

Rocket Report: A new Delta 2, Blue Origin inks with NASA, a fiery Falcon Heavy

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Welcome to Edition 1.45 of the Rocket Report! This week, half of our stories concern the biggest rockets on the planet, from Blue Origin engine tests at Marshall Space Flight Center to NASA's efforts to accelerate development of the Space Launch System.

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.

Stratolaunch flies for the first time. The world's largest airplane, nicknamed Roc, took to the skies for the first time on Saturday, April 13. The flight lasted 150 minutes, during which time the aircraft reached a maximum altitude of 15,000 feet and a top speed of 189mph, Parabolic Arc reports. Backed

by Microsoft co-founder Paul Allen and built by Burt Rutan's Scaled Composites, the aircraft is designed to air-launch satellites using boosters carried on the wing between its two fuselages.

Will it ever launch a rocket? ... After the successful first test flight, this is the dominant question. Following Allen's death last year, Stratolaunch ended plans to develop its own rockets internally. It's difficult to see how such a large airplane could competitively launch a commercially available Pegasus or other rocket in the current market, which is soon to be overflowing with smallsat launch providers. We'll be interested to see what the company's plans may be. (submitted by Ken the Bin and Unrulycow)

Skyroot aiming for 2021 launch. The Hyderabad, India-based startup Skyroot Aerospace says it is developing a solid-propulsion-based smallsat launcher that will make its first flight in 2021, The Economic Times reports. The Vikram 1 booster, with "highly reliable solid-propulsion stages," will have the capability to lift up to 280kg to LEO, the company says.

Rockets named after founding father ... "We are one of the rare companies building expertise in both solid and cryogenic propulsion," the CEO of Skyroot told the publication. "Solid propulsion is the cheapest option for small launchers, and cryogenic propulsion is complex but provides the best efficiency and is highly scalable for larger vehicles." The company's line of rockets, starting with the Vikram 1, is named after Vikram Sarabhai, who is regarded as the "father" of the country's space program. That's a *solid* choice for a name, but we'll have to wait to see how solid Skyroot's business model is.

PLD Space conducts reuse test. A Spanish startup that seeks to reuse its smallsat launch vehicle, the Miura 5, conducted its first drop test on April 11. During the test, a Chinook CH-47

helicopter lifted the 15-meter-long demonstration first stage to an altitude of 5km, then dropped it into the Atlantic Ocean off the coast of Spain. During the descent, electronic systems inside the demonstrator controlled a carefully timed release of three parachutes to slow it down until it splashed down at a speed of about 10m per second, the European Space Agency said.

Two years from launch? ... PLD Space hopes to debut the Miura 5 launcher by 2021, with a capacity of 300kg to low Earth orbit. The company hopes to recover the rocket by slowing its descent with a combination of engines and parachutes. We are interested to learn more about how the company plans to mitigate any damage from saltwater, but it's great to see yet another approach to smallsat launch. (submitted by Ken the Bin)

Could the AR1 power a Delta 2-like rocket? Even though United Launch Alliance selected the BE-4 rocket engine for its Vulcan rocket, Aerojet Rocketdyne said it is not giving up on its AR1 engine. Aerojet said it will complete development of the engine and seek partners for a new medium-class launch vehicle that could use the engine, according to SpaceNews.

Good luck with that ... "An AR1-based booster, with an RL10 upper stage, is a very nice rocket," said Jim Maser, senior vice president of the space business unit at the company, told the publication. "I think it could fill the gap left by the retirement of Delta 2." Aerojet doesn't want to develop the rocket, but it would look for a partner, Maser said. The problem with that is that the Delta 2 rocket was not a commercial success. And it's hard to see how even dramatically reducing its cost could make such a rocket (which certainly would not be available before the early 2020s) competitive

with a Block 5 variant of the Falcon 9 booster. (submitted by Ken the Bin)

A new place to buy Proton rockets. In a reshuffling of Russian rocket marketers, International Launch Services, the commercial sales division of Russia's Proton rocket manufacturer Khrunichev, is now part of Glavkosmos, a Roscosmos subsidiary that sells Soyuz rocket launches, SpaceNews reports. After averaging nearly 10 launches a year during the previous decade, the Proton booster launched just twice in 2018.

Lower costs coming ... ILS President Kirk Pysher said ILS' collaboration with Glavkosmos, Khrunichev, and Khrunichev's subcontractors resulted in cost savings "realized from quality-improvement initiatives coupled with significantly lower production and launch site costs" that will translate into lower Proton prices. We're not sure if customers are most concerned about Proton's prices or (more likely) reliability issues on recent launches. (submitted by Ken the Bin)

NASA awards Dart mission to Falcon 9 rocket. NASA said it has awarded SpaceX a contract to launch the Double Asteroid Redirection Test on a Falcon 9 in June 2021, from Vandenberg Air Force Base in California. (Rockets aside, this is a cool mission that could one day save the planet). The total cost to NASA for the mission, including the launch and related services, is \$69 million, SpaceNews reports.

Low-cost access to space ... The price is significantly lower than past NASA contracts for Falcon 9 launches, which have been much closer to \$100 million. "This award underscores NASA's confidence in Falcon 9's capability to perform critical science missions while providing the best launch value in the industry," SpaceX's president, Gwynne Shotwell, said. The announcement came a week after SpaceX dropped its protest of an earlier NASA launch contract awarded to United Launch Alliance.

NASA and Blue Origin formalize engine test deal. Under a new Commercial Space Launch Act agreement signed with NASA, Blue Origin will upgrade and refurbish Test Stand 4670 at Marshall Space Flight Center in Huntsville, Alabama, to support testing of its BE-3U and BE-4 rocket engines. "This test stand once helped power NASA's first launches to the Moon, which eventually led to the emergence of an entirely new economic sector: commercial space," said NASA Deputy Administrator Jim Morhard.

Upper-stage implications? ... Blue Origin will pay for the investments it makes to prepare the test stand for use, as well as any direct costs NASA incurs as a result of Blue Origin's use of the stand. This is part of an intriguing ongoing political struggle inside Alabama for the hearts and minds of its politicians. Boeing is still winning that battle for now, but this is a long-term play by Blue Origin. Note that NASA is also considering the BE-3U to power a revamped Exploration Upper Stage.

Falcon Heavy makes second flight. It's a big rocket, OK? Before it took off, the Falcon Heavy rocket stood on a Florida launchpad and packed the energy equivalent of a tactical nuclear weapon. Then, as it launched, all of this energy poured forth from 27 engines in a meticulously controlled explosion for the purpose of sending a 6-ton satellite into geostationary orbit. This launch photo was revelatory.

Busy times ahead ... SpaceX recovered the two side cores and will now set about refurbishing them for another Falcon Heavy launch (a rideshare mission for the US Air Force) as early as June. The company also caught the center core on a drone ship, but it toppled over in high seas. Finally, SpaceX plucked the two payload fairing halves from the ocean and intends to reuse

them (for the first time) on a Starlink launch later this year. (submitted by Ken the Bin)

Congressional sparring continues over Air Force contract. With the Air Force expected to soon issue a request for companies to bid on national security launch contracts from 2022 to 2026, a bipartisan group of 28 House members urged Air Force Secretary Heather Wilson not to alter the service's draft contract. The lawmakers support United Launch Alliance, which appears to be a beneficiary of the Air Force's selection criteria, The Hill reports.

Beginning of the process ... In their letter, the legislators urged Wilson "to do everything in your power to keep the acquisition on schedule." The Air Force prefers to open the competition this month, too. Some bidders, particularly Blue Origin, have urged a delay; they say opening the process now prejudices new bidders to the competition, which only received development funds for their rockets in late 2018. Even if the Air Force begins the bidding process, lawmakers will have ample chance to weigh in during the FY 2020 budget process this summer.

European Space Agency backs Ariane 6 production. An article in Les Echos reports that the European Space Agency council has passed a resolution that supports Arianespace's decision to begin production of the Ariane 6 rocket. Additionally, the ESA is committed to finding a customer for the first flight of an Ariane 64, a larger variant of the rocket, which has four solid-rocket boosters.

Seeking institutional support ... Being honest, our French isn't the best, and we don't understand all of the intricacies of the ESA-Arianespace relationship. But essentially, there are efforts underway to assure the builders of both the Ariane 6 and smaller Vega C rocket that there will be enough institutional launches to support both vehicles economically. However, it will also be incumbent upon industry to go out and

win commercial launch contracts in a highly contested market.

Boeing seeks to ship SLS core stage by the end of 2019. With a renewed emphasis from the Trump administration on completing the large Space Launch System rocket for a 2020 flight, NASA and prime contractor Boeing have reworked the final assembly plan for the first SLS Core Stage to bring its scheduled completion date back to the end of 2019, NASASpaceFlight.com reports.

Skipping the Green Run test likely ... We hear that NASA Administrator Jim Bridenstine will be briefed at the end of this week on this plan to accelerate development, which likely will recommend skipping a “Green Run” test of the full core stage at Mississippi’s Stennis Space Center. There are risks to this, both political (from Mississippi’s delegation) as well as technical due to the problems such an all-up test firing may uncover. Still, if NASA has any chance to launch the SLS rocket in 2020, it must make difficult decisions and trade risk.

Moon plan to rely on a mix of rockets. In an interview with Ars, NASA Administrator Jim Bridenstine said the agency is counting on the Space Launch System rocket but also commercial rockets such as the Falcon Heavy to carry out a lunar landing by 2024. That’s because he needs both capabilities as well as the political support behind them.

Bringing everyone together ... Bridenstine: “I would say, technologically, it’s realistic. It’s not easy. There’s a lot of schedule risk, programmatic risk, and technical risk. And so it’s not easy, but it’s doable. I think the bigger risk, that has to be retired earlier, is the political risk. How do we get the money? And so we have to make sure that, as much as possible, we’re driving bipartisan, apolitical decisions and processes into the matrix.”

Next three launches

April 20: Long March 3B | Beidou-3 | Xichang Satellite Launch Center, China | 14:30 UTC

April 26: Falcon 9 | Dragon CRS-17 ISS supply mission | Cape Canaveral, Fla. | 09:55 UTC

May 13: Soyuz 2.1b | Glonass-M | Plesetsk Cosmodrome, Russia | TBD

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