

Space: It's smaller than we think



Alex Miller 5 minutes

Space Sustainability



The International Space Station was threatened in 2021 when it passed through a debris cloud several times — the fallout from a Russian missile strike on a defunct satellite.

For much of humanity's time on Earth, the oceans seemed impossibly vast and indestructible. Over millennia, we treated it as an infinite resource and transportation medium — and polluted it with reckless abandon. We're only now confronting the consequences of ocean degradation brought about by centuries of unregulated carelessness.

The same is now happening with space, another seemingly vast entity so large as to be immune from human destruction or waste.

"Space may be practically limitless, but in our own immediate Earth neighborhood, we've already done a decent job compromising it in just 65 years of space activity," said E-Space Head of Spacecraft Design John Wallace. "It's something everyone in the satellite industry should be paying close attention to, as well as government regulators and anyone else interested in space sustainability."

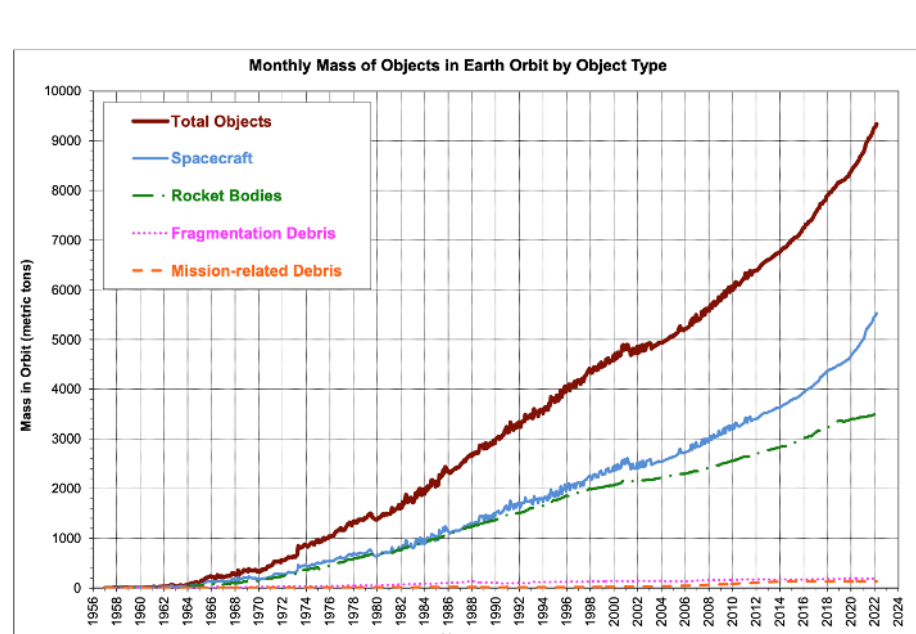
Hundreds of thousands of objects are already orbiting the Earth, with some of the deadliest being ones under 10 cm. They're so small as to be undetectable yet traveling so fast that they can cause tremendous damage in a collision. The FCC calls these objects "Lethal, Non-Trackable" or LNTs.

How much of a problem is orbital debris?

If we take no regulatory actions and let near-term economics drive our actions, we will pollute space's low-Earth orbits (LEO) with debris that can circle the entire planet in just 90 minutes. That equates to each individual piece of space junk orbiting the Earth about 16 times in a single day.

According to NASA, more than 27,000 pieces of space debris in orbit are tracked by the U.S. Department of Defense's global Space Surveillance Network. All told, there are an estimated half a million pieces of debris between 1 and 10 cm traveling around Earth and even more pieces a millimeter or more in size — equaling upwards of 100 million units of debris flying at an average speed of 15,700 mph.

NASA has also estimated the total mass of objects in Earth orbit over the years. While it grew gradually in the early days of the space industry, by 2000 the total mass had topped 4,500 metric tons, with that number doubling to where it is today at more than 9,000 metric tons.



This chart from the U.S. Space Surveillance network illustrates clearly the steep rise of objects in orbit.

Now add in the tens of thousands of other satellites planned to add to it and the problem grows even larger.

"It's clear we have a space debris problem on our hands," said E-Space Chief Satellite Systems Engineer Dalibor Djuran. "And it's not a new concern; it's something that has been discussed among scientists, engineers and academics for decades."

For example, the Kessler Syndrome is a theory presented in 1978 describing how one collision can have a cascading effect that never fully ends. That first collision creates even more debris, which then collides with other debris and on and on until the near-space environment is completely degraded. NASA scientist Don Kessler applied the same type of mathematical models used to describe "collision cascading" observed in an asteroid field — or among molecules in a box bouncing around — to describe the effect.

What's the reality of the Kessler Syndrome happening?

"We're already part of the way there," Wallace said. "In 2021, we saw it firsthand when a Russian missile strike of a defunct satellite created hundreds of thousands of pieces of debris."

The International Space Station passed through the new debris cloud several times, threatening the lives of NASA astronauts and Russian cosmonauts. The incident also damaged an Iridium communications satellite, and it's estimated the collision between Iridium 33 and the defunct Russian satellite created nearly 2,000 pieces of debris larger than 10 cm.

It's not hard to imagine that scenario playing out in multiples, resulting in hundreds of thousands of collisions which, in addition to the destruction in near-Earth orbit, would also create a debris blockade that would make it very difficult to launch new satellites — or communicate with existing ones. This is not a situation that can easily be reversed or cleaned up.

"What we don't want is for space to be our next ocean pollution scenario — where too many players act only in their own self-interest at the expense of the whole environment," said Djuran. "We can clearly see what's ahead, and today we have a great opportunity and responsibility to learn from our past mistakes and change."

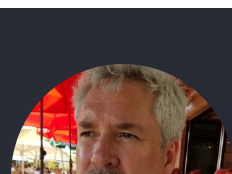
Here at E-Space, we're doing our part by creating a new class of spacecraft that puts sustainability front and center. Unlike traditional satellites, ours are designed with multiple unique features that both reduce the likelihood of collision and help de-orbit existing debris. We are creating a new standard in space safety designed with satellites that fail safe; offer 100% demise; have small cross-sections; are low mass; do not release components if impacted; and, ultimately, have the ability to entrain and de-orbit harmful space debris.

We aim to be part of a worldwide effort that involves governments, regulatory bodies, academia and industry to recognize the threat of orbital debris and the need for best practices in spacecraft design and orbital management.

"Cooperation on a global scale is essential if we are to ensure a safe space environment that is usable for all," Wallace said. "It's something we think about every day as we work on the world's first sustainable satellite constellation, and it's the direction we think everyone in the industry should be headed."

Dalibor concurred, noting how inaction will impact space for years to come.

"Space debris will impact operations of all space companies, and potentially endanger lives of astronauts during launch or on the ISS," he said. "We cannot let the focus on the business aspect of space exploration cloud our thinking, and the sooner all the key players in the space industry start working on this problem, the faster we'll reach the solution before it's too late."



Alex Miller

Alex Miller leads editorial at E-Space. Based in Denver, he's a longtime journalist who's been involved with the satellite industry for over a decade.

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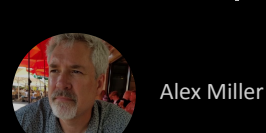
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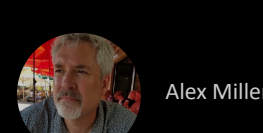
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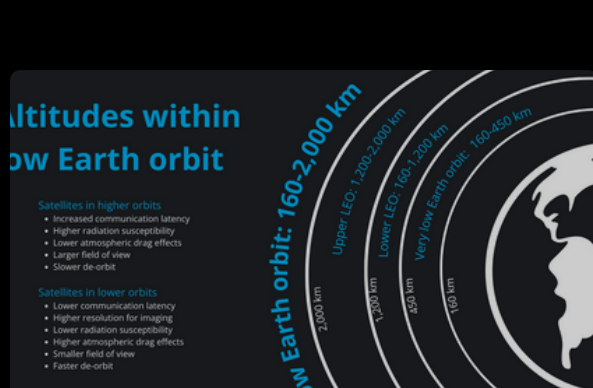
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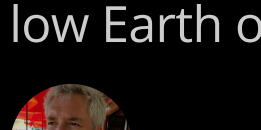
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