

Space Debris

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Flatiron School Data Science 5/31/24

What is space debris?

- Hardware left in orbit from previous space missions.
- Defunct satellites, spent rocket stages and fragments from collisions/malfunctions.
- Poses **substantial risks** for future space missions.



[Rendering for illustration only](#)

What are the risks from space debris?

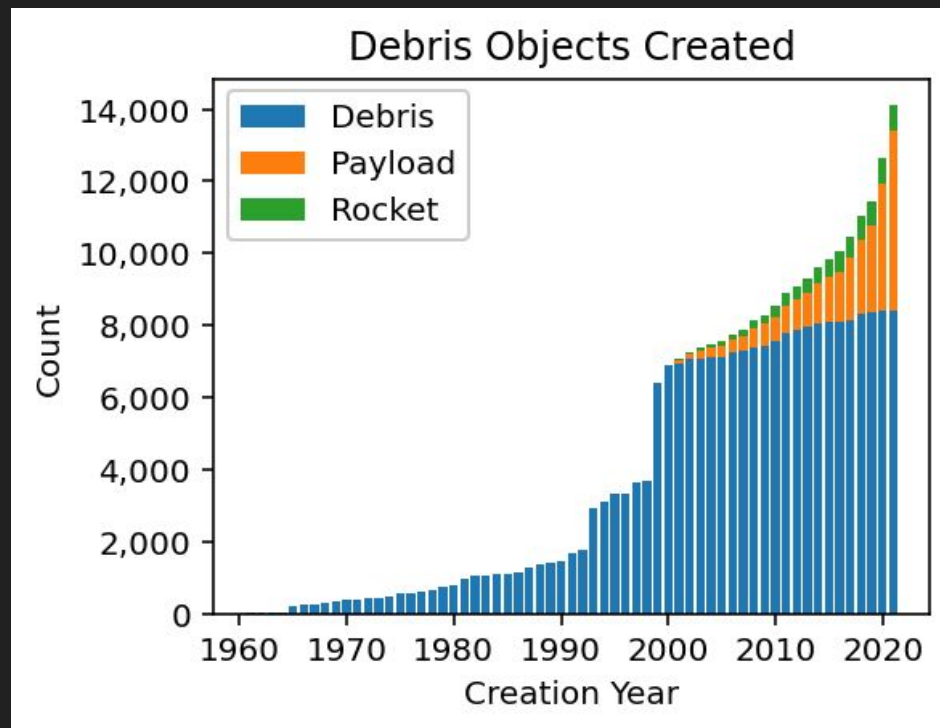
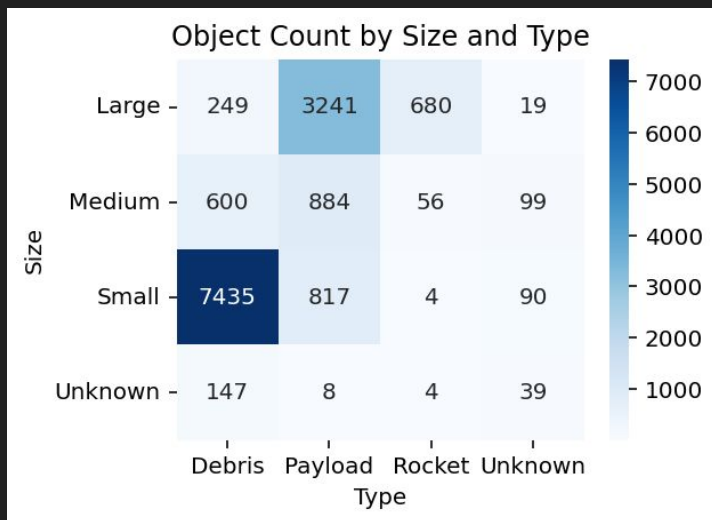
- **Collisions** - even small debris can cause catastrophic damage at such high speeds.
- **Astronaut safety** - collisions with manned spacecraft would be intolerable.
- **Kessler syndrome** - the debris field from one collision can cause exponentially more collisions.
- Can render orbits **unusable**.



[Scene from film Gravity \(2013\)](#)

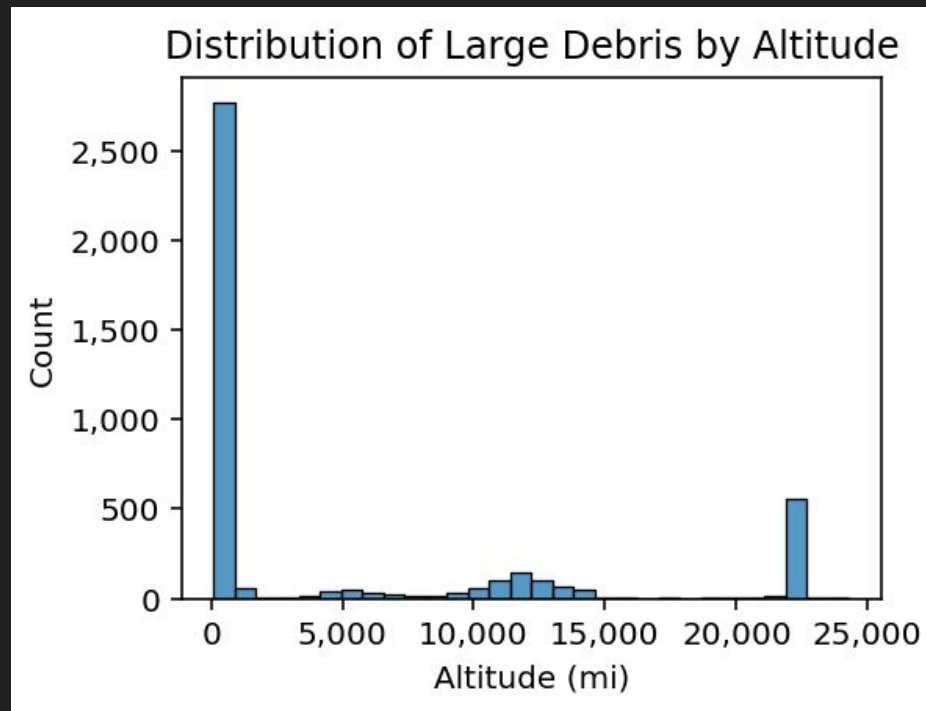
How much debris is there?

- NASA has identified over 55,000 objects.¹
- Millions more are too small to be tracked.
- **In my dataset: 14,000 objects.**



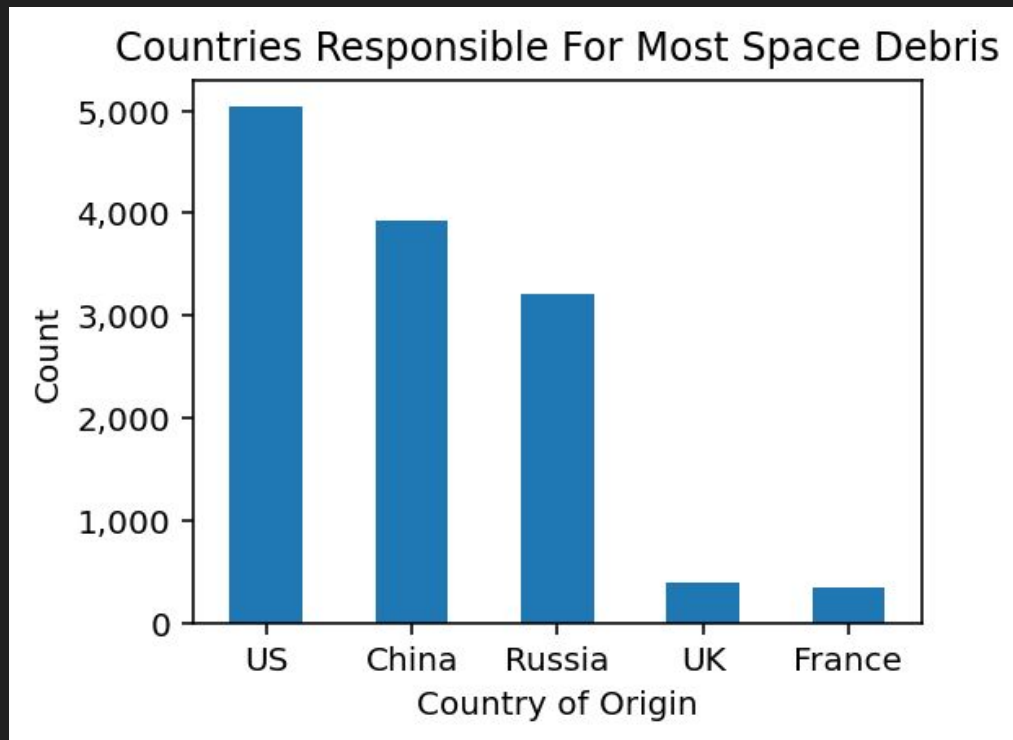
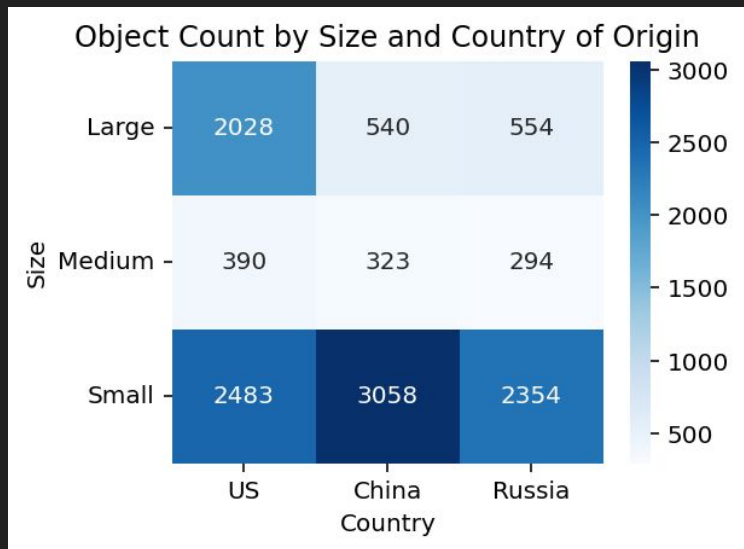
Where is most of the large debris located?

- Most large pieces are in low-earth-orbit, between 100 and 2,000 miles up.
- Some are in geosynchronous orbit, exactly 22,236 miles up.
- Many are scattered across medium-earth-orbit, between 2,000 and 22,000 miles up.



Who is responsible?

- **The US, China and Russia** together produced about **85% of it**.
- The US has produced far more **large debris** than any other country.



Recommendations

TRACK MORE

Invest in more robust tracking technology to **track smaller objects.**

REMOVE MORE

Develop removal solutions like **active capture** and **laser ablative steering.**

DESIGN BETTER

Adopt **sustainable** satellite and rocket design practices and end-of-life protocols.