



The Moon

The Cost Of Space Exploration

Michio Kaku, 07.16.09, 5:00 PM ET

We will always remember July 20, 1969, as a glorious moment, when humanity stood on the brink of an exciting new era. For the first time in human history, humans walked on the surface of another extraterrestrial body.

It was a technological *tour de force*. Scientists talked knowingly about setting their sights on Mars and beyond. The universe seemed within our grasp.

But historians will also recognize the irony of this magnificent feat. Today, in 2009, we are actually *behind* where we were back then.

Back then, we had a huge industrial infrastructure designed to send astronauts to the moon. We had a fleet of colossal Saturn booster rockets emerging from our factories. We had a cadre of fiercely loyal, dedicated and highly skilled engineers intensely focused on one mission. We had a public mesmerized and unified by the space age.

Today, all of that is gone. Only ghosts of that era remain, mainly in museums and dusty history books. Now, we are haunted by these memories as we painfully try to reach for the moon once again--in 2020, 60 years after the first moon landing.

What went wrong? Part of the reason is that the space race was ill-conceived from the start.

Back in the mid-1950s, President Dwight Eisenhower actually laid down a sober and methodical timetable for space exploration. He envisioned a fleet of robotic probes that would scout out the moon and beyond. Astronauts would join them later, launched on small, fast space planes. Like fighter pilots, our astronauts would be able to blast into space at the drop of a hat.

But when Sputnik's launch was splashed over every front page in October 1957, all of that changed. Suddenly, the race to the moon was all about proving the superiority of capitalism over communism. Arthur C. Clarke, the British author of *2001: A Space Odyssey*, once commented that he would have never imagined there would be a push to put men on the moon if it hadn't become the focus of competition between two nations.

At the height of the Cold War, the superpowers spared no expense in funding the latest space spectacular. Dazzling stunts in space, not cost-cutting, were the order of the day. No one bothered to read their price tag.

But after 1969, the Soviets dropped out of the race to the moon and, like a cancer, the land war in Asia began to devour the budget. The wind gradually came out of the sails of the space program; the Nielsen ratings for each moon landing began to fall. The last manned mission to the moon was Apollo 17, in 1972.

As Isaac Asimov once commented, we scored a touchdown, then took our football and went home.

After all is said and done about what went wrong, the bottom line is simple: money. It's about \$10,000 to put a pound of anything into a near-earth orbit. (Imagine John Glenn, the first American to orbit the earth, made of solid gold, and you can appreciate the enormous cost of space travel.) It costs \$500 to \$700 million every time the shuttle flies. Billionaire space tourists have flown to the space station at a reputed price of \$20 million per head.

And to put a pound of anything on the moon costs about 10 times as much. (To reach Mars, imagine your body made of diamonds.) We are 50 years into the space age, and yet space travel is just as expensive as it always was.

We can debate endlessly over what went wrong; there is probably no one correct answer. But a few observations can be made.

The space shuttle, the workhorse of the space program, proved to be somewhat of a disappointment, with large cost overruns and long delays. It was bloated and probably did not need to have seven astronauts on board. (The Soviet copy of the space shuttle, a near-clone called the Buran, actually flew into outer space fully automated, without any astronauts whatsoever.)

An alternative to the space shuttle was the original space plane of the Eisenhower era. It was to be small and compact, but provide easy access to space on a moment's notice, instead of the long months to prepare each shuttle launch. It was to take off and land like a plane, but soar into outer space like a rocket. President Ronald Reagan called one version of it the "Orient Express." (Ironically, now there will be a hiatus as the space shuttle is mothballed next year. Instead of fast and cheap access to space, for five years we will have no access to space at all. We'll have to beg the Europeans and Russians to piggy-back off their rockets.)

One of the primary missions of NASA should have been to drive down the cost of space travel. Instead of spending half a billion dollars on each shuttle mission, it should have diverted some of the funds to make research and development a primary focus. New materials, new fuels and innovative concepts, which would make space exploration less expensive, should have been prioritized. (Today, some of that entrepreneurial spirit still lives in the commercial sector, as it tries to nourish a fledgling space tourism industry.)

The space station costs upward of \$100 billion, yet its critics call it a "station to nowhere." It has no clearly defined scientific purpose. Once, President George H.W. Bush's science adviser was asked about the benefits of doing experiments in weightlessness and microgravity. His response was, "Microgravity is of microimportance." Its supporters have justified the space station as a terminal for the space shuttle. But the space shuttle has been justified as a vehicle to reach the space station, which is a completely circular and illogical argument.

Now, NASA is painfully reconstructing the infrastructure that it dismantled back in the 1970s as it prepares to send astronauts to the moon via the Orion crew vehicle and the Ares launch rocket in 2020. This time, though, there could be a traffic jam on the moon, since China, India and Japan have all publicly announced that by then they too will have sent astronauts to the moon. (Please see story, "[A Traffic Jam On The Moon?](#)")

Let's hope someone will map out a methodical plan for space exploration, like the one Eisenhower drew up, instead of wasting time and money with more fits-and-starts. Then, at the next milestone anniversary, we won't have to ask ourselves, "What if?"

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