



# MARS via the MOON

The Next Giant Leap

Erik Seedhouse

 Springer

PRAXIS

# Mars via the Moon

The Next Giant Leap

---



Erik Seedhouse

---

# Mars via the Moon

**The Next Giant Leap**



**Springer**

Published in association with

**Praxis Publishing**

Chichester, UK



Erik Seedhouse  
Assistant Professor, Commercial Space Operations  
Embry-Riddle Aeronautical University  
Daytona Beach, Florida

---

SPRINGER-PRAXIS BOOKS IN SPACE EXPLORATION

---

Springer Praxis Books  
ISBN 978-3-319-21887-8      ISBN 978-3-319-21888-5 (eBook)  
DOI 10.1007/978-3-319-21888-5

Library of Congress Control Number: 2015957057

Springer Cham Heidelberg New York Dordrecht London  
© Springer International Publishing Switzerland 2016

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.

Front cover image of astronaut used under license from Shutterstock.com  
Cover design: Jim Wilkie

Printed on acid-free paper

Springer International Publishing AG Switzerland is part of Springer Science+Business Media ([www.springer.com](http://www.springer.com))

# Contents

<b>Acknowledgments .....</b>	<b>ix</b>
<b>Dedication .....</b>	<b>xi</b>
<b>About the Author .....</b>	<b>xiii</b>
<b>Acronyms .....</b>	<b>xv</b>
<b>Kick-Starting the Next Giant Leap .....</b>	<b>xvii</b>
<b>1   Martian Dragons.....</b>	<b>1</b>
Dragon #1: radiation .....	2
Dragon #2: cataracts .....	9
Dragon #3: blindness .....	12
Dragon #4: bone loss and muscle atrophy .....	13
Dragon #5: early-onset alzheimer’s and brain damage.....	17
Dragon #6: entry, descent, and landing.....	18
References.....	25
<b>2   Government Anchors.....</b>	<b>27</b>
Lunar nations: Russia.....	28
Lunar nations: China.....	35
Phase 1: orbiting the Moon .....	38
Phase 2: landing on the surface.....	38
Phase 3: sample return .....	39
Phase 4: boots on the Moon .....	39
Lunar nations: European Space Agency (ESA).....	40
SinterHab .....	43
Lunar nations: US .....	45
References.....	56

<b>3 Commercial Anchors .....</b>	<b>57</b>
Moon open for business .....	58
Lunar markets .....	58
Resource extraction.....	59
Tourism .....	60
Technology, test, and demonstration.....	61
Defense and security .....	63
Science and exploration .....	65
Education .....	65
Support and supplies .....	66
Media .....	66
Shackleton Energy Company (SEC).....	66
Shimizu Corporation.....	70
Bigelow Aerospace .....	71
OpenLuna Foundation Inc. ....	73
Golden Spike.....	74
 <b>4 Technology .....</b>	 <b>79</b>
Transport.....	80
Hazard avoidance .....	85
Life-support system .....	86
Habitat design .....	92
Robotics and rovers.....	93
Structures and construction.....	98
In-situ resource utilization .....	100
Communications .....	106
References.....	107
 <b>5 The Human Element.....</b>	 <b>109</b>
Selection.....	109
Pre-emptive surgery .....	111
Sterilization and related issues.....	113
Genetic testing .....	114
Getting along.....	114
Uncharted territory.....	116
Martian analog mission.....	120
Death sims.....	123
 <b>6 Regulation.....</b>	 <b>125</b>
Moon Treaty.....	126
Property rights.....	129
Salvage.....	132
Commercial operations and Rules of the Road.....	134
Pollution.....	135
References.....	136

<b>7 Headwinds and Tailwinds.....</b>	<b>137</b>
Headwinds.....	138
Grounded.....	138
Financial crisis .....	140
International Lunar Decade.....	140
Space race .....	143
Asteroid.....	144
 <b>8 Making the Moon Pay: The Economical and Logistical Viability of Boot Prints on the Moon .....</b>	 <b>147</b>
Mining.....	152
Platinum .....	155
Propellant .....	156
 <b>Appendix I .....</b>	 <b>161</b>
 <b>Appendix II. International Lunar Decade Goals .....</b>	 <b>163</b>
 <b>Epilog .....</b>	 <b>165</b>
 <b>Index.....</b>	 <b>169</b>





## Acknowledgments

In writing this book, the author has been fortunate to have had five reviewers who made such positive comments concerning the content of this publication. He is also grateful to Maury Solomon at Springer and to Clive Horwood and his team at Praxis for guiding this book through the publication process. The author also gratefully acknowledges all those who gave permission to use many of the images in this book, especially Shackleton Energy Company.

The author also expresses his deep appreciation to Christine Cressy, whose attention to detail and patience greatly facilitated the publication of this book, and to Jim Wilkie for creating yet another striking cover. The author would also like to thank Production Manager, S. Reka, for her help in bringing this book to publication.



*To those who eventually take the next giant leap*



## About the Author

**Erik Seedhouse** is a Norwegian-Canadian suborbital astronaut. After completing his first degree, the author joined the second Battalion, the Parachute Regiment. During his time in the “Para’s” Erik spent six months in Belize, training in the art of jungle warfare. He also spent many months learning the intricacies of desert warfare, made dozens of jumps from C130s, performed more than 200 helicopter abseils, and fired more light anti-tank weapons than he cares to remember.

Upon returning to academia, the author embarked upon a master’s degree, supporting his studies by winning prize money in 100-km running races. After placing third in the World 100-km Championships and setting the North American 100-km record, Erik turned to ultra-distance triathlon, winning the World Endurance Triathlon Championships in 1995 and 1996. For good measure, he won the inaugural World Double Ironman Championships in 1995 and the infamous Decatriathlon – an event requiring athletes to swim 38 km, ride 1,800 km, and run 422 km. Non-stop!

In 1996, Erik pursued his Ph.D. at the German Space Agency. While conducting his studies, he won Ultraman Hawai’i and the European Ultraman Championships as well as completing the Race Across America bike race. Due to his success as the world’s leading ultra-distance triathlete, Erik was featured in dozens of magazine and television interviews. In 1997, *GQ* magazine nominated him as the “Fittest Man in the World.”

In 1999, Erik took a research job at Simon Fraser University. In 2005, the author worked as an astronaut training consultant for Bigelow Aerospace and wrote *Tourists in Space*, a training manual for spaceflight participants. In 2009, he was one of the final 30 candidates in the Canadian Space Agency’s Astronaut Recruitment Campaign. Between 2008 and 2013, Erik served as director of Canada’s manned centrifuge and hypobaric operations.

In addition to being a suborbital astronaut, triathlete, centrifuge operator and director, pilot, and author, Erik is an avid mountaineer and is currently pursuing his goal of climbing the Seven Summits. *Mars via the Moon* is his twentieth book. He currently works as an Assistant Professor in Commercial Space Operations at Embry-Riddle Aeronautical University where he spends time managing the suborbital spaceflight simulator and operationalizing pressure suits for use in space. He divides his time between the Space Coast, Sandefjord, Norway, and Kona, Hawai’i.

