CHAPTER EIGHT

A Report from Mars

W. Henry Lambright

"**Dispatch from Mars Exploration Base, Stardate July 20, 2039.** We have landed on Mars and have established our Mars exploration base. We landed today, the 70th anniversary of the Apollo 11 Moon landing by the United States in 1969. Let us tell you how we got to Mars and how the Mars 2039 mission differed dramatically from the way the United States reached the Moon in 1969."

A REPORT FROM MARS

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Our "Mars Together Project," as it is called, involves space agencies from the United States, Russia, China, Canada, Europe, Japan, Korea, India, and other nations. It is undergirded by hundreds of private sector and university partners, comprising thousands of scientific researchers from all over the world. The private sector partners are not only involved as contractors, but share in the costs of the project, an approach pioneered by Elon Musk's SpaceX earlier in this century. In contrast, the Apollo program was a strictly national project undertaken by the United States and its team of contractors.

A collaborative governance model was used to get us to Mars and to effectively deploy the expertise that was assembled for our Mars mission. The Mars Together Project is a strong contrast to the NASA-dominant Apollo model. Our Mars mission is a logical extension of collaborative programs that began with the International Space Station (ISS) and were succeeded in the late 2020's and 2030's by a global project to build a base on the Moon. Along the way, government and private sector companies found incentives to cooperate to explore the universe. Public interest in Mars was stimulated by unmanned soil-sample returns to Earth indicating strongly that Mars once had or still had life. In the past decade, the 2030s, human spaceflight and robotic technology merged in the interest of exploration.

First Steps on the Road to Mars (1969 to 2018)

What did it take to get to Mars? What made collaboration among nations, and between nations and the private sector, successful? The past was our guide to the present, 2039, and the past showed us examples of false starts, mixed results, and successes.

The first false start—actually a non-start—related to Mars came after the Apollo landing of 1969. NASA pushed for a comprehensive human space flight program that included Mars missions as early as the 1980s. President Nixon rejected this proposal, holding human spaceflight in low-Earth orbit via the space shuttle. A second false start came in 1989. President George H. W. Bush proposed a Space Exploration Initiative to return astronauts to the Moon and then advance to Mars. When the possible cost of such a program

leaked, Congress refused to fund the effort. It was aborted.

The road to Mars in 2039 also included projects with mixed results. In 2004, President George W. Bush announced his Vision for Space Exploration plan, along with Project Constellation. Vision for Space Exploration was akin to George H. W. Bush's program. It got underway but, in February 2010, President Barack Obama terminated it. Parts of the program were resurrected by Congress in a presidential-congressional compromise in October 2010. Obama substituted an asteroid mission for Bush's goal of a Moon landing, and called for reaching Mars in the mid-2030s. The Obama Administration emphasized commercial crew and delivery to the International Space Station. The 2010 compromise provided for NASA's development of a rocket (Space Launch System) and spacecraft (Orion) capable of taking astronauts to deep space. In 2018, President Trump ended the asteroid mission, and brought back a mission to the Moon with Mars the ultimate objective.

The road to Mars also included the ExoMars project, which was driven by the European Space Agency (ESA) and had mixed results. This was a robotic program designed in the Obama years to help answer the question of life on Mars. It aimed to return a sample of Mars soil to Earth for scientific examination. The program was initially led by ESA and NASA, and it entailed a sequence of missions. But the United States dropped out of the partnership as a lead funder owing to domestic budget troubles. ESA turned to Russia to keep ExoMars going, although delayed.

The International Space Station was not sold as a Mars mission, but NASA surely saw it as a "next logical step" beyond the shuttle in that direction. Moreover, it was a successful example of international space cooperation. Launched by President Reagan in 1984, ISS achieved "assembly complete" in 2011, and continued in operations during the decade of the 2020s. ISS served as a model of collaborative partnership for us in which the United States served a "managing partner" role of an enterprise embracing five space agencies and fifteen sovereign nations.

ISS was initiated during the Cold War to compete with the Soviet Union's space station, MIR. It was saved in 1993 as a post-Cold War symbol of cooperation between the United States and Russia by President Clinton. ISS partners included the United States, Russia, ESA, Japan, and Canada. Also involved were commercial companies that delivered cargo and later astronauts. Whatever else may be said of ISS, it was a remarkable success as a collaborative project, and helped make the Mars Together Project's mission in 2039 possible.

Another key step to Mars was the "roadmap" to Mars published in 2018 by the International Space Exploration Coordination Group (ISECG). ISECG was initially formed in 2007 after Bush's Moon/Mars decision and was established as a mechanism for sharing ideas and information. Members included the United States and space agencies from 13 other participants, including Australia, Canada, China, ESA, France, India, Italy, Japan, Republic of Korea, Russia, Ukraine, United Arab Emirates, and the United Kingdom. The ISECG's

2018 "Global Exploration Roadmap" was a technical roadmap, not a political or administrative design. The roadmap was consistent with then-US policy that made the Moon—a lunar base in particular—a key interim step.[1]

Becoming More Collaborative (2018-2030)

Following planning, in 2022 a group of nations and private sector companies agreed to create the Mars Together Project with a 2039 landing goal. Crucial to the success of this effort were key decisions on who does what, how, why, and when. The participants assumed (correctly) that NASA and other partners would accompany flight missions to the Moon and Mars with rigorous research and development to create new technologies to speed transport, bring down costs, and increase safety. For example, in-space propulsion technologies, were necessary, along with technologies enabling human stays on the Moon and Mars.

The path to Mars began with the International Space Station providing relevant knowledge about exploration and travel to Mars. Knowledge about the human impact of long-duration spaceflight was crucial. Astronauts on ISS suffered bone weakening and immune system deficiencies. Some astronauts also seemed to have alterations of DNA. Long-duration spaceflight was essential to Mars exploration, and ISS provided us with experience at long durations. It was necessary to learn the impact of space travel on humans, and how to mitigate negative impacts. Research included the psychological impact of being distant from Earth and loved ones. ISS showed us that humans from very different cultures and languages could work together. In addition, missions to the Moon during the 2020s proved a great testbed for our mission to Mars. We also learned how to work together as a team on the ground, as well as in space.

Policy shifts were made in the 2020s. The United States ended its role on the International Space Station and diverted funds to the Moon and beyond. During this decade, NASA relinquished its leadership in low-Earth orbital flights, and begin to move more aggressively toward the Moon and Mars in preparation for the 2030s.

Due to its age, the International Space Station mission ended in the late 2020s. Starting in the 2020s, newer, smaller space stations were launched and run by the private sector and other nations. Russia assembled its own space station in low-Earth orbit. China began a small space station in the 2020s and built and deployed larger space stations in the 2030s. The United States and NASA, in partnership with other nations and the private sector, began a robotic presence on and around the Moon in the late 2020s. The United States and China, previously rivals, furthered mutual exploration goals as partners throughout the late 2020s and early 2030s.

Exploring the Moon in Preparation for Our Trip to Mars (2030-2039)

During the decade of the 2020s, NASA and its partners (other nations and the private sector) built a small space station to go around the Moon as a step between the International Space Station and a Moon base. A space station orbiting the Moon, operating in 2030, enabled communications between Earth and the Moon and served as a vehicle from which international astronauts were able to guide robots and humans in lunar tasks. This outpost continued the International Space Station's function of studying how humans adapted to journeys away from Earth. The lunar outpost was 250,000 miles away, in contrast to the ISS's 250 miles, and astronaut stays exceeded one year. We were breaking the umbilical cord to Earth.

Our next step toward Mars, in the early 2030s, was to land and operate on the lunar surface. Other nations and the private sector also built landers and ascent vehicles. A lunar base was urged by the European Space Agency, which had proposed a "Moon Village" earlier, and it played a significant role in developing the Moon base. ESA, NASA, and their partners developed techniques to turn lunar materials into resources astronauts can use to sustain a presence. "Living off the land" was a requirement for our stay on Mars. Establishing a base on the Moon prepared us for that task on Mars. Given its minimal gravity, the Moon served as an ideal point of embarkation to Mars for humans and supplies. As with the International Space Station, NASA needed to pioneer, develop, and avoid becoming an "operating" organization on the Moon. The Red Planet was our goal.

With the Mars Together Project in place in the early 2030s, full attention was given to landing on Mars. We employed new propulsion and habitat technologies. We advanced techniques demonstrated on the Moon. Our first key success was an orbital outpost around Mars, a small space station around the planet. It helped direct robotic activity on the Martian surface, some of which was geared to establishing habitation and in-situ resource-conversion facilities.

In order to land on Mars in 2039, we required multiple transportation, navigation, communication, and other services. The Mars Together Project partners participated in planning and facilitating our Mars mission. Our achievement of landing on Mars was multi-national and multi-sectoral. In addition, the public participated through social media all along our trip to Mars.

Success Factors in our Trip to Mars

The Mars Together Project, declared in 2022, has reached its goal of landing on Mars. What critical factors brought our mission to its successful landing on Mars?

Success Factor One: Collaborative partnership and leadership. Collaboration embraced many nations and private companies. The overall "managing partner" was the United States and NASA. Senior partner status was based on who invested the most money and personnel in the project, and who took the greatest risks in moving outward towards Mars. Partners made policy mainly through consensus—using a "heads of organizations" committee. The Mars Together Project coalition had decided on roles and authority at the outset of the project. There were disagreements, but partners worked through them.

Success Factor Two: Inclusive partnership. Members of the project included all International Space Station partners plus additional nations and the private sector. It took time to bring China aboard, but China joined at the lunar-landing stage in spite of political opposition in the United States. China was going to go to the Moon and Mars eventually and was already investing more money and talent in doing so than any other nation aside from the United States. It was better for all if China was part of the project team to share costs and risks. NASA, as project catalyst, kept its aim on the goal. It led in developing capabilities, deploying hardware, using that hardware, and then relinquishing control as it advanced to the next step. Others took over operations of each specific milestone.

Success Factor Three: Interdependence. What motivated the partners to stay together was the realization that so ambitious a goal—a Mars landing in 2039—required multi-institutional cooperation. There was no practical alternative given financial realities. This meant a division of labor in which different organizations took the lead in different facets of the project. The partners in the Mars Together Project established goals and division of labor at the outset and sustained both throughout the project. Trust and transparency were observed. The US, as collaborative leader, made choices openly and distributed information to all members of the team as soon as possible whenever possible. It exercised "power with," not "power over."

Success Factor Four: Personal relationships and project cohesion. These factors developed among national and private sector participants. Cooperation involves people. The heads of organizations who served for long periods of time developed personal rapport. Political skills also proved crucial. This domestic-international maneuvering required not only political and managerial skill, but diplomatic talents of a high order.[2] Given the length of the project, a succession of NASA administrators demonstrated such political, managerial, and diplomatic skills. It was necessary to buffer the project from internal and external forces.

The success factors discussed above took the Mars Together Project from a concept to a launch to the Martian surface. The project required nations, government agencies, and private sector companies to think big and "outside the box" about ends and means.

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Endnotes

1 International Space Exploration Coordination Group, NASA, *The Global Exploration Roadmap,* (Washington, DC, January 2018).

2 Mark Boyer, "Issue Definition and Two-Level Negotiations: An Application to the American Foreign Policy Process," *Diplomacy & Statecraft* 11, No. 2, (2000).