

Don't expect SpaceX-NASA space race

March 9 2017, by Samantha Masunaga, Los Angeles Times



SpaceX, the upstart company, and NASA, the government agency, both have plans to venture to Mars and orbit the moon. But that doesn't mean they've launched a new space race.

In fact, NASA has long been SpaceX's most important customer, providing contracts to deliver cargo and eventually astronauts to the International Space Station. And the Los Angeles-area company will need NASA's technical support to achieve the first of its grand ambitions in deep space.

SpaceX Chief Executive Elon Musk acknowledged as much last week, shortly after announcing that SpaceX would launch two private, paying individuals on a weeklong lunar flyby in 2018.

"SpaceX could not do this without NASA," Musk tweeted. "Can't express enough appreciation."

NASA, on the other hand, has come to rely on SpaceX and other

companies for transport to the space station as its funding has tightened. In today's dollars, the agency's budget is about half what it was at the peak of the 1960s, and down from the 1990s.

In the wake of the SpaceX news, NASA issued a statement that said it is "changing the way it does business through its commercial partnerships," in part to "free" the agency to focus on rockets and spacecraft to go beyond the moon into deep space.

"The whole idea is that NASA is at the point of a spear," said Howard McCurdy, professor in the school of public affairs at American University. "It's like exploration of any terrestrial realm. This is the way the model is supposed to work."

Indeed, the rapid ascent of Musk and other space industry pioneers is validation of the public-private partnership envisioned when Congress passed the Commercial Space Launch Act of 1984.

By the mid-2000s, NASA was signing contracts with the private sector to fill in for its own funding constraints and the impending retirement of the space shuttle program.

In 2006, SpaceX won its first NASA award for \$278 million to help develop the company's now-workhorse Falcon 9 rocket and Dragon space capsule. It later received an additional \$118 million, and SpaceX contributed a total of about \$454 million of its own funds to finish development, according to a NASA report.

Two years later, SpaceX won a \$1.6 billion NASA contract to transport cargo to the space station. The deal came as the fledgling company of about 400 employees was starting to successfully launch the Falcon 1 from an atoll in the Marshall Islands.

It was not just NASA's financial resources and technical support that helped SpaceX, said company President Gwynne Shotwell, but also the agency's trust.

"We would not be the company that we are today without that early support from NASA," Shotwell said. "We would have made it, but it would have been more of a struggle, it would have taken us longer."

A major milestone for the partnership came in 2012 when SpaceX launched its first NASA cargo load, making it the first private company to send a spacecraft to the space station.

Marco Caceres, senior space analyst at the Teal Group, said the NASA supply missions gave SpaceX "almost instant credibility."

"Having NASA as an anchor client allowed them to have enough revenue flow so that they could establish themselves and eventually diversify and get some commercial contracts and eventually to be able to get into the military establishment," he said.

Today, SpaceX and Boeing Co. are developing separate crew capsules as part of NASA contracts to transport astronauts to the space station.

SpaceX noted that this NASA program provided most of the funding to develop the Dragon 2 spacecraft, which will make the moon trip. It is planning to conduct the first test flight of the Dragon crew capsule in November, followed by a flight test with humans in May 2018.

Once operational crewed flights to the [space station](#) are underway, the company said it would launch its Dragon capsule atop the Falcon Heavy rocket, which was developed with SpaceX funds, for the lunar mission in late 2018.

Other well-known, newer space companies have also recently been awarded NASA contracts, including Amazon.com Inc. founder Jeff Bezos' Blue Origin and British billionaire Richard Branson's Virgin Galactic.

Both of those companies intend to target the suborbital space tourism markets, though Blue Origin has also unveiled plans for a launch vehicle called the New Glenn, which the company has said could lift astronauts to low-Earth orbit or even beyond.

Blue Origin is interested in developing a lunar spacecraft and lander, and eventually, a delivery service for the moon, according to a white paper obtained by the Washington Post that the company sent to NASA officials and President Trump's transition team.

Virgin Orbit, which recently split from Virgin Galactic, is focused on launching small satellites.

NASA's role as a "development catalyst" has been part of the agency's objectives since its earliest days, said Sean O'Keefe, a former NASA administrator and current university professor at Syracuse University.

"The idea was to spin that into opportunities for commercial market potential for other discoveries, for those who would build on the knowledge base of what was determined, discovered or invented as a means to overcome obstacles and take it to another level," he said.

Phil McAlister, division director for commercial spaceflight development at NASA, called the recent advances of the space companies "really positive."

"Moving human presence deeper into space is going to require the best of NASA and the private sector," he said. Over the last 10 years, he

added, NASA's private partners have become more technologically mature and capable.

It's unclear whether NASA will provide any further assistance for the SpaceX moon shot, though Musk emphasized that the agency would have first priority if it wanted to work with SpaceX on a lunar orbit mission.

NASA also has its own plans to fly around the moon with a crew in tow.

Last month, NASA said it would look into the feasibility of putting a crew on the first flight test of its Orion spacecraft and heavy-lift rocket, Space Launch System, in 2019. That mission is set to go around the moon to test maneuvers that would be necessary to eventually go farther into deep space.

While both SLS and Falcon Heavy will have heavy-launch capabilities, they may not necessarily be redundant, said Dava Newman, former NASA deputy administrator and Apollo program professor of astronautics at MIT.

"If in the next two years there's two capabilities for heavy-lift, that'd be awesome," she said. "Having one system leaves you vulnerable" to system failures.

The nature of NASA's mission, and its funding, is up in the air under the new Trump administration, however. The agency is still waiting on Trump to appoint a new administrator, and there has been debate in Washington about whether NASA should go back to the moon or venture ahead toward Mars.

SpaceX's private moon mission could influence that debate, McCurdy said. "It certainly complicates the argument that the moon-firsters would

like to make."

Both SpaceX and NASA plan flights to Mars. Last year, Musk unveiled plans to colonize the Red Planet, sending up to a million people on more than 1,000 spaceships, stretched over decades. He called for a public-private partnership, but the nature of any collaboration was unclear.

The two entities will team up on at least one launch - SpaceX's first Red Dragon uncrewed mission to Mars, now aimed at 2020, two years behind Musk's original timeline.

NASA has more than 50 years of experience with Mars exploration and will provide SpaceX with technical support during the mission, which could include help with data transmission from deep space, flight systems and engineering, and mission design and navigation.

In exchange, NASA is interested in the entry, descent and landing data from the capsule.

SpaceX has started testing some of that supersonic retro-propulsion technology by landing its first-stage rocket booster on floating platforms and on land, a technique that could be important for future Mars landings, said Ellen Stofan, former NASA chief scientist.

NASA has successfully landed rovers on Mars weighing up to almost a ton. The robots have dropped to the planet's surface in air bags, using rockets, and with the assistance of cables extended from a "sky crane" - all methods that are problematic for landing humans.

A human mission would weigh considerably more, somewhere between 10 and 20 tons, Newman said.

"It is an order of magnitude greater than we've ever done," she said. "We

all want to figure out how to get to Mars. And one of the things we need to figure out is to get humans there safely."

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Citation: Don't expect SpaceX-NASA space race (2017, March 9) retrieved 2 May 2024 from <https://phys.org/news/2017-03-dont-spacex-nasa-space.html>

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