Here’s a reality check on NASA’s Artemis Moon landing program

Enlarge / Artist’s concept of a lunar lander.

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On Tuesday morning, NASA conducted what appears to have been a highly successful test of the launch escape system for its Orion capsule—a piece of the hardware needed to safely fly humans to the Moon. This test, in concert with the looming 50th anniversary of the Apollo 11 Moon landing mission, is likely to raise public interest in NASA’s new lunar landing program over the next month.

A little more than three months have passed since Vice President Mike Pence directed NASA to move up its plans to land humans on the Moon, from 2028 to 2024, and a lot has happened. Here, then, is a reality check on the state of the 2024 Moon landing program—now named “Artemis,” after the twin sister of Apollo. This report is based on interviews with multiple sources inside and outside NASA.

Sense of urgency

Pence’s announcement has succeeded in shaking up NASA and injecting a sense of urgency into the agency. Consider the Orion vehicle tested Tuesday; NASA originally sought bids for

the development of the deep-space capsule that would become Orion all the way back in March 2005. The agency awarded the contract to Lockheed Martin in 2006. NASA's administrator at the time, Mike Griffin, said Orion could carry humans into space as early as 2010.

Now, in 2019, the vehicle remains at least three or four years away from its first crewed flight atop the Space Launch System rocket. NASA has spent $16 billion in Orion development costs over nearly a decade and a half, and that burn rate will continue for the foreseeable future. NASA has spent almost as much on the SLS rocket since 2011. Pence has basically told NASA to stop spending all this money *building* Orion and SLS and get to the part where we're *using* them.

Although some of its life support systems have yet to be validated in space, by all current appearances Orion will be a capable vehicle that can safely get a crew of four astronauts into a high-lunar orbit and back home over the course of a 21-day mission.

Less certain is the status of the SLS rocket, which is only now being assembled for its first real test firings. By the end of this year, Boeing should complete the rocket's core stage, featuring four leftover Space Shuttle main engines and large liquid hydrogen and liquid oxygen fuel tanks. A successful test campaign in 2020—no guarantee, given past rocket development efforts—could lead to the first flight of Orion and SLS in early 2021. This would be the uncrewed Artemis 1 mission. That would then theoretically be followed by Artemis 2—which is planned to carry a crew around the Moon, Apollo 8-style—and then finally Artemis 3, the lunar landing flight.

Gateway

NASA's current plan calls for using commercial rockets, such as SpaceX's Falcon Heavy, Blue Origin's New Glenn, or United

Launch Alliance’s Delta IV Heavy, to launch two elements that will combine to form a small “Gateway” in lunar orbit by or before 2024. This includes a power and propulsion element, now under contract to Maxar Technologies, and a small habitation module with several docking ports, which NASA has not contracted for yet.

During a visit to Johnson Space Center last Friday, NASA Administrator Jim Bridenstine explained that, unlike the Apollo hardware, Orion and SLS need some help to get a crew to the lunar surface and that this is the role the Lunar Gateway will play. “We can get to low lunar orbit, but there’s not enough delta-V to leave low-lunar orbit,” Bridenstine said. “So we can go, but you can’t come home. This is why we need to get more delta-V. Think of a small space station in orbit around the Moon where we can aggregate landing capability by the year 2024.”

However, the White House Office of Management and Budget, which is typically loathe to initiate large new space programs, has pushed back against the Gateway. The budgeting office argues that a Gateway is not technically needed to stage a landing mission from lunar orbit. Depending on their designs, some lunar landers could be pre-placed in an orbit for rendezvous even without the Gateway.

“OMB is definitely trying to kill Gateway,” a senior spaceflight source told Ars. “OMB looks at what the vice president said about getting to the Moon by 2024 and says you could do it cheaper if you didn’t have Gateway, and probably faster. They are fighting tooth and nail to nix the Gateway.”

Bridenstine, a White House appointee, is caught in the crossfire between OMB on one side and industry and NASA human spaceflight managers on the other side. The industry supports Gateway because it offers another source of potentially lucrative contracts during the coming decade, and NASA managers view the Gateway as a sustainable project. With the

Gateway, they argue, Artemis won't turn into another flags-and-footprints program like Apollo.

Moon or Mars?

Back in 2003, President George W. Bush set the Moon as a destination for NASA's human spaceflight program. President Barack Obama tacked back toward an asteroid, and then Mars. Now, President Trump has turned NASA to the Moon again. What happens if a Democratic candidate wins the 2020 election?

This is in the back of everyone's mind, and it's probably the real reason that NASA human spaceflight managers like Bill Gerstenmaier are so adamant about sticking with plans to build a Lunar Gateway. A Democratic president would probably want to distance him or herself from the 2024 Moon landing date, which some in Congress already see as a politically motivated date because it falls within the last year of a potential second Trump term. So a Democratic president might revert to a more budget-friendly 2028 lunar landing date or return to the Obama policy of skipping the Moon and using the Gateway as a "deep space proving ground" for technologies needed to send humans directly to Mars.

"When someone like Elizabeth Warren gets elected, what are they going to do?" one source said. "Are they going to say we love the Trump space idea? Hell no. They're going to say we don't want to do that. Gerstenmaier has been around this block before. He's trying to cover all of the bases."

Lander

The biggest technical hurdle between NASA and the Moon is development of a lander to go from the Gateway (or somewhere in lunar orbit) down to the surface. At present—and these plans are fluid—NASA would like to send four astronauts inside Orion to the Gateway, from where two would go down to the

surface.

NASA has begun to award some preliminary design contracts for the lunar lander and has given industry some flexibility in how they design their systems to go from the Gateway down to a low lunar orbit, descend from there to the surface, and ascend back to low-lunar orbit and transit back to the Gateway. NASA appears to be using a more commercial-friendly contracting process for the lander. The biggest question now is whether NASA will get the funding from Congress needed to actually build the lander.

Funding

NASA will need $6 billion to $8 billion a year on top of its existing budget to carry out the Artemis program described above, with the lion's share of that needed for the lander and activities related to developing the Gateway and preparing for lunar activities. For fiscal year 2020, however, the Trump administration has only sought a modest $1.6 billion "down payment" on the Moon program.

Even this appears to be too much for Democrats, however. The US House budget legislation for fiscal year 2020 includes an extra $1.3 billion for science programs but nothing for the Moon. The US Senate has not finalized its 2020 budget yet for NASA, but in the past it has been more concerned about funding the Space Launch System rocket itself rather than programs that would actually make use of the large rocket (like, say, a new lunar lander). NASA Deputy Administrator Jim Morhard didn't sound overly enthused about the prospects of getting funding for Artemis when he visited a NASA facility in southern Louisiana last week.

Shortly after Pence's speech in March, Bridenstine sought to play up the prospects for commercial rockets in a lunar program, which could potentially lower the cost and provide more certainty about meeting the 2024 deadline. He even

noted that a modified Falcon Heavy rocket could get a crewed Orion vehicle to the Gateway. However, he has since walked that back and said that only the SLS rocket can and should launch humans to the Moon. (The recent exchange below between Bridenstine and Senate Appropriations Committee Chair Richard Shelby is illustrative of the power dynamic between those who fund NASA and those who manage it.)

[embedded content]
Exchange between Richard Shelby and Jim Bridenstine.

And here’s another example of the dissonance between a potential lunar landing and congressional priorities. Even as NASA needs to be spending money on a lunar lander, it has been directed by congressional authorizations to spend more money on the SLS rocket. To that end, NASA announced last week a $383 million cost-plus contract to build a second mobile launcher to be used for the Block 1B version of the Space Launch System rocket, which has a more powerful upper stage. This rocket is at least five years away from launching, will cost billions to develop, and is not currently used in any of NASA’s plans for the 2024 landing.

For all of these reasons, while there is hope about the urgency shown by the Trump administration to advance human exploration of deep space, there is nonetheless deep-seated and justifiable skepticism across the aerospace community about the possibility of a 2024, or even 2026, lunar landing.

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