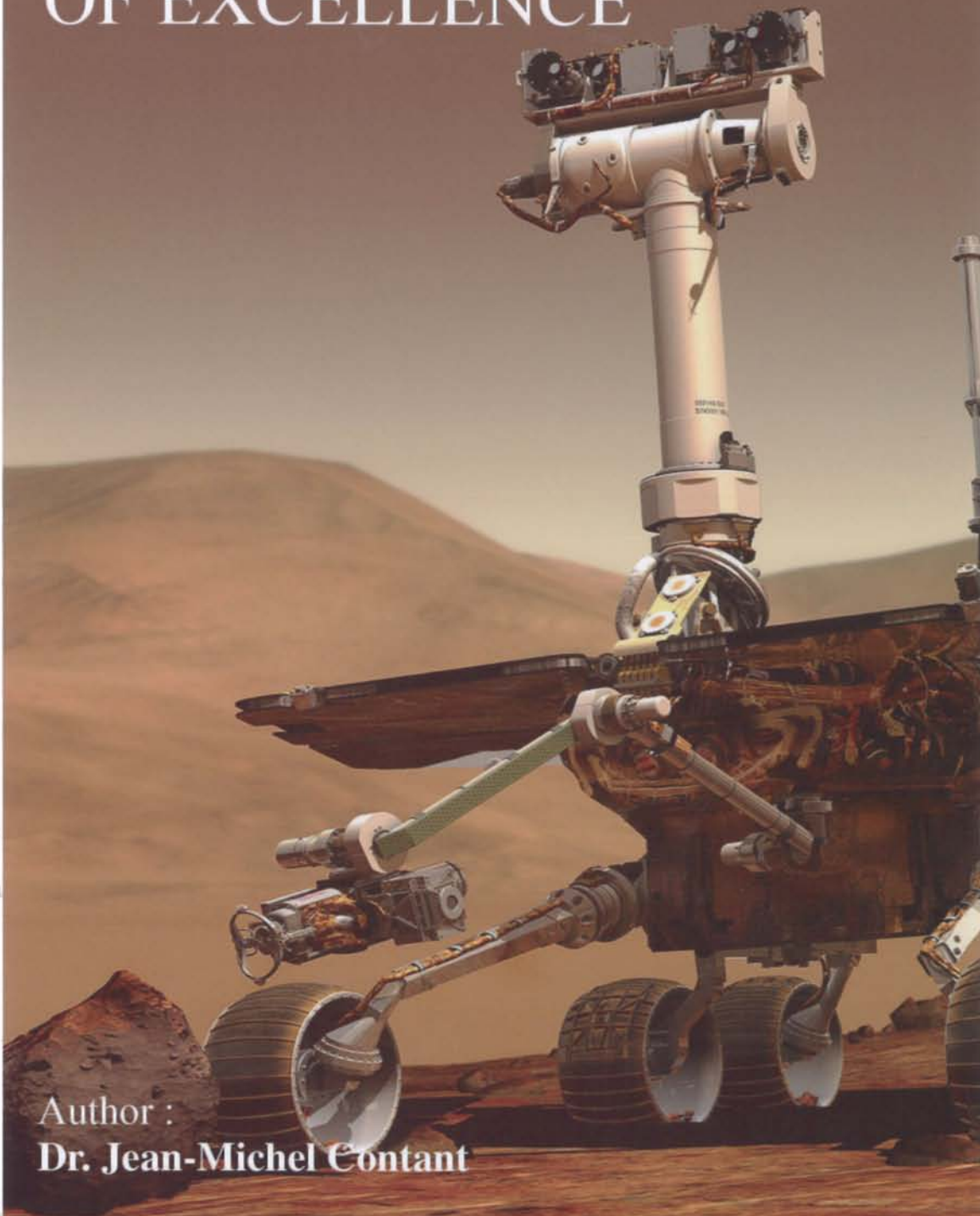




CELEBRATING 50 YEARS OF EXCELLENCE



Author :
Dr. Jean-Michel Contant

International Academy of Astronautics



International Academy of Astronautics



CELEBRATING 50 YEARS OF EXCELLENCE



Space for Humanity

Published by IAA
International Academy of Astronautics 2010
First Edition 2010
Printed in USA
ISBN 9782917761021



Edited by Dr. Jean-Michel Contant
Secretary General IAA

International Academy of Astronautics
Paris Secretariat:
6 rue Galilée, 75116 Paris
Mail address: Po Box 1268-16
F-75766 Paris Cedex 16, France
E-mail: sgeneral@iaamail.org
Web site: <http://www.iaaweb.org>

Cover photo credit: JPL NASA
Cover design credit: Ms Najla Sellami

Celebrating 50 Years of Excellence
Space for Humanity

© This publication is protected by copyright. The information it contains cannot be reproduced without written authorization.

© November 2010, IAA

CONTENTS

	Pages
Acknowledgements	ix
Foreword, George E. Mueller	xi
Preface, Norman Augustine	xiii
Executive Summary, Jean-Michel Contant	xv
Chapter 1 Space Pioneers and the Early Years of Space Exploration	1
1.1 A Twentieth Century Flourishing of Space Pioneers	3
1.2 Konstantin Tsiolkovsky in Russia	4
1.3 Robert Esnault Pelterie in France	5
1.4 Robert Goddard in the USA	5
1.5 IAA Academician Hermann Oberth in Romania and Germany	6
1.6 IAA Academician Werner von Braun in Germany	7
1.7 Max Valier in Austria	8
1.8 IAA Academician Eugen Sänger in Austria and Germany	8
1.9 Yuriy Kondratyuk in Ukraine	9
1.10 IAA Academician Mikhail Tikhonravov in Russia	9
1.11 IAA Academician Valentin Petrovich Glushko in Russia	10
1.12 Sergei Korolev in Ukraine and Russia	11
1.13 Mikhail Kuzmich Yangel in Ukraine	11
1.14 GALCIT in California	12
1.15 Pennemünde Germany: First Flight Test Center in the World	12
1.16 A4 German Rocket as the Root of Modern Launchers	13
1.17 The Secret Operations "Backfire", "Overcast/Paperclip" and "Osoaviachim"	13
1.18 Tsien Hsue Shen in USA and China	15
Chapter 2 The Beginning of the Space Era and the Creation of the Academy	17
2.1 The First Satellites	18
2.2 IAA Academician Eilene M. Galloway	19
2.3 The Unmanned Race to the Moon	19
2.4 The Race for the First Man in Space	20
2.5 The Secret N1 Rocket and the Race to the Moon	22
2.6 IAA Academician Theodore von Kármán	22
2.7 IAA Academician Frank J. Malina	25
2.8 Creation of the International Academy of Astronautics	26
2.9 IAA Academician Stark Draper	29
2.10 Famous Names in the Academy	31
2.11 The Saturn V Moon Rocket	36
2.12 IAA Academician George E. Muller	36
2.13 Acta Astronautica Journal: The Early Years	42
2.14 Acta Astronautica: Hundreds of IAA Academicians Engaged	44
2.15 Life Sciences in the Academy	46
2.16 Founding Committee of the International Academy of Astronautics	49
2.17 International Exploration of Mars: A mission whose time has come	51
2.18 Cooperation with the National Academies	52

Chapter 3 Space Industry and Technology	55
3.1 The Russian Mir Space Station	56
3.2 The Khrunichev State Research and Production Space Center	57
3.3 S.P. Korolev Rocket & Space Corporation Energia	58
3.4 The U.S. Space Shuttle	58
3.5 The Boeing Company	60
3.6 The Delta IV Launcher	60
3.7 Spirit and Opportunity Mission	61
3.8 Polar Satellite Launch Vehicle (PSLV), Cartosat-2 and Space Recovery Experiment (SRE) Mission	63
3.9 The Sea Launch Program	67
3.10 The Lockheed Martin Company	69
3.11 Atlas 5	70
3.12 The Pegasus Launcher	71
3.13 Ariane 5	73
3.14 Arianespace	73
3.15 The H2 Launcher	76
3.16 China: The Long March	77
3.17 IAA Science Awards	82
3.18 The Russian Proton Launcher	83
3.19 The Falcon 9	85
3.20 The EADS Company	86
3.21 Other Launchers throughout the World	87
Chapter 4 50 Years of Space Science and Applications	89
4.1 The Solar and Heliospheric Observatory	90
4.2 The Hubble Space Telescope	92
4.3 The VLBI Space Observatory	94
4.4 The Cassini - Huygens Program	97
4.5 The Double Star Program	98
4.6 The Voyager Program	100
4.7 The Magnetosphere: Fifty Years of Space Research	103
4.8 The IAA Book Awards	104
Chapter 5 International Cooperation: Past and Future	109
5.1 The Role of IAA in International Cooperation	110
5.2 International Cooperation: Lessons Learned	111
5.3 The ESA Fair Return: A proven model for international cooperation	112
5.4 U.S. Views on Lessons Learned	116
5.5 IAA in Africa	118
5.6 IAA Studies	120
5.7 IAA Engaged in Action	129
5.8 A High Level Board of Trustees	130
Conclusion	132
Contributors	133
Photo Credits	135

International Academy of Astronautics

FOREWORD

This fiftieth anniversary of the founding of the International Academy of Astronautics coincides with the fiftieth anniversary of the first human space flight by cosmonaut Yuri Gagarin on April 12, 1961. The Academy was formed to recognize and recruit the global leaders of the new frontier of Outer Space. The members were chosen for their ability to define, develop and direct space activities: conceptually, scientifically, technologically, fiscally and safely for the benefit of all mankind. Today the Academy has grown to be the proactive proponent of a reasoned and rational international space exploration program leading to the expansion of human travels and exploration throughout the solar system. And it did all of this with the goal of providing in its execution the maximum benefits to the peoples of Earth.

This meeting comes at a most challenging time in the development of an international cooperative and expansive space program. World politics and military actions are reducing the abilities of the United States and Europe to the point where resources and political will are not available for new ventures, much less expanded international cooperation.

But some developing nations in Asia, South America and Africa have begun the process of integrating their economies with the hope of creating the necessary economic environment for a major investment in science and technology, including a space exploration program. This concatenation of events has opened a window of opportunity in which the Academy is in a particularly strategic position to use to further its objectives.

The Academy has been fortunate over the years in adding and retaining members who are the leaders in space activities around the world. Thus it has carried out one of its purposes: to recognize and honor those individuals that have distinguished themselves in some branch of astronautics. To broaden its abilities, the Academy has sought and consummated affiliations with other international scientific bodies and established liaisons with nine national academies of science.

And the Academy has sought effective ways of establishing activities through which its members can contribute to the understanding, creation, and implementation of international programs and of international cooperation in advancing the peaceful uses of outer space. We have placed a great responsibility on our committees for the definition, analysis, critique, and unbiased presentation of the facts so adduced, concerning new and projected scientific initiatives in space, in support of and for the understanding of the authorities who are asked to sponsor these programs. For example: the Apollo program required the concerted efforts of a large part of the United States' best and brightest; it involved a total of 300,000 people and many of the universities and most of the aerospace companies in the nation. And it resulted in a legacy of scientific and technological developments upon which the United States still depends and exploits.

I believe that the rewards that resulted from the Apollo program are clearly perceived by all the nations of the world, and that, given the opportunity, they would embrace a program of lunar and Martian exploration and colonization, in fact, they will demand the right to participate and to share in the scientific and technological developments that inevitably will result.

I believe the greatest service the Academy can fulfill is to define what and how such participation and such an effort can be implemented. It is a challenge that we can, and must, meet.

George E. Mueller
Academician

PREFACE

Fifty years have passed since Yuri Gagarin introduced human spaceflight to planet Earth—only four years more than passed since Sputnik introduced spaceflight itself. Strikingly, exactly the same amount of time has elapsed since humans first landed on the moon as it took from Robert Goddard's first liquid rocket flight until humans reached the moon.

Today, the lives of citizens of planet Earth are impacted each day by accomplishments in space: telecommunications, weather observation, navigation using Earth satellites, and much, much more. Thousands of people are alive because of hurricane warnings from space—and important capabilities in medicine, electronics, materials, manufacturing and many other fields owe their existence to the space program. In fact, space has become such an accepted part of the fabric of our daily lives that former NASA administrator Daniel Goldin was once asked by a skeptic, "Why do we need meteorological satellites...we have the weather channel?!"

Today, any particularly complex and challenging undertaking has come to be referred to by many as "rocket science"—even if it has nothing to do with either rockets or science. And few things inspire people of all ages as much as major space accomplishments. Indeed, many of today's scientists and engineers were first motivated to follow their career path by the space program.

As the years have passed, space activity has matured from competition among nations to cooperation—with the International Space Station being an extraordinary example of the latter. Among the earliest promoters of this evolution was the International Academy of Astronautics, founded under the tutelage of the renowned aerodynamicist, Theodore von Kármán. The Academy's membership has included virtually all the individuals who led the space program of planet Earth, including such pioneers as Gagarin, Leonov, Oberth, Keldysh, von Braun, Armstrong, Aldrin and Glenn. Today, the global role of the IAA is more important than ever as the cost and technological demands of such pursuits as human landing on Mars strain those of any individual nation.

But with such a stellar history, what might lie in the future that could provide a comparable or even greater degree of achievement and inspiration? The list of opportunities is seemingly unlimited: including establishing bases on the Moon and Mars, docking with an asteroid, landing on Demos or Phobos, building a logistics station at a Lagrangian point. While the technical challenges associated with these undertakings are immense, even they are eclipsed by the enormity of the economic and political challenges. The severely constraining cost-volume spiral will likely be escaped only when space tourism to near-Earth-orbit becomes commonplace.

What lies beyond that? Perhaps saving our planet from an unwelcome asteroid...perhaps even discovering that we are not alone as we circle one of the 10^{22} stars in the universe and hurl through space and time on the fringes of our galaxy.

But perhaps most amazing of all to those who read these words is that we had the good fortune to have lived in this tiny sliver of time when humans first left our planet...a mere 0.000001 percent of the time since our planet was formed and 0.02 percent of the time since early humans first tread on its surface. How lucky could we be?

Norman R. Augustine
Academician

EXECUTIVE SUMMARY

The space era has deep roots that extend over the centuries, from Icarian mythology to Chinese fireworks and weapons, Jules Verne, Arthur Clarke and the modern rockets born during World War II. However the real start signal was given to the world by the *beep-beep* of the Sputnik satellite that billions of humans listened to curiously from their transistor bulb radios. It is amazing to realize that a very special organization, the International Academy of Astronautics (IAA), was born out of the scientific community as a unique body to recognize space experts around the globe at almost the same time Sputnik signaled to the world a major advance in space travel.

The IAA was established under the leadership of Theodore Von Kármán, known as 'the father' of the Jet Propulsion Laboratory, and was based on the tradition of the great classical scientific academies of the 17th century in Rome, London and Paris. These academies fostered scientific inquiry and the exchange of ideas and new information in the earliest days of the modern scientific era. The IAA was seen as a venue to recognize the leading contributors to this new realm of human activity and to foster the development of a spacefaring world for peaceful purposes. In the words of IAA's second President, Dr. Frank J. Malina, known as 'the father' of the first U.S. rocket, "the classical academies ... served in a remarkable manner the phenomenal advance of man's new method of understanding nature and of applying this understanding for the benefit of mankind."

The era of modern space exploration started with a race that actually achieved travel in space, a race with massive media impact, a race that also paralleled the development of defense systems. The Cold War era resulted in policies that generated competition that worked against international cooperation, exemplified by the emergence of the French/European or the Chinese space programs. In addition, many other countries gradually emerged in space becoming themselves new major players such as all countries members of the European Space Agency (ESA), Japan, India, China, Korea, etc. Those countries were bringing their own vision more focused on space applications making a new trend globally shared.

Dr. George E. Mueller, the IAA's fourth President, known as 'the father' of the Apollo and the U.S. space shuttle programs, summarized the Academy as follows:

In this era of the shift from the cold war to global economic warfare, of government privatization, industrial consolidation and widespread distrust of technology, the need for an active voice and presence in the world community providing a vision for the future of mankind has never been greater. For many years, the Academy has sought to enunciate and to define one such vision. It has recognized that exploration of the Solar system attracts and inspires the imagination and intellect of persons from all nations. Such endeavor not only has the potential to reveal many of the mysteries of creation and to augment the natural resources of our planet but, ultimately, to form a focus for international cooperation on a scale that few can even imagine. And because of the wide contacts of its members through all of the space faring nations and the leadership positions that many of them hold, the Academy is a unique position to translate that vision into reality.

Even so, much remains to be learned about the frontiers of this new realm of human activity. In the words of IAA's sixth President, Prof. Edward Stone, known as 'the father' of the Voyager spacecrafts:

Expanding these frontiers provides a unique opportunity for international partnerships. An important role of the IAA is to help expand these frontiers by fostering increased activity and broader involvement. There are five frontiers to this new realm of human activity as follows: the physical frontier sending robotic systems and humans where none have been before; the knowledge frontier discovering and understanding natural phenomena in space and observed from space; the engineering/technology frontier developing the innovative engineering and technology required to expand the other frontiers; the human frontier addressing the physiological, psychological, and other aspects of effective human activity in space; the applications frontier developing and demonstrating new uses of space that will benefit life on Earth.

Since 1960, the IAA has gathered the best historians and space experts, making this organization one of the most important international space institutions which captures memoirs and generates thousands of peer reviewed history papers. This book has made large use of those publications and has received the support of the IAA History Committee.

This commemorative book is an exceptional occasion to review space-related achievements during the past fifty years. It is also a unique opportunity to invite prestigious space experts and decision-makers who have made, or are currently making space policy and shaping space programs, to select relevant lessons learned, especially the ones ignored or forgotten to the attention of readers and future generations. About 40 Academicians have accepted to deliver such messages that have been compiled in this global and multidisciplinary story of 50 years of space exploration.

The IAA is international in membership with more than 80 countries represented to recognize the global significance of astronautics and space exploration. Recent developments, e.g. the easing of East-West tensions, the progressive integration of European economies, and emergence of the Asian economic revolution, have enhanced the political prospects for international cooperation in space. Cost, scope, complexity and other pragmatic considerations associated with space exploration necessitate cooperation among nations; and it is very likely that such 21st century initiatives as a manned lunar base and the first manned mission to Mars will be international ventures.

The IAA coordinates closely with other national academies to foster a spirit of cooperation and progress that transcends national boundaries, cultures, and institutions. For example, in recent years, joint meetings were held with the French Academy of Sciences, the Royal Society, the Royal Netherlands Academy of Arts and Sciences, the Royal Society of Canada, the U.S. National Academy of Sciences, the U.S. National Academy of Engineering, the U.S. Institute of Medicine, the Austrian Academy of Sciences, the Israel Academy of Sciences and Humanities, the Norwegian Academy of Science and Letter, the Chinese Academy of Sciences, the Italian Academy of Sciences together with the Lincei Academy and Pontifical Academy, the Australian Academy of Sciences together with the Australian Academy of Technological Science and Engineering, the Brazilian Academy of Sciences, the Deutsche Akademie der Naturforscher Leopoldina and the Akademie der Wissenschaften zu Göttingen in Germany, the Indian National Academy of Sciences (INSA), the Indian National Academy of Engineering and the Indian Academy of Sciences.

As stated by the IAA's fifth President, Dr. Michael Yarymovych, the rapid expansion in commercial space communication is the spark that will set off a revolution in space commercialization. The availability of launch at reduced cost, the miniaturization of spacecraft due to the great advances in electronics, and the preeminence of space activities in the minds of the people of the world will in turn provide the needed stimulus for public support for scientific exploration of the universe.

After fifty years of excellence, the Academy is transforming itself in order to be an important part of this revolution while retaining its unique role of promoting the development of space activities for the benefit of all. Indicative of this transformation, the IAA Board of Trustees now includes a President from India, a Vice-President from China, two Trustees from Africa and seven heads of space agencies. In the Academy, members are particularly engaged as exemplified by 16 standalone conferences in 2009 and over 30 studies currently in preparation. The IAA Secretariat, which has been based in Paris for fifty years, supports this growing world of space users by expanding and opening two branches, in Bangalore with a conferences center and in Beijing with a studies center, two regional offices in Russia and Ukraine, and three new regional "nodes" to open this year in Tunis, Yaoundé and Damascus. In addition, there are now 33 regional secretaries. As outlined by the new IAA President, Dr. Gopalan Madhavan Nair, the first non-U.S. President and known as 'the father' of the first Indian Moon program, the Academy must continue to actively promote "Space for Humanity" to bring people together to space to enrich all on Earth.

Jean-Michel Contant
Academician

Contributors

Foreword

Mueller George xi

Preface

Augustine Norman xiii

Chapter 2 Beginning of Space Era and Creation of the Academy

Almár Ivan 26

Fasan Ernst 30

Jasentuliyana Nandasiri 53

Koelle Hermann 40

Kopal Vladimir 28

Maccone Claudio 41

Marec Jean-Pierre 43

Morgenthaler George 51

Mueller George 37

Ortner Johannes 49

Villain Jacques 35

Vernikos Joan 47

Yarymovych Michael 24

Zhuang Fenggan 31

Chapter 3 Space Industry and Technology

Blamont Jacques 66

Ballhaus Jr., William 62

Bekey Ivan 80

Fester Dale 69

Hoffman Hans 85

Hornstein Rhoda 72

Kasturirangan Krishnaswamy 64

Kline Richard 71

Ma Xingrui 78

Sandau Rainer 84

Sax Hartmut 87

Stoewer Heinz 77

Vallerani Ernesto 73

Chapter 5

Chapter 4 Space Science and Applications

Bonnet Roger Contribution	91
Dordain Jean-Jacques Contribution	95
Elachi Charles Contribution	93
Genta Giancarlo Contribution	98
Haerendel Gerhard Contribution	101
Kanai Hiroshi Contribution	103

Chapter 5 International Cooperation: Past and Future

Bensoussan Alain	111
Betin Pierre	113
Liu Jiyuan	122
Masmoudi Mustapha	117
Menshikov Valery	129
Schrogl Kai-Uwe	128
Tennen Leslie	119

Human interest in exploring outer space is perhaps as old as civilization itself, evolved many millennia ago, as reflected in the Vedic literature, Greek mythology and the ancient Epics. The contribution of Jules Verne, Konstantin Tsiolkovsky, Robert Goddard and Werner von Braun led to the development of the modern rocket systems which became a powerful tool for access to space, providing further impetus for space exploration. The beginning of modern era of space research was marked by Sputnik in 1957. It is only a coincidence that the unique organization viz International Academy of Astronautics (IAA) was born around the same time. The prime objective of the Academy has been recognizing the leading contributions to this new helm of human activity and to foster its development for peaceful purposes among space-faring nations.

The space era that started in a competitive environment with an aim to establish an upper hand on military systems, has now grown into a worldwide network of operations. Apart from the USA and Russia which took lead in the early days, France, European Union, China, India and Japan have emerged as new space powers. With the combined strength of space-faring nations, the human mind is poised for a quantum jump in its endeavour to unravel the mysteries of the universe and use such knowledge for improving the quality of human life. The IAA has completed 50 successful years of its operation and has the potential to encourage and acknowledge the contributions of the scientific community in this cutting edge technology and to give focus and direction for future space exploration.

Dr. Gopalan Madhavan Nair, IAA President

© This publication is protected by copyright.
The information it contains cannot be reproduced without written authorization.
© November 2010, IAA



The publication of this book has been supported by Lockheed Martin and Elsevier.

