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How We Can Fly to Mars in This Decade—And on the Cheap

By Robert Zubrin

SpaceX, a private firm that develops rockets and spacecraft, recently announced it will field a heavy lift rocket within two years that can deliver more than twice the payload of any booster now flying. This poses a thrilling question: Can we reach Mars in this decade?

It may seem incredible—since conventional presentations of human Mars exploration missions are filled with depictions of gigantic, futuristic, nuclear-powered interplanetary spaceships whose operations are supported by a virtual parallel universe of orbital infrastructure. There's nothing like that on the horizon. But I believe we could reach Mars with the tools we have or soon will. Here's how:

> The technology now exists and at half the cost of a Space Shuttle flight. All that's lacking is the political will to take more risks.

SpaceX's Falcon-9 Heavy rocket will have a launch capacity of 53 metric tons to low Earth orbit. This means that if a conventional hydrogen-oxygen chemical rocket upper stage were added, it could send 17.5 tons on a trajectory to Mars, placing 14 tons in Mars orbit, or landing 11 tons on the Martian surface.

The company has also developed a crew capsule, known as the Dragon, which has a mass of about eight tons. While its current intended mission is to ferry up to seven astronauts to the International Space Station, the Dragon's heat shield system is capable of withstanding re-entry from interplanetary trajectories, not just from Earth orbit. It is rather small for an interplanetary spaceship, but it is designed for multiyear life, and it should be spacious enough for two astronauts with the right stuff.

Thus a Mars mission could be accomplished with three Falcon-9 Heavy launches. One would deliver to Mars orbit an unmanned Dragon capsule with a kerosene/oxygen chemical rocket stage of sufficient power to drive it back to Earth. This is the Earth Return Vehicle.

A second launch would deliver to the Martian surface an 11-ton payload consisting of a two-ton Mars Ascent Vehicle employing a single methane/oxygen rocket propulsion stage, a small automated chemical reactor system, three tons of surface exploration gear, and a 10-kilowatt power supply, which could be either nuclear or solar.

The Mars Ascent Vehicle would carry 2.6 tons of methane in its propellant tanks, but not the nine tons of liquid oxygen required to burn it. Instead, the oxygen could be made over a 500-day period by using the chemical reactor to break down the carbon dioxide that composes 95% of the Martian atmosphere. Using technology to generate oxygen rather than transporting it saves a great deal of mass and provides power and unlimited oxygen once the crew arrives.

The third launch would then send a Dragon capsule with two astronauts to Mars. The capsule would carry 2,500 kilograms of consumables—sufficient, if water and oxygen recycling systems are employed, to support the two-person crew for up to three years. Given the payload capacity, a light ground vehicle and several hundred kilograms of science instruments could be taken along as well.

The crew would reach Mars in six months and land their Dragon capsule near the Mars Ascent Vehicle. They would spend the next year and a half exploring.

Using their ground vehicle for mobility and the Dragon as home and laboratory, they could search the Martian surface for fossil evidence of life that may have existed when the Red Planet featured standing bodies of water. They could also assemble drilling rigs to bring up samples of subsurface water, within which native microbial life may persist. Finding either would prove that life is not unique to Earth, answering a question that mankind has wondered about for millennia.

At the end of their 18-month stay, the crew would transfer to the Mars Ascent Vehicle, take off and rendezvous with the Earth Return Vehicle in orbit. This craft would then take them on a six-month flight back to Earth, splashing down to an ocean landing.

Nothing in this plan is beyond our current technology, and the costs would not be excessive. Falcon-9 Heavy launches are priced at about $100 million each, and Dragons are cheaper. With this approach, we could send expeditions to Mars at half the cost to launch a Space Shuttle flight.

There is no question that this plan involves considerable risk, and a variety of missions, technology developments and testing programs in advance might reduce that risk. But if we try to do even a significant fraction before committing to the mission, we will never get to Mars.

Is it responsible to forgo any expenditure that might reduce the risk to the crew? I believe so.

The purpose of the space program is to explore space, and its expenditures come at the cost of other national priorities. If we want to reduce risk to human life, there are vastly more effective ways of doing so than by spending $10 billion per year for the next two or three decades on a human spaceflight program mired in low Earth orbit. We could spend the money on childhood vaccinations, fire escape inspections, highway repairs, better body armor for the troops—take your pick. For NASA managers to demand that the mission be delayed for decades while hundreds of billions are spent to marginally reduce the risk to a handful of volunteers, when the same funds spent on other priorities could save the lives of tens of thousands, is narcissistic in the extreme.

The Falcon 9 Heavy is scheduled for its first flight in 2013. All of the other hardware elements in this plan could be made ready for flight within the next few years. NASA's astronauts have gone nowhere new since 1972, but these four decades of wasteful stagnation need not continue. If President Obama were to act decisively and embrace this plan, we could have our first team of human explorers on the Red Planet by 2016.

Mr. Zubrin is president of Pioneer Astronautics and of the Mars Society. An updated edition of his book, "The Case for Mars: The Plan to Settle the Red Planet and Why We Must," will be published by the Free Press this June.