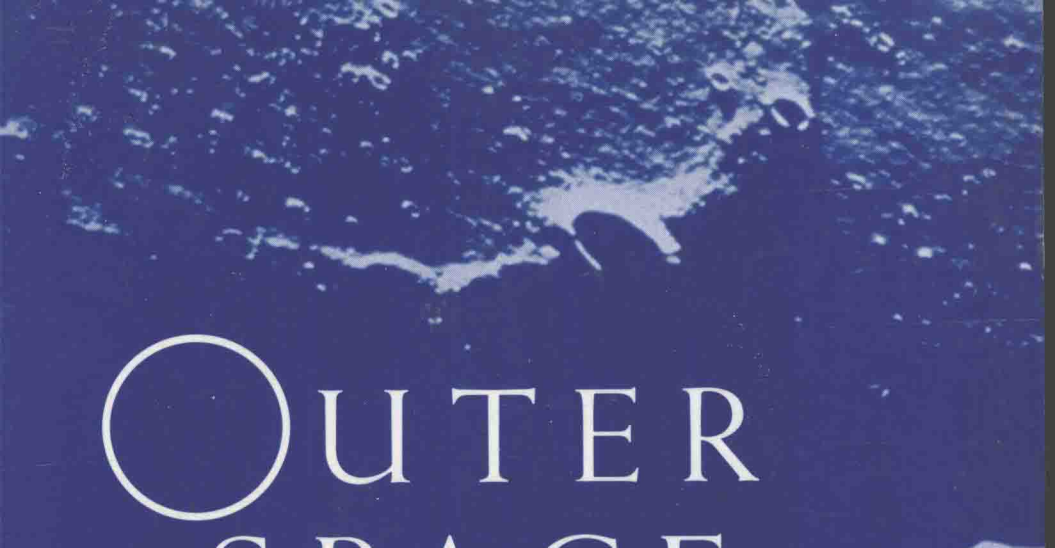

OUTER SPACE

PROBLEMS OF LAW AND POLICY

SECOND EDITION

Glenn H. Reynolds and Robert P. Merges

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Outer Space

Problems of Law and Policy

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Preface to the Second Edition

Almost eight years have passed since the first edition of this book went to the publisher. In writing it, we attempted to produce a work that would be useful in the sometimes contradictory roles of classroom text and self-teaching tool for interested lawyers, academics, and laypersons. Judging from the many gratifying reviews that the first edition received, we were generally successful. However, the passage of time changes many things, and we considered it important to keep this book up to date. Although some aspects of space law remain largely unaltered, others—particularly in the fast-growing field of commercial space activity (both in terms of its regulation, and of the international trade friction that it creates) and the contentious area of control over space resources—have changed a great deal. Our updating efforts have thus been greatest in those departments. We have also given additional attention to the burgeoning topic of space environmental issues. When the first edition of this book appeared, that subject had received little attention, and some thought our brief treatment somewhat daring for its mere existence. That has changed now, with topics like orbital debris and planetary protection receiving considerable attention in the literature, an expansion that has been matched in our treatment as well. And, naturally, the entire book has been brought up to date with reference to changes in the literature, the statutory background, and the general climate.

Of course, the greatest change that has occurred since the publication of the first edition is the apparent end of the Cold War, along with the breakup of the former Soviet Union into its various constituent states. Formally, this is of relatively little importance to the field of space law, as those constituent states, particularly the Russian Federation, remain adherents to all of the important international agreements. Realistically, however, the shift from a bipolar Cold War world to a multipolar post–Cold War world is of enormous importance for outer space policy, as the field is itself virtually a creation of the Cold War. The exact consequences of this change continue to be played out, and we do not pretend to be able to predict them all. However, we have done our best to anticipate and point out those features of space law that are most dependent on Cold War assumptions or politics, and suggest how those might change in the post–Cold War era. The rest, as the old mathematics textbooks used to say, is left as an exercise for the reader.

A number of individuals and organizations have provided assistance in the revision of this book. First and foremost are the reviewers of the first edition: Edward Gordon in *Science,* Carl Christol in the *American Journal of International Law,* Edward Binkowski in the *Fordham International Law Journal,* Wayne Dillingham in *Jurimetrics,* Stephanie Lessard in *Annals of Air and Space Law,* Robert O'Connell in *The Air and Space Lawyer,* and various student reviewers in the *Harvard Law Review,* the *Harvard International Law Journal,* the *George Washington Journal of International Law and Economics,* and the *Harvard Journal of Law and Technology.* We have not always followed the advice contained in those reviews, but we have considered, and appreciated, all of it.

In addition, we would like to thank our students and colleagues at the University of Tennessee and Boston University, and at the University of Virginia where one of us (Reynolds) taught space law to a startlingly large class of interested and interesting students in the spring of 1993 as this revision was underway. In addition, many other individuals have taken the time to correspond or speak with us regarding various issues; they include James Bennett, Barry Beringer, Linda Billings, former Justice William Brennan, Jr., Arthur C. Clarke, David Brandt, Dan Burk, Carl Christol, Richard DalBello, Hamilton DeSaussure, Eric Drexler, Lori Garver, Steven Gorove, Mark Hopkins, Beth Inadomi, Margaret Jordan, John Logsdon, Charles Miller, Nick McCall, Gerald Musarra, Scott Pace, John Pike, John Ragosta, Jim Schoettler, Courtney Stadd, Linda Strine, Charles Walker, and Alan Wasser. We have also received valuable feedback from groups to whom we made presentations or talks on topics covered in this book: Those groups include the U.S. Air Force Academy, the Harvard Law and Technology Society, the National Space Society, the University of New Mexico School of Law, the Princeton Planetary Society, the University of Tennessee Space Institute, and attendees at several American Bar Association and National Space Society convention programs.

Highly valuable research assistance was provided by Patricia Crotwell-Bentley, William Coffey, Jennifer Ashley, Elizabeth Bailey, Micaela Burnham, Brannon Denning, and the semi-bionic Brian Piperno. And last—but certainly not least—secretarial support above and beyond the call of duty was provided by Jackie Bonvin.

As we conclude this revision, we have one regret: The book is still too short. In the first edition we made a conscious decision to sacrifice comprehensiveness for clarity. We have thus limited our coverage of the trees in order to provide a clear picture of the forest. Nonetheless, there are aspects that we wish could have received more attention. We encourage readers to go about filling in the gaps themselves, with articles and student Notes on topics that we have left untreated or merely hinted at. The growth of space law is a project for many minds. This is our contribution; it is up to you to make yours.

We hope that readers will take up this challenge. We have devoted considerable time and attention to this subject in spite of the fact that other aspects of our

work are more professionally (and even financially) remunerative. We have done so because we believe that this field will not remain a quiet backwater for academics and a cozy niche for practitioners: We expect it to become far more important in the next several decades, and throughout the coming century. If that is true, then this subject will demand the best thinking available from all concerned, and we believe that it is time to start the conversation in earnest. This is, of course, something of an act of faith on our part. To take space law seriously as a subject, one must believe in a future in which humanity flourishes, and one in which law can make a difference for good. To us, that is part of the appeal. We hope that it is for others as well.

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 vi-

sion 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 farfetched 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