The New Atlantis
A Journal of Technology & Society

NASA's Next 50 Years

Robert Zubrin

We are living at a moment of great promise. Humanity's breakout into space is underway. Yet success is not inevitable. There is no such thing as destiny. Commenting on the failure of the French Revolution to produce a free society, the German writer Friedrich Schiller said, "A great moment has found a little people." We don't want a future historian someday to say the same thing about us.

It is not enough to cheer the efforts of those currently in the arena. Elon Musk, Jeff Bezos, and the rest could easily fail. There are those who think that because the entrepreneurial space companies like SpaceX and Blue Origin are moving ahead so nicely, we no longer need NASA or other government-led efforts. They could not be more mistaken. There are commercial opportunities that can support private space activities in suborbital and geocentric space, but they will need public support to make sure they are not blocked by hostile or obtuse bureaucracy.

Moreover, the critical initial breakout to the Moon, Mars, and beyond will need government funding. This is consistent with the history of exploration and settlement on Earth, where high-risk first missions like those of Columbus and Lewis and Clark needed government backing, with commercial development following later. The space entrepreneurs are facilitating the launch of such initiatives by developing in advance a substantial fraction of the required flight hardware set. These efforts are dramatically lowering the cost, risk, and schedule thresholds associated with such programs, thereby making them much more attractive to the political class, and more sustainable as well. But still, a decision for public funding will need to be obtained.

It's going to take a public–private partnership to place humanity on the Moon and Mars. Right now, the private side of that partnership is advancing boldly. But the equally necessary public side—the space program that reports to you and me—is badly adrift.

***Robert Zubrin**, a* New Atlantis *contributing editor, is president of Pioneer Astronautics and of the Mars Society, and the author, most recently, of* The Case for Space: How the Revolution in Spaceflight Opens Up a Future of Limitless Possibility *(Prometheus, 2019), from which this essay has been adapted.*

Our Space Program

NASA deserves a lot of credit. A space agency funded by 4 percent of the world's population, it is responsible for launching 100 percent of the rovers that have ever wheeled on Mars; all the probes that have visited Jupiter, Saturn, Uranus, Neptune, and Pluto; nearly all the major space telescopes; and all the people who have ever walked on the Moon. But while its robotic planetary exploration and space astronomy programs continue to produce epic results, for nearly half a century its human spaceflight effort has been stuck in low Earth orbit.

The reason for this is simple: NASA's space science programs accomplish a lot because they are *mission-driven.* In contrast, the human spaceflight program has allowed itself to become *constituency-driven* (or, to put it less charitably, *vendor-driven*). In consequence, the space science programs spend money in order to do things, while the human spaceflight program does things in order to spend money. Thus, the efforts of the science programs are focused and directed, while those of the human spaceflight program are purposeless and entropic.

This was not always so. During the Apollo period, NASA's human spaceflight program was strongly mission-driven. We did not go to the Moon because there were three random constituency-backed programs to develop Saturn V boosters, command modules, and lunar excursion vehicles, which luckily happened to fit together, and which needed something to do to justify their funding. Rather, we had a clear goal—sending humans to the Moon within a decade —from which we derived a mission plan, which then dictated vehicle designs, which in turn defined necessary technology developments. That's why the elements of the flight hardware set all fit together. But in the period since, with no clear mission, things have worked the other way.

Neither the space shuttle nor the International Space Station were designed as parts of any well-conceived plan to send humans to the Moon or Mars. Insistence that they be included as part of such programs only served to make them infeasible. More recently, other constituencies in NASA have made demands that any expedition to the Moon or Mars make use of new hobbyhorses, including variously a space station or asteroid fragment in lunar orbit, or high-powered electric propulsion, none of which are necessary, desirable, or arguably even acceptable for near-term human exploration.

NASA's current plan for the "Lunar Gateway" space station (formerly known as the Deep Space Gateway, and then until a few months ago as

the "Lunar Orbital Platform-Gateway," or LOP-G—I am not making this up) is a case in point. If you want to understand the merit of this project, consider a business proposition where you are offered a chance to rent an office in Saskatoon. Under the terms proposed, you will need to pay to build the office building and agree to a thirty-year lease at $100,000 per month rent, with no exit clause. In addition, you will need to spend one month per year in Saskatoon and travel through Saskatoon on your way to anywhere else for the rest of your life.

That, in a nutshell, is the Gateway project. It will cost a fortune to build and a fortune to maintain, and it will add to the propulsion requirements and timing constraints of all missions to the Moon and Mars that are forced to stop there—as they surely will, since otherwise the pointlessness of building it will be revealed to the public. It is not an asset but a liability, or rather an entitlement, created for no other purpose but to provide a mechanism to drain agency funds to NASA's largest contractors.

This is unacceptable. NASA's space program is *our* space program. It does not belong to the major aerospace contractors, or even to NASA's management. It belongs to *us*. That some of the money NASA's human spaceflight office throws around on useless projects might end up in the hands of entrepreneurial space companies is not enough. The American people deserve a space program that is really going somewhere. We are paying for it. We have a right to insist on real results.

A Clear Goal

The mission needs to come first. The NASA human spaceflight program needs a clear, driving goal, which should be to initiate a permanent human presence on the Moon and Mars within a decade. Such a deadline is as necessary as a defined destination, because without it, the goal has no force, and activities will continue to be directed by the entropic pressure of vendors or political constituencies, rather than by the alleged purpose.

Rather than continue paying for endless cost-plus contracts to "develop" things with no real purpose, NASA needs to set clear goals and contract for services to support those goals. So, for example, let's say enabling human lunar exploration is the goal—as it currently supposedly is. NASA should put out a request for proposals to industry for systems to deliver cargos to the Moon, and astronauts round-trip, offering to match development costs dollar for dollar and to award a certain number of missions to the best bidders. Whoever got such a contract would be strongly incentivized to minimize development cost and time because they would

be paying half the cost out of pocket and would not start making a profit until actual missions began.

This, in fact, is how the Commercial Orbital Transportation Services (COTS) program set up by former NASA administrator Mike Griffin enabled the rapid development of SpaceX's Dragon spacecraft for delivering first cargo, and now crew, to the International Space Station. And the Dragon system has done all this at a cost to the agency of less than five percent of what it has thus far spent on the cost-plus Orion spacecraft—which, after fifteen years of development, has yet to be flown.

If NASA wants to send humans to the Moon or Mars, it should not spend billions on random cost-plus infrastructure projects that supposedly might come in handy if some day there were a program to go. Instead it should just take competitive bids for delivery services. It should incentivize the development of additional systems, including rovers, habitats, life support, power units, space suits and so on, the same way.

Approached in this way, we can have our first permanent bases established and operating on both the Moon and Mars within a decade, for a small fraction of NASA's current budget. We will also have a vibrant private space industry, driving down the cost and advancing the technology of launch vehicles, spacecraft, propulsion, and every other system needed for space exploration and development with all the ferocious creativity that free enterprise can bring to bear. With that, the doorway to the universe will be flung wide open.

Fifty Years from Now

The fiftieth anniversary of the Apollo Moon landing is almost upon us. Over the past fifty years, our robotic planetary program has performed epic deeds of exploration, while our human spaceflight effort has stagnated. But now, with the entrepreneurial space launch revolution, we are poised to break out into the solar system. If we seize this opportunity, where might we be fifty years hence?

Here is a vision of where we could be: We will have fusion power and open-sea mariculture. We will be able to travel the globe freely through suborbital space in less than an hour. We will have research laboratories, industries, and hotels on orbit. We will have scientific bases, astronomical interferometers, and helium-3 mines on the Moon. We will have city-states on Mars—vibrant, optimistic centers of invention sporting lively and novel cultures, with many casting off the chains of tradition to strike out new paths to show the way to a better future. We will have mining

and settlement outfits finding their way into the main asteroid belt, and exploration missions to the outer solar system. We will have grand observatories floating in free space, mapping the planets of millions of stars, and finding other worlds filled with life and intelligence. And we will be making magnificent discoveries in physics and cosmology, learning the nature of the universe and life's role in it, and preparing our first interstellar spaceships to journey forth and find our place among the stars.