



# Space Business

## Emerging Theory and Practice

Edited by  
**Arto Ojala**  
**William W. Baber**

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Arto Ojala · William W. Baber  
Editors

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## FOREWORD

While we are still in the early stages of the new space economy, there is palpable excitement about its business potential. As of January 2024, the Space Foundation estimates that 91 countries operate in space, and that the size of the space economy is around \$546 billion. If projections are to be believed, the future space economy will become at least a trillion-dollar economy. Valuations by prominent financial institutions fuel the enthusiasm: by the 2040s, Morgan Stanley puts the space economy size at around \$1.1 trillion, Bank of America at around \$2.7 trillion, and Goldman Sachs even beyond that.

Something has changed about space, but what exactly? The popular narrative is that we have moved from an old model of government-led space ventures to a contemporary one dominated by a new generation of private firms and entrepreneurs with their own visions.

These new actors have brought an unprecedented range of technologies and services to the global space economy. A number of conditions favor their rise. Entrepreneurship and equity funding have combined fortuitously to benefit not just their interests but also other space stakeholders in the wider ecosystem. Thanks in large part to the pioneers of reusable rocketry, the costs of launching an object into space are going down; as well, processes of miniaturization are further reducing the size and weight of objects headed to space. Increasingly, space activities also force attention toward value chains based on data rather than just supply chains for assembling physical technologies.

This is among the first books that attempts to move beyond headline news to assess the landscape of new commercial prospects, primarily with a focus on activities in Low Earth Orbit (LEO). It is the business side of things that is of theoretical, substantive, and methodological interest to the collaborators of this volume. Who are the players in the new space realities? What are they making and for whom? What drives them? Who are the customers, and what motivates them?

It is difficult to know which space businesses will eventually thrive and profit. Meanwhile, they continue to draw attention worldwide. Space-related infrastructure, data, and applications are interlinked across civilian, commercial, and military activities. There are rockets that go up but also down, mega-constellations that tackle the digital divide, and small satellites producing big data that intersect with other technology frontiers like AI to enable constant observation of virtually all human activities on a planetary scale. There are of course continuing ventures with a strong element of science and exploration and off-world settlements; in parallel there is the push to harness space-enabled data for all kinds of purposes ranging from disasters to development around us on Earth. The market for space tourism is also gaining ground. While still branded as a luxury space item, the very idea attracts enthusiastic devotees from developed and developing countries alike. As 95 percent of space technologies are dual use, issues of space security and defense also condition profits and prospects for space business.

All governments, along with a wide range of their home commercial entities, are hoping to position themselves in this emerging multi-faceted ecosystem. This book is a valuable informational guide for such endeavors.

Seattle, WA, USA

Saadia M. Pekkanen

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## PREFACE

The editors created this book to update understanding of commercial activities of firms acting in space-related industries or utilizing services provided by space technology firms. These commercial activities are largely conceptualized by “New Space” concept where commercial activities in space are mainly taken by private firms, partly replacing the actions of government-resourced space institutions, i.e., “Old Space.” New Space refers to business opportunities exploited through small and low-cost satellites and innovative space data services. These services include, for example, precise navigation solutions, satellite imagery and processing, satellite telecommunication, data communication, remote sensing, among others. Further, commercial use of space technologies has created new services, businesses, business models, value chains, and ecosystems. Thus, space-related technologies, activities, and services are nowadays more easily available for entrepreneurs and small businesses. This increasing accessibility has created numerous research opportunities in this field that is known broadly as space business and which includes New Space as well as traditional space activities and business opportunities. Although space technologies and services have attracted growing interest in many technical disciplines, academic studies of space business and management activities among firms acting in New Space or utilizing the services provided by New Space are just emerging.

There are several theoretical insights encompassed in this volume. These include the main influences on space business for the near



term such as increasing resilience of space and communication systems, decreasing cost of equipment and launch services, and miniaturization. Taken together, these are likely to drive demand up and cost down. Space business, especially in the context of New Space, forms an ecosystem of much greater complexity and with far more partners than the previous space business could claim. This ecosystem has structures and layers discussed in this book that will guide the evolution of New Space, its business and research, for some time. Space business is now in fact not merely one large ecosystem, but is composed of smaller ecosystems around particular firms, technologies, and regions. Understanding these smaller systems as well as the overall ecosystem will aid business decision makers as the industry develops. Space business is no longer focused on technology as in the past when telecommunications or science projects from Moon landings to deep space exploration dominated. The current era is just beginning to provide services from tourism to services in orbit to development of lunar resources. These are characteristics of space business that are touched upon in this volume but which need more research in the near future.

This book is targeted toward both academic and business readers. In academia, the audience will include researchers, business students, and business educators seeking basic understanding of space business and its characteristics. These audiences will include students and researchers at universities as well as at polytechnics. Educators will assign various chapters for reading. Meanwhile, students in search of up-to-date theory and insights will frequently find these chapters in search results. Policy institutes and think tanks with focus on space will find the book of high interest.

Among businesspeople, the book will provide understanding of business activities, business models, value chains, and ecosystems in the space business. Economists in large multinational firms will be interested in the explication of theory and industry structure contained in the book. The audience further includes consultants, managers working in space-related industries, and entrepreneurs planning to establish space businesses.



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The editors and authors offer their acknowledgment and thanks to the reviewers who contributed time and expertise by making insightful and thorough comments. These comments improved the quality of the chapters and focused the authors on more clearly telling their stories and understandings.

Each chapter was peer-reviewed by two or more academics or practitioners from around the world. The review process was double-blind, except where the editors contributed reviews.

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PART I

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Space Business: Theory and State of the Art



# New Space Era: Characteristics of the New Space Industry Landscape

*William W. Baber*<sup>1b</sup> and *Arto Ojala*<sup>1b</sup>

## 1 INTRODUCTION

The space age dawned in 1957 with the successful orbiting of Sputnik by the Soviet Union, and it surged forward with the Apollo moon landings, ushering in the era of satellites and deep space probes. This situation in which space business relied on space science probes, space shuttle flights, and satellite launches largely persisted until the decentralization of space exploration began in the years following the 2003 Challenger Shuttle accident. In the subsequent decade, the US space agency, the National Aeronautics and Space Administration (NASA) shifted its focus from engaging in a wide array of space activities to concentrating on lunar, Martian, solar, and other deep space missions.

Nonetheless, historical events accelerated the decentralization trend as the Russian space agency experienced several highly visible launch failures

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from 2010 to 2014. It was evident that a transition from government-led space exploration to private-sector leadership would occur. The questions were how rapidly and effectively the private industry could make this transition. Time was of the essence as NASA canceled the space shuttle program, with its last flight in 2011, and had to depend on Russia's Roscosmos to deliver supplies and crew to the International Space Station (ISS). Even earlier, however, in 2001, the privatization of Intelsat occurred, marking a clear departure from government-dominated space services. The privatization, the move away from human launches by NASA, and similar events were steps toward the New Space era. New Space is understood here as a model where value stems from investor support for entrepreneurial ventures, in contrast to "old space," where value traditionally originated from government sources directed to research institutions and defense contractors (Paikowsky, 2017; Peeters, 2021; Weinzierl, 2018).

The development of New Space saw the establishment of private firms like SpaceX, Virgin Galactic, and Blue Origin in sectors that were previously limited to government activities. First, they took on launch services, and in subsequent years, milestones were frequently achieved, ranging from tests of new rockets to successful dockings at the ISS, the development of reusable rockets, and the emergence of space tourism experiences. These firms, however, also took on new services requiring satellite fleets and ground-based services. They were joined by many new entrepreneurial firms providing various services from satellite manufacturing to management to data analysis. The skills and technologies of these ambitious private firms are maturing, and the exploitation of Low Earth Orbit (LEO)—the region spanning roughly from 150 km to 2,000 km in altitude (Lawrence et al., 2022)—is now in full swing.

With a decade or more of rapid and profound changes behind it, this field is overdue for a review of its theories and characteristics, especially concerning business activities related to space. The most recent comprehensive assessment of the industry can be found in Gurtuna's (2013) book, "Fundamentals of Space Business and Economics." However, significant developments have occurred in the intervening years. The current book aims to comprehend these changes and establish the theoretical foundations of the rapidly emerging business field known as New Space. This field encompasses commercial LEO space services, trends, and technologies.

This book primarily centers on LEO and New Space; however, the delineation between these topic areas and conventional space business is not distinctly defined. The LEO space business, for instance, shares certain business aspects with higher orbits, contingent on the purpose and flexibility of satellites or fleets, as well as the utilization of ground stations and other services. The established space business, predominantly driven by major science projects and telecommunications, has not vanished; rather, it continues to coexist and, in certain instances, overlaps with New Space businesses and their innovative approaches. Dual use, that is for military and civilian purposes, is less clearly separated than in the past in space activities as seen in the examples of commercial space imagery delivered to support Ukrainian defenders and Starlink internet access exploited by all combatants.

The aim of this introductory chapter is to highlight the characteristics and recent development in space business. We present five propositions supported by literature and in-depth interviews with experts within the space industry. We then synthesize these into tentative theory elements, identifying the feedback loops that illustrate how the propositions interact with current trends and the realities of the industry.

## 2 EVOLUTION OF THE SPACE BUSINESS

In his book, Gurtuna (2013) identified seven features of space business before the New Space era. We will now elaborate on these features briefly. Firstly, business cycles in the post-Apollo era were defined by funding announcements or the lack thereof, which led to lengthy decision-making processes. The waning interest in space after the Apollo programs resulted in a lack of projects until satellites for defense and communications were launched. Secondly, long investment horizons were common in space business. At that time, probes might take 2–4 years for approval, followed by additional years for construction and the subsequent launch. For example, the New Horizons mission was discussed in the 1990s, approved in 2001, and eventually launched in 2006. Thirdly, most technological advances were driven by defense needs, while export restrictions made it difficult to provide services internationally. Major firms in the sector, such as Boeing and Lockheed Martin, had both military and civilian space programs with overlapping equipment, technology, and staff. Fourthly, the primary customers in this time period were national governments of developed countries and their agencies. Over time, other customers began