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The Space Debris Problem

Conventional Assumption

The probability that a piece of debris collides with another object is only dependent on the number of objects in orbit.

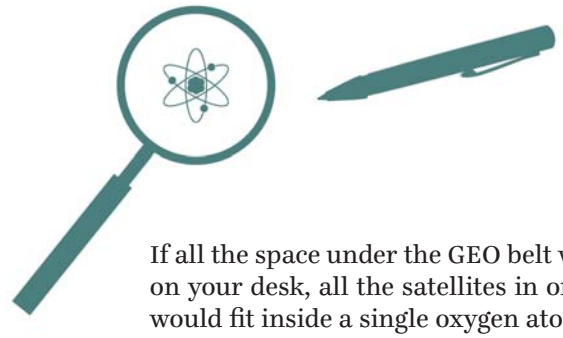
Reality

The probability that a piece of debris collides with another object is dependent on that object's **Surface Area** and **Time in Orbit.**

How Big Is Space?

A satellite's surface area is infinitesimally small compared to the vastness of orbital space around Eath. The total volume of space with orbiting satellites is approximately 110 trillion kilometers.

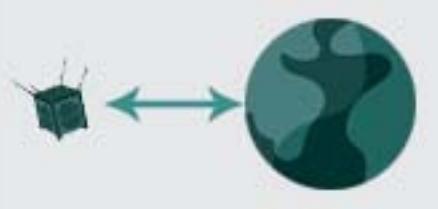
That's enough space to hold 113 Earths.



If all the space under the GEO belt was on your desk, all the satellites in orbit would fit inside a single oxygen atom.

What determines how long satellites stay in space?

Altitude & Atmosphere



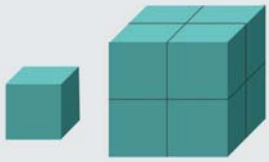
Satellites encounter atmosphere in orbit. The result is atmospheric drag. As you increase altitude, the density of atmosphere radically decreases. Low Earth Orbit has high drag and High Earth Orbit has almost no atmospheric drag to speak of.

Kinetic Energy

The higher a satellite's kinetic energy, the more it resists atmospheric drag.

In general, satellites with more mass have more kinetic energy than their lighter counterparts.

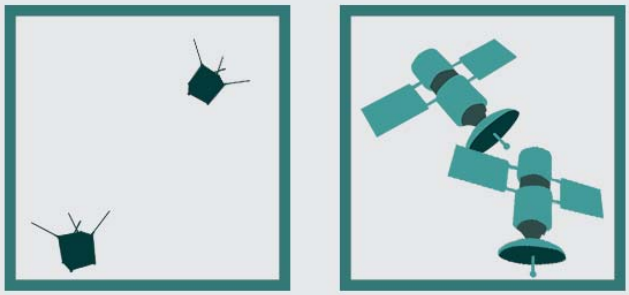
Surface Area & Drag



Atmospheric drag increases along with surface area. However, volume increases faster than surface area when increasing the size of an object. Unfortunately, increasing size & surface area also increases mass - creating a satellite that's less affected by drag.

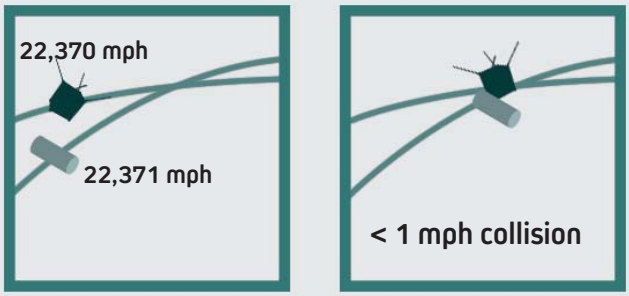
Space Object Impact

Surface Area & Space



Two objects inhabiting the same amount of space have a much larger probability of colliding if one or both of the objects are large. On the other hand, two small objects have a lower risk of collision when inhabiting the same amount of space.

Relative Speed of Impact



While the absolute velocity of items in space is impressive (often quoted at around 22,370 mph), it's relative speed that's more important. If you're on a plane traveling at 650 mph and you bump into another passenger, you do not feel the force of a 650 mph collision.

Other Considerations

Two objects collide when one object's orbit is degrading faster than the other. This leaves only a single chance for the two orbits to intersect. Even when an intersection happens, the odds of both objects being at that same point is incredibly low.

Orbital Matter & Risk

Total Surface Area

.000000204%

Surface Area of Cubesats as a Percentage of Total Satellite Surface Area

For every 1 square meter of surface area taken up by a cubesat, there is over approximately 49 million square meters of traditional satellites and left-over upper stages from previous launches*.

* Until recently, upper stages were not actively de-orbited after placing satellites in orbit.

Debris by Size and Altitude

	Small Size	Large Size
Low Altitude	Short Lifespan Low Space Debris Risk	Medium Lifespan Medium Space Debris Risk
High Altitude	Long Lifespan High Space Debris Risk	**Very Long** Lifespan Very High Space Debris Risk