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THE HOMESTEAD PROJECT: Making a Mars Settlement a Reality



Tech Wednesday

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The Homestead Project: Making a Mars Settlement a Reality



By [Ker Than](#)
Staff Writer
posted: 10 August 2005
ET

The Mars Foundation's hope for humanity's future on Mars is neatly summed up by their slogan: "To arrive, survive and thrive!"

In July at the International Conference on Environmental Systems (SAE-ICES) in Rome, the group presented plans for a permanent settlement they believe can be built using near-term technologies and resources already available on Mars.

The Mars Foundation is a non-profit organization made up of approximately 30 volunteer members, many of them scientists and engineers, and their effort is called the "Homestead Project."

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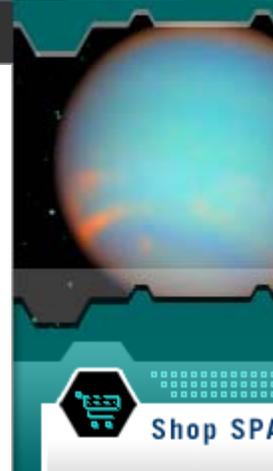
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Rendering of the Mars Homestead Settlement. This concept provides a clear vision for early life on the Martian frontier. It is built primarily from local materials, providing early life support and industrial capabilities, and will begin full-scale settlement of the Red Planet. Image Credit: Mars Foundation



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According to the plans, the settlement will rely on a curious blend of old and new technology: it will be built with the aid of robots and run on nuclear energy, but will utilize materials and building techniques reminiscent of earlier centuries on earth.

She's a brick house

Designs call for large masonry arches and vaulted ceilings and domed skylights built with bricks baked from Martian soil and stones cut from Martian quarries.

Bruce Mackenzie, a co-founder of the group and a former member of the National Space Society's board of directors, has been preaching the benefits of brick as an ideal building material for a Martian settlement for years.

"There are a number of ways you can make it, including just scooping up the soil, putting it in a mold, and compressing and heating it," he said. "You can also melt it and make glass, and it can be glued together."

Brick is also easy to manufacture, Mackenzie said, and quality control for brick is not critical the way it is for other materials like fiberglass.

Additional materials—such as steel, aluminum, ceramic, glass and plastics—will also be needed for the settlement's construction but the group believes these materials can be manufactured using local Martian resources.

"The industry and the technology that you need to produce these materials we'll have on hand," said Joseph Palaia, an MIT nuclear engineering graduate student involved in the settlement design. "It's based on last century's industrial engineering technology."

Compared to the cramped quarters within space shuttles and the International Space Station, the Martian settlement will be large—approximately 27,000 square feet—and will initially house a dozen settlers.

"We're not putting them in a trailer somewhere," said Mark Homnick, another Mars Foundation co-founder and a retired engineer who designed wafer-fabrication plants for Intel. "This thing is roomy and



The settlement greenhouses will include familiar fare like spinach, rice, radishes, peanuts and lettuce. Image Credit: Phil Smith/Mars Foundation



All the comfort of Earth on Mars: each settlement room will have windows looking out onto the Martian landscape and room for a personal garden. Image Credit: Phil Smith/Mars Foundation

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intended for permanent habitation."

As more settlers arrive, the site will be expanded and will ultimately be able to accommodate approximately 100 people, the group said.

Ideal conditions?

Conditions on Mars, however, are not exactly colonization-friendly and compared to Earth, in fact, they can seem downright hostile. Morning temperatures on the desert planet can dip can below -76 degrees Fahrenheit (-60 Celsius) and enormous dust storms sweep across its barren rocky fields at speeds of over 60 miles per hour.

A wispy atmosphere, combined with the lack of a planetary magnetic field, means that the air pressure on Mars is only a tiny fraction of Earth's and that harmful radiation from solar winds, cosmic rays and solar flares routinely bombard its surface. Factor in a minimum 6-month commute and a communications delay that can reach over 40-minutes and an obvious question arises: Why would anyone *want* to go to Mars? Let alone live there?

One reason, said Palaia, is because it's there. "We will go to Mars for the challenge," he said. "Anything short of Martian settlement will be too easy an undertaking."

Mars is also scientifically interesting—geologically and perhaps even biologically—and research conducted from a permanent base would be more efficient and less costly, the group said.

Compared to a round-trip exploratory mission, the group believes a permanent settlement may also be safer. Broken parts, for example, could be manufactured and replaced on-site, eliminating the need to haul heavy spare parts or risks dangerous shipping delays.

"Anything that is high-mass and low tech, we're going to make there on Mars," said Palaia. "Anything that is really high tech—like sensors, motors and complex mechanism—most of those things are relatively low mass and can be imported from Earth."

The group recommends sending a minimum amount of resources to Mars beforehand, a process known as bootstrapping. When the settlers arrive on Mars, they can use the prepared materials, along with local resources, to construct the settlement.

Forward thinking

One possible scenario, the group proposes is to send small gas tanks ahead that store methane and oxygen extracted from the atmosphere. When the settlers arrive, they can then use that equipment and stored gas to build things like steel production plants.



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Finally, Mars will be an integral part of an inter-solar system economy that the group believes will develop within the next century, one based on the convergence of four frontiers: Earth, the Moon, asteroids, and Mars—including its own rocky satellites, Phobos and Deimos.

Mars will catalyze the development of the other frontiers, said Homnick, acting as a supply house for vital resources like nitrogen, carbon dioxide and water for the moon and asteroids, places where such things are scarce or nonexistent.

Many of the technologies developed for use on Mars will also have applications for the other frontiers, the group said. For example, life support systems and mining equipment developed for use on Mars could also be used on the moon.

The group strongly supports President Bush's Moon, Mars and Beyond vision and said they are not trying to compete with NASA or any other space organization.

"We kind of look at NASA and the European Space Agency as analogous to Lewis and Clark in the old west," Homnick said. "They blaze the trail, go out to explore and do the science. Well, we are analogous to the pioneers—we follow the trail that they blazed, and we make the new frontier home and we add value."

Instead, the group believes that different agencies can benefit from one another and the colonization of space can be sped up.

"We hope they succeed because they'll help us succeed," said Palaia.

It's all about location

While drawing up plans for the settlement, the group restricted themselves to existing—or extrapolations of existing—technologies. Despite this limitation, the group believes the first stages of a Martian settlement could be in place as soon as 2025.

After studying Martian survey data collected by NASA, the group chose Candor Chasma as a tentative site for the settlement. Candor Chasma is a group of mesas located within an enormous canyon system on Mars known as the Valles Marineris.

In addition to being geologically varied and scientifically interesting, Candor Chasma is also relatively flat and situated near the planet's equator, factors that are important for shuttle take offs and landings.

The settlement will be an oasis built for posterity, one the group believes future generations will come to regard as "a place of veneration and pilgrimage."

With this in mind, the group's settlement designs call for the planting of a First Tree. The tree—the species of which will be determined later—will be planted in front of the settlement's main entrance and its seeds will be transplanted to new

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parts of the settlement as it expands.

"That was very important to us," said Palaia. "We wanted to have this in there as a symbol of bringing life to [Mars]."

Mackenzie and Homnick are both middle-aged and doubt they'll be able to go to Mars themselves. But Palaia, 25, thinks he may have a chance.

"It's been my life obsession since I was very young," he said.

Whether he'll be able to remain on Mars permanently, however, is another matter.

"It's a point of contention with my wife," he said.

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