

# Rocket Report: New Shepard will be expensive, Falcon 9 nets Moon mission

Enlarge / The Electron launch vehicle is ready to soar.

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Welcome to Edition 2.17 of the Rocket Report! The big news of this week came when SpaceX founder Elon Musk revealed his Starship in South Texas on Saturday night. The vehicle remains a long way from orbit, to be sure. Yet SpaceX sure seems a lot closer to realizing its dream of a flight-worthy Starship and Super Heavy than it did three years ago.

As always, we welcome reader submissions, and if you don't want to miss an issue, please subscribe using the box below (the form will not appear on AMP-enabled versions of the site). Each report will include information on small-, medium-, and heavy-lift rockets as well as a quick look ahead at the next three launches on the calendar.

**Relativity Space is terran up the venture capital markets.** Relativity Space announced Tuesday that it has closed a \$140 million Series C funding round led by Bond Capital and Tribe Capital. (The puns come at no additional cost). With this

funding, Relativity Chief Executive Tim Ellis told Ars that the company is fully funded to complete development of its Terran 1 rocket and reach orbit. However, instead of that happening in 2020, the first launch has now slipped into early 2021.

*Plenty of investor confidence ...* Relativity has ambitious plans to 3D-print the entirety of its rockets, reducing workforce costs and increasing the company's ability to iterate on rocket design. By using 3D printing, the company can evolve its rocket design from mission to mission, incorporate more complex geometries, and basically try more things more quickly. The new round of funding suggests key investors certainly believe in the company's path forward.

**New Shepard seat "hundreds of thousands of dollars."** Blue Origin has always shied away from saying how much it will cost to fly into space on its New Shepard suborbital spaceship, but now the company's CEO has said it will be expensive. "Any new technology is never cheap, whether you're talking about the first IBM computers or what we actually see today," Bob Smith said at a TechCrunch conference, according to GeekWire. "But it'll be actually in the hundreds of thousands of dollars for people to go, initially."

*Price to come down eventually? ...* Smith added that, over time, "We're going to get this down to the point where middle-class people" can afford a ticket to space. I'm middle class. I make a reasonable salary and, of course, I would love to go to space. But I have to wonder what Jeff Bezos would consider an affordable price for the middle class. (Based on the results of this informal poll, my readers think said price point is under \$25,000). (submitted by Ken the Bin)

## **The Rocket Report: An Ars newsletter**

The easiest way to keep up with Eric Berger's space reporting is to sign up for his newsletter, we'll collect his stories in

your inbox.

**Rocket Lab demonstrates flexibility.** New Zealand-based launch provider Rocket Lab has announced its next commercial mission, "As The Crow Flies," will take an Astro Digital satellite to orbit in October. Interestingly, this launch originally had a different payload but was switched out on fairly short notice. This kind of thing really isn't done much in the world of launch services, TechCrunch notes.

*A step forward ...* "Electron is a launch-on-demand service—we're ready when the launch customer is," Rocket Lab Chief Executive Peter Beck told the publication. "Electron is designed for standardized, rapid production—we don't build to tail numbers. This ensures we can have launch vehicles on standby, ready to be assigned a payload for launch on demand." This is one bit of evidence that the new-space launch industry is moving toward long-promised launch-on-demand services. (submitted by trimeta and Ken the Bin)

**Virgin Galactic, Italy sign research agreement.** On Wednesday, Virgin Galactic signed an agreement with the Italian Air Force to have humans fly on board its suborbital spacecraft and conduct scientific research. The deal marks the first time a government has bought a ride on a private suborbital space mission to conduct any kind of human-led experiments. The first research flight could take place as early as next year, the company said.

*First mission possibly in 2020 ...* "We're delighted to work with the Italian Air Force to further space-based research and technology development through this historic mission," Virgin's chief executive, George T. Whitesides, said in a news release. The announcement is significant for a couple of reasons. First, with a notional mission date of 2020, it buttresses the idea that Virgin Galactic may finally move into commercial operations with VSS *Unity* next year. The agreement also suggests that there may be a fairly robust market for suborbital spaceflight research.

**Is Pegasus finally ready to fly?** A Northrop Grumman Pegasus XL rocket is back at Cape Canaveral after a cross-country ferry flight Tuesday under an L-1011 carrier jet. The rocket is ready for final checkouts and a countdown dress rehearsal before an airborne launch off Florida's east coast October 9 with NASA's Ionospheric Connection Explorer satellite, Spaceflight Now reports. Three solid-fueled rocket motors on the Pegasus XL launcher will propel the ICON spacecraft into a 575km orbit.

*Final flight of the Pegasus?* ... The mission was originally supposed to launch in June 2017 from near Kwajalein Atoll, the home of a remote US military test site in the Marshall Islands. A series of delays has pushed the launch forward to this month. This is the last-known mission on the Pegasus manifest, and it's possibly the final flight the rocket will ever make. (submitted by Ken the Bin and Tfargo04)

**Three more Chinese companies progressing toward flight.** In a roundup of the Chinese new-space industry, in which 20 Chinese private firms are believed to be developing or manufacturing launch vehicles, rocket engines, or related components, SpaceNews reports on three companies taking concrete steps toward their first launches.

*Too much to track* ... Last week, a company called Galactic Energy carried out a successful 74-second hot-fire test of the second stage for its first launch vehicle. Another firm, Space Trek, announced it will perform a test flight of a suborbital rocket in the near future from a site in northwest China. And Beijing Deep Blue Aerospace Technology Co., Ltd., announced a successful thrust chamber hot test for a kerosene-liquid-oxygen engine. We could have a separate newsletter devoted entirely to Chinese rockets, but one is enough for me to edit, thank you very much. (submitted by Ken the Bin)

**Lunar Lander to ride on Falcon 9 rocket.** Intuitive Machines confirmed its plans this week to launch a commercial lunar lander aboard a SpaceX Falcon 9 rocket from Florida's Space Coast in 2021. This mission will deliver multiple payloads to the Moon, including up to five science instruments for NASA, Spaceflight Now reports. The Houston-based company's first robotic Nova-C lander will carry up to 220 pounds, or 100 kilograms, of payloads to the Moon's surface.

*Likely a rideshare mission ...* Trent Martin, vice president of aerospace systems for the company, said, "Essentially, we're a primary (payload). The reason it's a rideshare is we weigh 1,700kg, so they have remaining mass available." Intuitive Machines said they selected the Falcon 9 rocket due to its low cost and high quality.

**Elon Musk reveals his Starship prototype.** On Saturday night in South Texas, the SpaceX founder revealed the massive prototype of the Starship upper stage. The prototype loomed behind Musk as he addressed a crowd of a few hundred people, including employees, local residents from Brownsville and surrounding towns, and members of the media. Since September 2016, Musk has provided an annual progress report for the Mars transport vehicle.

*From science fiction to just science? ...* Three years ago, the idea of flying 37 engines on a single rocket seemed fanciful. And then, in early 2018, the company launched the Falcon Heavy with 27 engines. Three years ago, the notion of landing and re-flying a large rocket multiple times seemed distant. But now SpaceX has done this dozens of times. But most futuristic

of all seemed the notion of a 50-meter-tall spaceship that could launch into space, fly on to the Moon or Mars, and return to Earth. Yet here was a prototype of a vehicle that may just do that one day.

**NASA chief says private rockets leapfrogging SLS would be great.** During an interview with The Atlantic, NASA Administrator Jim Bridenstine was asked about SpaceX's Starship project and the potential for that vehicle and its Super Heavy booster to beat the Space Launch System to the Moon. "I think it would be fantastic if they could do that," he said.

*NASA will be a customer ...* More Bridenstine: "And if they can get to the Moon, we want to use those services. Our goal is to be a customer, not the owner and operator of all the equipment. But right now, if we're going to get to the Moon in 2024 with humans, SLS and Orion are the way to do it." The last sentence was brought to you by the US Senate. (submitted by platykurtic)

**Air Force does "last remnants" of non-compete.** This week, the US Air Force made a couple of announcements about future launches of the Delta IV Heavy launch vehicle as well as the Atlas V rocket. Both vehicles—built and launched by United Launch Alliance—once held a monopoly on the launch of US national security satellites. Both rockets received their final "launch operations support" contracts.

*No mas ...* "These are the last remnants of our sole source contracts," Col. Robert Bongiovi, director of Launch Enterprise for the Air Force, said during a teleconference with reporters, Ars reported. "We look forward to embracing the competitive landscape that we have worked hard with industry to create." Future national security mission-launch awards will be based on fixed-price contracts, without any "launch support" awards or contracts. (submitted by Ken the Bin)

# Next three launches

**Oct. 9:** Proton | Eutelsat 5 West B & MEV 1 | Baikonur Cosmodrome, Kazakhstan | 10:17 UTC

**Oct. 10:** Pegasus XL | ICON | Skid Strip, Cape Canaveral Air Force Station | 01:24 UTC

**Oct. 14:** Rocket Lab | Astro Digital | Mahia Peninsula, New Zealand | 23:00 UTC

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