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International Space Law: Into the Twenty-First Century

Glenn Harlan Reynolds*

ABSTRACT

In this Article, Professor Reynolds addresses the space law issues likely to be of most importance in the next several decades. Pressing issues include those of orbital debris and geostationary orbit crowding, private property rights in outer space resources, conflict over international trade in space goods and services, the danger of ballistic-missile technology proliferation, private remote-sensing systems, and the law of international cooperation in space. Professor Reynolds concludes with a philosophical and practical discussion of some more remote issues, including the legal systems that may govern future human societies in outer space and the legal issues that might be associated with contacting extraterrestrial intelligences.

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I. INTRODUCTION

The year 1992 marks many important occasions: the five-hundredth anniversary of Columbus' voyage, the thirty-fifth anniversary of *Sputnik*, and the seventy-fifth anniversary of the late, unlamented Bolshevik Revolution. It also marks a less conspicuous date—the beginning of space law's fifth decade. It was 1951, just over forty years ago, that saw the publication of what many consider the first serious space law article, by John Cobb Cooper of Princeton's Institute for Advanced Study.¹

When Cooper's article was published, the very idea of space flight itself seemed remote. Yet before twenty years were out, men (no women, alas) would walk on the moon, only to abandon that initial foothold on another planet in the interest of election-related pork-barreling.² Few observers in 1951 would have imagined that we would go so far, so fast—or that we would abandon our gains for such trivial reasons.

This record surely should make those of us who would forecast the future humble. Among other things, it teaches us that progress in space-related matters is determined more by politics than by technology. Unfortunately, the course of technology is easier to predict—and usually to follow—than politics. There are, as yet, no differential equations for human behavior.

Nonetheless, I will make the attempt. The pages that follow will outline what I expect will be the most important issues of space law in the next few decades, those representing the transition zone of the late twentieth century and the early twenty-first. I will also discuss a few other issues that may be less likely to come up, but that will be important if they do. Although my treatment of these topics will necessarily be a bit

1. John C. Cooper, *High Altitude Flight and National Sovereignty*, 4 INT'L L.Q. 411 (1951). For a good history of space law's early days, see WALTER MCDUGALL, . . . THE HEAVENS AND THE EARTH: A POLITICAL HISTORY OF THE SPACE AGE 177-94 (1985).

2. The last lunar mission was Apollo 17, which lasted from December 7 through December 19, 1972. In that same year, the Nixon Administration, with cooperation from congressional Democrats, drastically scaled back plans for future space exploration. For a complete listing of Apollo missions, see MICHAEL COLLINS, LIFTOFF 273-77 (1988). For a discussion of the Nixon Administration's treatment of the space program in the context of efforts to fund Nixon's election-year social agenda, see MCDUGALL, *supra* note 1, at 420-23.

brief, I hope that it nonetheless will be interesting, and I encourage others—particularly student writers, who have long careers ahead of them—to join in the discussion.

II. ENVIRONMENTAL CONCERNS

Many people are surprised to learn that the seemingly limitless expanses of outer space might need environmental protection. The environmental problems of space, however, are bad and getting worse.³ Already, the orbits near Earth are so cluttered with human-made junk—mostly fragments of discarded boosters and leftover shrapnel from antisatellite weapons tests—that an object in those orbits is more likely to collide with artificial debris than with naturally-occurring meteorites. More alarming still, once that debris reaches a sufficient density, collisions between objects will create more debris particles, which will undergo still more collisions, until the process becomes self-sustaining. This phenomenon is known in the trade as the “Kessler effect,” named after an author of the pioneering paper to analyze the topic.⁴ In addition, there is some evidence that the growing quantity of human-created space junk is affecting the composition of the Van Allen radiation belts, although whether this might affect conditions closer to Earth is unknown.⁵

Several potential approaches to these environmental problems have been proposed. One is to address liability issues. I have previously suggested a *Sindell*-type market share liability regime⁶ under which nations would pay compensation based on their proportional contribution to the

3. These issues are beginning to receive some attention. The new Restatement specifically addresses environmental problems involving international common areas, including space. RESTATEMENT (THIRD) OF FOREIGN RELATIONS LAW § 601 n.6. The Sierra Club also has published an interesting and provocative book on the topic. See BEYOND SPACESHIP EARTH: ENVIRONMENTAL ETHICS AND THE SOLAR SYSTEM (E. Hargrove ed., 1986) [hereinafter BEYOND SPACESHIP EARTH]; see also Hartmann, *Space Exploration and Environmental Issues*, 6 ENVTL. ETHICS 227 (1984).

4. Donald J. Kessler & Burton G. Cour-Palais, *Collision Frequency of Artificial Satellites: The Creation of a Debris Belt*, 83 J. GEOPHYS. RES. 2637 (1978). For more on orbital debris, see HOWARD BAKER, *SPACE DEBRIS: LEGAL POLICY AND IMPLICATIONS* (1989). See also Donald J. Kessler, *Earth Orbital Pollution*, in BEYOND SPACESHIP EARTH, *supra* note 3, at 47; Lawrence D. Roberts, *Addressing the Problem of Orbital Space Debris: Combining International Regulatory and Liability Regimes*, 15 B.C. INT'L & COMP. L. REV. 51 (1992).

5. See Andrei Konradi, *Effect of the Orbital Debris Environment on the High-Energy Van Allen Proton Belt*, 242 SCIENCE 1283 (1988).

6. See, e.g., *Sindell v. Abbott Lab.*, 607 P.2d 924, 937 (Cal. 1980), *cert. denied*, 449 U.S. 912 (1980) (defendant's liability based on market share in offending product).

orbital-debris population.⁷ This rule, of course, would not eliminate the orbital-debris problems and should be regarded more as a means of plugging holes in the Liability Convention⁸ than of completely settling the issue. Over the long term, some sort of prospective regulatory scheme is likely to be necessary. It, too, should encourage nations to reduce their contribution to the problem—perhaps by taxing practices in proportion to the orbital debris they create, with proceeds going into a pool that would pay for cleanup.⁹ In the interim, at least the time has arrived for the spacefaring nations to agree on sound practices for launch and on-orbit activities to minimize the problem. In a limited and informal way, this has already happened,¹⁰ but more needs to be done.

The orbital-debris question at least is beginning to receive the attention that it deserves, but it is not the only space environmental issue, just the most pressing. Another is the crowding of the geostationary orbital arc, the most suitable location for communications satellites. In essence, the problem is that satellites cannot be placed too closely together without creating excessive radio interference. Because satellites must remain within line of sight of their users, the problem is worse than it might seem—the orbital arc is most crowded where it is most needed. The International Telecommunication Union has recently arrived at a temporary solution, but the underlying difficulty will resurface unless technology rides to the rescue first.¹¹

Finally, nations have obligations under the Outer Space Treaty and under general principles of international law to avoid harmful contamination of other planets (for example, with micro-organisms from Earth) and to avoid so-called “back contamination” of the Earth with harmful extraterrestrial materials.¹² As plans go forward for both human and

7. See GLENN H. REYNOLDS & ROBERT P. MERGES, OUTER SPACE: PROBLEMS OF LAW AND POLICY, 176-77 (1989); Glenn H. Reynolds, *Space Law in the 1990s: An Agenda for Research*, 31 JURIMETRICS J. 1, 6-7 (1991).

8. Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187. This treaty requires that one identify the launching state of an object causing damage, which is likely to be difficult in the case of damage caused by space debris, much of which is too small to track. A market-share scheme would remove the need to identify the nation responsible for a particular piece of debris and give all nations an incentive to reduce their contribution to the problem.

9. Lawrence Roberts has made some interesting suggestions along these lines, drawing on common-resource theories. See Roberts, *supra* note 4.

10. See *NASA Strategy Aimed at Cutting Risk of Orbital Collisions*, AVIATION WK. & SPACE TECH., Sept. 5, 1988, at 217.

11. For more on the ITU resolution, see Milton L. Smith, *The Space WARC Concludes*, 83 AM. J. INT'L L. 596 (1989).

12. For this reason, space probes are sterilized before launch. For more on this issue,

robotic missions to Mars (including sample-return missions), mission planners and their counsel must consider both issues. Although it is highly unlikely, according to most experts, that Earth organisms could flourish on other planets, even in the comparatively friendly environment of Mars, and even less likely that organisms from those planets could infect life on Earth, the stakes are too high for carelessness until—as in the case of these possibilities with respect to the moon after the repeated Apollo visits—we have enough experience to feel secure.

III. PROPERTY RIGHTS

A law professor of mine was fond of saying that he used to think that all property was theft, but that was before he had anything worth stealing. This may turn out to be the story in the context of space property rights. Some years ago, when the United States and the old Soviet Union held a monopoly on space activity, considerable hostility existed to the idea of property rights—or at least sovereignty, which is a different thing—in space. This hostility stemmed from two sources: fear by the have-not nations—all those without space capabilities—that the two space powers would colonize the rest of the solar system, and fear by each of the two space powers that the other would gain a decisive advantage.¹³

In this context, the no-sovereignty provisions contained in article II of the 1967 Outer Space Treaty¹⁴ can be seen as a way for everyone involved to hedge the bet. Article II provides the following: “[o]uter 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

see REYNOLDS & MERGES, *supra* note 7, at 195-98. For an earlier treatment, see Stephen Gorove, *Pollution and Outer Space: A Legal Analysis and Appraisal*, 5 N.Y.U. J. INT'L L. & POL. 53 (1972). Under regulations that have remained in force since 1969, NASA retains authority to quarantine extraterrestrial material and individuals and objects that have been exposed to extraterrestrial matter. Extraterrestrial Exposure, 14 C.F.R. §§ 1211.100-1211.108 (1991) [hereinafter Extraterrestrial Exposure Regulations]. Although these regulations are unlikely to give rise to scenes like that at the end of the movie *E.T.*, they are evidence of the seriousness with which the United States has treated its obligations on this matter in the past.

13. For an early discussion of these concerns, see Myres S. McDougal et al., *The Enjoyment and Acquisition of Resources in Outer Space*, 111 U. PA. L. REV. 521 (1963).

14. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

by any other means.”¹⁵ This provision limits the extension of national territory, or *imperium*, to outer space. Some commentators also initially argued that the provision outlaws private property rights in outer space, but the consensus now is that it does not.¹⁶ In the context of superpower monopolies on space capability, and the Cold-War rivalry existing at the time, the no-sovereignty provision allowed everyone to breathe easier. The United States and the Soviet Union lost the opportunity to gain a decisive advantage by securing a claim to the moon. On the other hand, they were protected against the risk that the other would gain such a claim first. They also were able to avoid having to deal with the resentments that non-space powers were beginning to feel over the prospect of superpower expansion into a realm not accessible to anyone else, resentments that might have had a real impact on Cold-War diplomatic struggles. Meanwhile, the non-space powers were freed from the risk that they would lose out entirely on the opening of a new frontier.

These concerns with space colonization reached a new high with the 1979 Moon Treaty, which entered into force in 1984—though without the ratification of any major space power.¹⁷ The Moon Treaty represented the views of a then-influential group of developing-state economists who viewed Third World economic problems as resulting from Western exploitation.¹⁸ This group’s push for a “New International Economic Order” was reflected in the Moon Treaty’s hostile treatment of not only national sovereignty (already forbidden by the 1967 Treaty), but also of private property rights—with any for-profit exploitation of space resources to be undertaken only by a monopolistic international organization that would ensure that a share of the profits went to developing states.¹⁹

If the 1967 Treaty was something like an armistice in one part of the Cold War, the 1979 Moon Treaty can be seen as a sort of pre-emptive strike in the twenty-first century’s economic wars. Being ahead of one’s

15. *Id.* art. II, 18 U.S.T. at 2413, 610 U.N.T.S. at 208. For more on Article II and its meaning, see REYNOLDS & MERGES, *supra* note 7, at 62-93; see also Carl Q. Christol, *Article 2 of the 1967 Principles Treaty Revisited*, 9 ANNALS AIR & SPACE L. 217 (1984).

16. See Christol, *supra* note 16.

17. Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, U.N. Doc. A/AC. 105/L.113/Add. 4 (1979).

18. REYNOLDS & MERGES, *supra* note 7, at 102-66.

19. For more on the Moon Treaty in general, and for a brief description of the New International Economic Order, see REYNOLDS & MERGES, *supra* note 7, at 102-66. For a recent statement of the Third-World perspective, see Mark Orlove, *Spaced Out: The Third World Looks for a Way in to Outer Space*, 4 CONN. J. INT’L L. 597 (1989).

time, however, carries some risk, and the Moon Treaty—along, perhaps, with Article II of the Outer Space Treaty, depending on one's interpretation—is a treaty that is already obsolete. The economic theories and political realities that led to both are not enough to justify retaining them today and are likely to be less and less applicable in the coming years.

Today, space is not the sole preserve of the United States and the Soviet Union (or its successor states). A potent European space program now exists, Japan has a rapidly growing program, and Third-World opinion leaders like China, India, and Brazil have important space programs, too. Nor are these states the only ones. Although the programs of the United States and the former Soviet Union retain significant leads, those leads no longer look unassailable. When significant exploitation of space resources begins, many nations will be participating.

Furthermore, because of intervening events, the economic ideas that underlay the Moon Treaty are no longer in fashion. At the time of the Moon Treaty's drafting, many analysts disagreed with Walt Rostow's theory that Third World nations would be able to catch up with more developed nations.²⁰ And, at the time, such disagreement might have seemed well-founded, given the commanding lead of developed nations in technology and economic clout. Thus, statements such as the following were common:

Rostow, ignoring the phenomena of domination and imperialism, reduced underdevelopment to a mere question of backwardness. . . . This soothing belief in an automatic international redistribution of means and incomes in accordance with some sort of natural law is completely unrealistic, since it takes no account of the balance of power. The present international situation is characterized by an intensification of conflict and a widening of the differences in power between States.²¹

Things are different now. The enormous economic progress of many formerly underdeveloped nations—such as Japan, South Korea, and the other nations of the Pacific Rim—belies the notion that economic positions cannot change. Moreover, the futility of developed nations' efforts to stem economic tides, in both the United States and the former Soviet Union, undercuts the idea that political factors control economic outcomes. The result is that markets, once in bad repute, are now better regarded.

With the Cold War over, and with redistributionist, anti-market inter-

20. See WALTER W. ROSTOW, *THE STAGES OF ECONOMIC GROWTH* (1961); Walter W. Rostow, *The Take-off into Self-Sustained Growth*, 66 *ECON. J.* 25 (1956).

21. MOHAMMED BEDJAOUI, *TOWARDS A NEW INTERNATIONAL ECONOMIC ORDER* 67 (1979).

national economic policies out of favor, the root causes of hostility to property rights in outer space resources have disappeared. Accordingly, no real reason seems to exist to adopt the rather strained interpretations of the Outer Space Treaty that would prevent such property rights, or to endorse the explicit Moon Treaty provisions, which would flatly bar them. Simply deciding that property rights in outer space resources would not be such a bad thing is not enough. Property rights, properly implemented, would be a real boon to the rapid development of outer space, with concurrent economic and political benefits to those of us here on Earth.²² But the key concern is how such rights can be properly implemented.

Well set up, property rights can serve as an important incentive to outer space development because investors have a stake in success. That is why land grants were so instrumental in the development of the western United States: the railroads, for example, received plots of land along their rights of way. Without development, those plots of land would have been near-valueless plots of wilderness. With development, they were attractively located along rail lines. Similarly, property rights could help to promote development of space resources: without development, property rights in, say, lunar land have virtually no worth, while with development, they could become highly valuable.²³

On the other hand, property rights are also the kind of thing over which people fight precisely because they are valuable. Taking someone else's developed property is often easier than developing one's own. The challenge is to build a regime that encourages the beneficial aspects of property rights, while formulating rules that discourage conflict and predation.²⁴

Although decades will pass before this issue becomes immediately pressing, it is worth addressing soon. Fortunately, a vehicle for discussing these issues already exists. By its own terms, the Moon Treaty comes

22. For more on this topic, see Glenn H. Reynolds, *Structuring Development in Outer Space: Problems of How and Why*, 19 *LAW & POL'Y INT'L BUS.* 433 (1987) (book review); REYNOLDS & MERGES, *supra* note 7, at 325-29. Cf. Lawrence D. Roberts, *The Law of the Commons: A Framework for the Efficient and Equitable Use of the LaGrange Points*, 6 *CONN. J. INT'L L.* 151 (1990).

23. See Reynolds, *supra* note 22, at 445-46.

24. For a not-entirely-dated description of how this might be done, stressing international commercial development as a system for promoting the interests of peace, see Glenn H. Reynolds & Robert P. Merges, *The Role of Commercial Development in Preventing War in Outer Space*, 25 *JURIMETRICS J.* 130 (1985). See also Glenn H. Reynolds, *Toward the Peaceful Development of Outer Space: Some Thoughts on Structures and Relations*, 59 *TENN. L. REV.* ____ (1992) (forthcoming).

up for review in the United Nations General Assembly in 1994, ten years after its entry into force. Because this review will allow all nations—not just those few that actually ratified the Moon Treaty—to discuss proposed remedies for the Treaty's flaws, it will provide an opportunity to consider revisions. In particular, the United States should play a major part by proposing amendments to the Treaty that recognize the important role played by private property rights in promoting development of outer space. Land-grant type mechanisms, administered by the United Nations or by individual nations in accordance with agreed international principles, might reward private development efforts with long-term leases or permanent property rights in space resources that they develop. Structured properly, these mechanisms would promote a new kind of space race—one aimed at peaceful development rather than military domination. That would be a promising start for a new century indeed.

Some proposals have urged the United States to take unilateral action, several of which have gone rather far. For example, one group of California space enthusiasts has discussed the possibility of the United States simply repudiating the Outer Space Treaty's no-sovereignty provisions and laying claim to the northern half of the moon.²⁵ Such an action, in my opinion, would be a bad idea and would probably lead to ugly international repercussions. Nevertheless, the United States could do many things to promote space development through property rights that would not involve violation of the no-sovereignty provision at all.

Among other things, the United States simply could state that it would recognize claims by United States nationals (and perhaps by others as well) who discover valuable deposits of minerals or other wealth. Such resources may exist on the moon or in near-Earth asteroids that could be exploited relatively easily. Recognition of these claims (and protection of them, if necessary, from third parties) would not constitute "national appropriation" or the exercise of sovereignty over territory, but rather the exercise of United States jurisdiction over its citizens and of its power to protect them against third parties in international common areas.²⁶

25. Members of the California Space Development Council discussed this "Luna 2010 Resolution" at meetings in 1991. For more on this topic, see Kenneth J. Garcia, *Space Experts Set Sights on the Moon for Colonization*, L.A. TIMES, Dec. 27, 1991, at B1.

26. Indeed, even advocates of the New International Economic Order recognize that such exploitation would not violate the Outer Space Treaty, which is why they considered the Moon Treaty desirable. See, e.g., Orlove, *supra* note 20, at 610. "[T]he Outer Space Treaty, to which the space powers are a party, already grants the right to exploit lunar resources." "[T]he Outer Space Treaty, to which the major space powers are sig-

Something similar has already been done with regard to an international common area sharing the *res communis* character of the space environment. In 1980, the United States Congress passed the Deep Seabed Hard Mineral Resources Act (the Act), which established a mechanism for recognizing mining claims by United States ventures regarding deep seabed mineral deposits outside the territorial jurisdiction of any nation.²⁷ The Act specifically provides:

it is the legal opinion of the United States that exploration for, and commercial recovery of, hard mineral resources of the deep seabed are freedoms of the high seas subject to a duty of reasonable regard to the interests of other states in their exercise of those and other freedoms recognized by general principles of international law.²⁸

The Act also provides that it is not to be considered an extension of sovereignty over international common areas, but rather a mechanism for recognizing the rights of United States nationals in those areas. Section 3(a) of the Act states that:

(a) Disclaimer of Extraterritorial Sovereignty—By the enactment of this Act, the United States—

(1) exercises its jurisdiction over United States citizens and vessels, and foreign persons and vessels otherwise subject to its jurisdiction, in the exercise of the high seas freedom to engage in exploration for, and commercial recovery of, hard mineral resources of the deep seabed in accordance with generally accepted principles of international law recognized by the United States; but

(2) does not thereby assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any areas or resources in the deep seabed.²⁹

Because the Act applies to an international common area, the high seas, with the same *res communis* legal character as outer space, it provides an interesting precedent for unilateral United States efforts to recognize property rights in outer space pending some agreed-upon international regime.³⁰

natories, prohibits only the appropriation of areas of outer space. Nowhere does the Treaty mention non-appropriation of resources." *Id.* at 612.

27. Pub. L. No. 96-283, 94 Stat. 553 (1980).

28. *Id.* at § 2(a)(12).

29. *Id.* at § 3(a).

30. The Act is used as an illustration only. For an update on what has occurred since its adoption, see Katherine Dixon, Recent Development, *Law of the Sea—Deep Seabed Mining—United States Position in Light of Recent Agreement and Exchange of Notes with Five Countries Involved in Preparatory Commission of United Nations Con-*

This kind of scheme does not constitute the extension of sovereignty to outer space; strictly speaking, it does not even constitute the creation of full-fledged property rights. The right created by the provisions above is not a fee simple absolute governing part of a celestial body, but rather an extractive right as to certain resources. It is mineral right, or right of use. Such rights are a kind of property, but they do not represent title to land.³¹ The United States obligation under the Outer Space Treaty is simply to refrain from acts that involve national appropriation. In the absence of international agreements to the contrary, the United States is free to experiment with methods of creating incentives for space development involving these rights and even involving methods in which enterprises do acquire absolute title to land.³²

vention on the Law of the Sea, 18 GA. J. INT'L & COMP. L. 497 (1988); Lee A. Kimball, *Introductory Note, Belgium-Canada-Italy-Netherlands-Union of Soviet Socialist Republics: Agreement on the Resolution of Practical Problems with Respect to Deep Seabed Mining Areas, and Exchange of Notes Between the United States and the Parties to the Agreement*, 26 I.L.M. 1502 (1987).

31. For more on this, see L.F.E. Goldie, *Title and Use (and Usufruct)—An Ancient Distinction Too Oft Forgotten*, 79 AM. J. INT'L L. 689, 713 (1985) (pointing out that the Deep Seabed Hard Minerals Resources Act creates only a right of use). "The issue of territoriality, of both *imperium* and *dominium*, is irrelevant. The usufructuary enjoys his privilege without needing to assert any titular right to the seabed adverse to the common heritage of mankind. . . ."). *Id.* See also Reynolds & Merges, *supra* note 25, at 143-44 ("Such assurance does not constitute a right to exclusive use of a resource, except in the narrowest sense. . . . Rather, it embodies the very basic right to be left alone."); cf. *Treasure Salvors, Inc. v. Unidentified Wrecked and Abandoned Sailing Vessel*, 640 F.2d 560 (5th Cir. 1981).

32. My thoughts on this topic have been heavily influenced by Wayne White, and I strongly recommend his writings to all interested parties. See, e.g., Wayne White, *Mining Law for Outer Space*, in Proceedings, Tenth Annual Princeton/AIAA/Space Studies Institute Conference on Space Manufacturing (1991). In particular, I should note White's point that existing maritime law—which certainly provides a powerful analogy—already recognizes claims by telepresence, that is, by virtue of remote-control robotic operations. For example, in *Columbus-America Discovery Group, Inc. v. The Unidentified, Wrecked and Abandoned Sailing Vessel, S.S. Central America*, 1989 A.M.C. 1955 [American Maritime Cases] (E.D. Va. 1989), a United States District Court recognized claims to abandoned property found as a result of the claimant's use of telepresence. In a subsequent action by the same name, reported at 742 F.Supp. 1327, 1337 (E.D. Va. 1990), the court enjoined other potential salvors from entering a twenty-square-mile area around the ship. Given the likelihood that many for-profit operations in outer space will involve extensive use of remote-control robots (or even autonomous or semi-autonomous robots), this precedent is vitally important. For another, somewhat similar approach, see Fred Kosmo, *The Commercialization of Space: A Regulatory Scheme that Promotes Commercial Ventures and International Responsibility*, 61 S. CAL. L. REV. 1055 (1988).

Such efforts should be seen, however, as a transitional measure, not as a substitute for an eventual international agreement. Nor would they be uncontroversial, anymore than the Deep Seabed Hard Mineral Resources Act has been. They may provide, however, the degree of security necessary for early space resource ventures to secure capital for their efforts. Although this is not the place to work out an approach in detail, a full-scale property-rights regime would be desirable and probably should possess the following characteristics. First, it should involve land grants (or grants of other interests) that would be recognized at a minimum by all space powers and preferably by all nations on Earth. The United Nations or some other international body may be suitable grantors. Second, those grants, like the railroad rights-of-way used to facilitate the opening of the Western United States, should be contingent upon the grantee actually developing the land in question. Third, the land (or other interest) should be freely alienable, at least after development. This will promote liquidity and capital formation. Fourth, reasonable access and participation by non-space powers should be available, but only on an at-risk basis. That is, less developed countries should be real participants, not simply possessors of a rake-off of any profits that may happen to appear. Finally, realistic and practical dispute-resolution mechanisms should exist to ensure that disputes (over boundaries, for example) remain peaceful.

These issues may or may not become concrete within the next couple of decades. President Bush has proposed, and Congress has begun to fund, a "Space Exploration Initiative" designed to return astronauts to outer space beyond Earth orbit, beginning with the moon and Mars. As part of the planning process for the Initiative, a commission headed by former astronaut Thomas Stafford has proposed four different potential architectures.³³ All of these architectures involve a return to the moon for science and engineering; two involve a return to the moon for permanent colonization and extraction of resources. The most ambitious, although not necessarily the most expensive, involves lunar mining to support operations on the moon and Mars and the microwave beaming of solar power back to Earth.³⁴ If these programs are carried forward, they will generate considerable interest in the availability of property rights and other legal interests and quite possibly a good deal of international con-

33. See AMERICA AT THE THRESHOLD: REPORT OF THE SYNTHESIS GROUP ON AMERICA'S SPACE EXPLORATION INITIATIVE (1991). For a brief summary and analysis of the report, see Glenn H. Reynolds, *The Synthesis Report*, AD ASTRA, Oct. 1991, at 39-42.

34. Reynolds, *supra* note 33, at 52-57.

troverly as well. Although the Stafford Commission's plans may well be delayed by budget politics and post-Cold War adjustments, beginning to talk about these issues seriously is important.

IV. INTERNATIONAL COOPERATION

One strong possibility, in this "New World Order" decade of international cooperation, is that many space efforts, possibly including all or part of the Space Exploration Initiative, will be international efforts. These efforts invariably involve complex negotiations and detailed written agreements covering such issues as jurisdiction, intellectual property rights, and liability. One recent example is the set of agreements governing the multinational space station *Freedom*.³⁵ As the participants in these agreements resolve thorny issues, they will refine the agreements in many respects. This process eventually may produce a customary law of international cooperation in space, a prospect that I find both interesting and welcome.

V. INTERNATIONAL TRADE ISSUES

The steadily growing number of nations with some degree of space capability means that space activity is no longer a monopoly of the two superpowers (if the term "superpower" is even in vogue anymore). As a result, competition in the provision of space goods and services, for a profit or at least for a fee, also is growing.³⁶ The different space submarkets—launch services, satellite hardware, space communications, remote sensing, radiolocation services, and others—are all at different stages of maturity, but all are potential moneymakers and carry a considerable share of prestige and technology-forcing potential as well.

This may or may not be good. While vigorous competition in provid-

35. These agreements have received a good deal of attention in law reviews recently. See, e.g., Katherine M. Gorove, *The U.S./International Space Station Agreement of September 29, 1988: Some Legal Highlights*, 16 J. SPACE L. 182 (1988); Mary B. McCord, *Responding to the Space Station Agreement: The Extension of U.S. Law into Space*, 77 GEO. L.J. 1933 (1989); Helen Shin, "Oh, I have slipped the surly bonds of earth": *Multinational Space Stations and Choice of Law*, 78 CAL. L. REV. 1375 (1990); David C. Stewart, *Resolution of Legal Issues Confronting the International Space Station Project: A Step Forward in the Development of Space Law*, 29 VA. J. INT'L L. 745 (1989).

36. See generally Elizabeth Corcoran & Tim Beardsley, *The New Space Race*, SCI. AM., July, 1990, at 72 (growth of international competition in commercial space markets); Kevin M. Costello, *The Commercial Space Launch Act Amendments of 1988 and Launch Industry Insurance Reform*, 14 SUFFOLK TRANSNAT'L L.J. 492, 492-507 (1991) (history of commercial space industries to present).

ing space goods and services may drive prices down, benefiting users, such competition may not drive costs down. This may mean that the space markets will become a battleground of subsidies without space capabilities improving as they should. By "price" I mean the amount charged customers; by "cost" I mean the total claim on societal resources involved in providing a good or service. Subsidies lower prices, but they do not affect costs—they merely shift costs from customers to some other party, usually the taxpayer. A market characterized by extensive government subsidies rarely creates great gains in efficiency because efficiency gains cost money to achieve—for example, through research and development—but confer no real competitive advantage because competitors may simply increase the amount of government subsidy they receive. Thus, even a low-priced space market, if characterized by government subsidies, could have bad effects by discouraging technological developments that would lower costs and increase capabilities over the long term.

There is some reason to fear that the natural trend in the space field is toward such a market. Many nations are entering the field because of its importance for prestige, because it is a technology driver, and because it has considerable cross-fertilization potential with various military technologies, most notably those involved in the production of ballistic missiles. Having entered the field for non-market reasons, these nations may well prove reluctant to depart it for market reasons. Considerable trade friction already has occurred in the field. In the launch services arena, one section 301 action actually has been filed, and another came to the very brink of filing.³⁷ In addition, Japanese satellite purchases were named under a Super 301 trade proceeding initiated by the United States Trade Representative. This was resolved after extensive negotiations.³⁸ Other actions loom on the horizon.

Trade wars will harm the space industries and prevent free market forces from playing their normal role of increasing efficiency and improving capabilities. The obvious solution is a well-tailored and enforceable trade agreement covering space goods and services. Some desultory

37. Transpace Carriers filed the first space-related section 301 action. It was filed against the European Space Agency and the European launch company Arianespace. Excerpts are reprinted in REYNOLDS & MERGES, *supra* note 7, at 232-34. The Reagan Administration response appears at 50 Fed. Reg. 29,631 (1985). The second section 301 action was by the National Space Society, alleging that the Chinese government violated a 1989 launch trade agreement with the United States. This action was filed for technical review, but not action, on July 9, 1990. It was rendered moot by the enactment of a presidential ban on satellite exports to China.

38. See 55 Fed. Reg. 25761 (June 22, 1990); 55 Fed. Reg. 18693 (May 3, 1990).

work on this already has been done, with a number of semi-formal discussions among the United States and the European Space Agency and the European Community on establishing ground rules for space trade. Aggravating the problems are the close ties that space industries everywhere have to military research, development, and procurement administrations. These ties make subsidies hard to spot, or even to define. This is true even in the United States, which has gone further down the road toward a truly commercial space industry than any other nation. It is far truer elsewhere.³⁹

Paradoxically, the other space-related trade problem stems from the concern that space trade having to do with ballistic missile technologies might be too free. Although the danger of ballistic missile proliferation did not receive much attention prior to the Persian Gulf war,⁴⁰ an agreement among the major space powers has existed for some time that has been aimed at preventing the spread of critical technologies involved in the production and use of ballistic missiles.⁴¹ This agreement is not clearly adequate to the task, nor is any agreement clearly adequate to the task. The technologies involved are simply too easy to learn and too easily implemented with readily available equipment to restrict completely. Nonetheless, it is worth pursuing in considerable detail. Ultimately, vigorous and forceful diplomacy, not export-control law, will probably do the most to control the spread of ballistic missiles.

VI. REMOTE SENSING

The term "remote sensing" refers to a variety of information-gathering activities undertaken from space, such as satellite photography, infrared, laser, and radar imaging, and the gathering of electronic intelligence. Up to now, all such activity has been typically governmental in nature, either through the various military spy satellites operated by the superpowers, or through the far less capable public remote sensing systems, such as LANDSAT, operated by the United States through the

39. For a discussion of these issues, see REYNOLDS & MERGES, *supra* note 7, at 229-38. See also Glenn H. Reynolds & Robert P. Merges, *Toward an Industrial Policy for Outer Space: Problems and Prospects of the Commercial Launch Industry*, 29 JURIMETRICS J. 7 (1988).

40. *But see* Glenn H. Reynolds, *National Security on the High Frontier*, 2 HIGH TECH. L.J. 281 (1987) (book review).

41. For a complete and up-to-date discussion of this issue, see McCall, "The Inexorable Advance of Technology?" *United States and Multilateral Efforts to Curb Ballistic Missile Proliferation and its Consequences*, 32 JURIMETRICS J. ____ (1992) (forthcoming). See also REYNOLDS & MERGES, *supra* note 7, at 238-46.

EOSAT corporation, and SPOT, a French system. This governmental monopoly exists for both historical and technological reasons. Until recently, satellite imaging systems have been prohibitively expensive for private purchasers.

That is changing, and it is beginning to appear that private remote sensing systems are becoming feasible. Within the next ten to twenty years, a major news organization, or consortium of news organizations, probably will orbit its own spy satellite to gather news that cannot be gathered any other way. A good deal of discussion already has occurred concerning this "mediasat" and the legal and political issues that it would raise. Most discussion has centered around governmental efforts to control the information produced by such a satellite for national security reasons.

If the United States asserted this control, serious First Amendment questions would arise, although the regulations currently governing private remote sensing systems do not really reflect this problem.⁴² Furthermore, these systems would face an uncertain international legal regime. No existing international law prohibits the private remote sensing of other nations. Many nations, however, abhor the thought that other nations' satellites—perhaps under the control of large oil or mineral companies—might be learning more about their natural resources than they themselves know.⁴³ In addition, satellite photographs and data have obvious military importance. These photographs are far more likely to become available to hostile nations and groups if private systems produce them—particularly those owned by the news media—than if superpower intelligence agencies control them.

On the other hand, precisely because military officials would not control them, private remote sensing systems might play an important role in keeping the peace. News media organizations and private arms-control groups with access to satellite data could play an important arms-control monitoring role. Moreover, the general availability of this information would tend to discourage surprise attacks.

Currently, little law on the subject exists, and the 1967 Outer Space Treaty's provision that outer space "shall be free for exploration and use" is likely to pose a barrier to efforts to limit space-based remote

42. Licensing of Private Remote-Sensing Systems, 15 C.F.R. § 960 (1990). For a discussion of private remote sensing systems in general and the United States regulations specifically, see Robert P. Merges & Glenn H. Reynolds, *News Media Satellites and the First Amendment: A Case Study in the Treatment of New Technologies*, 3 HIGH TECH. L.J. 1 (1988).

43. See Orlove, *supra* note 19, at 629-32.

sensing in the name of national sovereignty. The issue, however, has not been ignored. The United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) has issued principles on remote sensing that, although they lack legal force, provide some guidance with respect to the expectations of the international community.⁴⁴ Among other things, these principles provide that sensed states shall have access, on reasonable terms, to the unenhanced data gathered by satellite imaging.

The principles are unlikely to be the last word on the subject, which may well turn out to be a contentious one. Nevertheless, the great benefits promised by private remote sensing systems are likely to ensure that, one way or another, they wind up flourishing.

VII. ARMS CONTROL

With the Cold War apparently over, the old disputes⁴⁵ about interpretation of the ABM treaty⁴⁶ seem passé. Space-related arms control issues, however, are not dead. Certain military uses of space, for example, as a staging point for nuclear weapons, are off-limits under the 1967 Outer Space Treaty.⁴⁷ This prohibition is so highly regarded that it likely would be considered binding even as against nonsignatories. Within a few decades, space-based lasers likely will be capable of menacing aircraft and even targets on the surface of the earth. Whether these weapons would count as "weapons of mass destruction" under the Treaty is unclear (although likely),⁴⁸ but certainly they are likely to be policed in some fashion. After all, if the prospect of being photographed from a satellite creates uneasiness, the prospect of being incinerated from one is likely to generate far stronger feelings. Finally, long-range plans for mining asteroids or the moon often involve moving around large bod-

44. Principles Relating to Remote Sensing of the Earth from Space, reprinted in REYNOLDS & MERGES, *supra* note 7, at 191-94.

45. For discussions of these issues, see REYNOLDS & MERGES, *supra* note 7, at 96-102. See also Abram Chayes & Antonia H. Chayes, *Testing and Development of "Exotic" Systems Under the ABM Treaty: The Great Reinterpretation Caper*, 99 HARV. L. REV. 1956 (1986); Abraham D. Sofaer, *The ABM Treaty and the Strategic Defense Initiative*, 99 HARV. L. REV. 1972 (1986).

46. Treaty on the Limitation of Anti-Ballistic Missile Systems, May 26, 1975, U.S.-U.S.S.R., 23 U.S.T. 3435.

47. Outer Space Treaty, *supra* note 14, art. IV, 18 U.S.T. at 2413, 610 U.N.T.S. at 208. Article IV of the Treaty provides in part: "States Parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction." *Id.*

48. See John M. Orr, Comment, *The Treaty on Outer Space: An Evaluation of the Arms Control Provisions*, 7 COLUM. J. TRANSNAT'L L. 259 (1968).

ies of material in Earth orbit. Such activity also could be done for war-like purposes, with multiton bodies of rock or metal being directed at targets on Earth with devastating effect. States will undoubtedly insist on strict controls on such activity for safety's sake. Those enthusiastic about the prospects for asteroid mining often forget this.

VIII. MORE REMOTE ISSUES

I close my discussion with a brief treatment of two issues that are less likely to come up in the next few decades, but that will be important whenever they do arise. The first is the legal treatment of independent (to a greater or lesser degree) space societies. The second is contact with extraterrestrial intelligences. Both issues have interested many fine minds,⁴⁹ and both will certainly gain the attention of everyone else should they become a reality.

A. *Governance of Space Societies*

The problems of governing human societies in outer space no doubt seem rather remote to most, perhaps making it surprising that the Smithsonian Institution has published an entire book on the subject,⁵⁰ and that many writers—some quite eminent—have written about it or participated in symposia on the topic.⁵¹ Yet the governance of space soci-

49. See, e.g., ERNST FASAN, *RELATIONS WITH EXTRATERRESTRIAL INTELLIGENCES* (1970); ANDREW HALEY, *SPACE LAW AND GOVERNMENT* 394-423 (1963); MYRES S. McDOUGAL ET AL., *LAW AND PUBLIC ORDER IN SPACE* (1963); Michael A.G. Michaud, *Interstellar Negotiation*, *FOREIGN SERVICE J.*, Dec. 1972, at 10. On governance of space societies, see Justice William Brennan, Jr., *Space Colonization and the Law*, 3 *HARV. J. L. & TECH.* 7 (1990). See also GEORGE S. ROBINSON & HAROLD M. WHITE, JR., *ENVOYS OF MANKIND* (1986); John A. Ragosta & Glenn H. Reynolds, *In Search of Governing Principles*, 28 *JURIMETRICS J.* 473 (1988) (review essay). Both topics are briefly surveyed in REYNOLDS & MERGES, *supra* note 7, at 307-23.

50. ROBINSON & WHITE, *supra* note 52. Of course, the Smithsonian has been ahead of its time before. In 1919, it published a paper by Dr. Robert Goddard on liquid fuel rocketry, *A Method of Reaching Extreme Altitudes*, despite the criticism of many who considered Goddard a crank. Today, a copy of Goddard's paper, autographed by the United States and Soviet crews of the Apollo/Soyuz mission, is in the National Air and Space Museum's collection as a testament to the Smithsonian's farsightedness.

51. For example, the Governance in Space Project, a joint effort of the Smithsonian Institution and Boston University's Center for Democracy, sponsored a series of meetings coinciding with the Bicentennial of the Constitution that included such participants as Justice William Brennan, Prof. A.E. Dick Howard, Walter Cronkite, William Rogers, Thomas Pownall, John Glenn, and Frank Fahrenkopf, among others. These meetings produced a Declaration of First Principles for the Governance of Space Societies that is reprinted in REYNOLDS & MERGES, *supra* note 7, at 310-11. See also Justice William

eties has managed to capture a great deal of interest, notwithstanding that these societies are still years in the future.

Rudimentary space societies do exist now—in the form of Space Shuttle or space station crews—and there are even the beginnings of legal principles to govern their operation.⁵² The chief interest of scholars and commentators, however, is not these micro-societies, but rather the principles that will govern full-fledged permanent settlements, such as those envisioned by Princeton physicist Gerard K. O'Neill.⁵³ I will not attempt to summarize the interesting literature that has developed on this issue, but rather will make a few general points here.

First, I am a bit concerned by the way in which many writers assume that space societies will necessarily be less free—that is, less amenable to individual rights to lead different or unconventional lives free from societal restraint. The far-more-fragile life support systems of space societies of course will require some degree of social control when activities that might endanger others are concerned. For example, sabotage will no doubt be sharply sanctioned, and many activities that are frequently tolerated on Earth (such as smoking) are likely to be strictly forbidden. This control, however, need not extend to enforced conformity in other areas when these concerns do not apply.

This, however, contradicts much of the literature. For example, William Wu argues that, “[s]pace colonists may face life on a political leash,” and compares space colony life to that in an oppressive company town.

Brennan, Jr., *Space Settlements and the Law: Address to the American Law Institute Annual Dinner, May 21, 1987*, reprinted in REYNOLDS & MERGES, *supra* note 7, at 307.

52. See, e.g., 18 U.S.C. § 451 (1988) (extending United States criminal jurisdiction to outer space for some purposes); 35 U.S.C. § 105 (1992) (extending United States patent law to cover inventions made, used, or sold on United States-registry spacecraft); 14 C.F.R. § 1214.702 (granting space shuttle commander legal authority to maintain order and discipline in flight). For more on existing United States legislative and administrative law applying to in-space activity, see REYNOLDS & MERGES, *supra* note 7; U.S. CONGRESS OFFICE OF TECHNOLOGY ASSESSMENT, *SPACE STATIONS AND THE LAW: SELECTED LEGAL ISSUES* (1986). See also Glenn H. Reynolds, *Legislative Comment: The Patents in Space Act*, 3 HARV. J. L. & TECH. 13 (1990) (discussing legislation extending United States patent law to United States-registry spacecraft); Glenn H. Reynolds, 27 JURIMETRICS J. 431 (1987) (book review) (reviewing OTA space stations paper); Leo Kanowitz, *American Labor Law and the United States Space Shuttle*, 34 HASTINGS L.J. 715 (1983); Karen Robbins, Comment, *The Extension of United States Criminal Jurisdiction to Outer Space*, 23 SANTA CLARA L. REV. 627 (1983).

53. GERALD K. O'NEILL, *THE HIGH FRONTIER* (rev. ed. 1982) (describing feasibility in next century of orbital colonies containing 10,000 or more citizens).

In a company town, freedom of expression may be in danger. Democracy permits citizens to make public statements about political figures that they would never say openly about their immediate bosses or top level officers of the companies for which they work. The security and efficiency of a well-organized and well-run company town in space might be politically stifling. . . . The colonization of space may point toward a weakening of individual rights and a strengthening of government power.⁵⁴

Many other writers seem to share this view. Life in outer space, they suggest, will be confined, regimented, and conformist; it would be more like duty on a nuclear submarine than exploration of the final frontier. Space colonists, because of their delicate life-support systems and precarious social structures, will simply find freedom unaffordable.⁵⁵ This view is probably wrong, but nonetheless it concerns me a great deal.

It is probably wrong because all of the available evidence is that things don't work this way. The closest current analogs to a space colony are Antarctic bases. But these are not harsh, dictatorial environments. By contrast, the kinds of conditions that Antarctic crews face tend to force the abandonment of traditional hierarchical systems in favor of more flexible ones:

A winter base in Antarctica is a unique world, where the cook often has greater prestige than the officer-in-charge and the radio operator can have more influence than an established scientist. The traditional hierarchical structure of the military, and of government as a whole, breaks down. . . . This was a controversial and embarrassing realization for the Navy. Flexible authority and sharing of tasks among everyone are vital. . . . This can run against the grain of highly specialized scientists and career military officers. The absence of women was also a factor. Navy traditions excluded females from the continent, and this increased tensions.

. . . .
Some lessons have been learned. With great reluctance, the Navy eventually allowed women on the continent. . . . A more flexible organizational structure is tolerated, and private enterprise is now providing some services and personnel. . . .

The Antarctic experience reminds us that the dangers of mutiny or psychosis in a space station or colony are as real as the threat of meteors

54. William Wu, *Taking Liberties in Space*, AD ASTRA, Nov. 1991, at 36. This point is reinforced by recent movies, such as *Outland* and *Total Recall*, that depict life in space colonies as harshly controlled.

55. This conclusion, for example, leads to a provision in the Declaration of First Principles stressing the need to balance "community safety and individual survival within the unique environment of space" with the exercise of "fundamental individual rights." Reprinted in REYNOLDS & MERGES, *supra* note 7, at 311.

or solar flares.⁵⁶

Experience, thus, tends to suggest that overly rigid and controlled environments are harmful to survival under such conditions, not essential to it. George Robinson and Harold White agree, stressing that "the real answer to [space] community success probably lies in motivated, self-actualized, strong, adventurous, unconventional, yet disciplined and well-trained human beings."⁵⁷

I said that the negative view of liberties in space societies worries me even though it is probably wrong. Here is why. Although I find the topic interesting, I cannot believe that the rather large amount of writing on space societies is driven solely by interest in the topic itself. Space societies are interesting, but few of us are likely to see them in our lifetimes. I believe that, consciously or unconsciously, interest in space societies is as high as it is because their future in many ways mirrors our own. Many characteristics of space societies, such as strong dependence on advanced technology, problems with maintaining environmental quality, the need for people to work together under stress, and individuals' strong dependence upon their society for basic necessities such as food and water, are simply amplified images of characteristics already present, and growing, in our own society.

This is a good reason for being interested in space societies, since by studying their problems we gain a window into our future on Earth. It is also a reason to be worried. For if there is a general belief that a high level of interdependence and environmental fragility means that space settlers will not be able to afford individual rights, then what of those of us who remain on Earth under similar conditions? I do not believe that the march of technology has made individual rights obsolete, but I worry that others might reach that conclusion. And I believe that it is a wrong conclusion. Just as space societies will need access to the creativity and individual initiative of their inhabitants to flourish, so will societies on Earth. Surely the failure of totalitarian societies worldwide to achieve any kind of social—or even material—greatness should underscore that need.

56. Andrew Lawler, *Lessons from the Past: Toward a Long-Term Space Policy*, in LUNAR BASES AND SPACE ACTIVITIES OF THE TWENTY-FIRST CENTURY 757, 762-63 (W.W. Mendell ed., 1985); see also Helmreich & Runge, *Psychological Considerations in Future Space Missions*, in HUMAN FACTORS OF OUTER SPACE PRODUCTION (T.S. Cheston & D.L. Winter eds., 1980); Alfred W. Crosby, *Life (With All Its Problems) in Space*, in INTERSTELLAR MIGRATION AND THE HUMAN EXPERIENCE 210-19 (Ben R. Finney & Eric M. Jones eds., 1985).

57. ROBINSON & WHITE, *supra* note 52, at 110.

B. *Contact with Extraterrestrial Intelligences*

After the rather remote topic of space societies comes another topic seemingly even more remote: contact with extraterrestrial intelligences. Like the previous topic, this question is interesting not only for its own sake, but for what it tells us about ourselves. The message here, however, is a bit more heartening.

The first question regarding extraterrestrial intelligences is the hardest one: Do they exist at all? This is a tough question, and any answer is largely meaningless as a result of the near-total absence of any data. We know little about our own solar system, and the rest of the universe is awfully large. Yet this inspires a certain kind of probabilistic reasoning. Our own galaxy contains tens of billions of stars. Starting with this large number, it seems that if only a tiny fraction of those stars have planets, and if only a tiny fraction of planets have life, and if only a tiny fraction of life is intelligent, then thousands of intelligent species around our galaxy still should exist, some of which should be relatively close to us. This reasoning led physicist Enrico Fermi's plaintive cry, "Then where is everybody?"⁵⁸

At any rate, our question is not whether intelligent life exists elsewhere, but what to do if we contact it. Contact could occur in several ways. First, we might go to it, but our technological capabilities are unlikely to be up to this task for many decades, if not centuries.⁵⁹ Second, it may come to us. This requires a very high level of technology on the part of the aliens—at least in the realm of space transportation. The

58. Quoted in Isaac Asimov, *Terrestrial Intelligence*, in *FIRST CONTACT: THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCES* (Ben Bova & Bryon Preiss eds., 1990) [hereinafter *FIRST CONTACT*]. Fermi's question is so famous that in scientific circles the apparent contradiction, between so many opportunities for intelligent life and only one known instance of it, is known as the "Fermi Paradox." *First Contact* contains chapters by illustrious scientists, futurists, and science fiction writers including, among many others, Frank Drake, Philip Morrison, Ben Bova, Arthur C. Clarke, Isaac Asimov, and David Brin. It is probably the best current source of information on the prospects for contacting other intelligences. See also Gregg Easterbrook, *Are We Alone?*, *ATLANTIC*, Aug. 1988, at 25-38.

59. This assumes, of course, no other intelligent life lives within our solar system. In a sense, this assumption is almost certainly wrong. Other species on Earth—such as dolphins and chimpanzees—are quite intelligent. In fact, some believe that dolphins may be as intelligent as humans, if not more so. Our rather poor record at recognizing this and at communicating with dolphins, even once we began to suspect that they might be very bright, bodes poorly for our interactions with alien species. By "intelligent life," however, we typically mean "intelligent life possessing a level of technology close to or superior to our own." Almost certainly, no such life, other than humanity, exists within our solar system.

legal problems that this sort of encounter might create would range from the dramatic to the picayune, but most would be drowned in the political backwash. Should this kind of contact occur, the prospects for humanity may not be bright. Certainly the history of our own species suggests that when technologically less-advanced cultures are brought into contact with technologically more-advanced cultures, the less-advanced cultures tend to suffer, both materially, through enslavement, exploitation, and so on, and spiritually, through a pervasive sense of inferiority and self-alienation.⁶⁰ The legal challenges stemming from this contact would involve attempting to manage the contact to avoid the deleterious effects while minimizing restraints on individual and academic freedom.⁶¹

Although the likelihood of this sort of event, quite literally, is incalculable,⁶² the potential consequences are significant enough that a bit of preventive lawyering may be in order. The world community, in drawing back from the nuclear brink (something that itself seemed wildly unlikely just a few years ago), has already taken one major step toward rendering itself better able to deal with alien contact. A logical next step would be for lawyers, scientists, and other interested parties to begin thinking about how this contact would be managed if it should occur.⁶³

This sort of group activity actually is beginning to happen. A recent publication, *First Contact: The Search for Extraterrestrial Intelligence*,⁶⁴ has brought together a number of these parties (including one

60. For an illustration of this effect, see COLIN M. TURNBULL, *THE LONELY AFRICAN* (1962).

61. About the only specific existing legal authority to cover such a situation is to be found in the NASA quarantine regulations. See *Extraterrestrial Exposure Regulations*, *supra* note 12. One should hope that these rather inartfully drawn regulations do not indicate how deftly such issues would be handled should the event come to pass.

62. Two equally valid (or invalid) ways of looking at the question are possible: (1) notwithstanding the claims of certain rather sensational popular writers, no evidence exists that humanity has ever been visited by extraterrestrial intelligences, so that the probability of these visits, therefore, must be small; or (2) although humanity has never been visited, this may simply mean that the time has now arrived—or, in the alternative, now that our radio broadcasts are expanding out into the cosmos, our chances of being noticed and investigated grow day by day. For more on this issue in particular, see W.T. Sullivan, III, et al., *Eavesdropping: The Radio Signature of Earth*, 199 *SCIENCE* 377 (1978). Either approach depends on assumptions that are currently untestable; both may in fact be wrong.

63. For many years, persistent rumors have circulated about secret agreements between the United States and the former Soviet Union regarding military cooperation in the event of alien invasion. While I have some doubt as to the truth of these rumors, such agreements, even if in existence, would address only one facet of the problem, and probably the least important.

64. See *supra* note 59. The book is recommended highly to those interested in the

lawyer)⁶⁵ to address just this problem. Furthermore, a number of scientists involved in searching for extraterrestrial intelligence have drafted a declaration of principles governing detection.⁶⁶ The text of that declaration follows:

DECLARATION OF PRINCIPLES CONCERNING ACTIVITIES FOLLOWING
THE DETECTION OF EXTRATERRESTRIAL INTELLIGENCE

We, the institutions and individuals participating in the search for extraterrestrial intelligence,

Recognizing that the search for extraterrestrial intelligence is an integral part of space exploration and is being undertaken for peaceful purposes and for the common interest of mankind,

Inspired by the profound significance for mankind of detecting evidence of extraterrestrial intelligence, even though the probability of detection may be low,

Recalling the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, which commits states as parties to that treaty "to inform the Secretary General of the United Nations as well as the public and the international scientific community, to the greatest extent feasible and practicable, of the nature, conduct, locations and results" of their space exploration activities (Article XI),

Recognizing that any initial detection may be incomplete or ambiguous and thus require careful examination as well as confirmation, and that it is essential to maintain the highest standards of scientific responsibility and credibility,

Agree to observe the following principles for disseminating information about the detection of extraterrestrial intelligence:

1. Any individual, public or private research institution, or governmental agency that believes it has detected a signal from or other evidence of extraterrestrial intelligence (the discoverer) should seek to verify that the most plausible explanation for the evidence is the existence of extraterrestrial intelligence rather than some other natural phenomenon or anthropogenic phenomenon before making any public announcement. If the evidence cannot be confirmed as indicating the existence of extraterrestrial intelligence, the discoverer may disseminate the information as appropriate to the discovery of any unknown phenomenon.

2. Prior to making a public announcement that evidence of extraterrestrial intelligence has been detected, the discoverer should promptly inform

subject.

65. State Department official Michael Michaud, a member of the International Institute of Space Law.

66. Reprinted in Michael Michaud, *A Unique Moment in Human History*, in *FIRST CONTACT*, *supra* note 59, at 243, 258-60.

all other observers or research organizations that are parties to this declaration, so that those other parties may seek to confirm the discovery by independent observations at other sites and so that a network can be established to enable continuous monitoring of the signal or phenomenon. Parties to this declaration should not make any public announcement of this information until it is determined whether this information is or is not credible evidence of the existence of extraterrestrial intelligence. The discoverer should inform his/her or its relevant national authorities.

3. After concluding that the discovery appears to be credible evidence of extraterrestrial intelligence, and after informing other parties to this declaration, the discoverer should inform observers throughout the world through the Central Bureau for Astronomical Telegrams of the International Astronomical Union, and should inform the Secretary General of the United Nations in accordance with Article XI of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies. Because of their demonstrated interest in and expertise concerning the question of the existence of extraterrestrial intelligence, the discoverer should simultaneously inform the following international institutions of the discovery and should provide them with all pertinent data and recorded information concerning the evidence: the International Telecommunication Union, the Committee on Space Research of the International Council of Scientific Unions, the International Astronautical Federation, the International Academy of Astronautics, the International Institute of Space Law and Commission 51 of the International Astronomical Union.

4. A confirmed detection of extraterrestrial intelligence should be made available to the international scientific community through publications, meetings, conferences and other appropriate means.

5. All data necessary for confirmation of detection should be made available to the international scientific community through publications, meetings, conferences and other appropriate means.

6. The discovery should be confirmed and monitored and any data bearing on the evidence of extraterrestrial intelligence should be recorded and stored permanently to the greatest extent feasible and practicable, in a form that will make it available for further analysis and interpretation. These recordings should be made available to the international institutions listed above and to members of the scientific community for further objective analysis and interpretation.

7. If the evidence of detection is in the form of electromagnetic signals, the parties to this declaration should seek international agreement to protect the appropriate frequencies by exercising the extraordinary procedures established within the World Administrative Radio Council of the International Telecommunication Union.

8. No response to a signal or other evidence of extraterrestrial intelligence should be sent until appropriate international consultations have taken place. The procedures for such consultations will be the subject of a

separate agreement, declaration or arrangement.

9. The SETI Committee of the International Academy of Astronautics, in coordination with Commission 51 of the International Astronomical Union, will conduct a continuing review of procedures for the detection of extraterrestrial intelligence and the subsequent handling of the data. Should credible evidence of extraterrestrial intelligence be discovered, an international committee of scientists and other experts should be established to serve as a focal point for continuing analysis of all observational evidence collected in the aftermath of the discovery, and also to provide advice on the release of information to the public. This committee should be constituted from representatives of each of the international institutions listed above and such other members as the committee may deem necessary. To facilitate the convocation of such a committee at some unknown time in the future, the SETI Committee of the International Academy of Astronautics should initiate and maintain a current list of willing representatives from each of the international institutions listed above, as well as other individuals with relevant skills, and should make that list continuously available through the Secretariat of the International Academy of Astronautics. The International Academy of Astronautics will act as the Depositary for this declaration and will annually provide a current list of parties to all the parties to this declaration.

The first point to be made about the Declaration is that it is not a formal set of binding legal principles: it is an agreement among scientists, not among states. Of course, it does not necessarily lose importance, or likelihood of being followed, for that reason. Indeed, agreements among scientific researchers have a strong history of being followed and this one is likely to be looked to should the event occur. Moreover, the agreement, although it appears to contemplate the receipt of extraterrestrial radio signals as the most likely mode of contact, is not limited to those occasions. Paragraph 1 refers to detection of "a signal from or other evidence of extraterrestrial intelligence", language that clearly reaches any situation in which extraterrestrial intelligence is discovered, including radio signals, discovery of artifacts, and outright visits.⁶⁷

Once discovery has been made and confirmed, the next question is: what do we do? That is, if we receive alien communications, do we an-

67. Although radio astronomy represents the most popular means of searching for extraterrestrial intelligence, it is not the only method that has been used. For example, scientists have examined locations in the solar system with optical, radar, and infrared sensors for indications of alien artifacts (such as alien probes that might be monitoring happenings on Earth). Others have inspected nearby stars for evidence of civilizations that might have dumped nuclear waste into space, or constructed "Dyson sphere" shells to capture solar energy, though so far none of these efforts has borne fruit. See Easterbrook, *supra* note 61.

swer? Humans have already attempted communication with alien species on a few occasions. We have placed gold plaques and recorded messages on board space probes whose trajectories will ultimately take them into interstellar space, and we have beamed messages from radio telescopes to distant stars. This last effort, which Frank Drake originated in 1974, drew considerable criticism regarding the right of a small group of scientists to speak quite literally for all humanity.⁶⁸

One might argue that these criticisms are unfounded. Interstellar distances are so vast that voyages between stars must be prohibitively expensive, and besides, any alien species that might receive our messages would be so technologically advanced as to be benign and harmless. The trouble with these arguments is that we have no particular evidence to support them. As to technology, the fact that we are unable to cross interstellar distances is hardly a guarantee that others may not be able to do it—we are, after all, only a few decades past being unable to cross the distance between the Earth and its moon. Anyone who has been at the game of space travel at all has probably been at it longer than us. And even we have the capacity, with technology readily extrapolatable from the present, to send small packages across interstellar distances. If we were paranoid enough, those packages could contain destructive nanodevices, or viruses, or other weapons that might be lethal even in small quantities. I do not believe that humanity is, or is likely to be, that paranoid, but it might be unwise to assume that other species share our disposition.

As for the argument that other, more advanced species necessarily would be more benign, that too is based on certain assumptions—most significantly, that intelligence is a civilizing factor. Scholars have noted that human history provides little support for this claim. As Easterbrook notes:

James Trefil, of George Mason University, has cautioned that if evolution functions approximately the same way on other worlds that it has functioned here—conferring survival upon the fittest—advanced extraterrestrials might still be aggressive, territorial, and quick to reach for the sword. In that case, counting on poor alien marksmanship might not be prudent. Even if a message arrived from a great distance, we might for defensive reasons be compelled to assume that the senders knew something

68. A history of these efforts appears in Michaud, *supra* note 69; a copy of the message beamed by Drake, which included information on human beings and our location, appears at 255; a copy of a recorded image from a *Voyager* probe appears on 248. A copy of the gold plaque affixed to United States space probes beginning with *Pioneer 10* appears earlier in the same volume at 185.

about the speed-of-light barrier that we didn't, and withhold our reply.

The most disquieting aspect of natural selection as observed on Earth is that it channels intellect to predators. Most bright animals are carnivores: stalking requires tactics, pattern recognition, and, for social animals, coordinated action, all incubators of brainpower. . . . This isn't much of a testimonial to "intelligence" [as a guarantee of nonviolence].⁶⁹

Perhaps an alien civilization would have outgrown its violent tendencies, even if innate, by the time it reached a level of technology that would allow it to contact us. Again, we cannot know. Logically, a species that has attained technological maturity without destroying itself ought to have tamed its innate tendencies toward violence—perhaps, however, it has merely learned to channel them exclusively outward, which would be cold comfort to humanity. Furthermore, based on our own experience, technological progress does not necessarily produce tendencies toward nonviolence. As Easterbrook notes:

Regrettably, the one example we have—human history—does not bear out an assertion that technical progress and social wisdom are natural partners. Our technology has grown in almost magical fashion over the past 2,000 years, but foreign policy is still practiced pretty much as it was during the Roman Empire.⁷⁰

While we should not allow our fears that an alien civilization might be hostile and paranoid to render us hostile and paranoid ourselves, these concerns certainly suggest that our approach should be cautious. The Outer Space Treaty's requirement that our activities in outer space should be "for the benefit and in the interests of all countries"⁷¹ reinforces this suggestion. Various scholars have discussed this problem from different perspectives. Andrew Haley formulated a rule of "metalaw" for dealing with other species that revises the Golden Rule: "Do unto others as they would have done unto them." As Haley says, "To treat others as we would desire to be treated might well mean their destruction."⁷² Obviously, the limits to this principle begin to appear when the others' interests begin to collide with our own: science fiction fans might call this the "Klingon Corollary." And, of course, there is no guarantee that other civilizations would adopt the same rule.

As always, McDougal, Lasswell, and Vlasic are more concerned with matters of power and relationship than Haley. They outline a number of

69. Easterbrook, *supra* note 61, at 37.

70. *Id.*

71. Outer Space Treaty, *supra* note 15, art. I, 18 U.S.T. at 2412-13, 610 U.N.T.S. at 207-08.

72. HALEY, *supra* note 51, at 395.

possible scenarios in which aliens quarantine the Earth (as too violent), or in which groups on Earth conspire with aliens (or even with dissident groups within alien societies) in various power-bloc games, or in which even an inferior Earth makes use of balance-of-power diplomacy, setting rival alien groups against one another to maintain its own independence.⁷³

Ernst Fasan takes an approach that combines some aspects of the two. Stressing that our ability to interact with alien species will be greater or lesser depending on how much we have in common with them, he recommends that we base our treatment of those species on Kantian principles. He proceeds to derive a number of universal rules for dealing with alien species based on natural law and the categorical imperative.⁷⁴ Other philosophers have addressed this issue in various other terms.⁷⁵

The scientists in the field have considered this approach as well. One group has developed a set of proposed rules, entitled *Proposed Protocol for the Sending of Communication to Extraterrestrial Intelligence*, to govern contact with extraterrestrials once they have been discovered.⁷⁶ Those rules follow:

PROPOSED PROTOCOL FOR THE SENDING OF COMMUNICATIONS TO EXTRATERRESTRIAL INTELLIGENCE

The Signatories agree that communications with extraterrestrial intelligence will be guided by the following principles:

1. Communications with extraterrestrial intelligence will be undertaken on behalf of all mankind, rather than specific nations, groups, or individuals.
2. Nations, organizations, and individuals will not unilaterally send communications to extraterrestrial intelligence until appropriate international consultations have taken place.
3. The Signatories will not cooperate with attempts to communicate with extraterrestrial intelligence which do not conform to the principles in this protocol.
4. An international group including representation from all interested nations will be formed to deal with the question of whether such a communication should be sent and, if so, what its content should be.

73. McDOUGAL, *supra* note 51, at 974-1021.

74. FASAN, *supra* note 51.

75. See, e.g., ROBERT NOZICK, *PHILOSOPHICAL EXPLANATIONS* 417 (1981); Callicott, *Moral Considerability and Extraterrestrial Life*, in *BEYOND SPACESHIP EARTH*, *supra* note 3, at 227; Tooley, *Would ETIs [Extraterrestrial Intelligences] Be Persons?* in *EXTRATERRESTRIAL INTELLIGENCE: THE FIRST ENCOUNTER* (J. Christian ed., 1976).

76. *Reprinted in* *FIRST CONTACT*, *supra* note 61, at 260-61.

5. If a decision is made to develop a communication to extraterrestrial intelligence on behalf of mankind, the following principles will be observed:

- a. Respect for the value of life and intelligence.
- b. Respect for the value of diversity, including respect for different customs, habits, languages, creeds and religions, approaches to social organization, and styles of life.
- c. Respect for the territory and property of others.
- d. Recognition of the will to live.
- e. Recognition of the need for living space.
- f. Fair play, justice, mercy.
- g. Reciprocity and *quid pro quo*.
- h. Nonviolation of others.
- i. Truthfulness and non-deception.
- j. Peaceful and friendly welcome.
- k. Cooperation.
- l. Respect for knowledge, curiosity, and learning.

6. The drafters of a communication to extraterrestrial intelligence will consider detailed information about mankind to be a commodity of high value which will not be transmitted without due attention to human security and well-being, and to reciprocity.

7. In the event that extraterrestrials appear to pose a threat to human health, well-being, or peace, no nation shall act without consulting the Security Council of the United Nations.

Although less ambitious than some of the scholarly writings mentioned earlier, the proposed rules make some important points. First, contact with alien intelligences would represent an event so important that a decent respect for the well-being of humanity would forbid any individual or single nation from going ahead without proper consultation. Second, dealings with extraterrestrial beings would set such an important precedent that they should be conducted in a manner that is straightforward, honest, and considerate. Third, the stakes would be so high that we should be cautious about revealing too much until we are very sure about the consequences. Finally, nations should make responses to any threats a global matter, not an individual one. In the unlikely, but horrific, circumstances of an encounter with hostile aliens, we would want all humanity united from the beginning.

One fascinating aspect of the draft proposal—and, indeed, all thinking about contact with extraterrestrials—is the way in which our vision of this contact, taking place as it does against a blank slate, is in large part a product of our own hopes, fears, and predispositions. Between the lines in both of the scientists' documents noted above is a sense that they would most likely be communicating with their opposite numbers—aliens, perhaps, but alien scientists. On the other hand, a healthy

dose of caution remains, perhaps because scientists themselves know, from long and sometimes bitter experience, that while doing their jobs, they are often doing the bidding of others less scrupulous. Our vision of intelligent aliens has wavered back and forth over the years. Sometimes, our vision has reflected Cold War paranoia; aliens are viewed as malevolent invaders, either wielding weapons of fearsome destructiveness or weaving deceptions of astonishing subtlety,⁷⁷ or both. Other times, especially more recently, they are pictured as noble teachers, far better than we poor humans, come to save us from ourselves, and bring us enlightenment. In reality, of course, neither is likely to be true. The one prediction I feel fairly confident in making is that if we encounter intelligent extraterrestrials, we will be surprised regardless of how much we have thought about the subject.

IX. CONCLUSION

In this rather brief and sketchy treatment, I have outlined a number of different issues. Some are of immediate importance: with orbital debris already altering the character of the Van Allen radiation belts thousands of miles into space and threatening spacecraft now in orbit with lethal collisions, we cannot afford to wait. With the Moon Treaty coming up for review in the United Nations General Assembly in 1994, this is the time to begin thinking very seriously about the place of resource-extraction rights since it is the failure of the Moon Treaty to recognize those rights that has doomed it to marginality since its entry into force. Other issues I have discussed are likely to materialize only well into the next century, if then.

In spite of these differences, all of these issues—and, indeed, all of the issues of space law generally—have one common feature. To take space law seriously, one must believe in a future in which humanity flourishes, and one in which law can make a difference for good. To me, that is part of the appeal. I hope that it is for others as well.

77. In many of the most obviously Cold War-inspired visions, alien beings (like communists) were able to disguise themselves effortlessly as normal human beings until the appointed time came to strike.

