SpaceX to make its second attempt to launch 60 Starlink satellites

Enlarge / The begrimed Falcon 9 booster is back at the launch pad with its Starlink satellite payload.

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Even though time remained in its launch window Wednesday night, SpaceX scrubbed an attempt to launch its first batch of Starlink satellites. The upper-level winds were just not cooperating, so the company stood down the launch attempt.

On Thursday, the rocket stands again at the launchpad. This time, the weather conditions have improved, and the winds in the upper level of the atmosphere appear to be more conducive to a launch. And so SpaceX will press ahead with a historic launch and unconventional deployment of 60 satellites that will provide Internet access. The deployment, about an hour after launch, will be fascinating to watch, and we are eager to know how successful the company and the Air Force will be at connecting with and tracking these satellites.

Below, you will find an embedded webcast, which should begin at about 10:15pm ET (02:15 UTC Thursday), as well as an edited copy of our story explaining the Starlink constellation, which was originally posted ahead of Wednesday’s launch attempt.

Heaviest payload

With a mass of 18.5 tons, Thursday's launch will be the company's heaviest to date for either the Falcon 9 or Falcon Heavy rocket. The rocket will boost 60 Starlink satellites, each weighing 227kg, to an altitude of 440km.

This is the first block of Starlink satellites for what should eventually be a much larger constellation, and they will help SpaceX gauge its performance and conduct tests of several key systems. Over the coming months, these first satellites will be joined by six additional launches carrying similarly sized payloads. These launches will bring the constellation to an initial "operational" capability.

There is no guarantee all will go well, SpaceX founder Elon Musk said during a teleconference with reporters on Wednesday evening. "This is very hard," Musk said. "There is a lot of new technology, so it's possible that some of these satellites may not work. There's a small possibility that all of these satellites will not work."

Launch and release

The initial part of the launch will be familiar to people who have watched a SpaceX launch before. This Falcon 9 first stage has flown twice before, and it will attempt to make a landing on the *Of Course I Still Love You* droneship in the Atlantic Ocean. The real action will come about 1 hour 2 minutes after launch, when the second stage begins deploying the Starlink satellites.

> *First 60 @SpaceX Starlink satellites loaded into Falcon fairing. Tight fit. pic.twitter.com/gZq8gHg9uK*
>
> *— Elon Musk (@elonmusk) May 12, 2019*

In order to save mass, each of the 60 satellites will not have its own release mechanism, such as a spring. Instead, Musk explained, the Falcon rocket's upper stage will begin a very slow rotation, and each of the satellites will be released in turn with a different amount of rotational inertia.

"It will almost seem like spreading a deck of cards on a table," Musk said. There may actually be some contact between the Starlink satellites, he added, but they are designed to handle it.

Powering up

After deployment, the satellites will power up their ion drives and open their solar panels. They will move to an altitude of 550km under their own power. Musk said he is concerned about the solar panel deployment, and he noted that there are two different deployment mechanisms on the satellites for this purpose. He also said the satellites have incorporated new technology with the thrusters as well as phased-array antennas that have yet to be fully tested in space.

The satellites are designed to control costs. For example, each will maneuver with Hall-effect thrusters (these are ion thrusters in which propellant is accelerated by an electric field). The conventional fuel for such a thruster is xenon, which offers high performance. The Starlink satellites, however, will use a different noble gas: krypton. It has a lower density, so the satellite fuel tanks need to be larger, and it offers less performance than xenon. But krypton can be bought at just one-tenth the cost of xenon, which matters if a company wants to fuel thousands of satellites.

"It costs a heck of a lot less than xenon," Musk said of krypton. (He also joked, in response to a question from Ars about this fuel, that the satellites would be immune to invasion from Superman's native world.)

During the call, Musk said each Starlink satellite costs more to deliver into orbit than it costs to manufacture. The list price for a Falcon 9 launch is $62 million. Factoring in a reuse discount and wholesale rates, this means the Starlink satellites cost significantly less than $1 million each to build.

Business plan

SpaceX is competing with about a half-dozen other companies to develop low-latency, high-bandwidth Internet from space. One competitor, OneWeb, launched six of its own satellites in February. But SpaceX appears to be well ahead of most of the rest of the field.

With six more launches and a total of about 400 satellites, Musk said the constellation will reach the point of being able to offer some initial connectivity to ground-based users. A dozen launches would bring "significant" connectivity, he said, and 24 launches would bring near-worldwide service.

After several recent rounds of fundraising, SpaceX has enough capital to launch the first 400 satellites and begin selling the service to telecom companies and governments that want to serve low- and medium-density populated areas. If there are significant problems with the rollout or performance of the first 400 satellites, he said SpaceX would probably have to go back to the capital markets.

Over time, Musk anticipates Starlink will become a commercial success for SpaceX and enable its goal of building a self-sustaining city on Mars. Potential launch revenue tops out at about $3 billion a year for the company, he said, but capturing just 3 percent of the global Internet market could bring in about $30 billion. "We see this as a way for SpaceX to generate revenue that can be used to develop more and more advanced rockets," he said.

Musk acknowledged the validity of concerns about orbital debris from so many satellites (SpaceX has a license to launch more than 11,000 Starlink satellites, far more than the total number presently in orbit of about 2,000). But he also said the chosen altitude of 500km and the design of the satellites will help ensure that the constellation cleans itself up due to interaction with Earth’s atmosphere.

[embedded content]
Starlink mission launch.
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