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INTERLUNE CONCEPT FOR HELIUM-3 LUNAR DEVELOPMENT

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INTERLUNE Concept for Helium-3 Fusion Development

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Abstract

Many considerations suggest that in the 21st Century, deuterium/helium-3 (D-^{3}He) fusion will be the electricity generation system of choice to replace fossil fuels (Kulcinski and Schmitt, 1987). The next major development in space law may come when humans and nations return to the moon to produce helium-3 and its by-products from the lunar regolith.

The INTERLUNE proposal of Joyner and Schmitt (1985) suggests that an INTELSAT or INMARSAT management model could be appropriately extended to lunar enterprises. Examination of INTERLUNE in the specific context of the development of both commercial helium-3 fusion technology and lunar helium-3 provides additional insights into its viability as a management approach and into appropriate modifications of that approach.

INTERLUNE grew from a recognition that space resources exist as common resources of the spaceship Earth. Its tenets do not require that territorial sovereignty be given up in space; they do not require that free-enterprise opportunities be abandoned in space; they merely require that sovereignty and opportunity be shared.

Background

The next major crucible of legal experimentation and development in space law may come when humans and nations return to the moon, seeking to produce helium-3 (^{3}He) as a fusion fuel to satisfy electricity demands of the Earth in the 21st Century (Bilder et al, 1989).

Experience with satellite communications and the International Telecommunications Satellite Organization

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(INTELSAT) has produced a model for a cooperative system to manage high technology of global significance. This model might be applied in large part to an international helium-3 enterprise. INTELSAT (Alper and Pelton, 1984) exists as a user based management organization for the operation of telecommunications satellites and has conformed successfully to the legal, operational, and self interest constraints that apply to international operations in space. This organizational approach developed because of a coincidence of the availability of new technology and obvious international need. INTELSAT has become an example of international cooperation that is not only remarkably successful but also utilitarian and profitable.

The INTELSAT model has already spawned one successful imitator, INMARSAT, which manages international maritime communication satellites. Modified versions of this model have been proposed for the management of international waterways (Schmitt, 1978) and space based antenna farms (Smith, 1980). Here, the INTERLUNE proposal of Joyner and Schmitt is examined in the context of the management of the development of commercial helium-3 fusion on Earth and helium-3 production on the moon (Wittenberg et al, 1986).

Philosophical Basis of INTERLUNE

Generally, the INTERLUNE concept appears to satisfy all the constraints of current space law as well as to be consistent with the principles of free enterprise. In particular, the concept acknowledges that technological advancements have produced a trend towards a realization that there exists an as yet legally undefined "common heritage of mankind" in certain international resources. This trend has been most apparent in negotiations regarding the resources of the seas and outer space. Many nations have declared their interest in sharing benefits from the development and use of these resources.

Increasingly, since the introduction of the "common heritage of mankind" discussion, nations also have become concerned about the protection of the environmental heritage of humankind here on Earth. The provisions of the Convention on the Regulation of Antarctic Mineral Resources, the current draft Antarctic Treaty, the international ozone agreement, and the rising interest in deuterium/helium-3 fusion power systems as an environmentally acceptable source of electricity demonstrate that the common heritage and the environmental heritage themes have become inextricably intertwined in international consciousness.

Most nations now recognize that the moon can become a common heritage resource for humankind, as witnessed by the intense negotiations surrounding the Moon Treaty. It is not so widely recognized that, pragmatically, the resources of the moon will never be available to humankind without a workable management system and a nonconfrontational management environment, as further witnessed by the current reluctance of most nations to sign the Moon treaty and the on-going impotence of the Law of the Sea Convention.

As envisioned by Joyner and Schmitt and viewed here in the context of the potential of helium-3 fusion, the resolution of issues related to space resources should be possible through an user based institutional arrangement, such as INTERLUNE. Such and arrangement would vest control of lunar resource production and distribution in an organization comprised of, first, nations who will actively participate in creating the necessary capabilities, second, other entities who will be solely users or beneficiaries, and third, investors in the enterprise as a whole. Such nations and other entities would be united by a common bond of policy and purpose which would be focused on both the technical and financial success of the enterprise.

Four principal advantages of sharing sovereignty and opportunity take form under this concept.

First, potentially disastrous disagreement over which nation should exert control over lunar resources would be alleviated.

Second, the concept provides institutionalized access and influence to all participants. Nations, customers, users, and investors, no matter what degree of participation in INTERLUNE, would have to be consulted, eliminating the possibility that small or temporarily small participants could be frozen out completely.

Third, the operational objectives of a lunar base or settlement would be best met by this concept. The most important of these objectives are (1) assuring reliable supplies of helium-3 and other resources to terrestrial and space customers, (2) assuring access by all members to the base and its services, (3) assuring access to proprietary technologies, available material resources, and profits in proportion to a fair valuation of member participation, (4) assuring access to lunar scientific opportunities, (5) maintaining reasonable and uniform rate structures bearing a realistic relationship to value derived, (6) assuring administrative stability,

(7) assuring effective maintenance and operation of facilities and services, and (8) assuring continued and environmentally sound expansion, improvement, and development of spacecraft, facilities, and services.

Fourth, creation of an international organization of all nations, customers, users, and investors who wish to actively participate in the excitement of space pioneering can improve the friendship and unity of purpose of nations and peoples on Earth.

Management Structure

The conceptual advantages of a user-based international organization will only be realized if the actual institutional structure provides an equitable system for various interests to exert influence and control, as well as assures efficient and proper management of the base.

Potentially, there are three distinct mechanisms for nations, users and investors to be involved in INTERLUNE. The first mechanism relates to the research and development activities necessary to commercialize helium-3 fusion power on Earth. This mechanism draws to INTERLUNE research and development interests, investors, and potential customers for helium-3 on Earth. The second mechanism encompasses the creation and operation of a lunar base. It brings to the table those nations that contribute directly and substantively to the activities required to establish the base and stabilize its initial operation. The third mechanism relates to the use and the terms and conditions for use of the base, its accessible resources, and the proprietary technologies required to establish it. This mechanism attracts those nations, users, and investors who contract with or invest in INTERLUNE in order to benefit from its activities.

The main functioning bodies within INTERLUNE would be the Assembly of Parties, the Board of Governors, the Board of Users and Investors, the Director General's Office, and a Judicial Tribunal (see figure 1). The member nations of the Assembly of Parties would collectively exert policy authority over the Board of Governors, comprised of major contributing nations, groups of smaller participating nations with common interests, and representatives of the Board of Users and Investors. The Board of Governors, in turn, would exert general operational authority over the Director General, the operating arm of INTERLUNE.

The Board of Users and Investors, working within

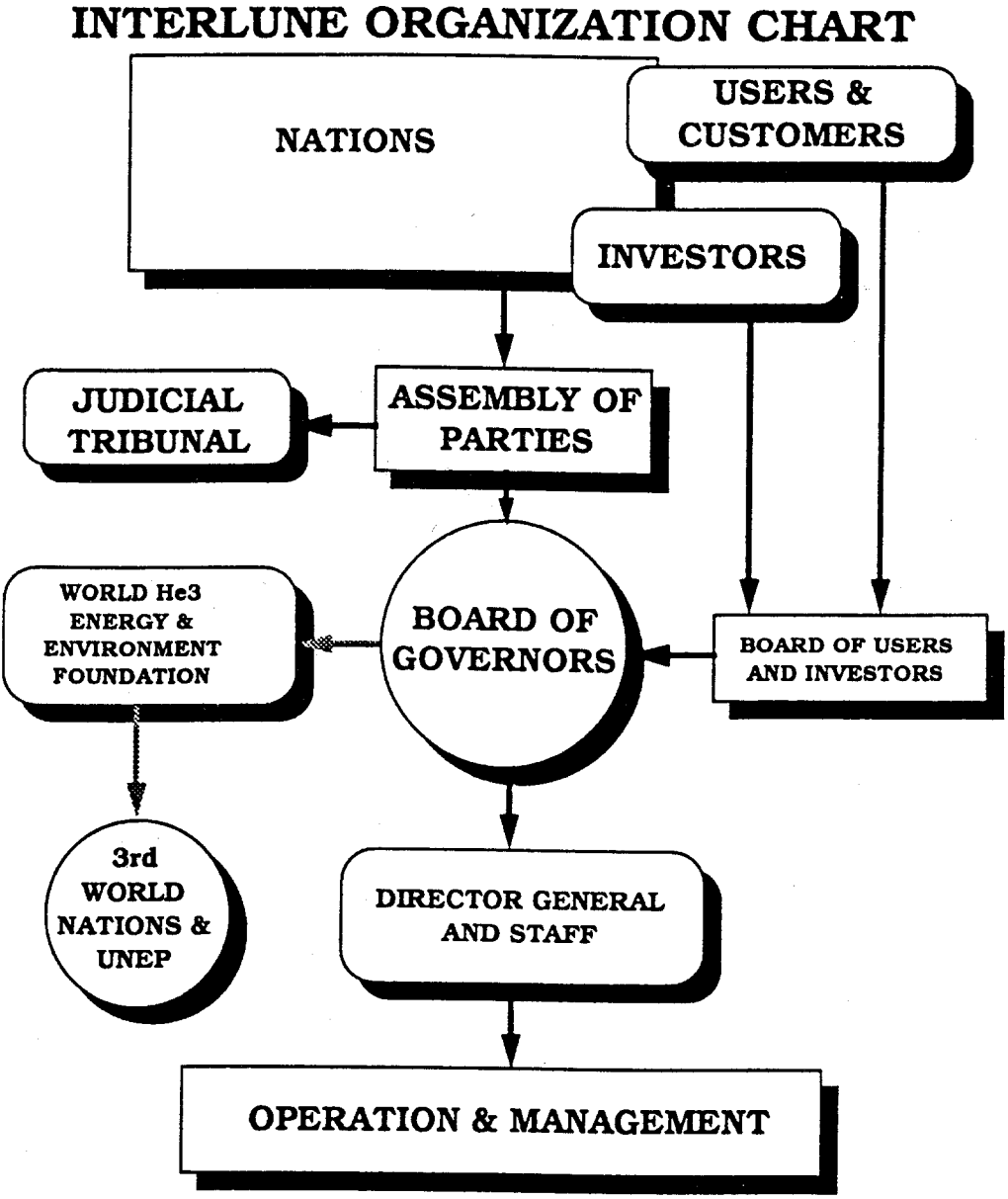

Figure 1. Schematic representation of the management structure and interrelationships of INTERLUNE as applied to helium-3 fusion development.

a policy framework set down by the Assembly of Parties, would develop recommendations on operational and financial issues affecting their interests. These recommendations would be presented to the Board of Governors through the Board of Users and Investors formal representatives on that Board.

The Judicial Tribunal would act as the final arbiter of internal disputes related to the legal interpretation of the INTERLUNE Charter and general international law. The Tribunal also would constitute the final court of appeals in criminal and civil matters.

The management objective of INTERLUNE would be the creation of commercial helium-3 fusion technology and a resource production and distribution system of high functional potential, quality, safety, and reliability. These capabilities would be available on an open and nondiscriminatory basis to all peaceful customers, users, and investors.

As ancillary goals, INTERLUNE would be expected (1) to develop a customer base for its products and services, (2) to seek a competitive return on investment in its assets and operations consistent with meeting its primary objective, and (3) to ensure the neutrality and security of activities under its jurisdiction.

The concept for INTERLUNE proposed by Joyner and Schmitt does not include provisions that explicitly recognized the concept of "common heritage" and "environmental heritage" as applied to space resources. For the purposes of helium-3 fusion development, INTERLUNE has been expanded to include the eventual diversion of a percentage of the profits of the enterprise to a World Energy and Environment Foundation. The mandate of this Foundation would insure that its resources would be applied to assisting Third World peoples in their use of helium-3 fusion power and to supplementing the efforts of the United Nations Environmental Program in its fight against adverse global effects of energy production and use.

Provision for Self Determination

The concept and the economic potential of establishing a permanent and self sustaining lunar base producing helium-3 for Earth, and space resources for other activities, includes the high probability that such a base would ultimately become a settlement of permanent residents. If history on Earth provides any guidance, such permanent residents will eventually desire a controlling voice in the governance of their activities.

This possibility should be taken into account in the initial structure of INTERLUNE so as to avoid the conflicts that have plagued colonial establishments in the past.

With eventual self determination in mind, INTERLUNE should incorporate a clear mechanism by which the settlers can be represented in its organizational entities and by which the settlers can have majority control of INTERLUNE at an appropriate level of population. Thus, the initial charter should contain provisions such as the following:

1. The provision for a seat for permanent settlers on the Assembly of Parties, the Board of Governors and the Judicial Tribunal;
2. The provision for permanent settlers to receive significant incentive compensation from successful on-going activities of INTERLUNE.
3. The provision for the systematic accumulation of voting shares for settlers based on the number who qualify as permanent residents; and
4. Clear recognition that the success of INTERLUNE will guarantee that settlers will ultimately gain political and financial control of the organization if they then desire such control.

The net result of the inclusion of these concepts would be the transition of INTERLUNE from an international development, exploration, management, and investment organization to a true lunar government.

Implementation

Initiation and then implementation of a new international concept or organization never will be simple, even in the face of as great economic and environmental incentives as presented by lunar supported helium-3 fusion. INTERLUNE would be no exception. However, establishment of such an organization clearly would be possible if there exists both an unequivocal commitment to the development of helium-3 fusion power and a sincere willingness to search for a fair and beneficial means of international participation in such an endeavor.

On the other hand, if the United States in particular appears to be hesitant and uncommitted either to the helium-3 fusion concept, to the establishment of a lunar base, or to international participation in their management, then probably other nations or groups of nations will "go it alone". If this should happen, a great opportunity for enhancing the future quality of life on Earth and for increasing cooperation and trust

among otherwise competing nations will be postponed unnecessarily.

Figure 2 shows one scheme by which the major milestones for helium-3 fusion, lunar helium-3 production, and INTERLUNE might by tied together. An analysis (Kearney, 1989) that it would be technically and economically feasible to activate the first commercial helium-3 fusion power plant in 2015 anchors the timing assumptions contained in figure 2.

With commitment by the United States to helium-3 fusion and a lunar base to support it, the next logical step would be the convening of an international conference to consider a draft of an INTERLUNE Charter. This draft charter should be the product of extensive bilateral and multilateral discussion between nations essential to the ultimate political, technical, and financial viability of the organization.

Although not ratified by nations with major space activities, the existence of the Moon Agreement of 1979 as a negotiated addition to the space law environment nevertheless will be viewed by most governments as the starting point for initiating new international agreements related to lunar resources. The development of an INTERLUNE Charter along the lines discussed here, and its ratification in the context of a conformable and coordinated ratification of the Moon Agreement, particularly with regard to Article 11, would satisfy most objections raised against that treaty.

The United States clearly should take the lead in this early drafting period, but there is no reason why the final drafting conference should not be by joint invitation of all interested parties, including organizations such as INMARSAT. All nations should be invited to send official delegates or observers as they are so inclined. Potential customer, user, or investor entities should be invited as observers or allowed to participate as members of official delegations.

The economic, environmental, and social promise of helium-3 fusion on Earth has grown great enough that the early activities of INTERLUNE might focus on the research and development necessary to demonstrate its commercial potential. Research and development might indeed be the catalyst for the initial organization and financing of INTERLUNE.

The initial forum for discussions of an INTERLUNE Charter could well be within the International Thermonuclear Experimental Reactor (ITER) group of

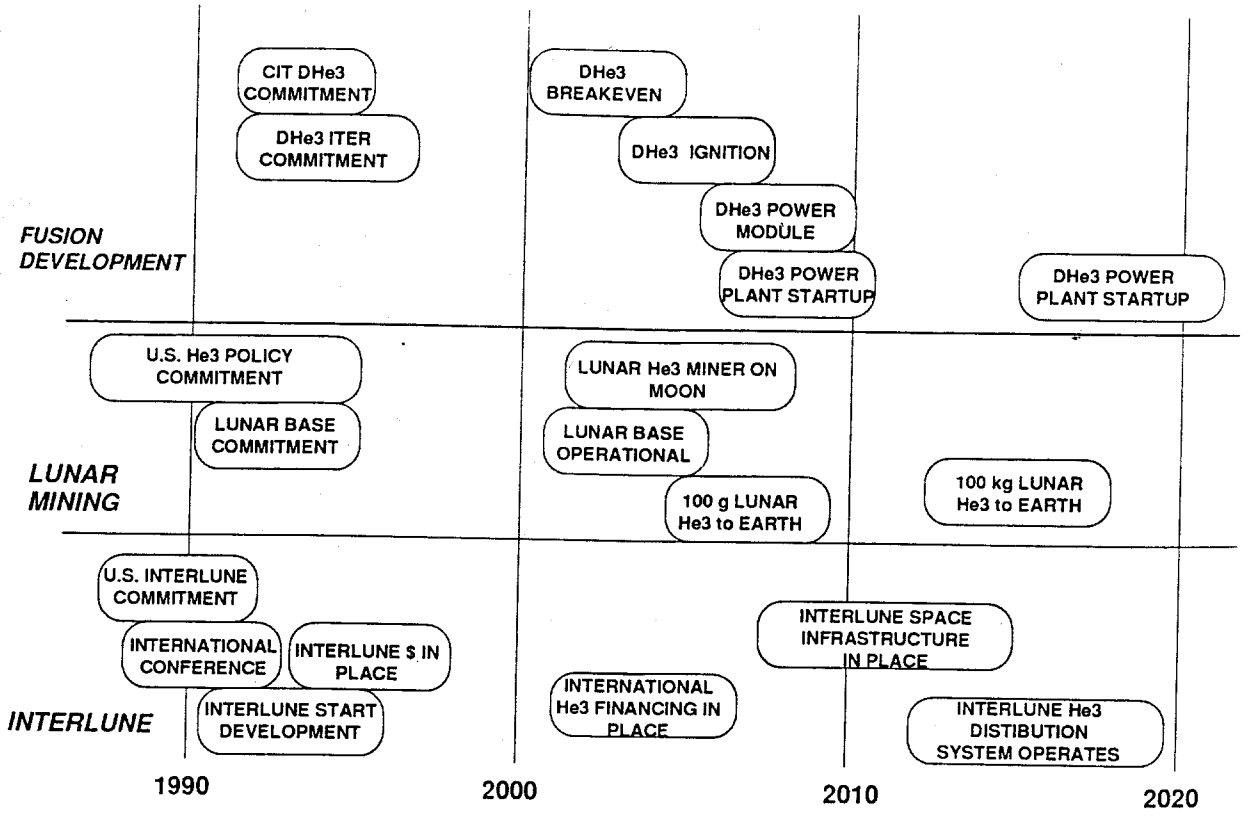

Figure 2. Approximate schedule of major events required to begin commercial helium-3 fusion power production by 2015.

nations initially convened by the International Atomic Energy Agency (ITER, 1988). These nations are committed to the conceptual design of a large scientific and engineering facility and related research and development activities that will demonstrate the scientific and technological feasibility of fusion power. This commitment has been followed by agreement on the terms of cooperation for the engineering design phase, extending over the next six years (Fusion Power Associates, 1991). The ITER participants include the United States, the Soviet Union, the European Community, and Japan with associated participation by Canada and the Peoples Republic of China.

Once a reality, and once it is clear it will be successful, INTERLUNE will attract many of those nations that may at first be reluctant to participate as proved to be the case for INTELSAT. Although conceived as an international self regulating monopoly, INTERLUNE should always be open to new members and investors. Thus, it will achieve its broad humanistic goals as well as its technical, economic, and environmental benefits. Most importantly, INTERLUNE would provide management of lunar resource production through a sharing of both sovereignty and opportunity rather than through unilateral control by any one nation or set of competing nations.

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