fault, Congress, as insurer of last resort, must decide how compensation is provided in the event of a major accident.”<sup>108</sup> The US follows similar approach with respect to possible space-related liability. Under the US Commercial Space Launch Act of 1984 (as amended),<sup>109</sup> a licensee of a space launch is required to have in place insurance or to demonstrate financial responsibility to a level or amount of a maximum probable loss (MPL) determined by the office of Associate Administrator of Space Transportation within the US Federal Aviation Administration. However, licensees are required to obtain insurance for an amount of \$100 million to cover potential losses sustained by the US government and not greater than \$500 million for third party claims.<sup>110</sup> In case, a claim exceeds these amounts the US government has undertaken to provide compensation up to \$1.5 billion.<sup>111</sup> In addition, risk allocation-sharing among a licensee, its customers and their respective contractors and subcontractors is provided for under the US law, which imposes mandatory reciprocal waivers of liability.<sup>112</sup> Such regulatory support, undoubtedly, serves an important stimulus to private entities involved in space activities.

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compensation for nuclear damage which have been established against the operator by providing the necessary funds to the extent that the yield of insurance or other financial security is inadequate to satisfy such claims.”

<sup>107</sup> Atomic Energy Act of 1954, 42 United States Code §§ 2210 et seq. (as amended)

<sup>108</sup> *Civil Liability for Nuclear Damage*, UIC Nuclear Issues Briefing Paper # 70, May 2006, online <<http://www.uic.com.au/nip70.htm>> (date accessed: 1 June 2006). For detailed description of the *Price-Anderson Act*, see US Department of Energy, Report to Congress: Price-Anderson Act, 1999, available online: <<http://www.gc.doe.gov/price-anderson/public-comments/Nuclear%20Energy%20Agency/paa-rep.pdf>> (date accessed: 1 June 2006).

<sup>109</sup> 49 United States Code, Subtitle IX. Commercial Space Transportation, 701.

<sup>110</sup> 49 United States Code, Subtitle IX. Commercial Space Transportation, 701, at Section 70112(a)(1).

<sup>111</sup> 49 United States Code, Subtitle IX. Commercial Space Transportation, 701, at Section 70113(a)(1)(B).

<sup>112</sup> 49 United States Code, Subtitle IX. Commercial Space Transportation, 701, at Section 70112(b).

*(d) Licensing of private space entities*

Article VI of the Outer Space Treaty specifies that the “activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty.” The above-mentioned international responsibility and possible liability of States have become the main basis for making the activities of their private entities subject to national regulation, which is normally initiated and exercised through administrative process of licensing. It may be noted that such requirement of national authorization or licensing of private entities is not unique for the space industry. In the field of radiocommunications, including space communications, international law obliges all States to ensure that the activities of their private operators are carried out in accordance with applicable rules of international law<sup>113</sup> and to require these operators to procure appropriate national licenses.<sup>114</sup> Therefore no State allows the use of radio frequencies by private entities without a prior national license.

Is this requirement of “authorization” or licensing an hindrance or barrier to the undertaking of space activities by private entities? Yes, it may be seen that way but only at national level, and if licensing is a cumbersome, time-consuming and expensive process. International space law, as expressed in Article VI, does not stipulate any specific form or condition of “authorization” and continuous “supervision.” States remain free to impose lenient or rigid conditions or procedures on their private entities. In other words, entry into space arena and continuous operation of space activities by private entities are exclusively determined by national policies, laws and regulations.

## **2. PRIVATE PROPERTY RIGHTS AND SHARING OF BENEFITS**

According to a wide-spread opinion, in order to facilitate commercialization in space, there needs to be a well defined property rights regime in place. According to many observers, by ensuring companies exclusive rights to resources, they would have the incentives to invest and develop a business enterprise.<sup>115</sup> As shown above, legal insecurities regarding resource

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<sup>113</sup> Article 45(2), Constitution of the International Telecommunication Union (1994, as amended in 1998 and 2002).

<sup>114</sup> Article 18(1) of ITU Radio Regulations.

<sup>115</sup> Sam Dinkin, “Property Rights and Space Commercialization”, *The Space Review* (10 May 2004), online: *The Space Review* website <<http://www.thespacereview.com/article/141/1>> (date accessed: 28 May 2006). The example of former-Communist countries in Eastern Europe where property rights were poor is given as example of what are the consequences of giving little

appropriation and protection of real property rights are perceived as the main barriers to private sector involvement in the use of natural resources. According to current international space law, there are some impediments to private property in space, but in our opinion they may not be insurmountable.

(a) *Provisions regarding Private Property Rights in International Space Law*

Article II of the Outer Space Treaty specifies that “Outer Space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.” Appropriation implies the exercise of exclusive control or use and denial of use by others. The term “national appropriation” has intentionally been designed to be comprehensive and thus must be understood to include all forms of appropriation, whether governmental, public, private, or otherwise. However, Gorove is of the view that Article II prohibits only “national appropriation” and thus appropriation by a private individual or company is allowed.<sup>116</sup> This view can not be fully justified since letting private entities to appropriate outer space (including the Moon and other celestial bodies) would defeat the very purpose of Article II and consequently of the Treaty. Article II is also understood to negate appropriation in the form public or private property rights in space.<sup>117</sup>

In response to a growing concern with the proliferation of sale of space deeds mentioned above, the International Institute of Space Law (IISL) issued in 2004 a statement addressing the validity of claims on property rights regarding the Moon and other celestial bodies.<sup>118</sup> According to this position paper, the Outer Space Treaty prohibits all territorial claims to outer space (Article II), including claims by private entities (whether individuals or corporations). This argument is drawn from the text of Article VI, which provides that “States bear international responsibility for national activities in outer space, including the Moon and other

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incentive for economic development.

<sup>116</sup> S. Gorove, “Interpreting Article II of the Outer Space Treaty” (1969) 37 Fordham Law Review 349 at 351.

<sup>117</sup> The French representative, speaking to the First Committee of the UN General Assembly on 17 December 1967, stated that the basic principle of the Outer Space Treaty was that there was a “prohibition of any claim to sovereignty or property rights in space”: cited in Carl Christol, “Article 2 of the 1967 Principles Treaty Revisited” (1984) IX Ann. Air & Sp. L. 217 at 218. Manfred Lachs also asserted that, “‘Appropriation’ in the wider sense is involved [in Article II of Outer Space Treaty]. States are thus barred from establishing proprietary links in regard to the new dimension”: *Ibid.*

<sup>118</sup> International Institute of Space Law (IISL), “Statement by the Board of Directors of the International Institute of Space Law on Claims to Property Rights Regarding the Moon and Other Celestial Bodies”, online: International Astronautical Federation/International Institute of Space Law website < [http://www.iafaastro-iisl.com/additional%20pages/Statement\\_Moon.htm](http://www.iafaastro-iisl.com/additional%20pages/Statement_Moon.htm) > (date accessed: 26 May 2006).

celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities”, meaning private parties, and “for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty”. In addition, Article VI provides that “the activities of non-governmental entities in outer space, including the Moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty.” The IISL Statement draws the conclusion that the prohibition of national appropriation by Article II includes, therefore, appropriation by non-governmental entities (i.e. private entities whether individuals or corporations) since that would be a national activity.<sup>119</sup> Such prohibition also applies to enacting legislation “on a territorial basis to validate a ‘private claim’”.<sup>120</sup> In the IISL’s view, “sellers of such deeds are unable to acquire legal title to their claims. Accordingly, the deeds they sell have no legal value or significance, and convey no recognized rights whatsoever.”<sup>121</sup> Finally, the position paper points out that “to comply with their obligations under Articles II and VI of the Outer Space Treaty, States Parties are under a duty to ensure that, in their legal systems, transactions regarding claims to property rights to the Moon and other celestial bodies or parts thereof, have no legal significance or recognised legal effect.”<sup>122</sup>

The provisions of Article II of the Outer Space Treaty have been reiterated in Article 11 (2) of the Moon Agreement.<sup>123</sup> However, Article 11 (3) of the Moon Agreement contains more specific wording to the effect that the surface, the subsurface of the Moon (and other celestial bodies) and any part thereof or their natural resources *in place* can not become property of any one.<sup>124</sup> In other words, once these resources are removed, they may be considered to have become the exclusive property of the entity that caused them to be removed. Moreover, under Article 6 (2) of the Agreement,<sup>125</sup> both public and private

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<sup>119</sup> *Ibid.*

<sup>120</sup> *Ibid.*

<sup>121</sup> *Ibid.*

<sup>122</sup> *Ibid.*

<sup>123</sup> Article 11 (2) of the Moon Agreement: “The moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any other means.”

<sup>124</sup> Article 11 (3) of the Moon Agreement: “Neither the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or non-governmental organization, national organization or non-governmental entity or of any natural person. The placement of personnel, space vehicles, equipment, facilities, stations and installations on or below the surface of the moon, including structures connected with its surface or subsurface, shall not create a right of ownership over the surface or the subsurface of the moon or any areas thereof. The foregoing provisions are without prejudice to the international régime referred to in paragraph 5 of this article.”

<sup>125</sup> Article 6 (2) of the Moon Agreement specifies that: “In carrying out scientific investigations

entities are entitled to collect and remove Moon's minerals and other substances for scientific investigations and explorations purposes and also use them for the support of their space missions. If one considers that there is a contradiction between Article 11 (2) and Article 11 (3), the latter shall prevail according to a well-accepted rule of international law; i.e. *lex specialis derogat generali*. Moreover, the Moon Agreement, being later in adoption, should be considered to have modified the meaning of the terms used in the 1967 Outer Space Treaty,<sup>126</sup> whose Article II on broad non-appropriation would seem to exclude such an exclusive use. We, therefore, believe that the Moon Agreement, as an improvement over the provisions of the Outer Space Treaty, is more conducive to the interests of private entities.

This point of view was reflected also in interesting case concerning a claim of property over an asteroid that came in 2003 before the Federal District Court for the District of Nevada.<sup>127</sup> Gregory William Nemitz registered on the Archimedes Institute's website a property claim to Asteroid 433 Eros.<sup>128</sup> Subsequently, NASA landed the spacecraft NEAR on Eros, and Nemitz submitted an invoice to NASA for "parking" or "storage" fees. After NASA denied his claim, Nemitz filed a complaint with the court alleging that NEAR's landing violated his property rights and that he is entitled to be compensated for such infringement. The Government filed a Motion to Dismiss, and the Federal District Court for the District of Nevada granted the Motion. The Court concluded that Nemitz has failed to demonstrate a legal basis for his claim of a private property rights on an asteroid. The Court ruled that "neither the failure to [*sic!*] the United States to ratify the [...] Moon Treaty, nor [...] the Outer Space Treaty, created any rights in Nemitz to appropriate

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and in furtherance of the provisions of this Agreement, the States Parties shall have the right to collect on and remove from the moon samples of its mineral and other substances. Such samples shall remain at the disposal of those States Parties which caused them to be collected and may be used by them for scientific purposes. States Parties shall have regard to the desirability of making a portion of such samples available to other interested States Parties and the international scientific community for scientific investigation. States Parties may in the course of scientific investigations also use mineral and other substances of the moon in quantities appropriate for the support of their missions."

<sup>126</sup> According to Article 31 of the 1969 Vienna Convention on the Law of Treaties (United Nations, *Treaty Series*, vol. 1155, p.331), the provisions or terms of an international treaty should be interpreted "in their context" and there "shall be taken into account, together with the context (a) any subsequent agreement between the parties regarding the interpretation of the treaty or the application of its provisions."

<sup>127</sup> *Nemitz v. US*, Slip Copy, 2004 WL 316704, D. Nev., 2004 (April 26, 2004).

<sup>128</sup> Note that Archimedes Institute maintains a registry of such claims as part of its mission to inform the public about space law but acknowledges that such claims do not "have the advantage of being protected by treaty or domestic statute." The Archimedes Institute, Space Property Registry, online: Archimedes Institute <<http://www.permanent.com/archimedes/PropertyRegistry.html>> (date accessed: 27 May 2006).

private property rights on asteroids.”<sup>129</sup>

## 1. Current Attempts to Claim Property Rights in Outer Space

In ignorance of the international legal regime, some have already “claimed” celestial bodies, merely by announcing their claim. Pursuant to such claims, some are even selling “title” to areas of outer space.<sup>130</sup> In 1980, being possibly the first to take the initiative of selling lunar property, Dennis Hope filed with a US governmental office for claim registries in San Francisco a property claim over the Moon, Mars and all other celestial bodies, except the Sun and the Earth.<sup>131</sup> Subsequently, he informed the General Assembly of the United Nations and the governments of Russia and the United States. Their failure to respond to his notification was interpreted by Hope as an acknowledgment of the validity of his property rights. This claim is based on what Hope considered to be an overlook by the 1967 Outer Space Treaty which prohibits governments from ownership of extraterrestrial property but failed to mention the same prohibition for individuals or corporations.

Although many legal experts have voiced their views that such legal claims are null and void under the Outer Space Treaty<sup>132</sup> or that such claims of property are useless without the protection of a government authority, Hope’s business initiative proved to be a successful enterprise, currently numbering almost 3,500,000 so-called “proud owners of their extraterrestrial property”.<sup>133</sup> According to the Lunar Embassy’s site, among the buyers of extraterrestrial

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<sup>129</sup> *Ibid.* Nemitz appealed the case to the Ninth Circuit Court of Appeals, and the lower court’s dismissal of the case was upheld “for the reasons stated by the district court.” *Nemitz v. N.A.S.A.*, 126 Fed.Appx. 343 (9th Cir.(Nev.) Feb 10, 2005) (Not selected for publication in the Federal Reporter, NO. 04-16223). As may be noted, the decision was not selected for publication in the Federal Register meaning that the ruling does not establish a binding legal precedent for future cases.

<sup>130</sup> “Legal History and Issues”, online: website < <http://www.permanent.com/ep-legal.htm> > (date accessed: 29 May 2006).

<sup>131</sup> Robert Roy Britt, “Lunar Land Grab: Celestial Real Estate Sales Soar” (2 February 2004), online: <SpaceRef.com < [http://www.space.com/scienceastronomy/mystery\\_monday\\_040202.html](http://www.space.com/scienceastronomy/mystery_monday_040202.html) > (date accessed: 24 May 2006).

<sup>132</sup> See e.g., the IISL Position Paper, *supra* note 118.

<sup>133</sup> The Lunar Embassy, “So Who on Earth Buys Extraterritorial Property?”, online: The Lunar Embassy website < <http://www.lunarembassy.com> > (date accessed: 24 May 2006). Most sought after properties on the Moon ( most recent count: 2'524'728 customers), followed by properties on Mars (most recent count: 945 344 customers). Note however that China revoked the license of the Chinese branch of Lunar Embassy by assessing that to own a piece of land on the Moon, although a “beautiful dream”, was fraudulent and illegal. Space Daily, “Chinese Lunar Land Sale A Great Idea but Illegal Says Government” (28 January 2005), online: Space Daily website < <http://www.spacedaily.com/news/lunar-05zzzb.html> > (date accessed: 29 May 2006).

property are not only individuals, but companies as well.<sup>134</sup>

This initiative's success has triggered increased competition from similar websites.<sup>135</sup> Such is for example the Lunar Republic, organized as an international business company and, according to its website, authorized to operate in more than 200 countries around the world.<sup>136</sup> Recognizing that under the current international law, no government nor private entity could own property on the Moon and that the Moon Agreement calls for the establishment of an "international regime" to govern the Moon, the proponents of this initiative came up with the idea of establishing "an independent and sovereign Lunar Republic, with a government *sine terra* elected by its citizen-partners and empowered to create a long-term plan for the exploration and settlement of the Moon and the development of its resources."<sup>137</sup> The Government of the Lunar Republic will be entrusted to guide the "peaceful occupation and exploration of the Moon and management of its resources", while "allowing individual property ownership in certain areas."<sup>138</sup> A Lunar Registry<sup>139</sup> is established with

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<sup>134</sup> *Ibid.* Although the names of the customers are confidential, the Lunar Embassy website mentions that among its customers are approximately 250 very well known celebrities as well as two former US presidents. Also, the site mentions that approximately 30 NASA employees are among the "owners of extraterrestrial property."

<sup>135</sup> The Lunar Embassy website <<http://www.lunarembassy.com>> acknowledges the increased competition from what they call "copycats" but point out that: "We the Lunar Embassy are the only recognized world authority for the sale of lunar and other planetary real estate (including Mars) in the known solar system. Please be advised that any others are copy cat companies without authority, soliciting your money for unauthorized products. As the Lunar Embassy are the sole holders of the property claim to all planets in the solar system and their Moons (with the exceptions of the Sun and the Earth), we of course, also intend to offer properties for sale on all of these stellar bodies in the foreseeable future." Dennis Hope allegedly spent thousands of dollars in legal fees to defend his company and challenge his competition. Some of the competing web sites were forced to shut down based mostly on copyright violations, not on property ownership claims. Robert Roy Britt, "Lunar Land Grab: Celestial Real Estate Sales Soar" (2 February 2004), online: SpaceRef.com <[http://www.space.com/scienceastronomy/mystery\\_monday\\_040202.html](http://www.space.com/scienceastronomy/mystery_monday_040202.html)> (date accessed: 24 May 2006).

<sup>136</sup> Lunar Registry, "Lunar Property Ownership: Is It Legal to Own Land on the Moon?", Lunar Registry website <<http://www.lunarregistry.com/info/legal.shtml>> (date accessed: 27 May 2006). Among these countries, the website mentions United States, Japan, Russia, China, India, Great Britain, Australia, France, Germany, The Netherlands, Switzerland, Denmark and Sweden.

<sup>137</sup> *Ibid.* See the text of the Proclamation of establishment of the Lunar Republic, online: Lunar Registry website <<http://www.lunarregistry.com/info/proclamation.shtml>> (date accessed: 26 May 2006).

<sup>138</sup> Lunar Registry, "Lunar Property Ownership: Is It Legal to Own Land on the Moon?", Lunar Registry website <<http://www.lunarregistry.com/info/legal.shtml>> (date accessed: 27 May 2006). According to the website: "Of the nine-billion acres of land that encompass Luna, only about 100-million acres will be offered for sale – approximately 2% of the total land available."

the main role “to protect and uphold the private property rights of Lunar land owners, while also working with other agencies and the Lunar Republic in developing plans for the settlement of the Moon, the construction of scientific centers, the promotion of Lunar tourism, the development of mineral and other resources on the Moon, and the respectful preservation of the environment, in accordance with international treaties.”<sup>140</sup>

The sales of land are conducted by the Lunar Republic in compliance with what is called the “Lunar Settlement Initiative”<sup>141</sup> which has the aim to provide a “framework for private development of the Moon” and to “promote privately funded exploration and settlement of Luna”. This initiative proposes an international public-private partnership with the commercial space industry and centers around the idea that any organization, whether operating for profit or not for profit, should be allowed to offer for sale to any private entity<sup>142</sup> a “legal and valid claim to property on Luna in exchange for payment that shall be directly utilized to fund a program that will result in the human settlement of Luna.”<sup>143</sup> Land claims are to be offered in individual parcels of one acre and no single organization can offer claims to more than 10% of the total land available on the Moon.<sup>144</sup> The condition for granting “legal recognition and certification” to a

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<sup>139</sup> Lunar Registry website <<http://lunarregistry.com>> (date accessed: 26 May 2006). According to the website, Lunar Registry has “a program through which you, your family, or your business enterprise can legally claim ownership of property on the Moon.” “In much the same way that major corporations – such as IBM or General Electric – offer shares of stock to raise capital, we are offering a limited number of ‘shares’ in lunar property in order to fund privatized exploration, settlement and development of the Moon. Proceeds will be pooled ‘in order to create the investment capital required to occupy and develop the Moon.’ Your property ownership is permanently registered by the International Lunar Lands Registry in its annual publication, which is copyrighted and deposited in the United States Library of Congress and with international patent and trademark offices, including the United Kingdom (UK Patent Office), Japan (Japan Copyright Office), Russia (Rospatent) and with the United Nations (UN Depository Library), in compliance with the Berne Convention.”

<sup>140</sup> Lunar Registry, “Lunar Property Ownership: Is It Legal to Own Land on the Moon?”, Lunar Registry website <<http://www.lunarregistry.com/info/legal.shtml>> (date accessed: 27 May 2006).

<sup>141</sup> The Lunar Settlement Initiative, An Initiative to Promote Privately Funded Exploration and Settlement of Luna (Opened for comment on 20 July 2003), online: Luna Settlement Initiative <[http://www.lunarsettlement.org/Lunar\\_Settlement\\_Initiative.pdf](http://www.lunarsettlement.org/Lunar_Settlement_Initiative.pdf)> (date accessed: 23 May 2006).

<sup>142</sup> A “private entity” is defined as “[a]n individual, corporation or consortium of companies, which is not controlled by a sovereign state or government.” The Lunar Settlement Initiative, An Initiative to Promote Privately Funded Exploration and Settlement of Luna, online: Luna Settlement Initiative <[http://www.lunarsettlement.org/Lunar\\_Settlement\\_Initiative.pdf](http://www.lunarsettlement.org/Lunar_Settlement_Initiative.pdf)> (date accessed: 23 May 2006).

<sup>143</sup> *Ibid.*

<sup>144</sup> *Ibid.* Note that, for the purposes of this document, it is established that Luna comprises nine billion (9,000,000,000) total acres of land.

land claim is the establishment of a human-based settlement and its permanent and continuous inhabitation.<sup>145</sup> According to this initiative, any such settlements are to be recognized as legal under public international law. As will be argued below, the terms of the Initiative violates the terms of the Outer Space Treaty and thus it cannot expect that the regime it tends to establish will enjoy protection under the international law which it ignores otherwise.

## 2. Proposed Solutions to Overcome the Prohibition against Claims of Real Property

Several theories are suggested by various experts in order to overcome what is generally perceived to be a prohibition of claims of real property *stricto sensu* under the existing international treaties.

### a) The Theory of “Pseudo Property Rights”

While acknowledging that the Outer Space Treaty prohibits States from making sovereign claims over portions of outer space, while requiring the signatories to closely monitor activities carried out by non-governmental entities over which they have jurisdiction, this theory proposes the recognition of a property right that would translate in the right to exclude others from interfering with one’s right.<sup>146</sup> As States are required to monitor non-governmental activities, they would be entitled to establish a “pseudo-property” regime applicable only to their nationals. Such regime would be similar to one governing patents under the US legal system. By filing a patent, a company can exclude all other companies from using a certain technology. Similarly, an outer space pseudo property right would be the equivalent of a title deed to a house based on which the “owner” has the right to exclude others from using the house. National entities would have to apply to their government for authorization to operate on a certain location. Individual States would have the task of registering such rights and ensuring that other non-governmental entities from that particular State do not interfere with them. Although not a full fledge property right, such arrangement would give certain guarantees of State enforcement against violators from the same State. Problems would arise, however, when entities from different States claim “pseudo-rights” over the same resources. The theory suggests that this is not likely to happen given increase evidence of respect for others’ property among space faring nations. Even if it does happen, bilateral agreements between the concerned States would be a solution. Although doubting the true enforcement power of the

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<sup>145</sup> *Ibid.*

<sup>146</sup> Sam Dinkin, “Property Rights and Space Commercialization”, *The Space Review* (10 May 2004), online: *The Space Review* website <<http://www.thespacereview.com/article/141/1>> (date accessed: 28 May 2006).

Outer Space Treaty, the proponents of this theory recommend, as a last resort, the withdrawal of the State concerned from the Outer Space Treaty.<sup>147</sup>

b) The Theory of Designated Zones of Functional Jurisdiction

Based on an analogy to the regime governing the continental shelf, this theory proposes an international agreement that would define certain specific cases when a State, being able to show a “particular and distinctive interest”, would be entitled to claim the right to exercise “functional jurisdiction” (as opposed to territorial jurisdiction) in a designated area of outer space or on a celestial body. States would have to enact unilateral legislation that creates such “designated areas” of functional sovereignty in outer space.<sup>148</sup>

c) Functional Property Rights

This theory is based on the principles of civil law (as opposed to common law) which distinguish between property and sovereignty. Under this theory conferral of title would not depend upon government’s sovereignty over a specific area, but rather on the State’s control over the space objects and personnel at that location. States may require private entities to maintain a facility (and/or conduct certain activities) in a fixed location for a specified period of time (e.g., one to five years) in order to perfect such property rights.<sup>149</sup> These rights would be limited to the area occupied by the space object, and to a reasonable safety area around the facility.<sup>150</sup> The proponents of this theory also suggest that States which establish such property right regime could insert a reciprocity provision in their property laws which recognize property rights of entities under the jurisdiction of other States that enact similar property regime. Once several States have implemented similar property regimes, an international registry would be necessary. In addition, States could negotiate and enact a

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<sup>147</sup> *Ibid.*

<sup>148</sup> Imre Csabafi, *The Concept of State Jurisdiction in International Space Law* (The Hague: Nijhoff, 1971).

<sup>149</sup> Wayne N. White, “Implications of a Proposal for Real Property Rights in Outer Space” (1999), Proceedings, 42nd Colloquium on the Law of Outer Space, at 366 ( IISL 2000). Published by American Institute of Aeronautics and Astronautics, online: Space Future < [http://www.spacefuture.com/archive/implications\\_of\\_a\\_proposal\\_for\\_real\\_property\\_rights\\_in\\_outer\\_space.shtml](http://www.spacefuture.com/archive/implications_of_a_proposal_for_real_property_rights_in_outer_space.shtml)> (date accessed: 29 May 2006).

<sup>150</sup> Wayne White, “Real Property Rights in Outer Space” (1997), Proceedings, 40th Colloquium on the Law of Outer Space, at 370 (IISL 1998). Published by American Institute of Aeronautics and Astronautics, online: < [http://www.spacefuture.com/archive/real\\_property\\_rights\\_in\\_outer\\_space.shtml](http://www.spacefuture.com/archive/real_property_rights_in_outer_space.shtml)> (date accessed: 28 May 2006).

multilateral treaty to coordinate property rights.<sup>151</sup>

d) Natural Law of "Use and Occupation" Theory

This theory is reflected in a draft for an Act to Promote Privately Funded Space Settlement, proposed by the so-called Space Settlement Initiative, under the name "The Space Settlement Prize Act".<sup>152</sup> According to the authors of this draft legislation "[t]he ratification failure of the Moon Treaty means there is no legal prohibition in force against private ownership of land on the Moon, Mars, etc., as long as the ownership is not derived from a claim of national appropriation or sovereignty (which is prohibited by the Outer Space Treaty)."<sup>153</sup> In order to circumvent the prohibition of claiming sovereignty over extraterrestrial property, the draft Act proposes that, for property rights on the Moon, Mars, and other celestial bodies, the US will have to recognize natural law's "use and occupation" standard and not the common law standard of "gift of the sovereign".<sup>154</sup> According to the Space Settlement Prize Act, a private entity that establishes the first lunar settlement on the Moon would be granted the ownership of up to 600,000 square miles in a contiguous, reasonably compact shape which includes its base,<sup>155</sup> the private entity that establishes the first settlement on Mars would be entitled to receive the ownership of up to 3,600,000 square miles in a contiguous, reasonably compact shape which includes its base,<sup>156</sup> while the private entity that establishes a permanently inhabited base on an asteroid will be entitled to receive ownership of up to 600,000 square miles in a contiguous, reasonably compact shape that includes its base, or the entire asteroid if its surface area is smaller than 1,000,000 square miles.<sup>157</sup>

e) The Theory of "Tele-Possession"

A relatively new concept to overcome issues of ownership of resources at least with regard to asteroids is 'tele-possession' which involves the use of robot

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<sup>151</sup> Wayne N. White, "Implications of a Proposal for Real Property Rights in Outer Space" (1999), Proceedings, 42nd Colloquium on the Law of Outer Space, at 366 (IISL 2000). Published by American Institute of Aeronautics and Astronautics, online: Space Future < [http://www.spacefuture.com/archive/implications\\_of\\_a\\_proposal\\_for\\_real\\_property\\_rights\\_in\\_outer\\_space.shtml](http://www.spacefuture.com/archive/implications_of_a_proposal_for_real_property_rights_in_outer_space.shtml) > (date accessed: 29 May 2006).

<sup>152</sup> "An Act to Promote Privately Funded Space Settlement", online: Space Settlement Initiative website < <http://www.spacesettlement.org/law/> > (date accessed: 28 May 2006).

<sup>153</sup> *Ibid.*, Sec. 2 (10).

<sup>154</sup> *Ibid.*, Sec. 2 (12).

<sup>155</sup> *Ibid.*, Sec. 6 (1).

<sup>156</sup> *Ibid.*, Sec. 6 (2).

<sup>157</sup> *Ibid.*, Sec. 6 (3).

emissaries that perform tasks that a hands-on asteroid miner could do at a remote site and thus gaining legal domain over the asteroid and establishing a form of legal possession.<sup>158</sup> This concept is based on the Roman law of *pedis possession*, which is the foundation for Western law of ownership. It means that the first entity to set foot (*pedis*) upon and occupy an area in outer space can claim possession. Modern law has already established precedent for robotic 'tele-possession' in the legal model applied to maritime salvage of a shipwreck by using underwater telerobots. The proponents of this theory agreed that this theory is more likely to be acceptable with regard to asteroids (which are not an intrinsically unique and environmentally fragile medium, nor are perceived as a limited resource) than to the Moon.<sup>159</sup>

f) Creating a New Nation out of a Colony in Outer Space

Another theory that was suggested was that a group of people that will go to a celestial body and colonize it, will declare themselves a new nation which would not be a signatory of the Outer Space Treaty and thus not bound by its prohibition of ownership and could claim territorial sovereignty over the local resources.<sup>160</sup>

g) Adopting a System Similar to the One Established by the Law of the Sea Convention

The Law of the Sea Convention<sup>161</sup> provides for a regime designed to govern appropriation of ocean resources beyond the limits of national jurisdiction that is very similar in nature to the regime proposed by the Moon Treaty to govern use of space resources. This Convention establishes an "Authority" entitled to grant mining rights to corporations, and an "Enterprise" which competes with these corporations and is responsible for distributing its mining profits to developing nations.<sup>162</sup> Thus, corporations have an incentive to invest in mining activities, while the Enterprise ensures that the benefits are shared by all nations - since the resources belong to all of them.<sup>163</sup>

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<sup>158</sup> Leonard David, "Extraterrestrial Resources: 'Living off the Land'" (14 November 2003), online: SpaceRef.com < [http://www.space.com/business/technology/technology/space\\_resources\\_031114.html](http://www.space.com/business/technology/technology/space_resources_031114.html) > (date accessed: 24 May 2006).

<sup>159</sup> "Legal History and Issues", online: website < <http://www.permanent.com/ep-legal.htm> > (date accessed: 29 May 2006).

<sup>160</sup> "Legal History and Issues", online: website < <http://www.permanent.com/ep-legal.htm> > (date accessed: 29 May 2006).

<sup>161</sup> *United Nations Convention on the Law of the Sea*, Nov. 1982, 21 ILM 1261.

<sup>162</sup> *Ibid.*

<sup>163</sup> Harminderpal Singh Rana, "The 'Common Heritage of Mankind' & the Final Frontier: A Reevaluation of Values Constituting the International Legal Regime for Outer Space Activities"

h) Amendment of or Withdrawal from the Outer Space Treaty

State Parties can amend or even withdraw from the Outer Space Treaty and subsequently assert territorial claims over areas of outer space. The OST provides that Parties can withdraw by giving one year's notice.<sup>164</sup> However, it is doubtful that States will take this course of action. First, such withdrawal followed by territorial claims will likely lead to strong political opposition from non-space-faring nations and possibly military conflict with competing space faring nations.<sup>165</sup> Second, there are almost no objectionable provisions in the OST. For the most part, the Treaty allows States to govern their own space activities, subject only to general principles of international law by which they are already bound and to which they already subscribed.

If one agrees that a property rights system, the next question is whether such system should be established before extensive development of technology to extract and use such resources has taken place or after. The "Positivist School" of space law argues that the current air or sea law cannot be applied to an area of exploration that is virtually unknown. Consequently, space law addressing property rights must evolve gradually as the realities and needs require.<sup>166</sup> More specifically, it is advocated that, with the exception of environmental laws in near-Earth space, governments should not be allowed to implement laws applicable to the use of space resources until "the field matures further, i.e., until the field defines itself through actual operations and demonstrations."<sup>167</sup> On the other hand, the "Natural Law School" of space law adopts an approach guided by the principles of equity and morality. According to this school, it

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(1994) 26 Rutgers L.J. 225 at 233-34.

<sup>164</sup> *Outer Space Treaty*, Art. XVI.

<sup>165</sup> Wayne N. White, "Implications of a Proposal for Real Property Rights in Outer Space" (1999), Proceedings, 42nd Colloquium on the Law of Outer Space, at 366 ( IISL 2000). Published by American Institute of Aeronautics and Astronautics, online: Space Future <[http://www.spacefuture.com/archive/implications\\_of\\_a\\_proposal\\_for\\_real\\_property\\_rights\\_in\\_outer\\_space.shtml](http://www.spacefuture.com/archive/implications_of_a_proposal_for_real_property_rights_in_outer_space.shtml)> (date accessed: 29 May 2006).

<sup>166</sup> Kim Alaine Rathman, "Sharing the Harvest of the Skies: Outer Space Commercialization and Third World Development" (Summer 1998) 3(4) PHIL & TECH 1 at 1.

<sup>167</sup> "Legal History and Issues", online: website < <http://www.permanent.com/ep-legal.htm>> (date accessed: 29 May 2006). Bruce S. Marks, a lawyer in the field of space resources, is quoted as saying: "... those miners themselves who are active should first devise practical regulation upon which they would consensually rely. As has been the situation previously, from the time of the California Gold Rush through the recent negotiations surrounding the seabed treaty and hard mineral extraction projections for the seabed, extra-legal regimes, followed by eventual codification of consensual law, appear to be the most workable solutions for humankind's advance into new frontier resource regions." *Ibid.*

would be important to plan for the future uses of space resources in order to ensure not only an equitable distribution of resources but also to prevent conflicts among nations as history shows possible whenever competing nations get involve in exploring new resources.<sup>168</sup>

(b) *Sharing of benefits*

Article I (1) of the Outer Space Treaty declares that, “The exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development.” This legal principle, ensures that outer space, the Moon and other the celestial bodies are a “global commons” to be explored, used and exploited as a “public good,” in contradistinction to possible exclusive control or claim by individual States.<sup>169</sup> The negotiating history of the Treaty shows that it clearly established a fair balance of interests all States.<sup>170</sup> This “common interest” principle is the basis for other principles that ensure “freedom of outer space”, “non-appropriation of outer space”, and respect for the corresponding interests of all players in the exploration and use of outer space, the Moon and other celestial bodies, so that space activities may be carried out without any international conflict and in a orderly manner. Though pursuant to Article I(1), all space activities must be such that they contribute somehow to the well-being of all countries, it does not impose any specific obligation on a State to share with others the benefits acquired with the exploration and use of outer space (including the Moon and other celestial bodies). The nature, scope, manner and process for such distribution are left to be determined by each State Party to the Treaty. This understanding of the provisions of Article I(1) has consistently been maintained by both the space-powers and non-space powers.

On the other hand, Article 11 of the Moon Agreement, according to which the

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<sup>168</sup> Kim Alaine Rathman, “Sharing the Harvest of the Skies: Outer Space Commercialization and Third World Development” (Summer 1998) 3(4) PHIL & TECH 1.

<sup>169</sup> According to Carl Christol, “Exclusive rights may not exist even though the practical capabilities of some explorers, users, and exploiters may be greater than others”: Carl Christol, *The Modern International Law of Outer Space* (1982) at 47-48.

<sup>170</sup> After the completion of the draft treaty in the COPUOS, the US delegate stressed that the “spirit of compromise shown by the space Powers and the other Powers had produced a treaty which established a *fair balance* between the interests and obligations of all concerned, including the countries which had as yet undertaken no space activities”: Official Records of the General Assembly, Twenty-First Session, First Committee, Summary Records of Meetings, 20 September-17 December 1966, U.N., New York, at 427-428. Similarly, the Soviet delegate stated that Article I, Paragraph 1, was not “a mere statement of the rights of States” but was designed “to guarantee that the interests, not only of individual States, but of all countries and of the international community as a whole, would be protected”: U.N. Document A/AC.105/C.2/SR.57, 20 October 1966, at 12.

Moon, other celestial bodies and their natural resources are the 'common heritage of mankind' (CHM), is said to be the most controversial legal principle from the perspective of the private industry, because it is considered by some to require the sharing of benefits derived from those resources. However, the CHM principle of the Moon Agreement, has often been misinterpreted and misunderstood. For example, the U. S. Army Space Reference Text on Space Policy and Law mentions that under the 1979 Moon Agreement, that was "signed by five countries but not the United States or the Soviet Union, ... ..the moon is a common heritage for all mankind which implies that all nations would share *equally* in any benefits derived from moon exploration. If the US signed this treaty it would be hard to get private firms to invest in future moon projects if they had to divide the profits."<sup>171</sup> Such contention is wrong. The Moon Agreement does not require "equal" sharing but an "equitable" sharing, and that too would be implemented only through an international regime, which needs to be negotiated and established at a later date.

The negotiating history of the Moon Agreement shows that while the developing countries and the United States supported the inclusion of CHM principle in the Moon Agreement, the Soviet Union had opposite views.<sup>172</sup> However, during the last session of the Legal Subcommittee of the COPUOS in 1979, the Soviet Union withdrew its opposition when the meaning of the CHM was tied to the provisions of the Moon Agreement itself. The finally adopted wording of Article 11 (1) states that "The moon and its natural resources are the common heritage of mankind, which finds its expression in the provisions of this Agreement and in particular in paragraph 5 of this article [i.e. Article 11]," which in turn, specifies that "States Parties to this Agreement hereby undertake to establish an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the moon as such exploitation is about to become feasible." Therefore, meaning and scope of the CHM principle will be clarified and elaborated in the envisioned international regime, if and when

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<sup>171</sup> Chapter 3, SPACE POLICY AND LAW, [US] ARMY SPACE REFERENCE TEXT, (available online <[http://www.fas.org/spp/military/docops/army/ref\\_text/chap3im.htm](http://www.fas.org/spp/military/docops/army/ref_text/chap3im.htm)>, date accessed: 25 January 2006), emphasis added. The purpose of this Reference Text is "to provide information on space systems and their use as they relate to US Army operations. The intended users are US Army commanders, staff officers and Noncommissioned Officers, students attending Army courses of instruction and their instructors. The format and contents are intended to provide the reader a central reference as to the environment of space, the capabilities of US and foreign space systems and how they can impact on US Army operations at strategic, operational and tactical levels": online: <[http://www.fas.org/spp/military/docops/army/ref\\_text/chap1\\_im.htm](http://www.fas.org/spp/military/docops/army/ref_text/chap1_im.htm)> (date accessed: 25 January 2006).

<sup>172</sup> For details, see Agreement Governing the Activities of States on the Moon and other Celestial Bodies, Prepared by Mrs. Eilene Galloway at the request of Hon. Howard W. Cannon, Chairman, Committee on Commerce, Science, and Transportation, United States Senate, May 1980.

established and no reference to the principles and rules under any other treaty, including the 1982 UN Law of the Sea Convention, is supposed to be made. Moreover, attempts to understand the meaning of the CHM principle, as included in the Moon Agreement, with the use of or by heavy reliance upon, analogies and/or the traditional international law concepts like *res nullius*, *terra nullius*, *terra communis*, *res communis*, *res extra commercium*, etc. is not only unwarranted but could also prove to be counter productive. None of these concepts has been incorporated in the text of the Moon Agreement. Their meaning and scope have evolved according to the needs, interests, preferences, policies and circumstances of various members of the international community mainly during the by-gone centuries. The physical characteristics of each of “*terra*” or “*res*”, its situation or location, and its subjection or non-subjection to the legal principle of national sovereignty have also played a significant role in determining the scope of each of these concepts. On the other hand, these concepts could, or perhaps should, be considered when assigning a precise scope to the CHM principle during the negotiations of the envisioned international regime.

Under the Moon Agreement, an international regime needs to be established only when the exploitation of the natural resources of the Moon “is about to become feasible.” Here the term ‘exploitation’ should be understood to mean regular extraction and refinement of natural resources for commercial purposes. It is not research, scientific investigation and exploration as such activities are only precursors of exploitation.

The envisioned international regime should be based upon several principles enumerated in Article 11 (7)<sup>173</sup> and one of which deals with “equitable sharing by all States Parties in the benefits derived from those resources, whereby the interests and needs of the developing countries, as well as the efforts of those countries which have contributed either directly or indirectly to the exploration of the moon, shall be given special consideration.” The requirement of an equitable sharing is not currently applicable. Its specific scope, implications and methodology would be ascertained by the States Parties to the Agreement when negotiating the envisioned international regime. If they are such Parties, the US and other industrialized States, whose private entities would be engaged in research and exploration of the natural resources of the Moon, cannot be expected

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<sup>173</sup> They are specified in *Moon Agreement*, Article 11, paragraph 7, as: “(a) The orderly and safe development of the natural resources of the Moon; (b) The rational management of those resources; (c) The expansion of opportunities in the use of those resources; (d) An equitable sharing by all States Parties in the benefits derived from those resources, whereby the interests and needs of the developing countries, as well as the efforts of those countries which have contributed either directly or indirectly to the exploration of the moon, shall be given special consideration.”

to remain inactive participants during the negotiations for the envisioned international regime, which would possibly happen only in about 20 to 30 years from now. In other words, it is unthinkable that the interests of the private industry would be compromised under the envisioned regime.

According to Arthur Dula, "If the United States becomes a party to the Moon Treaty, the opportunities and prospects for private enterprise development of the resources of the Moon and other celestial bodies will be negligible if not non-existent. Specifically, the draft treaty would: 1. Create a moratorium on the commercial exploitation of the resources of the Moon and other celestial bodies, until a second, much more comprehensive treaty for regulating resources activities is concluded."<sup>174</sup> In our view, the text of the Moon Agreement does not support such an interpretation. There is no moratorium on the exploitation of the natural resources of the Moon and other celestial bodies before the creation of the envisioned international regime. At its July 1979 session, the COPUOS added, under paragraph 65 of its report, a clarification to the effect that, "article 7 is not intended to result in prohibiting the exploitation of natural resources which may be found on celestial bodies other than earth."<sup>175</sup> The UN General Assembly, when adopting a resolution containing the text of the Moon Agreement, has asserted that paragraph 65 should be taken into consideration for a proper interpretation of the Moon Agreement.

Before the establishment of the envisioned international regime, the provisions of Article 6 (2) shall remain applicable.<sup>176</sup> As noted above, private entities of those States that are Parties to the Moon Agreement, can legally collect, remove and use Moon's minerals and other substances for scientific investigations and explorations purposes and also use them for the support of their space missions. Thus, it seems important that States that wish their public and private entities to be use natural resources of the Moon and other celestial bodies are better off by

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<sup>174</sup> Arthur Dula, "Free Enterprise and the Proposed Moon Treaty" (1979) 2 *Houston Journal of International Law* 3, cited in Glenn H. Reynolds and Robert P. Merges, *Outer Space: Problems of Law and Policy* (Boulder, CO: Westview Press, 1989) 139 at 140.

<sup>175</sup> Report of the Committee on the Peaceful Uses of Outer Space, United Nations General Assembly, Official Records: Thirty-Fourth Session, Supplement No. 20, 1979, Un Document No. A/34/20.

<sup>176</sup> Article 6 (2) of the Moon Agreement specifies that: "In carrying out scientific investigations and in furtherance of the provisions of this Agreement, the States Parties shall have the right to collect on and remove from the moon samples of its mineral and other substances. Such samples shall remain at the disposal of those States Parties which caused them to be collected and may be used by them for scientific purposes. States Parties shall have regard to the desirability of making a portion of such samples available to other interested States Parties and the international scientific community for scientific investigation. States Parties may in the course of scientific investigations also use mineral and other substances of the moon in quantities appropriate for the support of their missions."

being Parties to the Moon Agreement.

In our opinion, under the Moon Agreement, the private entities carrying out exploration, and eventually exploitation, of the natural resources of the Moon and other celestial bodies are not required to share the benefits of such explorations. Moreover, they may legally collect, remove and use Moon's minerals and other substances for investigations and for the support of their space missions. Such legal entitlement should encourage private investment and thus result in the expansion of capabilities to ascertain the exploitation viability of the natural resources of the Moon and other celestial bodies.

### **3. INTELLECTUAL PROPERTY RIGHTS AND USE OF SPACE TECHNOLOGY**

#### *(a) Acquisition and protection of intellectual property rights*

Intellectual property (e.g. patents, copyrights etc.)<sup>177</sup> is protected in order to encourage creativity and development. However, in providing legal protection of a creator's rights, the interest of the society in knowledge is also taken into consideration. The fundamental principles of intellectual property law are:

- Intellectual property rights (IPRs) are acquired and protected in the territory in which they are granted. (i.e. intellectual property law is fundamentally national and territorial in nature).
- IPRs are not protected unless properly granted by an appropriate national body after following an administrative procedure;
- For proper and effective transfer of IPRs it is imperative that the

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<sup>177</sup> According to Article 2 of the Convention Establishing the World Intellectual Property Organisation (WIPO), Stockholm, "intellectual property shall include rights relating to

- literary, artistic and scientific works,
- performances of performing artists, phonograms, and broadcast,
- inventions in all fields of human endeavours,
- scientific discoveries,
- industrial designs,
- trademarks, service marks, and commercial names and designations,
- protection against unfair competition,

and all other rights resulting from intellectual activity in the industrial, scientific, literary or artistic fields": available online at:

<[http://www.wipo.int/treaties/en/convention/pdf/trtdocs\\_wo029.pdf](http://www.wipo.int/treaties/en/convention/pdf/trtdocs_wo029.pdf)> (date accessed: 1 June 2006).

concerned technology must be sufficiently and effectively protected by law.

- IPRs are limited in scope, time, and space.
- In all countries, except the US, patent rights are granted on the 'first-to-file' basis. In the US, the rule of 'first-to-invent' is followed.

Intellectual property rights are protected under national laws only. However, to some extent protection in other countries could be secured through inter-governmental bilateral and multilateral agreements. For example, the Contracting States of the Paris Convention for the Protection of Industrial Property<sup>178</sup> constitute a Union for the purpose of protection of industrial property. Article 2 (1) of the Convention provides that:

“Nationals of any country of the Union shall, as regards the protection of industrial property, enjoy in all the other countries of the Union the advantages that their respective laws now grant, or may hereafter grant, to nationals; all without prejudice to the rights specially provided for by this Convention. Consequently, they shall have the same protection as the latter, and the same legal remedy against any infringement of their rights, provided that the conditions and formalities imposed upon nationals are complied with.”

Since June 1, 1978, under the European Patent Convention (1973), the European Patent Office has instituted a procedure for single application for patent which will be valid in all the European countries that are Parties to the Convention. The Convention attempts to make the patent protection simpler, cheaper and more reliable.

There is no possibility of acquiring protection for inventions made on space objects registered by international organizations since such space objects cannot be treated as the territory of these organizations. In case of inventions made on a space station, which operates in international space, it becomes imperative to determine its “territoriality”; i.e. the legal status of that space station. Therefore, the determination of the legal status of a space station is necessary. Article 21(2) of the 1998 Intergovernmental Agreement on International Space Station, specifies that “for purposes of intellectual property law, an activity occurring in or on a Space Station flight element shall be *deemed* to have occurred *only in* the territory of the Partner State of that element's registry.” However, “for ESA-

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<sup>178</sup> Paris Convention for the Protection of Industrial Property of March 20, 1883, as revised at Stockholm on July 14, 1967.

registered elements any European Partner State may *deem the activity to have occurred in its territory.*"

There is only one example of a specific national law of intellectual property rights in outer space and that is of the US. The US patent law provides that: "any invention made, used or sold in outer space on an aeronautical and space vehicle [as defined in section 103(2) of the NASA-Act] under the jurisdiction or control of the United States shall be considered to be made, used or sold within the United States for the purposes of this title with respect to any space vehicle or component thereof that is specifically identified and otherwise provided for by an international agreement to which the United States is a party."<sup>179</sup>

Bradford-Lee Smith in his paper on "Recent Developments in Patents for Outer Space Activities"<sup>180</sup> raises the following questions with respect to the application of current intellectual property laws to outer space activities:

1. US patent law and IGA make explicit reference to the State of Registry to determine the applicable law. What if the State of Registry changes in time?

2. Since IP law is territorial, which State's law applies in outer space? Which jurisdiction will be applicable in the case of space activities of multinational corporations and multinational co-operations? What about transfers of IPRs between entities belonging to different States?

3. Due to the limited number of players and programs, competitors on one program could be partners on another program, customers on another, and/or subcontractors still on another.

Legal certainly is indispensable for the success of private space ventures. In order to achieve such certainly, Bradford-Lee Smith suggests the "globalization" of the jurisdiction in outer space activities, i.e. adoption of a single worldwide IPR law for space activities and creating a single territory for IPR in space activities, including space access (launch sites and vehicles), space objects (UN registry), and space settlements (Moon and other celestial bodies).<sup>181</sup>

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<sup>179</sup> H. R. 1510 Cong. rec. Oct. 5, 1988, P. H. 9669, "Patents in Space Act", Chapter 10, Title 35, par. 105.

<sup>180</sup> Bradford-Lee Smith, "Recent Developments in Patents for Outer Space Activities", a paper presented at the United Nations/Nigeria Workshop on Space Law entitled "Meeting international responsibilities and addressing domestic needs" held on 21-24 November 2005, at Rockview Hotel, Abuja, Nigeria.

<sup>181</sup> *Ibid.*

*(b) Barriers related to the use of space technology*

Simply possessing know-how serves no purpose unless it is put to some use. Normally law encourages the use of useful know-how so that it could serve society. Therefore, law grants exclusive right to exploit that knowledge. The inventor or innovator of any technology can exploit it himself or authorize others to do so. Such authorization is called an act of transfer of technology. Technology, in simple terms, means specific information (data) which is required for the development, production or use of a product. Technology transfer implies transfer of knowledge or know-how. The knowledge as we have mentioned earlier is intellectual property which has been granted legal protection in various forms; like patent, copyright, industrial design, trade mark etc.

Technology transfer could occur through many methods or channels; i. e. outright sale or licensing for compensation. Licenses are legal instruments or contracts that contain several clauses dealing with various terms and conditions for the transfer of technology. One must also be careful about the retransfer of technology by the licensee to any one else other without the permission of the licensee. Other legal matters need to be taken into considerations are: firstly the level of legal protection under the legal system of the country where the transferee is; secondly the compliance with applicable laws especially those that prohibit the transfer of certain kind of technology to certain countries.

Transfer of technology across national borders is controlled mainly for security and economic reasons. There is no internationally binding treaty that requires or restricts the transfer of space technology. However, several international efforts to control the proliferation of space technology, weapons and missiles had resulted in the adoption of international policy guidelines or understandings, like the Missile Technology Control Regime (MTCR) and the Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies (the Wassenaar Arrangement). The MTCR was adopted on 16 April 1987 by the G7 countries (Canada, West Germany, France, Italy, Japan, the UK, and the US) for the purposes of coordinating their respective national regulations directed at the control of proliferation of missile technology.<sup>182</sup> The term “missile” includes

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<sup>182</sup> For details, see “Missile Technology Control Regime (MTCR) Questions and Answers,” available at <http://www.state.gov/t/np/rls/fs/27517.htm> (accessed: 6 June 2006). Argentina (1993), Australia (1990), Austria (1991), Belgium (1990), Brazil (1995), Canada (1987), Czech Republic (1998), Denmark (1990), Finland (1991), France (1987), Germany (1987), Greece (1992), Hungary (1993), Iceland (1993), Ireland (1992), Italy (1987), Japan (1987), Luxembourg (1990), Netherlands (1990), New Zealand (1991), Norway (1990), Poland (1998), Portugal (1992), Republic of Korea (2001), Russian Federation (1995), South Africa (1995), Spain (1990), Sweden (1991), Switzerland (1992), Turkey (1997), Ukraine (1998), United Kingdom (1987), and United States of

ballistic missiles, space launch vehicles, and sounding rockets. The MTCR, currently subscribed by 33 States, attempts to restrict the export of missile systems, and related technology, capable of carrying a 500 kilogram payload at least 300 kilometers, as well as systems intended for the delivery of weapons. The Wassenaar Arrangement was agreed upon in 1996 to deny the trade in dangerous arms and dual-use goods and technologies to regions and States that are perceived to pose security threats.<sup>183</sup> Forty participating countries<sup>184</sup> share a common control list and a common set of objectives, but each implements its control list and objectives independently.

Therefore, controls or barriers to transfer of space technology are imposed by States at national level. The most important example of such restrictions is the US Arms Control Act and Export Control Act, and specifically the regulations, known as the International Traffic in Arms Regulations (ITAR's) that have been adopted pursuant to the Arms Control Act.<sup>185</sup> Some Wassenaar items are included in the US Commerce Control List;<sup>186</sup> the remainder are included in the US Munitions List.<sup>187</sup> Those items included in the US Commerce Control List are subject to US national security controls. From the US government perspective, the rationale for the imposition of such regulatory mechanisms is the control of proliferation of arms and sensitive technologies; e.g. the Wassenaar Arrangement "is designed to prevent destabilizing accumulations of arms and dual-use goods and technologies."<sup>188</sup> The US Export Administration Act, whose provisions have been elaborated in the US Export Administration Regulations through which the US Office of Export Licensing exercises control of the re-export of the goods and technologies of the US origin.<sup>189</sup>

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America (1987).

<sup>183</sup> For details, visit the official website of the Wassenaar Arrangement at <<http://www.wassenaar.org/>>

For the US perspective on the Arrangement, see Department of State website <<http://www.state.gov/t/isn/rls/fs/2001/5285.htm>> (date accessed: 3 June 2006).

<sup>184</sup> Argentina, [Australia](#), [Austria](#), [Belgium](#), [Bulgaria](#), [Canada](#), [Croatia](#), [Czech Republic](#), [Denmark](#), [Estonia](#), [Finland](#), [France](#), [Germany](#), [Greece](#), [Hungary](#), [Ireland](#), [Italy](#), [Japan](#), [Latvia](#), [Lithuania](#), [Luxembourg](#), [Malta](#), [Netherlands](#), [New Zealand](#), [Norway](#), [Poland](#), [Portugal](#), [Republic of Korea](#), [Romania](#), [Russian Federation](#), [Slovakia](#), [Slovenia](#), [South Africa](#), [Spain](#), [Sweden](#), [Switzerland](#), [Turkey](#), [Ukraine](#), [United Kingdom](#).

<sup>185</sup> CFR Title 22, § 120.29 Missile Technology Control Regime. For a detailed analysis, see Ram Jakhu and Joseph Wilson, "The New United States Export Control Regime: Its Impact on the Communications Satellite Industry" (2000) XXV Ann. Air & Sp. L 157 *et seq.*

<sup>186</sup> Export Administration Regulations, 15 C.F.R. Special Reporting, Part 743, §743.1, part 774, Supplement No. 1.

<sup>187</sup> International Traffic in Arms Regulations, 22 C.F.R. sec. 121.1.

<sup>188</sup> Department of State online: <<http://www.state.gov/t/isn/rls/fs/2001/5285.htm>> (date accessed: 1 June 2006).

<sup>189</sup> Section 774.1 of the Regulations provides that:

While the US laws are the most extensive ones, similar laws exist in almost all West European countries. Thrust of these laws is that they prohibit and in certain cases restrict the sale of goods and transfer of technology to certain countries. There are a number of lists enumerating the prohibited or restricted goods and technology, and satellites and launch vehicles and their subsystems are invariably on these lists. In practical terms, when a company from these countries wants to transfer technology related to these items, it needs a special export license from an officially designated authority. Generally, it is a very cumbersome procedure because a number of ministries or government offices may be involved in the assessment of that license application; e.g. ministry of foreign affairs, ministry of defense, ministry dealing with international trade, etc. The rigidity and the manner in which the ITAR's are implemented have become a serious impediment in the conduct of global space business not only by the American private companies but also foreign entities. A recent study by the International Space Business Council on the *2005 State of the Space Industry* cites the "US export regulations under ITAR 'the industry's most serious issue' and states, 'what initially was a nuisance to businesses has evolved into a serious problem for US industry.'"<sup>190</sup> It is therefore obvious that to encourage the use of space technology by private entities of various States, national export control regulations might need to be relaxed to a maximum possible extent.

## Conclusion

This brief analysis of the current international legal regime shows that the often cited regulatory barriers, such as the licensing requirement, the "common heritage of mankind" concept and protection of intellectual property rights are not any real and serious obstacles to economic and commercial exploitation and development of outer space resources by private entities.

We witness that governments around the world are opening the space industry for private investment. Various space application sectors witnessed significant

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"Unless the reexport of commodity previously exported from the United States has been specifically authorised in writing by the Office of Export Licensing prior to its export.... no person in a foreign country (including Canada) or in the United States may a) reexport such commodity directly or indirectly, in whole or in part, from the authorised countries..."

"Parts, components, materials, or other commodities from the United States and incorporated abroad into a manufactured or produced foreign product are subject to US export controls" (Sec. 774.12). Only if the US content value is both 10% and less than \$10,000 or less, they may be exempted from control.

<sup>190</sup> "Space & Satellite Market Surpasses \$103B, To Reach \$158B By 2010," Bethesda MD (SPX) (Aug 10, 2005), online: <<http://www.spacedaily.com/news/industry-05zg.html>> (date accessed: 10 August 2005).

developments with the active involvement of the private sector. Commercialization appears to be a natural sequel to the initial phase of space exploration of space resources. This process will bring efficiency in operation and will encourage effective use of space systems; thus is likely to lead to a reduction in the government subsidies and the burden on the taxpayers. Although there is a fair level of confidence in the potential of commercial uses of space, governments need to place a growing emphasis on encouraging private sector's involvement in the exploration and use of space resources.

“Comments of a Tyrolean Mountain Peasant on  
the Outer Space Treaty and Private Property -  
‘Closed Space’ vs. ‘Open Space’”  
by Klaus P. Heiss  
(High Frontier Washington DC)

-

power point presentation

Comments of a Tyrolean Mountain Peasant on  
the  
Outer Space Treaty and Private Property

“Closed Space” vs. “Open Space”

Klaus P. Heiss  
Executive Director  
High Frontier Washington DC

IASL-IISL International Workshop  
June 28<sup>th</sup> 2006

June 28<sup>th</sup> 2006

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Logos at the bottom include: SEKUR, INMECCANICA, Alenia, telespazio, INAF, ENEA, and others.

## Basic Points

- Create Laws to ENABLE economic/market activities – not prohibit them
- Broaden the “Zero Sum” Mentality of Space Law to “Positive Sum” Doctrines
- The Crucial Role of Private Property
- The Jamestown Approach of 1607 as a useful precedent

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## From Zero Sum Thinking to Positive Sum Thinking

- Pareto Optimality
- Two Irreconcilable Concepts of Equity
  - Everybody according to their needs
  - Everybody according to their contribution
- Theory of Games
  - Positive Sum vs. Zero Sum Thinking
  - Shapley Value(s)
- Markets as determinants: Resources not used are “useless”

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## Apparent Contradictions to be resolved

- “Contributions” vs. “Benefits”
  - US contributed \$500+ Billion and will contribute another \$500+ Billion in next decades
  - Liechtenstein has contributed \$100,000.-
  - Good Precedent: Intelsat, Inmarsat – based on contributions and uses!
- To claim “Property” / Apply “Law” needed:
  - Delineated Territory
  - Settlement (Population)
  - Use / Control

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## Property Fundamental to the Origin of Law

- The Code of Manu (allegedly 3,000 BC)
- The Code of Hammurabi (1780 BC)
- Roman Law (Cicero, 100's BC)
- Tyrolean Freedoms and Homestead Rights (1342 AD)
- The Company of Virginia and Jamestown (1606)
- Declaration of Rights of Virginia (1775)
- The Austrian School and Chicago (1920's to 1950's)

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## Property Rights and Homesteading Precede “National Sovereignty”

- National Sovereignty is a rather **recent construct**: it was generated in the fog of the French Revolution.
- Before then **all property was private** (by persons) or Companies (groups of persons) or since the institution of celibacy the Church.
- Homesteading is at the very root of property rights, the rise of agriculture, law and civilization
- Conflicts do arise in the transition from Nomadic societies to agricultural ones – see Darfur today.

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## OST, Property and Homesteading: Article I

- **Article I**
  - The **exploration and use** of outer space, including the moon and other celestial bodies, shall be carried out for **the benefit and in the interests of all countries**, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.
  - Outer space, including the moon and other celestial bodies, **shall be free for exploration and use** by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and **there shall be free access to all areas of celestial bodies.**
- Comments:**
- Exploration and Use for all countries **REQUIRES** private property as proven by history;
  - Private property shall be assured to **citizens of all countries** under Article I
  - “shall be free for exploration and use” **warrants exactly such private access and property**
  - “there shall be free access to all areas of celestial bodies” seems to imply an obligation by one and all Space faring nations **to provide such free access to private enterprise and property**

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## OST, Property and Homesteading: Article II

### Article II

- Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.

### Comment

- National appropriations are excluded
- Yet Article I demands the beneficial exploration and uses of celestial resources
- Since nations are prohibited hereunder to do so, clearly private persons are the only possible actors/proprietors: who else – the Martians?

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## Well established historical Principles for Claims of Property

### “FIXED ASSETS”

- Physical Control
- Active Use
- In case of Land Resources: Human presence and use
- With Homesteads: minimum/maximum land claims
- Squatting Rights

### “MOBILE ASSETS”

- Physical capture & control (fish, prey, nodules)
- Ability to move to market (use)

Claims “in the abstract” are null and void

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## “Outer Space Treaty” & “Rules of the Road”

- **Outer Space Treaty**

- Basic Flaw: “Zero Sum Thinking”
- Outlaws ‘National Sovereignty’ to all celestial bodies – including other Galaxies ...
- But not Private Property or Homesteading
- “Free Access for one and all”
- Outlaws Weapons of Mass Destruction (Nuclear)
- “Benefit of Mankind”: My Profit is Mankind’s Benefit?!

- **Rules of the Road**

- Private Property
- Homesteading
- Based on Use (IntelSat Model)
- Condominium Rules
- Freedom of Navigation
- Sea/Air Travel Legal/ Litigation Regime

- **Historical Precedent:**

- Private Property precedes National Sovereignty (a “1789” concept)
- No Damage Caused – No Say
- **“Positive Sum Thinking”**

Warranted: A “Declaration of Space Rights” Williamsburg 1775

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## A Comsat/Intelsat Approach toward an ISS-Lunar Condominium?

- **Pro Forma Private Placement Memoranda**

- technologies, potential applications in Space
- pro forma financial commitments
- exclusive rights by PPM Groups
- additive cost access rights

- **“Declaration of Space Rights”**

- Homesteading
- Property Rights
- “Fishing Rights” (Asteroids)

In all cases **physical control, active use** and , for land ownership, **human presence** required.

- **“Rules of the Road”**

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## Prohibition of Private Property: calamity of the 20<sup>th</sup> century

- **Soviet Land Expropriation** in the 20's and 30' killed tens of millions
- Pol Pot Land Communization killed millions more
- **Mao's "Collectivization"** in the 1960's killed possibly up to 100 million
- In **Darfur Nomads** are likely causing genocide: applying the OST there would seem to take the side of the Janjaweed.

**No Property – No Use: When will we ever learn?**

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## Prohibition of Private Property in Space: 1984

- NOT by the Outer Space Treaty but the US
- US ONLY country – to my knowledge – to actually OUTLAW private rights in Space:
  - The 1984 "Landsat Commercialization Act" – Title IV
    - To prevent European (German) / US (COMSAT) and Private Group to provide world-wide Remote Sensing Data
    - ABC brought Constitutional challenge to this Law
    - Since revoked/modified

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## ITAR: A “State Property” Technology Apartheid in Space?

- Private Property Rights contradict “National Ownership”
- Under US Constitution: all Rights of the Federal Government are derivative of Rights ceded by the People (States)
- People are not the Property of States or Nations: Slavery in the US was abolished in the 1860's
- Private Property: the basis of Academic Freedom

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## Conclusion

Nothing in the Outer Space Treaty states or implies, directly or indirectly, the prohibition of private property.

Quite to the contrary: Article IV explicitly states that the rights of peaceful use even for military personnel shall NOT be prohibited.

**OPEN SPACE: Private Property is FUNDAMENTAL to the economic exploration and uses of Space – starting with the Moon**

**CLOSED SPACE: Without Private Property Space will remain unused and be left to the MONOPOLY of one or a few “Space Monopolies”**

**Q.E.D.**

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## OST, Property and Homesteading: Article IV

- ...The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment or facility necessary for peaceful exploration of the moon and other celestial bodies shall also not be prohibited.
- Not only does this article **EXPLICITELY** allow the use of any equipment or facility for peaceful purposes, but allows even military personnel to do so!

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## OST, Property and Homesteading: Article VI

- States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the moon and other celestial bodies ...for assuring that national activities are carried out **in conformity with the provisions set forth in the present Treaty**
- Article I implores **the exploration and uses of the Moon and Celestial bodies** and assures **free access** to one and all for the exploration and use of these bodies;
- Article II **disallows National Sovereignty** – but NOT private property;
- Article IV assures **private AND military persons any and all peaceful uses of facilities and equipment!**
- Thus Article VI applies **STRICTLY** only to the provisions **“AS STATED”**

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## The “Virginia Company” 1606

- In June of 1606, King James I granted a charter to a group of London entrepreneurs, the Virginia Company, to establish a satellite English settlement in the Chesapeake region of North America.
- By December, 108 settlers sailed from London instructed to settle Virginia, find gold and a water route to the Orient.

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## Jamestown - 1607 First Representative Assembly - 1619

- **On May 14, 1607**, the Virginia Company explorers landed on Jamestown Island, to establish the Virginia English colony on the banks of the James River 60 miles from the mouth of the Chesapeake Bay
- **The first representative assembly** in the New World convened in the Jamestown church on July 30, 1619. The General Assembly met in response to orders from the Virginia Company "to establish one equal and uniform government over all Virginia" which would provide "just laws for the happy guiding and governing of the people there inhabiting".

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## Jamestown on the Moon: Gate to Self-sustaining Space Enterprise

- **US Government:**
- **Current NASA Budget**
  - Projections through 2020
  - Strong 2020 – 2030 Lunar Program as outlined
  - Space Transportation and Ports Infrastructure for:
    - CELSS, Robotics, ISRU, Energy Options, Observations, Cis-Lunar Operations
- **Private&International Investments:**
  - CELSS,
  - Robotics,
  - ISRU,
  - Energy Options,
  - Observations,
  - Cis-Lunar Operations
  - Tele-Medicine
  - Tele-Operations
- **Space Port to Destinations beyond**

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## Jamestown on the Moon 2015-2030

- **Put the Money where the opportunities are**
  - for US taxpayers
  - strategic interests
- **Maximize Industry and International Participation from Start (\$10 B+)**
- **Create New Organizations and Market Mechanisms to Implement Space Exploration Program**
- **Private Sector Participation ESSENTIAL for Space Exploration**

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## Jamestown Group Prospective PPMs

- Looking at Earth
    - Earth's Resources and Environs
    - Sun-Earth Weather Interactions & Predictions
  - Cis-Lunar Communications Infrastructure
    - Communications Gateway "Moon"
    - Secure Data Bases and Archives
  - 1GWe+ Energy: Nuclear, Solar
  - Fuel-less Space Transportation Systems
  - Habitats and CELSS
- 

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## Precedent(s)

- ComSat – IntelSat
  - InmarSat
  - GPS
  - Iridium/Brilliant Pebbles
  - "on-board" Commercial Routers
  - SpaceTran (Green Orbiter, Titans)
  - SPARX Remote Sensing Venture (1983/4)
- 

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## US History

- The Virginia Declaration of Rights 1775/6
  - That all men are by nature equally free and independent, and have certain inherent rights ... namely, the enjoyment of life and liberty, with the means of acquiring and possessing property, and pursuing and obtaining happiness and safety

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## US HISTORY (cont.)

- The Homestead Act - Creating Prosperity in America - 1862
  - The free homestead law has been called the most important act for the welfare of the people ever passed in the United States

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## The Homestead Act (1862)

- In 1852 a political group, called the Free Soil party, demanded free homesteads for the people. In 1854 the first free [homestead bill](#) was introduced in Congress by Congressman Galusha A. Grow of Pennsylvania. The people of the [West](#) and poor people everywhere were in favor of the bill; however, there was strong opposition to the bill.



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## Jamestown on the Moon – 2030: Trullis, Alpine Huts and Igloos



It was not until May 20, 1862, that the free [Homestead Act](#) was finally passed and signed by President Abraham Lincoln. The law took effect on January 1, 1863.

Under this law any man or woman twenty-one years old or the head of a family could have 160 acres of undeveloped land by living on it five years and paying eighteen dollars in fees. They were also required to live on the land, build a home, make improvements and farm the land before they could own it outright. Alternatively, the homesteader could purchase the land for \$1.25 per acre after having lived on the land for six months.



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## Establishing Property Rules in Space within OST

- By Sovereigns (Signatory Nations)
- By Groups of Signatory Nations such as the ISS Group of Nations
- By Precedent following successful models of past exploration and economic development – see e.g. the **Virginia Declaration of Rights of 1775** and **US Homesteading Acts**

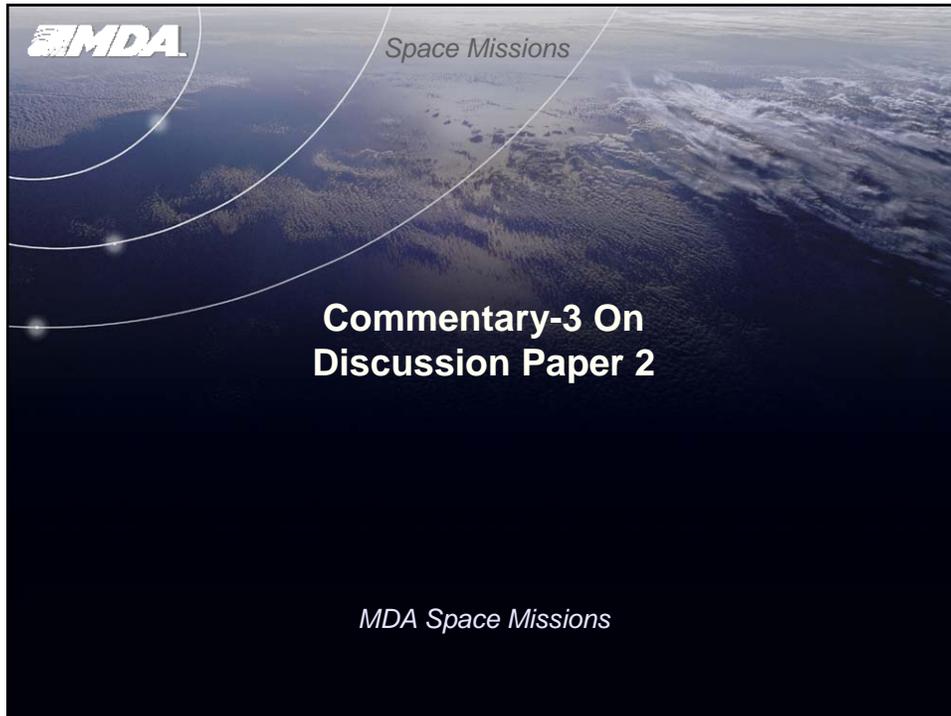


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“Commentary on the Discussion Paper”  
by  
Nadeem Ghafoor  
(MDA Corporation, Canada)  
–  
power point presentation





## Requirements for private sector interest *(extract from Discussion Paper)*

1. **Market**
2. **Payback time**
3. **Access cost of LV, transport**
  - *(demos & early stage extraction)*
4. **Technology readiness / availability**
  - *(for participants in current exploration programs)*
5. **Risks / insurance**
6. **Legal protection**
  - *(e.g. property (real & intellectual), resource beneficiation)*



## Technology readiness: Canadian industry view

- Remote prospecting
- Autonomous landing & GNC
- In-situ prospecting & characterisation
- Mobility / rovers
- Surface / subsurface acquisition & extraction *(demo level)*
- Autonomous space rendezvous / servicing
- Autonomous space assembly
- Space-based manufacture *(demo level)*
- Mission & Ground Segment

### Government

- Tech development
  - R&D
  - Mission participation
- Science & resource / environment characterisation
- Incentives / prizes
- Legislative / regulatory framework
  - Public interest & safety
  - Reduce risk of conflict

### Private

- Implementation / operations
- Non-critical services
  - Tourism?
  - Precious resource mining?

### PPP

- Critical space-based public services?
  - space resources
  - space-based energy
  - planet protection

- Challenge 1
  - Property rights - Developers have a right to expect that others will respect the infrastructure they have established
  - A clear need exists for legal framework, not only to encourage commercial investment but also mitigate conflict etc.
  - A challenge exists in establishing the necessary regulatory framework, to do so responsibly whilst respecting public interests, safety / environment and moral obligations wrt CHM (esp. developing nations)
- Challenge 2
  - An onus exists for countries with an interest in participation to express this interest
  - Perhaps a duty also exists to ensure that this opportunity is communicated

- There is a genuine imperative to begin addressing the legislative and regulatory issues now
- Government obligations to bring benefits of space to the public. From a technology perspective:
  - R&D --> mission participation --> commercial adoption
- Meeting the challenge of a legal framework that facilitates trend towards commercial exploration, that also meets moral obligations (safety, environment, fairness, CHM) will take time

## Comments on the Session 2's Discussion Paper

by

*Leslie Tennen*

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Congratulations again on the successful Workshop, and thank you for providing Patricia and myself with the opportunity to participate. We greatly enjoyed your hospitality, and seeing so many friends and colleagues.

I read your paper with great interest, and as promised to Ram, offer some comments. Let me state at the outset that I agree with many of your core conclusions. For example, there is not just one critical path to the commercialization of space; that the Moon Agreement encourages private enterprise, and that the private sector will be a part of the negotiations for any future international legal regime, which may or may not be the same as the "international regime" of the Moon Agreement; and that many of the perceived problems are overstated. We may, however, be in the minority on some of these points.

I also agree that the entry and operation of private entities are exclusively determined by national policies, laws and regulations. I would go somewhat further, however, and suggest that the states have wide latitude in enacting and implementing these policies, laws and regulations, with the limitations coming from perceived national self interest and international law. Insofar as the latter is concerned, most of the applicable limitations derive from the space treaties, especially the Outer Space Treaty. Thus, states must ensure that the entities they license will conduct the activities in space in conformity with the space treaties. In particular, Patty and I have argued that some of the essential elements include the non-appropriation provision, non-interference with the activities of other states/licensed entities, and the right of visitation. Within these parameters, together with international liability for damages and national security and other self interests, the state can create any kind of licensing regime it desires, and implement any policies consistent with the foregoing.

Therefore, I must take some issue with the discussion of Dinkins' scenario of finding water and having others move in - claim jumping in space if you will. Dinkins fails to consider the requirement of state authorization and continuing supervision. Assume that a private entity finds water and establishes a facility for extraction and use of the resource. Dinkins' fear of a claim jumper is unfounded. A potential claim jumper can come from four basic sources: the state of licensing; a second state; a second private entity from the same state that

licensed the discover/developer of the resource; or a private entity from a second state. With regard to a state as a claim jumper, it is unlikely that the licensing state would undertake a mission to interfere with its licensed entity. If there was a problem with the licensed entity, there are far more cost effective and efficient means of dealing with violations of a license on earth than launching a mission to a celestial body. If a second state conducted a mission which could cause interference with the operation of the private facility, such interference would be a violation of article IX of the Outer Space Treaty, and diplomatic consultations would be required to seek a resolution. If a second state was bound and determined to interfere with another entity's facility, whether public or private, there would be much bigger problems politically between the two states that would require more than just space law to resolve.

These political problems may not be present if the potential interference came from a private entity licensed by a second state. In such an event, the consultations of the Outer Space Treaty may prove sufficient to resolve the problem, in advance of any actual physical interference. Finally, it is unlikely that the potential interference would come from a second private entity licensed by the same state as the discoverer/developer. The disclosure of an intention to cause interference on a license application would be grounds for denial, or at the very least litigation instituted by the discoverer/developer. Interference on site would be a violation of a license and grounds for revocation and other sanction by the state, as at the very least it would appear to be a violation of the peaceful purposes provision of the Outer Space Treaty.

There is very little chance that interference could come from a rogue private entity. Space ventures are expensive and take planning, and no private entity has the technological capability, yet, to conduct a space mission completely in house.

I must also comment on your references and citations to Wayne White. My concern is that the statements you cited were taken somewhat out of context, and as a result, your paper appears to cite his approach with approval, when his fundamental premise is directly contrary to your conclusions.

Specifically, you state at text and notes 116 et seq., and I fully agree, that private entities cannot violate article II of the Outer Space Treaty. But Wayne's entire premise is that article II does not prohibit "private appropriation," and he then proceeds to transport traditional real property concepts to extraterrestrial development. So when he advocates the institution of a regime of real property rights, and that investors need to be protected, as you cite at notes 72 and 73, he is not speaking in the same sense as the focus of the workshop on "enterprise rights," but rather is seeking a legal rationale to be able to sell fee simple lots,

horizontal property regimes, etc. Your paper did not seem to advocate for such a position.

As I mentioned during the workshop, much of the debate appears to be semantic, and the term enterprise rights may be more accurate than the nomenclature of property rights. That however, is a topic for another day.

My last comment concerns your reference to auctions at text and notes 80 and 81. Ram, you may recall during the AAS conference in Scottsdale that there was a discussion of auctions. I have long opposed auctions for many reasons, including that they are inherently anticompetitive and monopolistic, that they inhibit the entry into the market of smaller entities, and that they are simply a revenue producing vehicle for the government at the expense of the abandonment of the primary purpose of promoting the best use of limited resources.

## Rapporteur's Notes for Session 2: The Role of Private Actors

(Report by Frans von der Dunk, IIASL, Leiden University, The Netherlands)

1. Whether public or private, in the last resort all funds come from people's pockets, people paying taxes to governments & buying products & services from private entities...
2. Part 1. Economic potential space natural resources: esp. as new energy sources (for space missions) & construction material (for permanent space bases)
3. General indicative impression: costs not insurmountable for direct private participation in lunar exploitation activities to take off
4. Part 2. Developing the field: potential players & scenarios: since 70's IGO's, as per the 90's increasing private involvement
5. Who is better placed to handle risks & carry cost burdens...? Exclusively governmental actors? Private sector, as in certain space applications? PPP's?
6. Part 3. Legal implications & regulatory issues participation private entities: treaties written with (only) states in mind - & states will, for the time being, remain the main actors, as well as scope etc. of private participation in space activities
7. States (hence) should regulate: freedom of exploration & use in principle only applies to states, for private actors this depends upon their national state → state responsibility & state liability (not a bad thing for private entities!) → private space activities should be licensed by appropriate states (like the use of frequencies by private operators!); also here: only rigid licensing regimes would be burden for private operators
8. Property rights: impediments only in the area of owning 'real estate' (cf. Art. II OST discussion), but these should be considered marginal - property rights over resources once extracted & transparent regime for rights to exploitation are much more crucial to feasible, efficient & fair private exploitation]
9. Ref. top p. 21: appropriate Protocol to OST for solving interpretation "appropriate State"; is perhaps not politically feasible - in view of little chance of being adopted - & in view of risks *vis-à-vis* OST
10. Claims Art. 11(5), MA, imposes moratorium
11. Exploration, use & exploitation close enough to worry about - International Lunar Observatory (ILO) is one case study
12. "Closed space *versus* open space": the former, when only a few are allowed to go there (monopolising, i.e. excluding private entities)
13. Wants to create laws to enable economic & market activities, not prohibit them - unless one can prove damage

14. Considers, amongst requirements for private sector interests, legal issues the only 'red' light; risks & insurance is 'orange', rest is 'green' (market; payback time; access-to-space costs; technology readiness & availability)
15. As to property rights: developers have the right to expect others to respect their infrastructure & other investments; clear need for legal framework not only to encourage commercial investment but also mitigate conflicts; also include respect for public interests, safety, environment & moral obligations.