

What Elon Musk's 42,000 Satellites Could Do To Earth

You're looking at 60 satellites **hurtling**⁽¹⁾ into the sky. And over the next few decades, Elon Musk is hoping to send 42,000 of these satellites to space, 15 times the number of operational satellites in orbit today.

It's part of *Starlink*, the expansive constellation from Musk and SpaceX that hopes to bring the world low-latency high-speed internet, promising no more **buffering**⁽²⁾ and nearly instantaneous internet in every corner of the world.

But experts worry it may come at a **hefty**⁽³⁾ cost for space exploration. Nearly half of the world's population does not have access to the internet, because most internet options require an extensive track of costly underground cables, leaving many rural locations offline. And while satellite internet can reach those areas...

Dave Mosher: Traditional satellite internet is provided by a bus-sized spacecraft that is launched 22,236 miles into space in orbit around Earth.

Narrator: That distance means the satellite can reach places that cables can't. But since that one satellite is meant to service a lot of people, its data capability is limited, which then limits connection speeds. And that signal has to travel a long way, creating a lot of **lag**.⁽⁴⁾ This is where Elon Musk and SpaceX come in.

Mosher: *Starlink* is a globe-encircling network of internet-beaming satellites that is trying to get you online no matter where you are in the world.

Narrator: And there's a rather persuading element for SpaceX as well.

Mosher: Elon Musk has said he's just trying to grab a small percentage of a trillion-dollar-a-year telecommunications industry around the world. If SpaceX can pull this off, the company could net about \$30 to \$50 billion a year.

Narrator: Musk and SpaceX president Gwynne Shotwell say that much money could **single-handedly**⁽⁵⁾ fund the development of *Starlink*, Starship, and SpaceX's Mars-launch infrastructure. As of early October, SpaceX has launched more than 700 satellites into orbit, with a plan to release a total of 12,000 over the next five years, half of them by the end of 2024. And Musk wants to add another 30,000 to that, coming to a total of 42,000 satellites circling Earth. All of these satellites will also be much closer, anywhere from 200 to 400 miles above the planet in low-Earth orbit.

Mosher: This reduces the connection delay that is found with traditional internet satellites.

Narrator: Once in orbit, these *Starlink* satellites will be constantly on the move, which is why so many are necessary.

Mosher: The problem is you have to have many satellites orbiting to make up for the fact that you can't stay in one spot above the Earth. Because you need several satellites overhead at any one time to cover many users.

Narrator: Every satellite will connect with several others via laser **beams**,⁽⁶⁾ creating something like the network's backbone. And to actually bring this internet into your home, you'll need to get a pizza-sized antenna. This phased-array antenna can aim its beam at whatever satellite is overhead, which will maintain an internet signal in your home. But this scheme isn't without problems. *Starlink* satellites are bright. They reflect the sunlight and shine it back towards Earth, so they end up looking like bright moving stars. As cool as it may look, that comes with problems.

Mosher: *Starlink* satellites are most visible in the night sky right before dawn and right after dusk, which is the exact time that astronomers are hunting for near-Earth objects or asteroids, objects that could hit Earth and possibly harm us.

Narrator: And as more satellites go up, so does the likelihood that they'll interfere with astronomers' views.

Mosher: If *Starlink* continues to be a problem for these type of sky surveys, we may not have as much notice as we want to detect a near-Earth object and **thwart**⁽⁷⁾ it and prevent it from hitting Earth.

Narrator: Beyond detecting deadly asteroids, the wall of satellites could also obstruct the search for new planets or even black holes.

Mosher: SpaceX realized it had to do something, and it did. It created what's called a DarkSat, which is a satellite that has all of its shiny parts coated in a very black, dark material.

Narrator: It also tried adding visors to shield those shiny parts from the ground. But unless the satellites are **cloaked**⁽⁸⁾ like a spaceship in "Star Trek," technology that does not exist, none of this will fully solve the problem. And even if it did, there is a much bigger issue at hand.

Mosher: There's a concern about space debris, because when you have so many satellites in the closest, tightest, densest orbits around Earth, there's a higher chance that those satellites could collide with each other or with other satellites.

Narrator: Those crashes would create clouds of **debris**⁽⁹⁾ that can orbit the Earth for years, decades, or even centuries.

Mosher: And that debris can then disable or cause other satellites to crash into each other, creating even more debris, and this problem **spirals**⁽¹⁰⁾ out of control in an effect called the Kessler syndrome. And if we reach that, then essentially space is too unsafe to access.

Narrator: To be clear, the risk of a runaway Kessler syndrome is very low.

Mosher: But the potential impacts of that are so high that scientists are working very hard to control such an event from ever happening.

Narrator: SpaceX has said its satellites can automatically move out of the way to avoid collisions. But dozens of SpaceX satellites are already disabled and can't move at all, posing a potential threat. And those concerned with SpaceX's plans are lobbying the FCC to **rein in**⁽¹¹⁾ the company and more strictly regulate low-Earth orbit. And that could make it more expensive and harder to deploy the planned 42,000 satellites. But it doesn't stop at *Starlink*. Amazon's *Kuiper* project, *OneWeb*, China's *Hongyan*, and other projects are looking to challenge SpaceX by launching their own global networks of hundreds or thousands of satellites. If they all got their way with little to no regulation, we could end up with 100,000 satellites **encasing**⁽¹²⁾ our planet within the next 10 years, dramatically increasing the risk of blocking off space for everyone.

Match the highlighted words from the script to their meanings.

_____ rays of light _____ pieces of waste; detritus

_____ covered _____ wrapping up

_____ impressively large _____ moving fast, out of control

_____ control; restrain _____ increases dramatically

_____ store data in a temporary memory while it's being processed

_____ period of time between one event or phenomenon and another

_____ without any help

_____ stop something from happening or someone from doing something