

## BENEFIT SHARING: THE MUNICIPAL MODEL

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### Abstract

The principle of benefit sharing from usage of space resources is well settled space policy. The "benefit of mankind" is part of Article I of the Outer Space Treaty of 1967. The "Common Heritage of Mankind" was introduced in the Moon Agreement of 1979 and may be defined in the UN Convention on the Law of the Sea, 1982. The concept is not only established, it is also praiseworthy. It is asserted that administration of this policy must be accomplished by an agency like a trustee of the resources for the benefit of all. Administration by individual nations and/or by the UN may not be appropriate, nor legally adequate. A municipal authority like the Lunar Economic Development Authority, Inc. (LEDA), which can provide site specific allocations to the space venue developers on a professional and completely independent basis, is recommended. An analogy is made to the town of Castle Rock, Colorado. The policy basis for this municipal undertaking is stronger than that of national and international UN administration; there is less chance of discrimination; sharing is based on recourse to space resources; there is no recourse to national

treasuries; and a relevant space governance paradigm is enabled with the proposal.

### Administration by the Courts

The legal basis for benefit sharing as a principle of international space law is well established. It is a part of the Outer Space Treaty of 1967, our constitution for space regulation.<sup>1</sup> It was part of a UN General Assembly Resolution before that.<sup>2</sup> It appears in later treaties, resolutions, and international agreements, notably the Moon Treaty of 1979 under the concept of Common Heritage of Mankind.<sup>3</sup> This last treaty may or may not have failed, but the UN continues to advance the concept as a universal treaty burden and integral part of *Corpus Juris Spatialis* as a lien on the appropriate percentage of manufactured goods using space resources.<sup>4</sup>

It has been asserted that the treaty burden is not self-executing because the wording is too general and no legally enforceable standards can be applied to it.<sup>5</sup> The Moon Treaty has been cited as the problem that ended an era by bringing to a halt the viability of the UN process of generating treaties for the

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peaceful use of outer space.<sup>6</sup> No space treaties have been passed by consensus or otherwise since then.

The satellite industry has incorporated a form of benefit sharing into its mosaic of doing business in LEO (low earth orbit). The treaty burdens of international cooperation, resource non-appropriation, and benefit sharing of profits were accommodated by allowing nations to participate as shareholders and directors.<sup>7</sup> This brand of satisfaction is now a standard for performance in the communication satellite industry. No court cases have been decided and none are expected because the entire concept of benefit sharing is probably not self-executing, although this is untested in any court.<sup>8</sup>

The underlying problem is a cloud on every nation's general fund. If the International Court of Justice in a future case decides that the Article I treaty provisions of the 1967 treaty are self-executing, or that the "Common Heritage of Mankind" phrase in the 1979 treaty is binding, and that the satellite industry has not demonstrated any substantial compliance, an adverse judgment could result. This would be a money judgment against the satellite organizations and, per force of the 1967 treaty, against each sponsoring nation jointly and severally. It would be in favor of all nations, not just the plaintiffs and not just those who signed the 1967 or 1979 treaties.<sup>9</sup> Such a result has no time limit because there is no statute of limitations on such treaty breaches and because usage of the orbits is ongoing and will involve long term future damages as well as past damages.

Continuation of this cloud on title to space business profits is not tolerable. It increases the uncertainty of legal opinions and dampers business

generally. Perhaps the worst result is the possibility of litigation forever in the future in almost any court, especially in national courts of Third World countries. A default judgment or consent decree among selected nations would threaten national treasuries worldwide. Any judgment amount would be immense and could be collected worldwide. Perhaps the difficulty in enforcing treaty judgments will reduce the value of this cloud. Non-payment of treaty judgments is one of the more difficult, recurring, and structural difficulties with the treaty system as a whole.<sup>10</sup> The value of the benefit sharing treaty burden might be deemed to constitute a general obligation on the general credit of the sponsoring nations in favor of all nations. This could then be supported by a judgment of the International Court of Justice pursuant to an international class action by the UN: the Security Council has no veto over litigation. Such a judgment would result from the treaty burden and be collectible against assets of the defendant nations wherever found. Under this scenario, the fact that the defendant state reserved rights or asserted a different interpretation or enacted contrary domestic legislation is irrelevant. The judgment will rest on international law only and be interpreted by judges. This litigation is inevitable at some future date.

### **Focus on Space Resources**

The legal impediments notwithstanding, space resources will be utilized. The orbits around earth are already so crowded that frequency allocations are hotly contested and in need of more and better regulation. The International Telecommunications Union Regime is now supplemented by a parallel paradigm within the USA, the Federal

Communication Commission. This is a convenient supplement to UN auspices but it was born out of real need.<sup>11</sup>

Benefit sharing as a treaty burden is not a decreed accomplishment in the communication satellite industry. In fact, the compliance as defined may be more nominal than substantial: there is no "actual sharing" as contemplated by the 1982 UN Agreement on the Law of the Sea and its definition of "Common Heritage." Instead, a version of financial international cooperation by allowing nations to invest capital in satellite organizations and receive future dividends and societal benefits is the stated mode of compliance.<sup>12</sup> Is this going to satisfy the Third World when all orbits and all frequencies are gone to others? There is a litigation risk that it will not.

Physical space resources will be used up as well. When the parade to space starts, when access becomes more economical, and when the challenge to participate and the fear of losing out is heightened, a rush of space developers may emerge: the Moon will be settled and developed quickly. The space science and technology community has already advocated the liberal usage of space resources in such a migration.<sup>13</sup> Therefore, the administration of benefit sharing must focus on the resources and how they are allocated well before the developers arrive. Otherwise, physical resources may soon be compromised, perhaps lost forever, before the non-spacefaring nations and humankind can enjoy the benefits promised to them since 1967.

The experience gained in the satellite industry is important. Frequency bands and relevant orbits have become scarce. Benefit sharing was not based on resource allocations. Management of

space debris was neglected. Administration of benefit sharing was far too informal and voluntary. This aspect needs to be corrected for physical space resources particularly at the Moon, our next obvious target.<sup>14</sup>

### Individual State Administration of the Benefit Sharing Treaty Burden

Benefit sharing as a treaty burden may not be self-executing. The general principle sounds more like a sermon than a law.<sup>15</sup> Therefore, in order for individual states to administer a formula for space resource allocations and benefit sharing burdens, each will need to adopt domestic legislation declaring what its policy will be and then enter into another international agreement as to which states it will extend that policy to in space, under what conditions, and in respect to which space resources at what venue. The combinations of incongruous and contradictory results may be very large. The weight of translating the nation to nation treaty system into an effective *Corpus Juris Spatialis* may be so heavy that it jeopardizes the entire concept.<sup>16</sup> As the more venue specific body of law called astro law develops, these treaty burdens may also become less important, if not irrelevant.

Sovereign states may impose self-interest on top of the benefit sharing principle. For example, one may require satisfaction in kind in some part, thus requiring that part of the space resource be allocated to it here on Earth. Non-spacefaring nations may also require a cash up front payment as a fee to negotiate the treaty burden because it will have expenses. A nation may claim a royalty on gross revenues, much like in

the tradition of the worldwide mining industry. Another nation may call for a lump sum settlement of its claims. Yet another nation may desire a capitalized life of the project royalty amount to be paid up front. The point is that the legal principle does not contain any measurable restraint on the beneficiary nations' desire for benefits.

If one nation tried to administer benefit sharing for all nations, it would run the risk of improperly administering its duties. This is a legally substantial risk since every nation is a beneficiary of benefit sharing so any single nation would have a conflict, or an appearance of conflict, if it assumed the role of trustee or manager. The resulting damages could be substantial. If this nation was also the spacefaring nation that exploited the space resource, that problem would be exacerbated. The ethical and legal analysis of conflict could be a real problem. The benefit sharing administration is like a trustee's function and the law would impose a fiduciary duty. That high level of liability brings with it equitable remedies such as asset tracing, project-wide accounting, injunction, mandamus, and execution. The risks are substantial.

#### **United Nations Administration of the Benefit Sharing Treaty Burden**

The UN may not want to undertake space resource allocation and benefit sharing treaty burden administration. It sponsored the treaty. It adopted the General Assembly Resolution that set up the concept. UNCOPUOS is thought of as our upper legislative house, a senate for outer space. The only executive office likely to

serve in this capacity is the Division of Outer Space Affairs. It may be deemed an agent of the UN which, in turn, is an agent of member states. As a space policy, it may be wise for the UN to remain aloof and act more as a senate.

Furthermore, UN membership does not include all nations.<sup>17</sup> Even those larger spacefaring nations, such as the USA, may not have adequate influence in the UN to effect any kind of plan for space resource management.

A proposal has been made for the creation of new executive offices at the UN for space resource management and space governance generally.<sup>18</sup> The IOSSA could be tailored\* to include a master planning function at least. It has been 17 years since UNCOPUOS has launched a space treaty and none are pending. The committee's working group of the legal subcommittee has proposed a draft resolution for the General Assembly. It deals with international cooperation and benefits in the interests of all states. However, it does not nominate any UN office to administer these benefit sharing treaty burdens. It is unlikely the UN will seek executive authority in this particular because individual states have not spoken on the subject, there are no consensus standards, and its own authority is unclear in the face of substantial liability for misadministration.

#### **The Municipal Model for Administering Benefit Sharing Treaty Burdens**

The municipal model refers to a direct governance entity administration of space resources at their *in situ* venue. This may be a unique application but the model itself is widely trusted and may be considered traditional.

## Castle Rock, Colorado

My home town, much like yours, benefit shares each time a developer applies for approval of project plans. Castle Rock, Colorado, has a municipal ordinance that requires 10% of the land be dedicated for schools, police, and such; 20% for parks; and 10% for buffer zones which require approved landscaping. Another 20% is allocated for open space although this percentage may overlap into some of the other areas. The town council approves the developments after recommendation by a professional staff having completed a process of several layers of reviews. A planning commission hearing is always a challenge and the water certification is a basic first step in the process. However, when the council does approve the development, permits issue, licenses and inspections follow, and legal certainty attaches. The town council is comprised of citizens, the staff is made up of professional persons, and the town is enabled under Colorado State Law. It has a court system and also a mayor. Many towns predate the state and county and their national governments and they still fit into this model functionally.

Our town is financed 5% from property taxes, 35% from a sales tax, 35% from state and federal sources, and 25% from utility use fees. The residents *qua* residents only account for 50% of this budget: 5% from property tax, 20% from sales tax (because the other 15% comes from tourists), and 25% from utility fees. In contrast, all of the budget is expended on Castle Rock business for the benefit of current and future residents, to be shared in common by all people who utilize the town.

Another interesting feature of this municipal model is that the town is

subject to State of Colorado development laws and to a Douglas County Master Plan for real estate in its region; but, otherwise it is exclusively in charge. The USA and the UN are not. It is almost universally a practice that municipal governments control zoning and building and real estate development.

## Benefit Sharing in Space

Many adjustments to this model will be necessary in space. For example, a larger consensus on a master plan for space and for each space venue should be developed either in advance or as we go project by project. The town council, so to speak, should be reflective of the world citizenry and our space industries. The staff might need to have a specialized space background. However, these adjustments can be made as we design an appropriate entity to perform the function.

Sources for funding of the governance structure in space may include user fees, rents, and royalties associated with the development of space resources. Moreover, like the Castle Rock model, off-site revenue sources may also be used such as grants and Earth nation contributions. This would sustain the effort until a balance can be achieved with space resource based funding. The budget may be modest until the venue is developed and regulated, no doubt.

A benefit sharing formula, however, can be asserted and implemented in advance. Conceivably, half of the space resources may be set aside. This is consistent with the Castle Rock ordinances and it approximates the maximum burden permitted by municipalities generally in our societies. Developers of space resources should be

able to count on having half of the properties for their private property uses, however complicated that may be in outer space.<sup>19</sup>

The application of the reserved half may be complicated, but not something to prevent development proposals from coming forward. In other words, we can work on how to apply the public half of these resources while the rest of the world and our space industrialists propose what they want, and how they want to develop space. The tandem evolution may lead to a synergy.

The suggestion of a liberal 50:50 ratio of public and private (perhaps "non-public benefit shared property" is better terminology) is based on the idea that the treaty burden could not be interpreted to be any more than that. Fifty percent is far higher than the typical public mineral rights royalty, which usually run 2-25%, and it approximates the usual municipal burdens on developed land in a city. The 101 nations that ratified the Outer Space Treaty of 1967 are almost all free enterprise democracies which rely on a free economy and a foundation of private property. They are all accustomed to striking a sort of economic equilibrium with their private sectors. Therefore, a burden over 50% would be too high. A formula of less than 50% allocated to public uses may be subject to criticism, on the other hand, as too low because the developer has no direct cost basis in the resource. Humankind, in effect, donated that asset to the project so long as the municipal jurisdiction is effective.

### The LEDA Proposal

The LEDA, Lunar Economic Development Authority, proposal reflects a municipal style entity with special

quasi-public authority. It is proposed by USIS, United Societies in Space, Inc., and tendered to congresses and parliaments worldwide for sponsorship. It is less than a town but more than a space agency for coordinated civilian development of the Moon. It involves a large corporate board of directors with representatives of each participating nation, as well as persons to represent humankind generally. It has executive and judicial branches, as well as authority to raise money. A professional staff will be sought. Its mission is to assume authority of the cislunar venue, plan its logical development, and help finance projects that qualify for that objective.

The host nations for this authority and four others will be participating nations and a Metanation to be formed as a space commonwealth or federation of nations to deal with jurisdiction in outer space. This long range future entity is proposed by USIS and work has already begun on its design and function.<sup>20</sup> It may be operational by 2010 AD according to its sponsor. Viewgraph No. 1 depicts the essential elements of that space governance proposal.

LEDA will move forward with or without Metanation. The host nations of Earth are adequate sponsorship for such an authority, even if fewer than all of them participate. The English Channel Tunnel (called the Chunnel Project) operated in international territory with very few national sponsors. Moreover, note that less than half the nations on Earth have ratified the Outer Space Treaty of 1967; nevertheless, it is commonly referred to as our constitution of space law. Hopefully, LEDA will gain a broad base of consensual and shared legal authority for its important mission for the benefit of all.<sup>21</sup> There is no doubt

that it will effect benefit sharing at the point of development as its mission. Viewgraph No. 2 depicts its structure.

### Risk Management

The municipal model of space resource allocation and benefit sharing administration, whether by LEDA or some similar entity, will tend to limit legal risks. The liberal formula for dedicating half of the resource back to authority for the benefit of all uses up the burden, so to speak. No further burden should be required so the general credit of spacefaring nations will not be threatened. For example, if Lockheed Martin, as a USA licensed space developer, undertook a project on the Moon, perhaps placing oxygen producing plants at the Apollo 17 landing site on the Moon, and it cleared the 50:50 dedication processes at LEDA in order to obtain approval of its project, no greater burden should be asserted against the US Treasury. The project is already encumbered to its reasonable limit in a legal sense. If LEDA gains wide support in the space community, this result would be certain.

Licensed developers such as Lockheed Martin should not object. They recognize that municipal services will be needed at the Moon. The price to be paid may seem high but it now includes a premium benefit not previously available: legal certainty in space development activity. Their contribution will make the Apollo 17 site accessible to all nations as LEDA (or some similar municipal style entity) applies the public benefit sharing funds to ready the premises for others, particularly non-spacefaring nations and all of humankind.

There is significant risk management benefit to the developers favor. It is

assured that some relevant governance infrastructure will grow up at its project's venue. A rising tide of traditional municipal services will have a good effect on its project, give comfort to its investors, and solidify the future for expansion purposes, if desired.

Obviously, the greatest risk reduction accrues to all nations and to future generations of humankind. It is less likely that they will be cheated out of their benefit sharing of lunar based space resources: Improvements will be in place for their usage when they arrive. These may include free oxygen at the Apollo 17 landing site.

### Conclusion

Benefit sharing is a part of space policy and space law. Whether or not it is judicially enforceable is not as important as whether it is a good idea. If it is to be preserved as a policy, its administration must be in good hands and under a reasonable formula. State administration has questionable merit and UN administration may not be appropriate. An independent quasi-public Lunar Economic Development Authority has been proposed. It would effect a municipal style space resource allocation subject to treaty benefit sharing burdens. This functional satisfaction of the burden would reduce the salient risk of litigation and national treasury recourse for space licensee activities off-world. The municipal model also adds to planning, zoning, permitting, regulating, inspecting, and policing the space venue development. A relevant future space governance paradigm would be accommodated accordingly and the Common Heritage of Mankind may be salvaged from almost certain extinction as a good idea but not self-executing as a law.

### Viewgraph No. 1

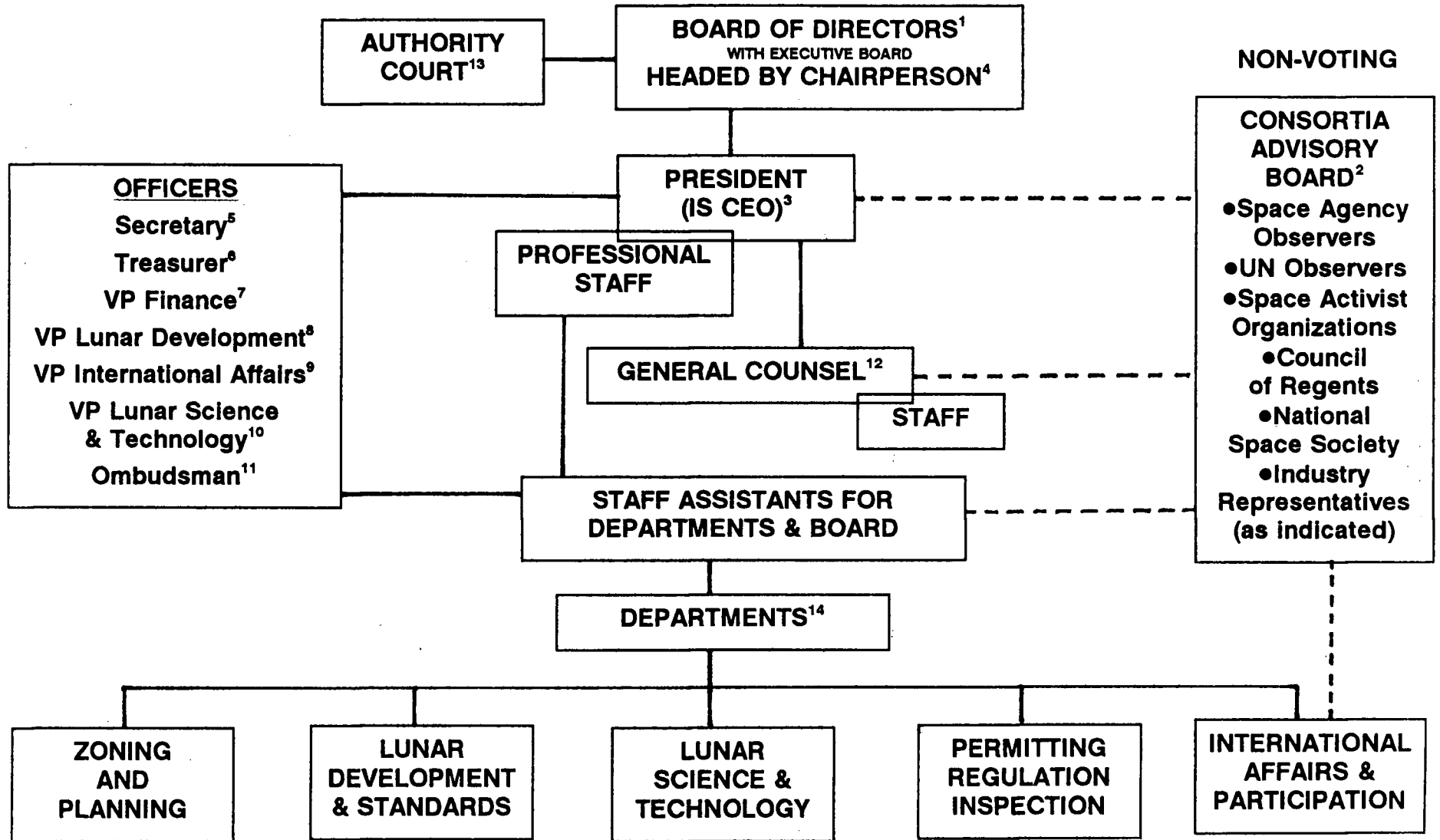
New words to be added to the lexicon on space policy dialogue worldwide:

1. **SPACE METANATION:** An entity to be created for the purpose of managing our space resources and governing the venue known as outer space as trustee for all.
2. **SPACE DEVELOPMENT PLAN:** A comprehensive plan to develop settlements at the moon and Mars and in GEO and LEO from 2010 AD for 100 years using then state of the art technology under Metanation auspices.
3. **SPACE AUTHORITIES:** Five quasi-public corporations to be assigned venue specific municipal planning, zoning, and permitting tasks with ability to raise money and provide funding for qualifying projects at the venues, all under host nation and Metanation auspices. The five authorities indicated are:
  - **LEDA**, Lunar Economic Development Authority
  - **MEDA**, Mars Economic Development Authority
  - **GOODA**, Gerard O'Neill Orbit Development Authority
  - **LPA**, Lunar Port Authority (for SSTOs)
  - **MHA**, Metanation Headquarters Authority (and theme park)
4. **SPACE MONETARY SYSTEM:** The Metanation banking system through a MetaBank of space money to be authorized for use in outer space.
5. **SPACE COMMON LAW:** A general background common law to be adopted by the Metanation for the venue of space. The likely basis will be USA common law at August 4, 2000 AD.
6. **UNITED SOCIETIES IN SPACE, INC.:** A Colorado non-profit corporation with a mission of creating the Metanation and the five authorities and assembling the Space Development Plan. In order to accomplish this it features the following programs:
  - Ten Countdown Conferences
  - Constitutional Convention at August 4, 2000 AD
  - College of Delegates
  - Council of Regents
  - Corps of Observers
  - SPACE GOVERNANCE Journal (with the WSBA)
7. **WORLD-SPACE BAR ASSOCIATION:** A Colorado non-profit corporation with an agenda to promote good governance, law, and order worldwide and to assist in the making of astro law. It was formerly known as the World Bar Association. Its programs include:
  - Founding and sponsoring United Societies in Space, Inc.
  - Annual and Global Space Essay Contests.
  - Space Humanitarian Award
  - Various space law research projects
  - Lobbying for space causes



# LEDA Management Structure

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## FOOTNOTES TO VIEWGRAPH NO. 2

1. The Board of Directors will have the responsibility for overall management of the LEDA. Appointees by the participating Nations will control this Board: Each will appoint six. We foresee about 100 nations participating because that is how many have already signed the Outer Space Treaty, 1967. The original board is already in place running the Colorado Not-for Profit Company. The third world appointees represent a bonus consistent with the benefit sharing tenor of space treaties. The advisory consortia committee will have three of its members on the voting board. These will be taken from the National Space Society appointees, probably.

An executive committee of the Board will be comprised of three members of the Board. A staff is to be provided. This committee will work directly with the president and general counsel. Several other special committees of the Board are provided. These will work with the VP's for Finance, Lunar Development, International Affairs and Lunar Science and Technology.

2. The Advisory Consortium is a non-voting group of advisors to the board and to the managers. Each appointee will represent a space and governance entity. Fifteen from the National Space Society will be appointed to the voting board, also. The NSS Board of Directors is invited to serve on the advisory consortia board. Likewise, the sponsor World Bar Association has nominated the USIS Council of Regents to same. These groups may change or expand in the future, but their constituencies are relevant and they have an ongoing interest in space governance. Finally, space industry representatives will serve as advisors also.

3. The President is the Chief Executive Officer of the enterprise. He is elected by the Board of Directors. He will appoint the Vice Presidents, the General Counsel and employ the staff.

4. The Chairman of the Board is elected by the Board.

5. The Secretary is elected by the Board and reports to it regarding all record keeping functions of the enterprise.

6. The Treasurer is elected by the Board and reports to it regarding the overall management and banking of monies.

7. The VP for Finance is appointed by the President and reports to the office of the President. This VP coordinates revenues and budgets as proposed by the President. He works with a three number committee of the Board of Directors. This office will coordinate all bond market and securities underwriting activities and will coordinate with the general counsel's office.

8. The VP for Lunar Development is appointed by the President and works with a committee of the Board. The mission of this office is to create a consensus development plan for the moon, one that may be similar to the NASA baseline scenario, (S.P.509). Then bids would be let for development of the consensus plan. Common standards are to be promulgated. A zoning, building, and architectural control process is supervised by this

department. This will be reviewed by the Council of Regents, NSS, and space activists on the advisory committee.

9. VP for International Affairs is appointed by the President and works with a three board member committee. This office will coordinate national participation in the financial, development, and settlement aspects of LEDA, as well as consult with space agency representatives on the advisory committee.

10. VP for Lunar Science and Technology is appointed by the President and works with a three board member committee, as well as with the industry representatives on the advisory committee. All plans and contracts for lunar development must be approved here before any LEDA funds can be committed to them.

11. The Ombudsman is elected by the Board. This office will deal with special problems, complaints, and lobbying requests from those who can not otherwise access the LEDA administration.

12. The General Counsel is appointed by the President. Two associate general counsel are contemplated, as well as a legal staff, in order to deal with the special problems involved in lunar development. Astro law, international law, securities law, tax law, and quasi-governance authority law are some of the topics to be handled as they apply to LEDA. General counsel will also serve the legal needs as requested from the Chairman of the Board and President of the consortia advisory committee.

13. The Authority Court is an administrative law department with judicial authority to interpret and apply LEDA ordinances, rules and regulations, as well as handle violations and civil disputes generally. An appeals procedure to the World Court will be sought.

14. The departments include line authority over municipal functions such as zoning, planning, standards, development, science and technology and regulation of safety. There is also another department to coordinate international cooperation and participation on a professional basis.

## References

1. The Outer Space Treaty, 1967, Article I, formally entitled "Treaty on Principles Governing the Activities of States in the Exploration and Uses of Outer Space, including the Moon and other Celestial Bodies, January 27, 1967."
2. UNGA #1962 (XVII), A Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, 1963.
3. The Moon Treaty, 1979, Article XI, formally entitled "Treaty Governing the Activities of States on the Moon and Other Celestial Bodies, 1979."
4. Dembling, P.G., Report to the Scientific and Technical Subcommittee of UNCOPUOS, 1994, reported in the *Journal of Space Law*, Vol. 22-2, 1994, p. 129. To the contrary see, Dekanozov, R.V., "Juridical Nature and Status of the Resources of the Moon and Other Celestial Bodies." IISL 23 (1980), p. 5:
5. Goldman, N.C., *American Space Law: International and Domestic*, 2nd edition, Univelt, San Diego, 1966, p. 70.
6. *ibid*, p. 94.
7. There are no identifiable benefits actually paid to all nations and/or mankind by satellite organizations, albeit in kind benefits result to society. See, Doyle, S.E., "Benefits to Society from Space Exploration and Use," *Acta Astronautica*, 1989, Vol. 19-9, p. 749; Doyle, S.E., "Space Law and the Geostationary Orbit: The ITU's WARC-ORB 85-88 concluded," *Journal of Space Law*, Vol. 17-1, 1989, p. 13; and Doyle, S.E., "Equitable Aspects of Access to and Use of the Geostationary Satellite Orbit," IAF, IAA-87-642, Brighton, UK, 1987.
8. Jasentuliyana, N., "Review of Recent Discussions Relating to Aspects of Article I of the Outer Space Treaty," IISL 26, (1983), p. 7 at p. 9.
9. The treaty beneficiaries are all countries as a class with no exclusion for those producing the space resources as the burdened parties.
10. Robinson, G.S., and White, H.M., *Envoys of Mankind*, Smithsonian Institution Press, Washington, D.C., 1989.
11. Rothblatt, M., "Lex Americana: The New Legal Regime for LEO Satellite Communications Systems," *Journal of Space Law*, Vol. 23-2, 1995, p. 123.
12. See, Reference No. 7.
13. Space resources appropriation has been the principal component of the following Space Settlement Scenarios: Mission to the Moon Programme, SP1150, ESA, 1992; Space Resources, Materials, McKay, M.F., McKay, D.S., and Duke, M.B., including the following contributions: "Exploring, Evaluating and Mining Non-Terrestrial Resources" by Richard E. Gertsch, "Lunar Exploration for Resource Utilization" by Michael B. Duke, "Asteroid Resources" by John S. Lewis, "Benefaction and Extraction of Non Terrestrial Materials" by William N. Agosto, "The On-site Manufacture of Propellant Oxygen From Lunar Resources" by Sanders D. Rosenberg, Robert L. Beegle, Jr., Gerald A. Guter, Frederick E. Miller, and Michael Rothenberg, "Lunar Cement" by William N. Agosto, "Iron and Alloys of Iron" by Sankar Sastri, and "Bioprocessing of Ores-Application to Space Resources" by Karl R. Johansson, NASA

S.P.-509, Vol. 3, 1992, pp. 242-258; Robert Zubrin of Lockheed, Martin Marieta re: terraforming Mars by mass industrialization and restructuring on the surface, and S. Nadis, "Mars, the Final Frontier," *New Scientist*, 2/5/94, p. 28; Michael Simon, "Utilization of Space Resources in the Space Transportation System, NASA S.P. 509 Vol. p. 97; Garvey, J.M., "Adaptation of Space Technology for Lunar Operations," NASA Second Conference on Lunar Bases and Space Activities, 1992, p. 25; Sirko, R.J., "Lunar Base Reference Design," IAF No. 92-0515, 1992; Repic E.M., Richter P., Roy C., "The Lunar Resource Base, Stepping Stone to Mars," IAF No. 92-0542; Criswell, D.R., "Lunar Solar Power Satellites," *Journal of Practical Applications in Space*, Vol. 3:4, 1992, p. 63; Kulcinski, G.L., "Helium 3 Fusion Reactors - A Clean and Safe Source of Energy in the 21st Century," 9th National Space Symposium, U.S. Space Foundation, Colorado Springs, Colorado, 4/13/93; O'Neill, G.K. "High Frontier - Human Colonies in Space," Space Studies Institute, Princeton, N.J., 1976/1989; Stephensen, D.G. "Lunar Manufacture of Helium 3," *Journal of Practical Applications in Space*, Vol. 2:2 1991, p. 41; Bova, B., "The Vision of Spaceflight" in *Blueprint for Space*, Smithsonian Press, 1992, p. 19; President George Bush, "America at the Threshold," U.S. Government Printing Office, 1989; The National Commission on Space, "Pioneering the Space Frontier," Banta Books, N.Y. 1986; Hartmann, W., "Out of the Cradle," Publ., N.Y. 1984; Wernher von Braun, *Space Frontier* (rev. ed.), Holt, Rinehart, & Winston, N.Y., 1963; Arthur C. Clarke, "Profiles of the Future: An Inquiry into the Limits of the Possible," Harper and Rowe, N.Y., 1963; (to name a representative sample only).

14. The National Space Society has adopted the following theme in 1995: "Back to the Moon, this Time to Stay."
15. See, Reference No. 5 and 8.
16. O'Donnell, D.J., "Overcoming Barriers to Space Travel," *Space Policy Journal*, Vol. 10-4, Nov. 1994, p. 252.
17. The UN started with 52 signatures in 1947. It grew to 130 nations in 1967 when the Outer Space Treaty was adopted. There are 267 nations worldwide. Many UN Nations are subject to expulsion for non-payment of dues, including the USA. Clearly the UN does represent the class of nations as a matter of international law whether or not all nations are signed or in good standing. The point is that UN membership in fact is dangerously non-representative on a head count basis, or may appear so.
18. The IOSSA, International Organization for Sentient Space Activities, and, IARC, International Agreement for Recognition and Capacity, were proposed 16 years ago and remain dormant at the UN. See, Sterns, P.M., and Tennen, L.I., "International Recognition of the Art of Living in Space: The Emergence of Settlement Competence," 22 IISL (1980), p. 221.
19. O'Donnell, D.J., "Property Law in Outer Space: A-E-I-O-U and Sometimes Y as a Rule," *Space Governance Journal*, Vol. 3-1, July 1996, p. 14.
20. O'Donnell, D.J., and Harris, P.R., ""Metanation" and Other Words," IAA-96-IAA.5.1.05, Beijing, 1996.
21. Goldman, N.C., "A Lawyer's Perspective on USIS Strategies for Metanation and the Lunar Economic Development Authority," *Space Governance Journal*, Vol. 3-1, July 1996, p. 16: "The Metanation and the Lunar Economic Development Authority can answer many practical questions which are simply untouched by extant space law," p. 17.