

Commercial-Space Shoots for the Moon

By John Benson

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1. Introduction

The space-launch and landing systems sectors need to develop into an industry, along with ancillary firms that will support this new industry. This will promote competition that will drive down prices and increase volume. The good news is, today, on the second of March (as I'm starting to write this), one of those firms, with an unlikely name, landed an amazing act-1 of this evolution.

Firefly Aerospace's "Blue Ghost" lander dropped out of lunar orbit and swooped to a rocket-powered touchdown early Sunday (March 2), pulling off the first fully successful moon landing by a commercially-built and operated robotic spacecraft.¹

Flying above the far side of the moon in a circular 62-mile-high orbit, the squat lander fired its main engine at 2:31 a.m. EST, kicking off a white-knuckle 63-minute descent to the landing site in Mare Crisium -- the Sea of Crises -- in the northeast quadrant of the moon as viewed from Earth.

The 6.6-foot-tall lander coasted for the next 52 minutes before using its main engine and eight smaller reaction control system (RCS) thrusters to reduce its velocity from about 3,800 mph to just 90 mph as it moved into position above the landing site.

After autonomously analyzing the terrain below for boulders, slopes, and other hazards, Blue Ghost descended using the power of its eight RCS jets. The jets pulsed as needed to control velocity and orientation before slowing the craft to just 2.2 mph for the last 30 feet or so of the descent.

Firefly Aerospace employees and family members, known collectively as "Fireflies," watched telemetry stream in on a large monitor near the company's Austin, Texas, headquarters and mission control center, no doubt on the edges of their seats as the 11.5-foot-wide spacecraft neared the surface.

"Eleven meters up," a flight controller said on the Firefly mission control audio loop. A moment later, the thrusters shut down and surface contact sensors on Blue Ghost's shock-absorbing landing legs indicated they were on the lunar surface.

"Engine shutdown confirmed," a flight controller verified.

"Power is nominal, vehicle is charging (with its solar cells)," someone else chimed in.

"IMU (inertial measurement unit) reports lunar gravity, and it is stable," another controller reported, prompting the start of applause from onlookers.

¹ William Harwood, CBS News via MSN, "Firefly Aerospace sticks moon landing with flawless Blue Ghost touchdown," March 2, 2025, <https://www.msn.com/en-us/news/us/firefly-aerospace-sticks-moon-landing-with-flawless-blue-ghost-touchdown/ar-AA1A5fPB?ocid=BingNewsBrowse>



L A dramatic photo beamed back from a camera on the Blue Ghost lander shows the spacecraft's shadow on the moon shortly after touchdown with Earth suspended in space above the lunar horizon. / Credit: Firefly Aerospace

2. Blue Ghost

Will Coogan, the chief engineer, then came on the line with the official results: "You all stuck the landing! We're on the moon!"

The assembled Fireflies instantly burst into cheers, hugs and raucous applause. A few minutes later, "Make Space Great Again" hats were handed out.

"Firefly successfully touched down on the moon in an upright, stable condition, becoming the first commercial company to complete a fully successful moon landing," said Brigitte Oakes, Firefly vice president of engineering.

Launched on Jan. 15, the landing was timed to coincide with the start of a two-week-long lunar day. The solar-powered Blue Ghost will operate 10 NASA-sponsored experiments while sunlight is available and, if all goes well, for a few hours into the lunar night using stored battery power. After that, it will fall silent.

"Once in a blue-moon, a long-time ago, these types of lunar landers took billions of dollars and countries behind (them) to land on the moon," Firefly CEO Jason Kim told CBS News in a pre-launch interview.

"This is Firefly Aerospace that's going to land on the moon at fractions of the cost on a fixed-price contract, and doing it with the latest commercial technology," he said. "Just like Simone Biles stuck the landing in the Olympics, we're going to do the same thing for the state of Texas, for America and for the world."

For Ray Allensworth, spacecraft program director at Firefly, the moon will never look the same.

"We were all dreaming up until now that you look up at the (moon) and you just imagine, like, that's where it's going to be," she said. "But now, you know it's there, and that's a totally different feeling. So, yeah, the next full moon, I just won't sleep. I'll just stare at it all night."

NASA agreed to pay Firefly Aerospace \$101 million to carry 10 agency-sponsored science instruments and technology demonstrations, built for \$44 million, to the moon as part of the agency's Commercial Lunar Payload Services (CLPS) initiative.

The CLPS program aims to encourage private industry to launch agency payloads to the moon to collect needed science and engineering data before Artemis astronauts begin work on the surface near the lunar south pole later this decade.

"Before we can send our humans back to the moon, we are sending a lot of science and a lot of technology ahead of time to prepare for that," said Nicky Fox, director of space science at NASA Headquarters.

"We learned so many lessons during the Apollo era, and the technological and science demonstrations on board Firefly's Blue Ghost will be critical in our ability to not only discover more science, but also to ensure the safety of our spacecraft instruments, and, most importantly, the safety of our astronauts."

Firefly's instruments include three designed to study how landing thrusters disturb the lunar soil, how fine-grained dust particles adhere to spacecraft surfaces and whether electrodynamic techniques for removing accumulated contamination will work in the lunar environment.

A drill will bore into the surface below the Blue Ghost to measure soil temperatures at different depths while a novel sample collection system will attempt to literally blow surface particles into a capture device, foregoing the need for robot arm-type retrieval systems.

A radiation-tolerant computer will be tested, another instrument will attempt to pull in and process GPS navigation satellite data from Earth, a retroreflector will serve as a positioning target for Earth-based lasers and another instrument will take X-ray images showing interactions between the solar wind and Earth's magnetic field.

3. Other Flights

I had hoped that this section will be replaced with articles about other successes by other firm when I post this paper in Mid-April, but that didn't happen.

Along with its initial Blue Ghost mission, Firefly holds a \$130 million CLPS contract for a second flight in 2026, this one to the moon's far side featuring a Blue Ghost lander and an orbital spacecraft called Elytra. Another CLPS contract valued at \$179 million is helping pay for a Blue Ghost lander, a rover and another orbiter.

"One of these days, we're going to get there in terms of the commercial aspects of the moon," Kim said. "There's going to be a lot of business plans that are going to be self-sustaining and growing. It's a great location to frequently go and test out new missions to sustain life in space, and it's a stepping stone for Mars as well."

Blue Ghost is the first of three commercially-developed landers, all launched within the last month and a half, to reach the lunar surface.

Sharing a ride to space with Blue Ghost aboard the same Falcon 9 rocket last January was another moon lander, a spacecraft called "Resilience" that was built by Tokyo-based ispace. The company sent its first lander to the moon last year, but it crashed to the surface after running out of fuel due to a software glitch.

The appropriately-named Resilience took a different route to the moon than Blue Ghost, a low-energy trajectory utilizing lunar gravity to help reach the desired descent orbit for a landing attempt in May.

Yet another lunar lander, built by Houston-based Intuitive Machines and known as **Athena**, was launched last Wednesday by another Falcon 9 and was expected to touch down on the moon March 6. The company's first lander, Odysseus, successfully landed on the moon last year, but it tipped over on touchdown and was unable to complete all its planned research.

Note that Athena "landed sideways in a crater" and its mission is considered over per Intuitive Machines.²

NASA awarded a \$15 million technology "tipping point" contract to Nokia to test cellular communications on the moon and another \$41 million to Intuitive Machines for a small rocket-powered "hopper" that will jump into a permanently shadowed crater in search of ice deposits.

² <https://www.msn.com/en-us/news/technology/intuitive-machines-athena-space-craft-declared-dead-after-landing-sideways-in-a-crater-on-the-moon/ar-AA1AsPmj?ocid=BingNewsBrowse>