Outer Space

Problems of Law and Policy

Glenn H. Reynolds
and Robert P. Merges

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About the Book and Authors

This book examines the international and domestic American legal problems associated with activity in outer space from a strong policy perspective, with particular attention given to problems associated with space commercialization and with military activities in outer space. *Outer Space: Problems of Law and Policy* is indispensable as a casebook, reference, and self-teaching tool for students, practitioners, academics, and members of the aerospace industry.

Glenn H. Reynolds, a graduate of Yale Law School, is an attorney with the Washington, D.C., office of Dewey, Ballantine, Bushby, Palmer and Wood. Beginning in the fall of 1989, Reynolds will be associate professor of law at the University of Tennessee. **Robert P. Merges,** also a graduate of Yale Law School, is associate professor of law, Boston University Law School.

Preface and Acknowledgments

Writing a book has been compared to giving birth; the comparison is apt, except that few books are gestated in as short a time as nine months, and more people generally provide assistance in the conception and bringing to term of books than of children. The initial impetus toward this book came from a review of the two seminal works in space law, Andrew Haley's *Space Law and Government,* and Myres McDougal, Harold Lasswell, and Ivan Vlasic's *Law and Public Order in Space,* both of which were published in 1963. Despite all that has changed since then, those books remain in many ways the cornerstones of the field, and it is unlikely that anyone will match their breadth and depth for some time.

For all their many virtues, however, those books are not really suitable for use as teaching tools. The very depth of their coverage, and the broad range of the topics addressed, means that much must be passed over lightly or skipped entirely, and the passage of time has resulted in many changes—such as the adoption of the Outer Space Treaty of 1967 and the development of a commercial space launch industry—that render them incomplete or obsolete in places. Given that more and more law schools are teaching space law, the time seemed right for a volume in casebook-format that would be of use in law schools and as an entry point into the field for interested practitioners, scholars, and policymakers.

In developing our approach to this subject, we circulated a number of outlines to attorneys, scholars, government officials, and members of the industry. Among those who commented at some length (mostly favorably, and always constructively) were Dennis Ahearn, Walter Boyne, Robert Brumley, Richard DalBello, Arthur Dula, Nathan Goldman, Jefferson Hofgard, Neil Hosenball, Diana Josephson, John Logsdon, W. Michael Reisman, George Robinson, Courtney Stadd, and Jason Steptoe. In addition, we circulated draft chapters for review, and many individuals provided valuable input there as well. Among them were Walter Boyne, Heidi Ebel, Albert Halprin, John Ragosta, Gerald Rosberg, James Schoettler, and Josephine Stein. Among other individuals who provided helpful advice and equally helpful encouragement, were Joseph Califano, Lori Garver, Maria Hylton, Harold Edgar, Clark McFadden, Gueta Mezzetti, Peter Schuck, Douglas Weinstein, and, most especially, our excellent and long-suffering editor at Westview Press, Kellie Masterson, and her two able assistants, Mary Beth Nierengarten and Ellen Williams. Valuable research and organizational assistance was provided by several future lawyers of note: Rene

Augustine of Vanderbilt Law School, Cheryl Hesse of U.Va., Nina Nichols of Harvard, Laura Plessala of Georgetown, and Jamie Saltman of N.Y.U. and by the energetic and talented library staff at Dewey, Ballantine, Bushby, Palmer & Wood, Washington, D.C. We must also thank Dr. Charles Reynolds for being kind enough to make the palatial quarters of his so-called "cabin" on Norris Lake in the mountains of Tennessee available for extensive interruption-free drafting sessions. Neither he nor any of the other individuals named here is responsible for any errors that slipped through.

For reasons that immediately become apparent once one begins writing, the acknowledgments in virtually every book bestow enormous praise on the hapless typist responsible for the manuscript. In the case of this work, the misfortune was divided among the various and talented members of the word processing staff at Dewey, Ballantine, Bushby, Palmer & Wood. For their first-rate work, we too extend enormous (and well deserved) praise; if law professors got such high-quality support, the law reviews would all be twice as thick, which may be the reason why they don't.

A Note on Style

Since this book is organized as a casebook, it contains a considerable quantity of excerpted material. Except in the case of obvious typographical errors (which we have taken the liberty of correcting in a few cases), all excerpted material retains its original punctuation and emphasis. We have omitted footnotes, inserting especially important citations in brackets in the text. In general, however, we have tried to keep the number of citations manageable: This book is meant to be used in the classroom, not as a reference manual, and we have striven to guide readers to primary sources rather than provide a comprehensive bibliography ourselves. Those desiring all citations contained in excerpted material may, of course, refer to the originals. Excerpt titles are indicated in centered, bold-faced headings; excerpt ends are indicated by a centered ruler line. In light of the fact that this book will probably be used by nonlawyers, we have spelled out all names of journals, etc., in full, thus sparing the readers the arcana of bluebook abbreviations. In all other significant respects we have followed bluebook style to the best of our ability, though not all of the material excerpted does the same. We trust that the law review managing editors among our readers will forgive us.

Glenn H. Reynolds
Robert P. Merges

Introduction

To many, "space law" still belongs to the realm of science fiction. Yet many real-life lawyers work in the field already, and their numbers are growing rapidly. Their work cuts across the boundaries of traditional legal disciplines—from commercial law and contracts to international law and even torts—but is unified, like that of Admiralty lawyers, by the demands of an industry with unique problems. That industry is growing steadily and is placing new demands on its legal counsel (and on government officials responsible for regulating the area) every day. Furthermore, study of the problems faced (and created) by space industries and other uses of space helps to shed light on issues growing from high technology areas in general and is thus a useful part of an overall legal education.

In response, many law schools have begun teaching courses in space law, and many practitioners have had to educate themselves in an *ad hoc* manner. What has been lacking, though, is a comprehensive introduction to the subject. That is the purpose of this book.

The book is organized around the needs of the space industry and those who deal with it. As private companies become involved in providing launch services and in conducting research and manufacturing in outer space, and as governments band together for multinational space stations and other ventures, legal questions are raised that touch on virtually every subject in the law school curriculum, but in new settings. As a consequence, it is not enough for a lawyer in this industry to know just the traditional legal subjects; she must also know how to apply that knowledge to the special needs of the industry—although space contracts are still contracts, to be useful they must anticipate the kinds of problems that are likely to arise only in this industry. Those in the industry, meanwhile, will find it useful to familiarize themselves with the legal issues that are likely to be important to them.

In addition, it helps immeasurably to know something about the technical and scientific basis for the industry. One need not know how to design a rocket engine, or how to service a satellite. Nor does one need an exhaustive knowledge of the history behind the industry and the legal regime that has grown up around it. But to understand the problems the industry is likely to present, it will help to know something about the basics. For this reason, we provide a brief introduction to the history and technology behind the industry, as well as extensive references to the literature on those subjects.

Because government has traditionally played a major role in the shaping of the industry, lawyers and clients alike are likely to have to persuade policymakers to pay attention to their particular problems for some time. For that matter, law schools (both in the United States and, increasingly, in other countries) are key training grounds for future policymakers, meaning that those taking courses in this area may well be the space decision-makers of the future. For these reasons, we pay considerable attention to the policy issues involved, both in the context of individual areas of the law and more general discussions of various policy issues.

We also discuss a wide variety of international law issues. Many, like the jurisdictional provisions of the Outer Space Treaty, touch directly on the space industry. Others, like the ABM Treaty, do not. All, however, are an important part of space law and form part of the background against which events take place. And, of course, international law issues are of considerable importance to government lawyers and to policymakers.

Most legal texts are casebooks. That presents a problem in the aerospace field because there are so few cases. But the casebook format has many advantages, providing a variety of viewpoints and a sense of how legal rules are applied in courts. In addition, it presents the subject matter in discrete units, allowing the teacher more flexibility in organizing a course. With this in mind, we have emulated the casebook format by including excerpts from leading publications and from key legal sources such as treaties and statutes. However, in order to provide context and background, and to remedy gaps in the published literature, we provide a much greater than usual amount of original commentary and notes. Discussion points and study questions, along with references to additional reading, are also included. The result, we hope, is a book that will be useful both as a text in law school classes and as a tool for self-education by practitioners and interested people both within and outside the legal profession.

If the space industry is to develop as it should, there must be a body of law that supports its growth. That law is developing now, through the efforts of scholars and practitioners. It is our sincere hope, reflected in the pages of this book, that we can contribute to this process.

G.H.R.
R.P.M.

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Some History and Background

This is a book about space law, not the history and technology of space exploration. But just as lawyers in other fields must know something (often a great deal) about their clients, lawyers serving the space industry must know something about the context in which they work. This brief introductory chapter provides an overview of how spaceflight (and space law) came to be a reality, of the key technical concepts needed to understand many important issues, and of the industry's directions in the future, along with a number of references for further reading. Readers are strongly encouraged to pursue those references, as what is set out here is the briefest synopsis (a "capsule version," if you will) of a rich and interesting literature.

SPACE HISTORY—*THE BRICK MOON* AND ALL THAT

The idea of space travel is not new—trips to the Moon and beyond have been the subject of fanciful tales for thousands of years. But not until the last century or so did people begin seriously examining the methods and implications of going into space. It is amazing, in retrospect, how much of the work of early pioneers has remained useful—even essential—to carrying out operations in space, and how clearly some of those early figures foresaw the problems and opportunities that would arise as human beings moved into outer space.

One of the first to do so, and in many ways the undisputed pioneer of space studies, was a Russian, Konstantin Tsiolkovsky. Tsiolkovsky's work, which started over a century ago, laid the foundation for many technological developments that followed, and anticipated much that still seems futuristic today. In 1883 he wrote of the problems likely to be encountered in zero gravity; in 1903 he published an essay entitled *Exploration of Cosmic Space with Reactive Devices* that outlined the principles of navigation in space. Throughout the rest of his life, he wrote and pondered not only the practical, but the philosophical aspects of outer space development.

Tsiolkovsky envisioned an era in which space exploration would lead to cities in space and, ultimately, to utopian societies throughout the solar system—a vision shared by many space supporters today. Because these

societies would have access to unlimited solar energy and to all the resources of the solar system's planets and asteroids, Tsiolkovsky reasoned, they would be free from the scarcities that plague earthbound economies and hence free from social problems stemming from unequal distribution of wealth. When the Bolsheviks came to power in 1917, they found Tsiolkovsky's theories well-suited to their own professed belief that social injustices stemmed from unequal distribution of wealth—and found research into rockets a promising part of efforts (first by Lenin, then by Stalin) to build up the Soviet Union's technological base and armaments industry. Tsiolkovsky, previously an obscure schoolteacher, received a seat on the Soviet Academy, and his disciples (such as Sergei Korolev, F.A. Tsander, and Valentin Glushko) began serious work on rocketry, work that was to lead to a succession of firsts by the Soviet Union in the late 1950s and early 1960s.

Although Tsiolkovsky was the first to conduct serious study into problems of space flight, many others were soon doing the same—indeed, the American Edward Everett Hale had published a science fiction story about an artificial satellite used for navigation, entitled *The Brick Moon,* in the *Atlantic Monthly* as early as 1869. Serious work on the subject in the United States, however, began with Robert Goddard. Goddard published a paper in 1919 entitled *A Method of Reaching Extreme Altitudes* that described the prospects for reaching outer space using rockets. Although many skeptics (including the editors of the *New York Times*) subjected Goddard to ridicule for what were then thought of as far-fetched ideas (such as sending a probe to the Moon), he devoted his life to the perfection of liquid-fueled rockets and provided considerable inspiration and information to the German rocket pioneers who began organizing in the early 1920s. Goddard was the first to successfully launch a liquid-fueled rocket, and the first to demonstrate a working guidance system. Aside from Goddard, various groups of enthusiasts in the United States such as the American Rocket Society, the Cleveland Rocket Society, and the Yale Rocket Club did significant initial work in the development of rocket technology and in laying other important groundwork for later space exploration efforts.

In Britain, meanwhile, the Explosives Act of 1875 (which banned all private research in ordnance) proved a near-absolute barrier to actual experimentation, providing a concrete example of how bad or shortsighted law can frustrate space development. This did not stop British enthusiasts from contributing, however—it simply forced the British Interplanetary Society, including individuals like Phil Cleator and Arthur C. Clarke, to devote energies to long range studies, such as a famous 1939 plan for a Moon mission that served as the foundation for the actual Moon landing thirty years later.

Germany, too, had its pioneer in Hermann Oberth, who in 1923 published *Die Rakete zu den Planetenaumen* (The Rocket into Planetary Space). Oberth's book was far more ambitious than Goddard's work, discussing

ways of putting human beings into space in the (relatively) near term and the problems (such as the need for space suits, the composition of space food, and the minutiae of operating space stations) that would have to be overcome. Oberth's book was followed in short order by a number of works by other German enthusiasts, most notably Walter Hohmann, whose 1925 work on celestial mechanics set out principles still relied on today and for whom the economical "Hohmann transfer orbit" used by interplanetary space probes is named.

The next twenty years were to see a flowering of German rocket science (unhampered by Explosives Laws) that began with small groups of dedicated individuals and culminated with the immense government-financed effort that produced the V-2 missile (designated the A-4 by its inventors). The V-2 was of dubious value as a weapon of war—each missile cost as much to build as a bomber, delivered a smaller load of explosives, and was destroyed at the end of a single mission—but it was the first really viable space booster.

W. McDougall, . . . the Heavens and the Earth: A Political History of the Space Age 43 (1985)

The A-4

In 1929 the Ordnance Ballistic Section of the German army assigned Walter Dornberger to develop a liquid fuel rocket of longer range than any existing gun, a sobering assignment, given that the Big Berthas of World War I fired projectiles sixty-five miles. Dornberger visited the "rocketport" of the amateur Verein fur Raumschiffahrt in Berlin, set young Wernher von Braun to work completing his doctorate, and together they recruited the Rocket Team. Just as in the Soviet Union, the rocketeers did not find state support—the state found them, and at a propitious moment. "The more time I have to think about it," wrote Willy Ley, "the more I have arrived at the conclusion that the VfR progressed as far as any club can progress. . . . Experimentation had reached a state where continuation would have been too expensive for any organization except a millionaires' club."

Von Braun and Dornberger chose for their lonely, spacious test site a sweep of sandy coast on the Usedom Peninsula beyond the mouth of the Peene River. But by the time Peenemunde opened in the fall of 1939, the Wehrmacht was rolling over Poland, and Hitler decided the big rockets would not be needed. Von Braun and Dornberger pressed on, with reduced budgets, toward a prototype of their majestic A-4, the first medium-range ballistic missile, standing 46.1 feet high. It was a single-stage rocket powered by LOX [liquid oxygen] and alcohol, developing a thrust of 56,000 pounds, a payload of 2,200 pounds, and a velocity of 3,500 miles per hour while inertially guided by gyroscopes and leveling pendulums to its target 200 miles distant. The first A-4 flight test finally took place in June 1942. It

failed, and so did the next. But the third bird, in October, rose from the Baltic dunes in a stable and gentle arc fifty miles high until it passed out of sight en route to the impact area 119 miles downrange. Dornberger's team watched in exultation—like the Alamogordo physicists three years later, they attended in the delivery room as a new Power was born. But where the elemental blast of the atomic bomb rendered its makers diminished, apprehensive, in a sense imprisoned, the elegant, finned cylinder of the A-4 was a metaphor of liberation, defying gravity as it soared aloft with little hint—after the first moments—of the brute force it contained. An aspiring and creative thing, it had brushed the sleeves of space.

Although their work was financed by the military and led to the V-2, von Braun's team secretly dreamed of building rockets that would carry human beings into outer space. Unbeknownst to their superiors, the German rocket teams designed larger and more powerful rockets, winged spacecraft, and atmosphere-skipping rocket/ramjet space planes. With the end of World War Two, von Braun and virtually all of his key staff signed on to work for the United States, bringing their designs and the remaining stock of V-2s with them.

The immediate postwar period saw a brief flurry of interest in space activity. The exploits of the German rocket scientists were still fresh in everyone's mind, which lent credibility to plans that would have been thought outlandish in the prewar era. Arthur C. Clarke published a paper proposing the use of satellites placed in geosynchronous orbits (where they would remain in position above the same point on earth) as a means of relaying communications; shortly thereafter the RAND Corporation issued a prophetic report on the feasibility of using earth satellites for military purposes such as intelligence collection and weather observations.

But the postwar era was not fertile ground for rapid progress in the space field. America was occupied with satisfying the pent-up demand of its consumers, with helping Europe rebuild, and with countering the gradually-unfolding Soviet threat, while the European powers that had played an important role in prewar years were in no position to undertake any projects beyond recovering from devastation. The Soviet Union *was* working on development of large boosters as a counter to American air superiority, but results were not to come for some time and no one outside a select group of Soviet leaders and engineers knew what was going on.

Still, work on space boosters continued to progress slowly in the United States, and some American scholars, politicians, and diplomats began to take an interest in issues of space law. As the Soviet Union acquired the status of America's key adversary, interest in using satellites for reconnaissance grew. There were, however, serious concerns about the international law ramifications of satellite overflights, concerns that were sharpened considerably after the Soviet Union launched the world's first satellite, Sputnik. Some argued that such overflights would constitute violations of the sovereignty of the nations overflown, with injury being added to insult