Alessandra Vernile

The Rise of Private Actors in the Space Sector





SpringerBriefs in Applied Sciences and Technology

From the European Space Policy Institute

More information about this series at http://www.springer.com/series/15974

Alessandra Vernile

The Rise of Private Actors in the Space Sector





Alessandra Vernile European Space Policy Institute Vienna Austria

ISSN 2191-530X ISSN 2191-5318 (electronic)
SpringerBriefs in Applied Sciences and Technology
ISSN 2523-8582 ISSN 2523-8590 (electronic)
SpringerBriefs from the European Space Policy Institute
ISBN 978-3-319-73801-7 ISBN 978-3-319-73802-4 (eBook)
https://doi.org/10.1007/978-3-319-73802-4

Library of Congress Control Number: 2017963520

© The Author(s) 2018

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Acknowledgements

The author is grateful to the external contributions of the interviewees for the invaluable contributions and insights they provided during the course of the project. Sincere thanks are also extended to the ESPI Director, Jean-Jacques Tortora, to the ESPI Coordinator of Studies, Sebastien Moranta, and to the whole ESPI team for their constant assistance and support throughout the research and writing process of the report.

Finally, the author would also like to express her personal gratitude and thanks to Gabriella Arrigo, Maria Cristina Falvella and Danilo Rubini from ASI (Italian Space Agency), and Sara Cavelli from SIOI (Italian Society for the International Organisation), for the support during the whole year.

Contents

1	Dos	sier 1: Innovative Public Procurement and Support	
	Sch	emes	1
	1.1	NASA Innovative Programmes	1
		1.1.1 Rationale for a New Approach to Orbital	
		Transportation	1
		1.1.2 COTS and Related Programmes: New Approach	
		to Procurement	4
	1.2	Institutional Shift: From "System Ordering Customer"	
		to "Industry Service Consumer"	8
		1.2.1 Public-Private Partnerships	8
		1.2.2 More Ambitious Schemes	Ģ
	1.3	European Perspectives	11
2	Dos	sier 2: Private Investment in Space	15
	2.1	New Sources and Mechanisms of Investment	
		in the Space Sector	15
	2.2	Drivers of Private Investment in Space	20
	2.3	Business Approach in the U.S. and in Europe	21
3	Dos	sier 3: Hubs for "Astropreneurship"	25
	3.1	Seattle and the Silicon Valley, Cradles of "Astropreneurs"	25
	3.2	ESA Business Incubation Centres and Other European	
		Initiatives	27
	3.3	United Kingdom Space Catapult: An Innovative Approach	
		in Europe	29
4	Dos	sier 4: New Target Markets for Private Actors	33
	4.1	Mega Constellations: Global Connectivity by Satellite	33
		4.1.1 OneWeb's Mission: Create an Affordable Global	
		Gateway	35
		4.1.2 SpaceX and Iridium Partnership	39

viii Contents

	4.2	Asteroid Mining	42
		4.2.1 An Unforeseen Area of Entrepreneurship	42
		4.2.2 The Luxembourg Initiative	47
	4.3	Orbital Spaceflight and Space Exploration	51
		4.3.1 Space Travels: Virgin Galactic	52
		4.3.2 Space Habitats: Bigelow Aerospace	54
		4.3.3 Mars Colonization: SpaceX	58
	4.4	Small Satellites	61
		4.4.1 Research and Education Projects	64
		4.4.2 Leaf Space: A Successful Italian Example	68
5	Doss	sier 5: Legal Regime	71
	5.1	Should We Encourage the Private Sector Through New	
		Legal Measures?	71
	5.2	Property Rights in Space and Liability for Private Actors:	
		Articles II and VII of the Outer Space Treaty	75
6	Doss	sier 6: Selected Success Stories	81
	6.1	SpaceX	82
		6.1.1 SpaceX Development	82
		6.1.2 SpaceX's Reusable Launch Vehicle	86
		6.1.3 Perspectives on Investments	87
	6.2	Planet	89
	6.3	PLD Space	93
	6.4	D-Orbit	97
Mi	ission	Statement of ESPI	101

About the Author

Alessandra Vernile has worked as a Resident Fellow at the European Space Policy Institute (ESPI), Vienna, Austria, since May 2016 under a fellowship from the Italian Space Agency (ASI) and the Italian Society for International Organisation (SIOI). Previously, she worked as an Intern in the Strategy Department of the European Space Agency HQ, Paris and as Event Manager at the NATO Defence College Foundation, Rome. She holds an MA in International Relations from LUMSA University, Rome, and a Master's in Economic Security, Geopolitics and Intelligence from SIOI. In 2015, she completed a Master of Advanced Studies in Space Policy at SIOI-ASI-CNR, Rome.

Acronyms

AES Advanced Exploration System Programme (NASA

Programme)

ARTES Advanced Research in Telecommunications Systems (ESA

Programme)

ASI Agenzia Spaziale Italiana (Italian Space Agency)

ASL Airbus Safran Launchers

BEAM Bigelow Expandable Activity Module

BIC Business Incubation Centre (ESA Programme)

C3PO NASA Commercial Crew and Cargo Programme Office
CCDev Commercial Crew Development (NASA Programme)
CCP Commercial Crew Programme (NASA Programme)
CCtCap NASA Commercial Crew Transportation Capability

CDTI Centro para el Desarrollo Tecnològico e Industrial (Spanish

institution)

CNES Centre Nationale D'Etudes Spatiales (French Space Agency)
COFACE Compagnie Française d'Assurance pour le Commerce

Extérieur

COSME European Programme for the Competitiveness of Enterprises

and Small and Medium-sized Enterprises

COTS Commercial Orbital Transportation Services (NASA

programme)

CPC Certification Products Contract (NASA initiative)
CRS Commercial Resupply Service (NASA programme)
DARPA US Defence Advanced Research Projects Agency

DFJ Draper Fisher Juvertson (US investors)

DLR Deutsches Zentrum für Luft- und Raumfahrt (German Space

Agency)

DoD US Department of Defense
DSI Deep Space Industries
EC European Commission

xii Acronyms

EELV Expendable Launch Vehicle Programme (US Air Force)

EIB European Investment Bank
EIF European Investment Fund
ELV Expendable Launch Vehicle

EO Earth observation

ESA European Space Agency

ESPI European Space Policy Institute

EU European Union

EX-IM US Export–Import Bank

FAA US Federal Aviation Administration
FCC US Federal Communications Commission

FLPP Future Launchers Preparatory Programme (ESA

programme)

FY US fiscal year
GEO Geostationary orbit
GSO Geosynchronous orbit
GTO Geostationary transfer orbit

H2020 Horizon 2020

IAC International Astronautical Congress
ICAO International Civil Aviation Organization

ICCS International Space Station Commercial Cargo Services

ICTs Information and communications technologies

IDIQ Indefinite delivery indefinite quantity IFC International Finance Corporation

IPO Initial public offering
ISS International Space Station

ITAR International Traffic in Arms Regulations

ITS Interplanetary Transport System (SpaceX project)

ITU International Telecommunication Union

LEO Low Earth orbit

LPRS Liquid Propulsion Stage Recovery MoU Memorandum of understanding

NASA National Aeronautics and Space Administration

NEA Near-Earth asteroid NEO Near-Earth object

NGO Non-governmental organisation

OSTF Open Sky Technologies Fund (ESA Programme)

PPP Public–private partnership R&D Research and development

REDD+ Reducing emissions from deforestation and degradation

RLV Reusable launch vehicle ROI Returns on investment SAAs Space Act Agreements

SDGs Sustainable development goals SES Société Européenne des Satellites Acronyms xiii

SME Small and medium enterprises

SMILE Small Innovative Launcher for Europe

SNCI Societé Nationale de Crédit et d'Investissement du

Luxembourg

SPACE ACT US Spurring Private Aerospace Competitiveness and

Entrepreneurship Act

SpaceX Space Exploration Technologies Corporation TEPRUEL Spanish Reusable Technologies for Launchers

TESER Technology for Self-Removal of Spacecraft (EU Project)

TTP Technology Transfer Programme

TUGSAT-1/BRITE Technische Universitat Graz Satellite-1/BRIght-star Target

Explorer

UKSA UK Space Agency
ULA United Launch Alliance

UNOOSA United Nations Office for Outer Space Affairs

VC Venture capitalist

VCSL Venture Class Launch Services (NASA programme)

List of Figures

F1g. 1.1	How much NASA is paying Russia to send astronauts	
	into space	3
Fig. 2.1	Size and types of investments in U.S. space companies	
	2000–2015—USD billion	17
Fig. 2.2	Investment type per year expressed in USD Millions	18
Fig. 2.3	Percentage of active space investors over 2015	19
Fig. 4.1	Projected satellites to be launched (2017–2020)	35
Fig. 4.2	OneWeb's funding rounds	36
Fig. 4.3	Airbus Defence and Space new era in space with OneWeb	38
Fig. 4.4	Number of launches forecast over the years 2017–2020	42
Fig. 4.5	Prospector-X Concept	49
Fig. 4.6	SpaceX Mars mission timeline	59
Fig. 4.7	QB50 operational scheme	65
Fig. 4.8	Fly Your Satellite! Programme's phases	67
Fig. 5.1	Chronology of space treaties and agreements ratified	
	and entered in action	73
Fig. 6.1	SpaceX's round of investments 2006–2015	88
Fig. 6.2	SpaceX investors	88
Fig. 6.3	Planet labs' rounds of investment from 2013 to 2015	90
Fig. 6.4	Flow of investments to PLD space	94