

Growing Population of Satellites and Kessler Syndrome

Over 40 years ago, Donald Kessler predicted we were headed for trouble due to the increasing amount of space debris we humans have left in orbit around our planet. He predicted that satellites would start to collide and create an irreversible artificial asteroid belt that made future launches difficult or impossible.

In February 2009, Cosmos 2251 [collided](#) with [Iridium 33](#) in the first major collision of two satellites in Earth orbit. The Iridium satellite, which was operational at the time of the collision, was destroyed, as was Kosmos-2251. This collision produced almost 2,000 pieces of debris, measuring at least ten centimeters (4 inches) in diameter, and many thousands more smaller pieces.

The yearly rate of increase of objects in space has been fairly modest up until this time at a relatively small, ~300 object per year on average. But that is all about to change with an unprecedented surge in satellite launches planned in the next 3 years. Predictions vary, but based on announced satellites, permits, and trends, there will be 22,000 satellites launched, doubling the number of tracked objects in space, and increasing the number of live satellites by 10x. These numbers do not include military or similarly unannounced satellites from government agencies.

The models built by Kessler and maintained by NASA and ESA show a dramatic growth in collisions as the number of objects in space increases more the 600 per year, and we are over 7,000. Even accounting for more releases into higher orbits, the numbers are alarming. Cleaning up space debris will soon be an urgent need for our growing space economy, now over \$400B USD annually. The next collision could create a debris field of thousands of objects, cascading into a much more volatile environment for satellites.

The top announced launches include:

Space X	12,000
Blue Origin	3,326
SatRevolution (REC)	1,024
Misc. Cubesats and other small sats	1,100
Galaxy Space	1,000
EarthNow	500
Hongyan (CASC)	320
KLEO	300
Efir / Sfera	228
Sky and Space Global	200
ADASpace	192
LaserFleet	192
Hongyun / Xingyun (CASIC)	156
Spire	150

Swarm Technologies	150	
AISTech (DANU, HYDRA)	150	
Kepler Communications	140	
ZeroG Lab (Lingque Magpie)	132	
Telesat		117
Canon	100	
Fleetspace	100	
Orora.Tech	100	
Satellogic	90	
Astrocast	80	
NanoAvionics	72	
SpaceFlight Blacksky	60	
HawkEye 360 Inc.	18	

Over 1,300 smallsats launched 2012 – 2018 (includes smallsats on both successful and failed launch attempts) 2018 saw 6x as many smallsats launched as 2012

<https://spacenews.com/amazon-planning-3236-satellite-constellation-for-internet-connectivity/>

<https://spacenews.com/spacex-plans-24-starlink-launches-next-year/>

https://brycetech.com/downloads/Bryce_Smallsats_2018.pdf

<https://www.newspace.im/>

http://www.esa.int/Our_Activities/Space_Safety/Space_Debris/Space_debris_by_the_numbers

<https://orbitaldebris.jsc.nasa.gov/faq/>