

Martian Orbital Debris Population Report

Post-Impact Analysis: Hex-Asteroid Collision Event

Initial Ejecta Statistics

The collision of six 60km asteroids releases a total kinetic energy estimated at $\sim 1.8 \times 10^{26}$ Joules. A significant fraction of the excavated Martian crust is accelerated beyond the escape velocity, but a substantial volume remains trapped in the Martian gravitational well.

Debris Category	Estimated Initial Count	Typical Composition
Large Fragments (>1km)	$\sim 120 - 150$	Solid basaltic/silicate rock
Medium Fragments (10m - 1km)	$\sim 180,000$	Mixed regolith and rock chunks
Small Fragments (1cm - 10m)	$\sim 11,000,000$	Pebbles and coarse gravel
Dust & Fine Particles (<1cm)	>300 Trillion	Pulverized silicate dust

Orbital Residence Time & Decay

Debris in Martian orbit is subject to atmospheric drag (in lower orbits), solar radiation pressure, and gravitational perturbations from Phobos, Deimos, and the Sun.

Longevity Estimates:

- Short-Term (0 - 100 Years):** Approximately 60% of small fragments in low orbits (< 500km) will re-enter the Martian atmosphere, creating persistent meteor showers.

- **Medium-Term (100 - 10,000 Years):** Gravitational interactions with Phobos and Deimos will "clear" specific orbital lanes, either by accretion (hitting the moons) or by ejecting debris into deep space.
- **Long-Term (100,000+ Years):** Large fragments and dust in stable "storage" orbits (between 5,000km and 15,000km) can persist for millions of years, forming a permanent, though thin, ring system.

Specific Impact Site Influence

Polar Ejecta: Debris from the 4 polar impacts tends to enter highly inclined orbits. These stay over the poles and intersect the equator twice per orbit, making them high-speed collision risks for any equatorial satellites.

Equatorial Ejecta: Debris from the 2 equatorial impacts forms a dense "torus" or donut shape around the planet's middle, which is where a ring system would most likely stabilize over time.