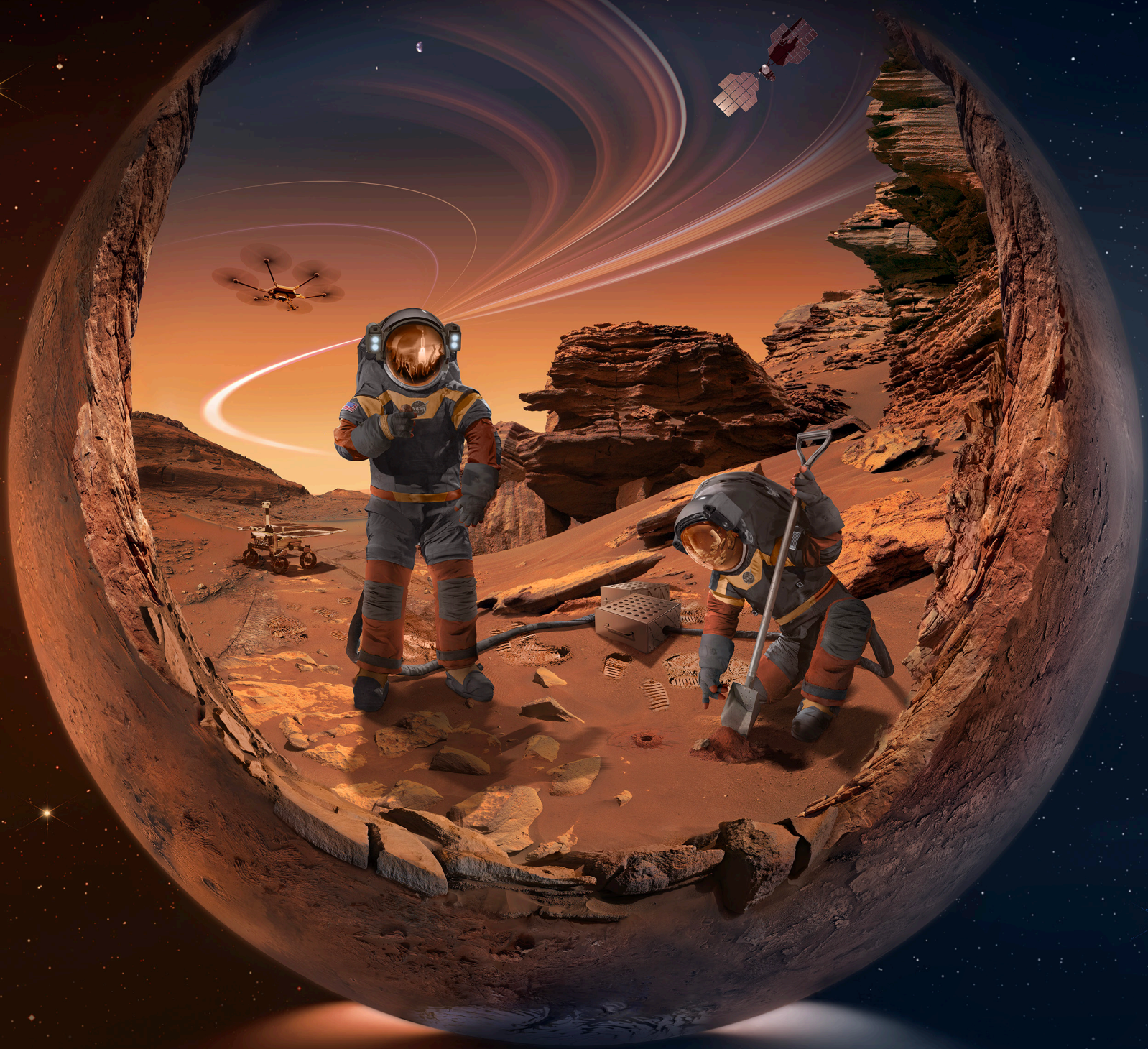
National Aeronautics and Space Administration



MARS | REVEALING MARTIAN MYSTERIES

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WHY MARS?

There are several strategic, practical and scientific reasons for humans to explore Mars. Mars is the most accessible planet in the solar system, its exploration provides a possible opportunity to answer questions about the origin and evolution of life, and it could someday be a destination for a sustained human presence.

In the strategic sense, exploring Mars demonstrates our global scientific and technological leadership as a nation, supports economic growth, and expands U.S. leadership in the peaceful, international exploration of space. Mars exploration missions also improve life on Earth with the development of durable technology, inspiration for autonomous systems applications similar to those used on Mars, and access to a Martian rock record that can reveal more clues about the history of the solar system.

From a practical perspective, we know Mars is a terrestrial planet with a thin atmosphere and climate, its geology is very diverse and complex, and it appears that, like Earth, its climate has changed throughout its history. Mars is unique across the solar system because its rock record preserves its early history from a time when life began on Earth, where that physical record no longer exists.

Overall, many key questions in solar system science can be addressed effectively by exploring Mars. This endeavor also serves to inspire the next generation of explorers and to dramatically expand human knowledge.

SCIENCE GOALS

The Mars Exploration Program studies Mars as a planetary system in order to understand the formation and evolution of the planet, the history of geological and climatic processes that have shaped Mars through time, the potential for Mars to have hosted life, and to prepare for future human exploration. Our strategy has evolved as we have learned more, from “Follow the Water” to “Explore Habitability” to “Seek Signs of Life.”

HUMANS TO MARS

In anticipation of sending humans to Mars, NASA has begun searching for locations of high scientific value that could also provide resources for humans to land, live, and work on Mars. Locally derived natural resources such as water and oxygen could be exploited for humans to explore the planet.

Liquid water could potentially be extracted from ice in the ground, water vapor in the atmosphere or hydrated minerals. Oxygen can be generated from the carbon dioxide of Mars’ atmosphere, as demonstrated by the Mars Oxygen In-Situ Resource Utilization Experiment (MOXIE) on NASA’s Mars Perseverance Rover. This demonstration has helped mission planners test ways to support future human explorers and improve designs for life support and transportation on Mars. A MOXIE-like technology is represented in this illustration by the silver boxes located between the astronauts. Orbiting spacecraft also monitor weather in the Martian atmosphere, which will help future human explorers better understand the environment.

TECHNOLOGY

Technology development makes missions possible. Each Mars mission is part of a continuing chain of innovation: each relies on past missions to demonstrate capabilities and new technologies and contributes its own innovations to future missions. This chain allows NASA to continue to push the boundaries of what is currently possible while also relying on proven technologies.

Technologies of Broad Benefit include: Entry, descent, and landing methods that ensure precise and safe landings; propulsion for providing the energy to get to Mars; power for providing more efficient and increased electricity to the spacecraft and its subsystems; telecommunications for sending commands and receiving data faster and in greater amounts; smaller, higher performance electronics for operating the spacecraft and its subsystems; and software engineering for providing the onboard autonomy necessary to operate the spacecraft and its subsystems.

In-situ Exploration and Sample Return benefits include: Autonomous planetary mobility for enabling rovers and aerial vehicles to make decisions and avoid hazards on their own; technologies for making systems robust enough to handle extreme conditions and severe environments in space and on Mars; sample return technologies for collecting and transporting rock, soil, ice, and atmospheric samples to Earth for further laboratory analysis; and planetary protection technologies for cleaning and sterilizing spacecraft and handling the samples.

Science Instrument benefits include: Remote science instrumentation for collecting Mars data from orbit; and in-situ instrumentation for collecting Mars data from the surface.

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