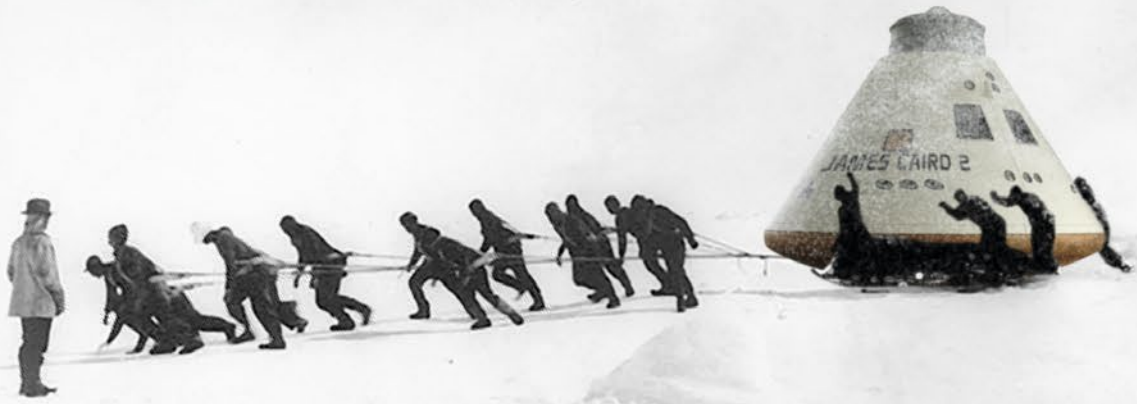
SURVIVAL AND SACRIFICE IN MARS EXPLORATION

What We Know From Polar Expeditions



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Erik Seedhouse

Survival and Sacrifice in Mars Exploration

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Springer

Published in association with
Praxis Publishing
Chichester, UK

PRAXIS

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SPRINGER-PRAXIS BOOKS IN SPACE EXPLORATION

Springer Praxis Books
ISBN 978-3-319-12447-6 ISBN 978-3-319-12448-3 (eBook)
DOI 10.1007/978-3-319-12448-3

Library of Congress Control Number: 2015932248

Springer Cham Heidelberg New York Dordrecht London

Cover design: Jim Wilkie
Project copy editor: Christine Cressy

Printed on acid-free paper

Springer International Publishing AG Switzerland is part of Springer Science+Business Media (www.springer.com)

Contents

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, to Clive Horwood and his team at Praxis for guiding this book through the publication process and to D. Raja and Rekha Udaiyar for their meticulous attention in bringing this book to publication. 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.

To those select few who boldly follow
in the footsteps of Amundsen, Mawson,
Shackleton, and Nansen

About the Author

Erik Seedhouse is a Norwegian suborbital astronaut whose life-long ambition is to work in space. After completing a degree in Sports Science, the author joined the 2nd Battalion the Parachute Regiment. During his time in the "Para's", Erik spent six months in Belize, where he was trained in the art of jungle warfare. Later, he spent several months learning the intricacies of desert warfare in Cyprus. He made more than 30 jumps from a C130, performed more than 200 helicopter abseils, and fired more anti-tank weapons than he cares to remember!

Upon returning to the comparatively mundane world of academia, the author embarked upon a master's degree in Medical Science, supporting his studies by winning prize money in 100-km running races. After placing third in the World 100 km Championships, the author turned to ultra-distance triathlon, winning the World Endurance Triathlon Championships in 1995 and 1996. For good measure, he won the World Double Ironman Championships and the Decatriathlon, an event requiring competitors to swim 38 km, cycle 1,800 km, and run 422 km. Non-stop!

Returning to academia, Erik pursued his Ph.D. at the German Space Agency's Institute for Space Medicine. While studying, he won Ultraman Hawaii and the European Ultraman Championships, and completed Race Across America. As the world's leading ultra-distance triathlete, Erik was featured in dozens of magazines and television interviews. In 1997, *GQ* magazine nominated him as the "Fittest Man in the World".

In 1999, Erik retired from triathlon and started post-doctoral studies. In 2005, he worked as an astronaut training consultant for Bigelow Aerospace and wrote *Tourists in Space*. He is a Fellow of the British Interplanetary Society and a member of the Space Medical Association. In 2009, he was one of the final 30 candidates in the Canadian Space Agency's Astronaut Recruitment Campaign. Erik works as a spaceflight instructor for the American Astronautics Institute, professional speaker, triathlon coach, author, and Editor-in-Chief for the *Handbook of Life Support Systems for Spacecraft*. He is the Training Director for Astronauts for Hire and, between 2008 and 2013, he served as director of Canada's manned centrifuge operations.

In addition to being a suborbital astronaut, triathlete, centrifuge operator, pilot, and author, Erik is an avid mountaineer and is pursuing his goal of climbing the Seven Summits.

Survival and Sacrifice is his seventeenth book. When not writing, he spends as much time as possible in Kona on the Big Island of Hawaii and at his real home in Sandefjord, Norway. Erik and his wife, Doina, are owned by three rambunctious cats – Jasper, Mini-Mach, and Lava.

Inside the Fram Museum, Bygdøy, October 2014, Credit: Adrian Seedhouse

Acronyms

AAE	Australasian Antarctic Expedition
AFT	Advanced Food Technology
ASCR	Astronaut Strength and Conditioning Rehabilitation
ATLS	Advanced Trauma Life Support
ATS	Adaptability Training System
BAE	British Antarctic Expedition
BMD	Bone Mineral Density
CHeCS	Crew Health Care System
CSA	Canadian Space Agency
CSM	Command Service Module
CT	Computed Tomography
DC	Damage Control
EDL	Entry, Descent, and Landing
FMARS	Flashline Mars Arctic Research Station
GCR	Galactic Cosmic Rays
HI-SEAS	Hawaii Space Exploration Analog and Simulation
ICE	Isolation, Confinement, Environment
IHMC	Institute for Human and Machine Cognition
ISRU	In-Situ Resource Utilization
ISS	International Space Station
LEM	Lunar Excursion Module
MIS	Minimally Invasive Surgery
MRE	Meals Ready to Eat
MRI	Magnetic Resonance Imaging
NAA	North American Aviation
POMS	Profile of Mood States
SA	Suspended Animation
SDSC	Space Development Steering Committee
SEI	Space Exploration Initiative

SLS	Space Launch System
SPE	Solar Particle Event
SSME	Space Shuttle Main Engine
STP	Supersonic Transition Problem
VASIMR	Variable Specific Impulse Magnetoplasma Rocket

Foreword

Much has been written about manned missions to Mars. Intuition and experience during long-duration spaceflight tell us the experience of such a mission will be so different from life on Earth that unearthly changes will manifest themselves in the crew, hence the need for extensive research. We know there will be dramatic physiological changes during such a mission and therefore believe there must be comparable psychological changes. We search for answers in analogs of the space environment, stuffing crewmembers inside hermetically sealed cans for months at a time, and see in these analogs only examples of human frailty. We read that the incidence of psychiatric cases in Fleet Ballistic Missiles submarines is 4/1,000, conveniently overlooking the fact that the rate of reported psychiatric illness is lower in submarines than in the surface fleet.

F.1 Credit: Mars Society

The history of polar exploration provides us with myriad examples of how explorers have performed admirably under appalling and testing circumstances. The crew of Fridtjof Nansen's *Fram* left home on 24 June 1893 and did not return for more than three years. More than two years of that absence was spent frozen in the polar ice with no outside contact. No Wi-Fi or Facebook for these guys, yet they survived an ordeal that was far, *far* more arduous than a mission to Mars, and did so in (mostly) good spirits.

> Men wanted for hazardous journey. Small wages. Bitter cold. Long months of complete darkness. Constant danger. Safe return doubtful. Honour and recognition in case of success.
>
> *Job description from Ernest Shackleton, recruiting for his 1915 Imperial Transantarctic Expedition*[1]

Another example of an arduous expedition was Shackleton's Imperial Transantarctic Expedition, an epic journey that took as long as a manned Mars mission is envisaged to take using chemical propulsion. Given the brutally honest nature of the ad, it is perhaps surprising anyone

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[1] This advertisement is perhaps one of the most famous in history, but its origins are very obscure because no one has actually seen the ad printed in a newspaper: the Antarctic Circle has a US$100 reward out for anyone who can find it, but the reward has yet to be claimed. The ad was supposed to have appeared in the *London Times* on 29 December 1913.