Space Law and Space Resources

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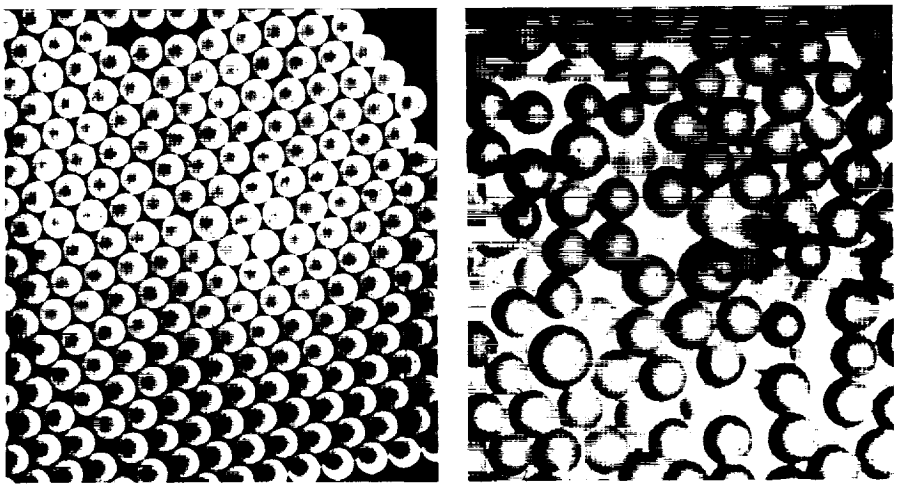
Law is not immutable; it responds to the needs of society. Since World War II, humanity has moved increasingly into outer space, encountering new conditions and new needs along the way. The law of outer space has addressed the new political, economic, and technical needs that accompany this transit of human society into space. Space law has been expressed in broad, vague principles that have permitted the maximum flexibility necessary for exploratory space activities. But, as exploration gives way to settlement, this predominantly international law lacks the specificity and legal certainty necessary for mature commercial activity.

Space industrialization is confronting space law with problems that are changing old and shaping new legal principles. Manufacturing in space and exploiting nonterrestrial resources pose economic and political issues that the nations must address. Space exploration has been conducted in the names of peace and humanity; yet, the increasing awareness of the value of space exploration and space applications dictates a new consideration of the merits of international competition and international cooperation in space.



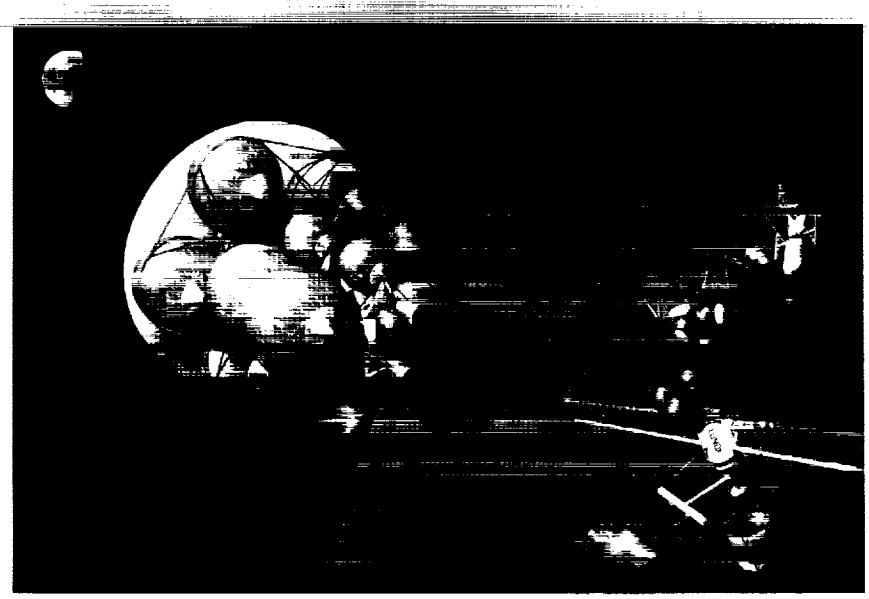
(a) (b)

Space Manufacturing

a. Latex beads produced in the microgravity of space

b. Latex beads produced in Earth's gravity

In the microgravity of low Earth orbit, perfectly uniform spheres of latex can be manufactured. Compare these produced on the Space Shuttle (a) with those produced on Earth (b). Note that the products influenced by gravity are of different sizes and sometimes deformed.



Shipping Lunar Oxygen

In this concept, based on a model by Hubert Davis of Eagle Engineering, a lunar lighter is delivering oxygen produced on the Moon to the LUNOX propellant storage depot in lunar orbit. A lunar freighter, equipped with an aerobraking heat shield, is leaving the storage depot carrying oxygen to low Earth orbit for use as propellant on outward bound journeys. On the other end of the storage depot are two larger tanks of hydrogen for use in the manufacture and shipment of lunar oxygen. In orbit with the LUNOX platform is a small space station providing support to lunar astronauts.

Artist: Pat Rawlings

It is given that nations must pursue their national interests. The policymakers in the United States have not always considered well the national interest in space. This lack of policy sophistication resulted in part from arrogance over the American lead in space and in part from ignorance of the importance of space in the future balance of power. Today, with our dwindling lead and with the growing importance of space, the United States must negotiate its international space agreements with the same concern for national priorities that it has in any other international arena. Of course, in any given situation, either cooperation or competition may better serve the national interest.

The Treatles

The U.N. Committee on the Peaceful Uses of Outer Space (UNCOPUOS) is responsible for the major portion of international space law. It has negotiated five treaties. The first four, from 1967 to 1976, have been ratified by the United States, the Soviet Union, and many other nations, active and inactive in space. The fifth treaty, the Moon Treaty, was ratified by

the U.N. in 1979 but has been ratified by only seven nations, none of whom has an active space program.

The first treaty, called the Outer Space Treaty or Principles Treaty, has been ratified or acceded to by almost 100 nations. Its broad principles provide the foundation and the philosophy for activities in outer space—that is, a commitment to explore space in peace and for the benefit of all humanity. The second, 1968 treaty—the Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched Into Outer Space—expands on the 1967 principle that astronauts are the "envoys" of humanity who should be honored and assisted in every respect (U.S. Senate 1978).

Space Station Emergency Rescue Vehicle

This design is one of several being considered to provide a safe and reliable emergency return from the space station. The Assured Crew Return Vehicle (ACRV) would be based at the space station and use de-orbit engines to return to Earth.

Rescue capability would be offered to astronauts of any nation, as in September of 1988 the United States offered tracking and recovery help to the Soviets when their cosmonauts, Russian pilot Lyakhov and Afghani copilot Mohmand, had difficulty returning from the Mir space station in a Soyuz spacecraft.

Artist: David Russell

Ratified in 1973, the Convention on International Liability for Damage Caused by Space Objects spells out many of the liabilities and duties of spacefarers and describes a procedure to enforce these obligations. The final major treaty, the 1976 Convention on the Registration of Objects Launched Into Outer Space, expands on the 1967 principle that nations retain jurisdiction over and responsibility for their facilities and objects in space. It mandates that a nation register its launch with a U.N. Registry, and thereby legitimate that nation's jurisdiction over the vessel or facility.

Skylab Is Falling!

Lou Pare, flight controller, marks an area in the Atlantic Ocean, part of the final "footprint" of Skylab, as Gene Kranz, deputy director of flight operations at the Johnson Space Center, looks on. Skylab, America's first space station, was launched in 1973 and served as home for three crews, during 1-month, 2-month, and 3-month stays in 1973 and 1974. The spacecraft (which was not designed to be restocked) was turned off, its orbit decayed, and it broke up as it reentered the atmosphere July 11, 1979. Most of its pieces burned up in the atmosphere. Of the pieces that survived the heat of reentry, most fell into the ocean. Only a few fell on land (some were recovered in Australia); none caused any damage.

The 1979 Moon Treaty builds on another 1967 principle, space for the benefit of mankind, to dictate an international regime that will be established at a future date to regulate space resources "in place," declared now the "common heritage of mankind." Neither the United States nor the Soviet Union is likely to sign this treaty. Nor is the treaty likely to gain wide acceptance, authority, or standing as law. Nevertheless, the treaty does represent the most complete international effort to date to deal with the legal and public questions of colonizing and exploiting space.

This thumbnail sketch of space law has been neither comprehensive nor detailed, but it provides a background suggesting serious legal-political problems that will confront the first efforts to mine and use the resources of the Moon and other celestial bodies (Goldman 1988).

Treaty Issues

The utilization of space resources will raise many issues that diplomats and international lawyers need to consider. This section identifies only four of these issues: (1) international competition and cooperation, (2) property rights and nonterrestrial mining, (3) legal liability and responsibility, and (4) environmental impact.

International Cooperation

International cooperation is a theme that pervades the legal regime of space. According to the 1967 Outer Space Treaty, space is to be used for "the benefit of mankind" (Article I). Nations cannot annex or appropriate outer space or the celestial bodies (Article II). The United States has always balanced these more altruistic principles against a second theme: nations are permitted by the treaty to "use" and exploit space. As participant in the negotiations and ever since, the United States has always argued that nations can mine and claim resources "in place" even under the 1979 Moon Treaty (Christol 1982, pp. 293-296).

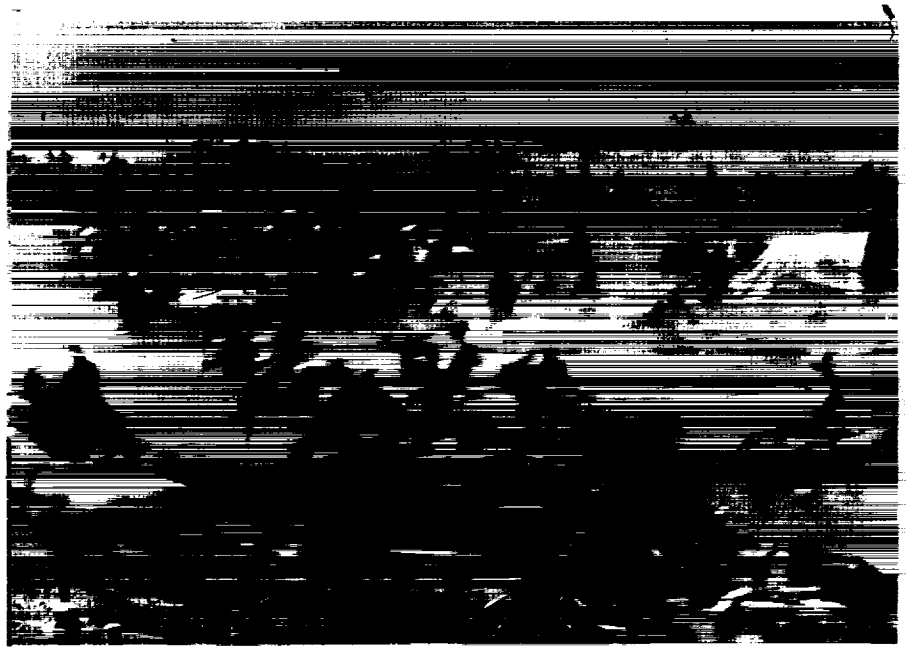


Photo (just after the start of the run into the Cherokee Outlet, September 16, 1893): L. D. Hodges

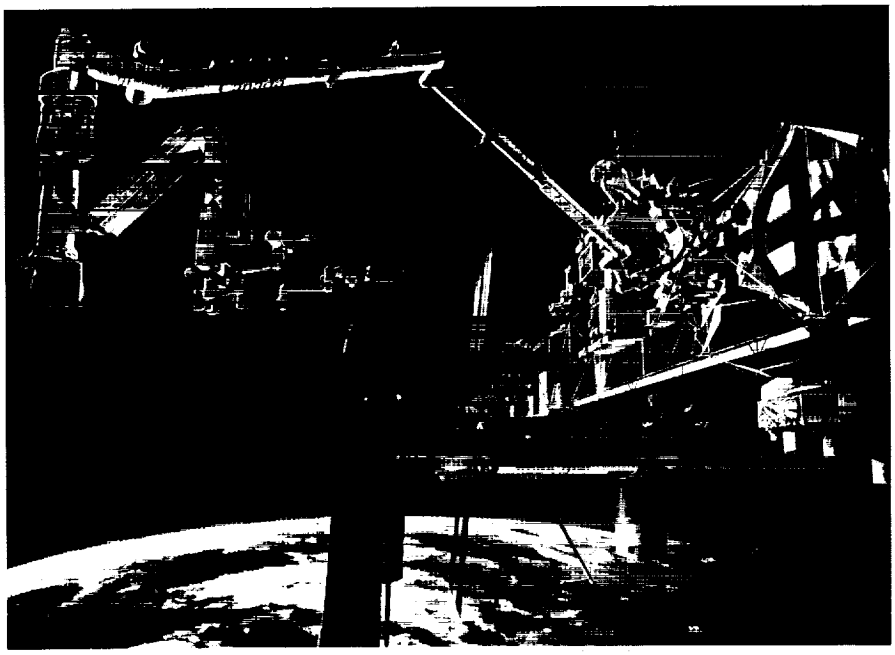
Provided by the courtesy of the Archives & Manuscripts Division of the Oklahoma Historical Society.

Oklahoma Land Rush

On April 22, 1889 (some a little sooner), 15 000 settlers from 32 states lined up to make a run into the unassigned lands of the Oklahoma Indian Territory and stake claims to homesteads. Within 5 days a tent city had sprung up on the prairie at Guthrie. International law prohibits the staking of claims to lunar territory, but nations who can get there can use the resources onsite. The United States has always maintained that under the 1967 Outer Space Treaty, which it signed along with almost 100 other nations, and even under the 1979 Moon Treaty, which it has not signed (nor has the Soviet Union), lunar settlers would be able to mine and claim the resources at a lunar base.

Provided by the courtesy of the Western History Collections, University of Oklahoma.

Of course, separate from the legal issue, the United States will need to make a political decision whether to proceed alone or in consortium with other nations. Such cooperation may offset opposition to its activities from many governments, especially in the Third World. Cooperation spreads the risks and the cost of the program; all partners gain from the expertise of the others. Then, the partners can share the technical and financial riches of so momentous an undertaking.



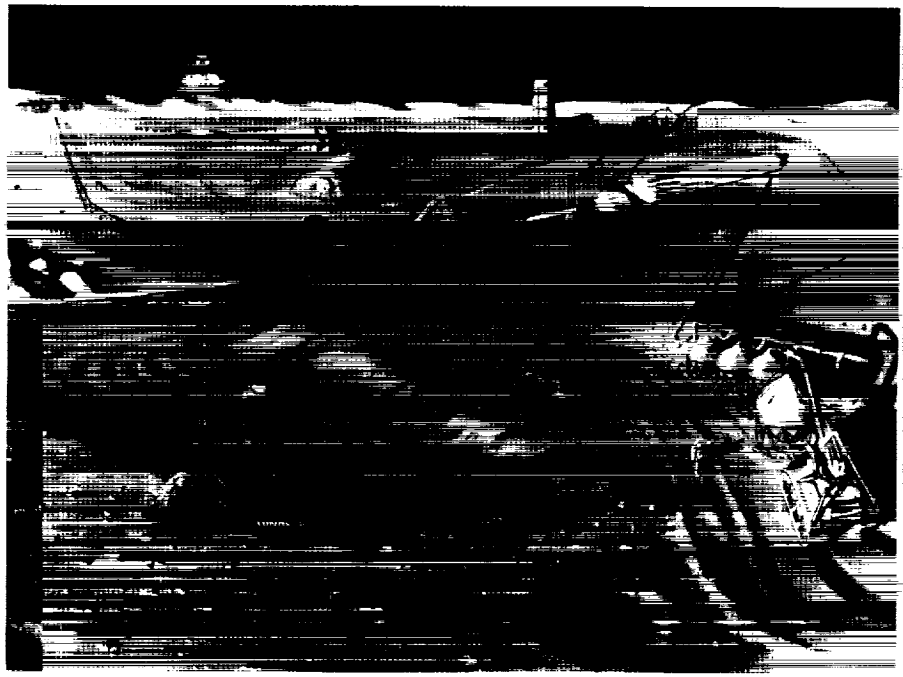
***International Cooperation in Space Station* Freedom**

Cooperating with the United States in the construction and use of Space Station Freedom *will be Canada, Japan, and the nations of Europe. The U.S.A. will supply the habitat module and one laboratory module; the European Space Agency (ESA) will supply a second laboratory module; the Japanese, a third. Canada will supply a mobile servicing center, which will include an improved version of the remote manipulator arm currently in use on the Space Shuttle. It will help assemble the space station and will provide grappling capability thereafter. Such international cooperation spreads both the costs and the benefits of space development. All the partners gain from the expertise of the others.*

Artist: Paul Fjeld

Mining

According to present space law, all mining in space—lunar, asteroidal, or planetary—is treated alike. The operative treaty provisions are (1) that space is reserved for the benefit and is the province of all mankind; (2) that every nation shall have equal access to outer space; (3) that nations cannot appropriate space under any claim of national sovereignty; (4) nevertheless, that nations are free to explore and "use" outer space. The official position of the United States, clearly enunciated in the debates of UNCOPUOS, interprets these provisions to permit any nation or corporation to mine and otherwise use the resources of outer space.



Lunar Mining and Processing

Though international law prohibits the annexation of any part of the Moon, it would allow the use of raw materials mined at a lunar base. In this concept, based on a model by Hubert Davis of Eagle Engineering, bulk soil from a strip mine is delivered by front-end loaders to an automated processing facility. The oxygen won from the process is liquefied and piped to the storage tanks on the right. One filled tank is being loaded now, perhaps to be used at the lunar base, perhaps to be shipped to orbit. The slag is carried by conveyor belt to a dump in the background to the left. Near it, a lunar lighter can be seen landing. The tanks stacked to the right of the buried habitat module contain hydrogen for use in the process and as propellant. Power lines stretch over the ridge to a power station, possibly a nuclear reactor.

Artist: Pat Rawlings

Even under the rather anticapitalist Moon Treaty, the official position of the U.S. negotiators in UNCOPUOS has been that the treaty permitted companies and nations to mine the Moon. For instance, light elements—hydrogen, nitrogen, and carbon—exist in limited quantities in the lunar soil, and frozen water may exist in larger amounts at the lunar poles. Under the longstanding U.S. legal interpretation, the nation finding these resources will be able to mine them. The nation will not own the site, but its labor will attach ownership to the ore (Christol 1982, pp. 39-43). American legal and political planners need to consider the scenario in which spacefarers from another nation go to the Moon and find a singular deposit of volatiles.

American negotiators of the Moon Treaty have argued that the treaty language prohibiting ownership of space resources "in place" means that when the resources have been removed from "in place," personal labor attaches and the mining concern would own the extracted materials. The treaty also envisions that the signatory nations would "undertake" to establish an international regime when utilization of space resources becomes an active possibility. By analogy to the international regime described in the Law of the Sea Treaty (which transfers technology and proceeds from the resource developer to nonparticipants), the regime for space has been vilified by many writers and politicians, and this was a major issue in the defeat of the treaty. The interpretations of the U.S. negotiators evoke alternative regimes, including an international investment organization which nations could join if they desired. Intelsat, the International Telecommunications Satellite Consortium, is such a model.

Although much of the world will object, the legal bottom line on mining nonterrestrial resources is that the United States, the Soviet Union, or any other nation that can get there can mine the Moon and other celestial bodies.

The case of the near-Earth asteroids, however, raises a trickier legal issue. Although a nation cannot appropriate a celestial body, it can use the resources. If space mining basically consumes an entire, small near-Earth asteroid, has the "use," become an "appropriation" of the celestial body? This situation appears to be another example in which the technologies have rendered the treaties obsolete. Perhaps the diplomats need to amend the treaties to redefine these smaller asteroids as a different class of celestial bodies.

Liability and Responsibility

According to the 1967 Treaty, nations are responsible for the space activities of their nationals (Article IV). The Liability Convention in 1973, moreover, established an absolute liability for damages on Earth caused by space activities. Liability based on fault is authorized for damage in space (Article II). Therefore, if the United States decides to take in private industry as a partner in transporting or mining, the U.S. Government would have to monitor these partners closely.

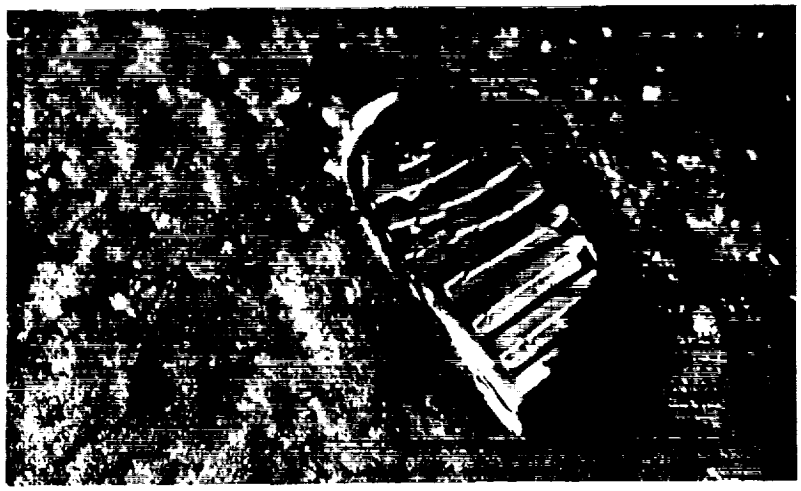
The Liability Convention also provides that nations are jointly and severally liable for damages caused by their cooperative space effort (Articles IV and V). Although the memorandums of understanding or treaties among these national partners will apportion liability and provide a mechanism for settling disputes, the bottom line remains that one nation may be held liable for the entire accident.

Environmental Impact

Two broad concerns for space resources and environmental impact raise treaty issues: (1) back-contamination of Earth and (2) environmental protection of the celestial bodies. The Outer Space Treaty requires consultation about the environmental issues (Article IX). The Moon was seen as sterile, and the rules for back-contamination were not as strict as many scientists wanted. Mars and other celestial bodies may require a different set of regulations. The unratified Moon Treaty suggests that nonterrestrial sites of scientific interest should remain pristine.

Should the Moon Remain Pristine?

"That's one small step for a man, one giant leap for mankind," said Neil Armstrong as he set foot on the surface of the Moon July 20, 1969. His footprints, those of fellow explorer Buzz Aldrin, and the footprints of the 10 other Apollo astronauts to walk on the Moon remain clear and sharp on this windless satellite, despite the passage of 20 years. In fact, the footprints of these astronauts will likely last about 1 million years before they are eroded away by micrometeorite impacts. Development of such nonterrestrial sites will create further disruptions. Where should the line be drawn between protecting the environment and developing the resources?



Conclusions

The return to the Moon, the next logical step beyond the space station, will establish a permanent human presence there. Science and engineering, manufacturing and mining will involve the astronauts in the settlement of the solar system. These pioneers, eventually from many nations, will need a legal, political, and social framework to structure their lives and interactions. International and even domestic space law are only the beginning of this framework. Dispute resolution and simple experience will be needed in order to develop, over time, a new social system for the new regime of space.

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