SpaceX's 3rd Starship launch makes it to space without exploding, but is lost on reentry

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SpaceX's powerful Starship and Super Heavy rocket completed a more successful third orbital test flight from Texas on Thursday morning with

no explosive endings on the way up that marred the first two test flights in 2023.

The way down, though, still saw more destructive ends as the first-stage booster came in at more than 600 mph hitting the Gulf of Mexico and the upper stage spacecraft broke up on reentry halfway around the Earth. The overall mission, though, was considered a success by SpaceX officials.

"This is the furthest that we've gotten in our test flight, but the further we fly, the more data that we can get and that's ultimately the measure of success here," said SpaceX commentator and quality systems engineering manager Kate Tice. "I think today has been a huge success, given where we were, we'd gone, and how much further we've gotten with both the booster and Starship itself."

The Federal Aviation Administration announced late Wednesday it had granted SpaceX a license for the Orbital Flight Test 3, and the 396-foot-tall rocket took flight at 9:25 a.m. EDT from the company's Starbase launch site in Boca Chica, Texas.

SpaceX is continuing test flights from Texas, but has stated it plans to shift operations to the Space Coast once the spacecraft is deemed operational. SpaceX has already begun construction on a Starship launch tower at Kennedy Space Center and is in talks to build out a site at Cape Canaveral Space Force Station.

NASA is also eagerly awaiting Starship to come to fruition so it can support the Artemis III mission as the lander that will bring humans including the first woman back to the moon's surface for the first time since Apollo 17 in 1972. That mission could come as soon as September 2026.

"Congrats to @SpaceX on a successful test flight! Starship has soared into the heavens," posted NASA Administrator Bill Nelson on X. "Together, we are making great strides through Artemis to return humanity to the moon—then look onward to Mars."

To get there, though, more SpaceX test flights must continue from Texas, with as many as six more planned for 2024, according to SpaceX CEO Elon Musk. The third one was a step forward in its efforts.

The Super Heavy booster's 33 Raptor engines that produce more than 17 million pounds of thrust on liftoff performed just as well as the last flight. They remained lit until SpaceX performed a hot staging maneuver during which all but three of the Raptor engines shut down while letting the Starship upper stage light its engines and safely separate. The Starship then continued its climb into space for a suborbital trip that took it east for an attempt to splash down in Indian Ocean.

The second launch attempt in November saw both the Super Heavy booster explode on its way back down to the Gulf of Mexico and Starship self destruct before it completed its ascent burn.

This time, though, the Super Heavy booster made it closer back to Earth, although not completing what SpaceX had planned, a controlled burn right above the surface of the Gulf to demonstrate its capability to land similar to how Falcon 9 first-stage boosters land. SpaceX lost control of the booster, though, still traveling more than 600 mph when it hit the water.

Attention turned to the Starship upper stage then, as it completed its burn less than 10 minutes after launch and began a 30-minute coast phase during which SpaceX performed some new tests including the opening and closing of the spacecraft's payload door and a fuel transfer demonstration on board the spacecraft.

Images of reentry delivered via a Starlink satellite flying on board that connected to SpaceX's constellation showed plasma buildup surrounding the spacecraft just under 62 miles altitude with cheers from SpaceX employees coming in waves in the background during the broadcast. Imagery cut out with Starship still traveling at 16,500 mph at about 46 miles altitude.

"This was wild. We've never seen the super hot plasma grow in real-time," Musk posted to X.

"We're not expecting Starship to survive the impact," said SpaceX's Dan Huot during the broadcast. "We're not going to be recovering any of the hardware."

Huot said data from the Starlink broadcast cut out at the same moment as the tracking and data relay satellite, so that could mean the spacecraft came apart on reentry.

"It is a realistic possibility that we lost our ship, which honestly was always on the table," Tice said. "We didn't know how far it was going to get. The further we could fly and the more data we could collect was always the biggest win."

Huot confirmed the spacecraft known as Ship 28 was lost.

"So no splashdown today," he said. "It's incredible to see how much further we got this time around. We had a couple of those ambitious objectives … that we were able to take advantage of while Starship was in outer space flying over our planet for the very first time, so that was just really incredible."

Eventually, plans are for both halves to make vertical safe landings as part of the spacecraft's reusable design.

The fully-stacked rocket takes off from a 469-foot-tall launch integration tower, which SpaceX CEO Elon Musk refers to as "Mechazilla." It's designed to one day capture the Super Heavy booster on its return with the aid of two pivoting metal arms called the "chopsticks," but that won't occur until a future test launch.

Neither the April or November launches ended according to plan, but instead had explosive ends. The first attempt saw the Super Heavy booster and Starship upper stage fail to separate prompting SpaceX to send a self destruct command while it was over the Gulf. It also demolished the launch pad, although SpaceX was able to improve that so it survived fairly intact after launch No. 2.

The second attempt saw a successful separation with the first use of the hot-staging technique, but the Super Heavy still blew up on its way down to the water and the Starship upper stage, while it made it into space, did not finish its ascent burn and had an automatic self destruct sequence enacted.

"Starship's second flight test achieved a number of major milestones and provided invaluable data to continue rapidly developing Starship," read a launch preview on SpaceX's website. "Each of these flight tests continue to be just that: a test. They aren't occurring in a lab or on a test stand, but are putting flight hardware in a flight environment to maximize learning."

That flight with the upper stage technically making it to space despite the explosion made Starship the most powerful rocket to ever make it to space. It bested NASA's Space Launch System rocket's 8.8 million pounds of thrust produced when it flew the Orion capsule to space on the Artemis I mission back in 2022.

For the third flight, original plans were for SpaceX to also try to relight

one of the upper stage's six Raptor engines while in space and attempt a controlled reentry, but teams opted out of that as it approached reentry.

Even if it had performed the burn, there was never a plan to attempt any sort of landing on a droneship like its Falcon 9 first-stage boosters.

The change in flight path to the Indian Ocean from the first two attempts' plans for a Pacific Ocean landing near Hawaii allowed for more public safety while attempting the new rocket features.

"This rapid iterative development approach has been the basis for all of SpaceX's major innovative advancements, including Falcon, Dragon, and Starlink," reads the post on SpaceX's website. "Recursive improvement is essential as we work to build a fully reusable transportation system capable of carrying both crew and cargo to Earth orbit, help humanity return to the moon, and ultimately travel to Mars and beyond."