MISSION TO MARS

Sam is celebrating his sixth birthday in Candor, the capital of the small Mars colony where he was born. . . . It could easily happen in our lifetime according to the projections of Stanford's truly cost-effective, international Mars study.

BY RAYMOND HARDIE

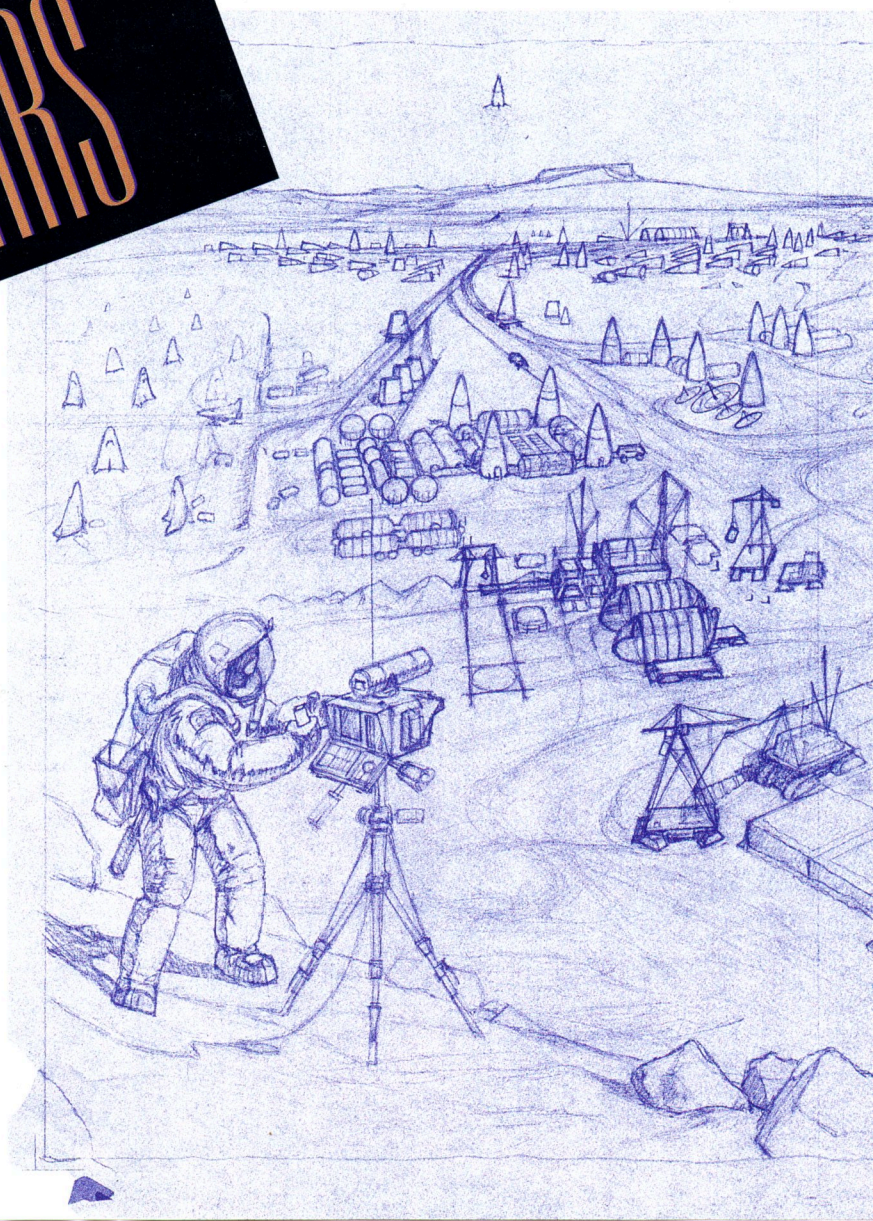
David pushes his bike through the banana grove toward his son's school. It is late afternoon and as the sun sinks low on the Martian horizon, it casts a burnt orange glow through the hard, clear plastic of the sectioned roof. It is Sam's birthday and David doesn't want to be late for the school party. Sometimes it's hard to believe. It is March 1, 2025, and Sam is 6 years old. Six! That means that David and his wife, Srinija, have lived on Mars almost eight Earth years. Sam was the 10th child to be born on Mars and, like the other young Martians, Sam feels special, part of this "brave new world" as his teachers like to call it. The colony has nearly 200 children under 18, one-third of them Martian born.

David stops as the beeper goes off under his lapel. He leans his bike against a palm trunk. The bike is a squat machine, twice as hefty as an Earth two-wheeler and built that way to counteract the effects of Martian gravity, which is one-third of Earth's. David gazes through the roof into the evening glow as he hits his lapel to listen to his message. It is a short reminder to listen to the special program being relayed from Earth in 15 minutes. As usual, the message ends: "This is Candor Broadcasting Corporation, Mars Colony."

Candor is the capital of the small Mars colony. The first people landed on Mars 15 years earlier and already Candor has a population approaching 1,000. It is situated within Candor Chasma II, a side canyon of the Valles Marineris rift valley, and serves as the capital city of the Mars settlement. Valles Marineris, which is 6,437 kilometers long, lies like a deep gash across the Martian equator. There are two other smaller settlements, named Washington and Moskau, that lie some 60 kilometers in opposite directions along Marineris. There is also an experimental science station, called Tokyo, 48 kilometers away at the foot of the high ochre cliffs of Valles Marineris.

Through the trees David sees the children bounding out to their play area. He looks across the grove through the openings in the thick red walls toward Terra-2, the next greenhouse. These nine-meter-high walls form the rectangular greenhouses called terras. The settlement grows virtually all of its own food in these terras, each measuring 86 by 86 meters. The crops are grown in a hydroponic system and are cultivated at different levels in long, plastic-based terraces fed by a mix of water and chemical fertilizer. The walls of the long greenhouses are two meters thick in order to anchor the artificially pressured buildings, and the arched roofs are made of durable but flexible, see-through plastic, covered with an ultraviolet filter.

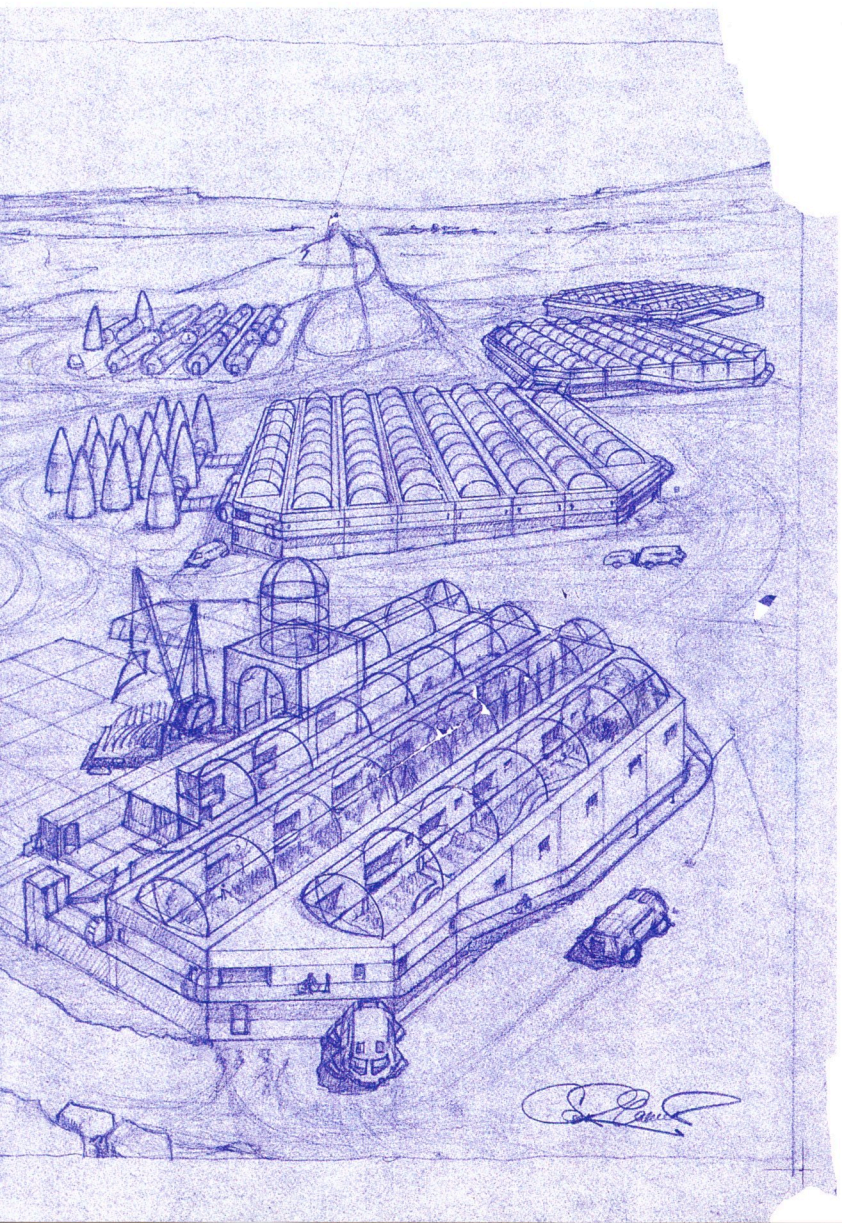
The town has a state-of-the-art water recycling plant. Water is also hauled in from an ice mine 45 kilometers away and melted. A number of the townspeople live in the old habitat modules—reconstructed cargo spacecraft—at the Gorbachev Spaceport, or in



the modules clustered around Mars College. The majority, however, lives within the agricultural buildings. The major part of the oxygen they breathe is produced from plants grown in the terras, but oxygen is also extracted from the thin Martian atmosphere. Electricity is generated from banks of hundreds of solar collectors, and there is a small nuclear generator under construction 15 kilometers outside the town.

David comes to the small school playground and parks his bike. Sam sees him and waves. He is playing a game of team leapfrog, a strangely balletic game in Martian gravity. He hasn't yet told Sam that tomorrow he has to leave for a monthlong stay at Manhattan, one of the three experimental science stations located at the edge of the northern ice cap. There, David will monitor an ongoing experiment in which the surface of the ice has been seeded with genetically engineered plants. It is an attempt to see which of the various plants can absorb the harsh ultraviolet rays and release oxygen into the thin Martian atmosphere. Manhattan and the other far-flung scientific bases stay in contact with Candor and the valley towns by use of rocket-powered gliders that can carry two persons and 250 kilograms in supplies.

ILLUSTRATION BY CARTER EMMART



As David starts toward the video screen on the schoolhouse wall, he hears a bicycle bell ringing behind him. He turns and sees Srinija speeding toward him on her bike. She has just cycled from the college through one of the Kevlar tunnels that connect the various parts of Candor. She skids to a halt beside him just as the screen flickers. The connection to Earth is good and one of the announcers from New York quickly introduces the head of the International Space Council. The news of the day is momentous. The ISC, which has overseen the development of the Mission to Mars since the late 1990s, has unveiled its plans for the next stage of colonization. The plan projects the building of five more towns the size of Candor in the Mars equatorial region and the construction of a major launch base to facilitate the exploration of the outer planets and their moons. David glances past Srinija to Sam, who is bouncing gleefully over the backs of his friends. Sam may be one of the first Martians, but who will his children and grandchildren be?

Science fiction or science fact? According to the projections of a Stanford study, many of us could be witnessing events like these within our lifetimes. A Mission to Mars study team, led by Bruce Lusignan, an associate professor in the Department of Electrical Engineering, has concluded that the first humans could land on Mars by the year 2010 and that a permanent base could be established within four more years.

The current Stanford Mars study began in January and will run through June as part of an annual six-month, graduate-level course called "Space Systems Engineering" (E235). Roughly 25 students per year take the class, and previous groups have worked on Earth-centered technology, such as television satellites and satellite weather prediction. Beginning in 1987, the Stanford group started on the first of three studies that examined unmanned robotic missions to Mars. In 1991, E235 took on the next stage of exploration as the class constructed a detailed mission plan to land the first people on Mars. The conclusions of that study flew in the face of conventional wisdom about humankind's plans to journey to the red planet.

In June 1991, NASA coincidentally had produced its own report on a Mission to Mars study, chaired by Tom Stafford, an Apollo astronaut who flew missions in 1969 and 1975. A few weeks later, Lusignan presented the results of the Stanford study at a press conference on Capitol Hill in Washington, D.C. Lusignan later wrote: "There was a bit of a discrepancy between the two reports. Stafford said we could get there in 30 years for $500 billion. We said we could get there in less than 21 years for $68 billion." How could there be such a "discrepancy" in price tags? The genius of Stanford's plan is in its simplicity. Its essence: Make the Mission to Mars project international, not national, in scope.

The Stanford study's conclusion was based on two realities that were crystallizing in the aftermath of the Cold War. First, the resources available from individual nations for space exploration were shrinking and, second, international resources from former enemies were