Preface

This book is an appeal to NASA, the Mars science and mission support community, and the powers that be to recognize that before we attempt to land on Mars, there ought to be a precursor, crewed orbital mission to the planet's moons, Deimos and Phobos.

The desire to land on Mars is driving the mission planning and clouding the real risks and extreme difficulties of taking the ultimate step from orbit to the surface. The magnitude of the difference between an orbital mission and a landing/stay mission could be a decade and many billions of dollars. From an operational point of view, there is great value in learning "how" to "fly" to Mars's moons first. This would include all of the tasks that a crew and their supporting team in Mission Control must conduct in order to just get there and come home. While it is very clear to the JPL operations people how to send a robotic spacecraft to Mars, it is quite another thing for the NASA Johnson Space Center (JSC) flight operations people to send a crew to Mars and return them safely back to Earth. Would the Apollo 11 mission have been successful if we had not carried out the Apollo 8 and Apollo 10 missions first? Would we have ever attempted a mission as demanding as Apollo 11 without those precursor missions?

One argument for doing the landing first is: "Would you ever go all the way to Mars and not land?" Some do not realize the amount of equipment and systems required to land, stay, and get back off the surface of Mars, let alone "how." The increase in risks to achieve these goals and activities is orders of magnitude more than those required for a Mars Orbital Mission. But as of 2017, many of those landing/stay vehicles and systems are not yet designed or developed, and they are certainly not yet budgeted. Mission planners and engineers can conceive of systems far ahead of actually getting funds to design, develop, and test their creations. They can actually be decades, even hundreds of years, ahead of reality – as is evidenced by those who have visions of colonies of people living on Mars and terraforming it. Operations people live more in the "here and now." They must "do" what the "dreamers" conceive. But then, what would we do without the dreamers? Isn't everyone working on the Mars program a dreamer? Flight operations people dream of completing the mission. Interwoven throughout this book are operational perspectives from the crew and flight operations point of view.

I have attempted to describe what can be done to explore the Mars orbital environment sooner than a landing mission and hope to encourage the NASA administrators and planners to begin a detailed "Design Reference Orbital Mission" to Deimos and Phobos. The scientific community definitely has goals and objectives for undertaking science there, and many scientists agree that an orbital mission should be a precursor to a landing. These objectives have been defined for years. The more the scientists learn from the robotic missions, the more they can "fine-tune" their detailed science objectives for human missions. The potential astronaut crews need to be educated and trained to conduct those experiments. There are some very interesting operational EVA aspects related to how to collect samples from the Martian moons and deploy sensors that can assist in gathering more scientific data, as well as leaving equipment behind that might facilitate future flights.

After putting the planning of a Mars mission into a historical context, the book will describe what is currently planned which relates to an orbital mission. It will describe what is *not* required to go to the Martian moons, to ensure that the reader understands the vast difference in missions and therefore how much sooner an orbital mission can be achieved and at significantly less risk. The risks to the astronauts will be covered, as will the habitability considerations for such a long and perilous flight. Some of the unique technology advances that enable such a mission are also described.

Also included are references to what many of the organizations and contractors are doing to support a flight to Mars. An important aspect of the planning is the experience gained over the decades from the robotic missions to Mars. This is included in one of the several Appendices. It is apparent that future human missions to Mars will involve the commercial space industry and our international space partners. The cooperative nature of the International Space Station (ISS) is an illustration of how a Mars mission should be organized.

In summary, the intent of this book is foremost a plea to NASA to begin detailed planning for a human orbital mission to the Martian moons as a precursor to a landing on the planet itself. In addition, it is hoped the book will become a reference for such a mission for university students and space aficionados. As of the spring of 2017, the book will cover what vehicles and systems are required and what needs further definition. Appendices provide not only a historical context for the current state of Mars exploration but also a review of the human analog research undertaken over the years. Links to NASA and contractor sources are included for the reader desiring even more information.

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