AEROSPACE

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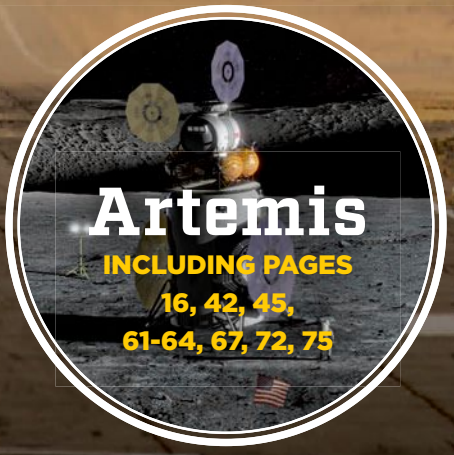
2019

YEAR IN REVIEW



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AIAA
SHAPING THE FUTURE OF AEROSPACE

◀ Blue Origin's New Shepard booster lands after its 11th flight in May.
Blue Origin

Private space companies strive for crewed flights, lunar exploration

BY DALE ARNEY

The **Space Transportation Technical Committee** works to foster continuous improvements to civil, commercial and military launch vehicles.

SpaceX continued to advance reusability of the Falcon 9 launcher this year. In November, the company achieved the **fourth launch and recovery of the same Falcon 9** first stage. The stage powered the Falcon 9 that delivered **60 Starlink satellites** to orbit. The rocket's payload fairing was flown previously on a Falcon Heavy launch. Also, the company's **Dragon spacecraft** returned from a third mission to the International Space Station in August. SpaceX also captured two fairing halves from launches in June and August. After its inaugural demonstration flight in February 2018, **Falcon Heavy commenced commercial launches** in April with the delivery of a communications satellite to geosynchronous orbit. Throughout the year, SpaceX continued development on its next-generation launcher, **Starship**, in Texas and Florida in preparation for demonstration flights in late 2019 or 2020. **Starhopper, the test platform for Starship**, completed a 150-meter test flight in August at the SpaceX South Texas Launch Site.

United Launch Alliance this year launched Atlas V, Delta IV Heavy and the final Delta IV Medium rockets. The Atlas V launch in August was ULA's 135th consecutive. ULA's next-generation launcher, **Vulcan Centaur**, completed its final design review in May, and the company converted its Alabama factory to produce the vehicle in preparation for its planned debut in 2021.

Blue Origin flew the **New Shepard** suborbital vehicle for the 11th time in May in preparation for its first crewed flight in late 2019 or 2020. Blue Origin expanded its manufacturing facilities near Kennedy Space Center in Florida to prepare for **New Glenn**, the company's orbital launcher. Blue Origin revealed its **Blue Moon lander** and BE-7 engine in May; it foresees its initial flight in 2023. Blue Origin broke ground in Huntsville, Alabama, in January, on its **factory to build BE-4 engines**, which will be used for its New Glenn and ULA's Vulcan Centaur launchers.

NASA's **Orion** crew capsule, essential for the **Artemis program,** performed a flight test of its ascent abort motor in July. The engine section of NASA's **Space Launch System** was completed in August in preparation for its "green run" test, in which the integrated core stage will test fire its engines at NASA's Stennis Space Center in Mississippi, planned for 2020.

SpaceX and Northrop Grumman Innovation Systems continued to deliver cargo to the International Space Station as part of the **Commercial Resupply Services** contract. Sierra Nevada Corp. completed the final design review for its **Dream Chaser spacecraft**, on track to launch cargo to the ISS in 2021 on ULA's Vulcan Centaur. In March, SpaceX completed its first demonstration mission to send crew to the ISS by launching an **uncrewed Crew Dragon** to autonomously dock with the ISS and then return to Earth. Boeing's Starliner crew vehicle performed **parachute tests** in July in preparation for its planned demonstration mission in late 2019.

In August, an Ariane 5 flew the design's 105th mission after eclipsing 100 launches in late 2018. China landed the **Chang'e-4 lander and rover** on the far side of the moon in January. In the first privately funded mission of its kind, SpaceIL of Israel delivered the **Beresheet robotic lunar** lander to lunar orbit in April before its failed landing attempt. The Indian Space Research Organization delivered the **Chandrayaan 2 orbiter** to lunar orbit in August before losing contact with the Vikram lander during its September landing attempt.

Also in August, the U.S. Air Force's **X-37B reusable spaceplane** broke its previous flight record of 719 days in orbit.

After starting commercial operations in late 2018, Rocket Lab launched **Electron rockets** four times this year with hopes for more launches before the end of the year. In February, Virgin Galactic launched the first passenger in the **Virgin Space Ship Unity**, its suborbital launcher for tourism, after the Unity launched above 80 kilometers in December 2018. ★