



Orbital Debris Mitigation through Artificially Concentrated Plasma Fields

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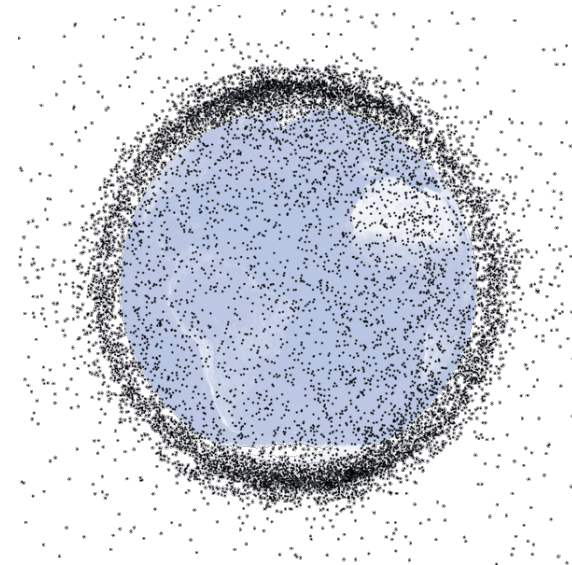
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Introduction

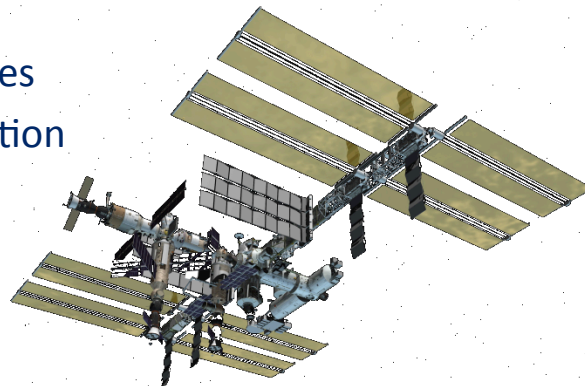
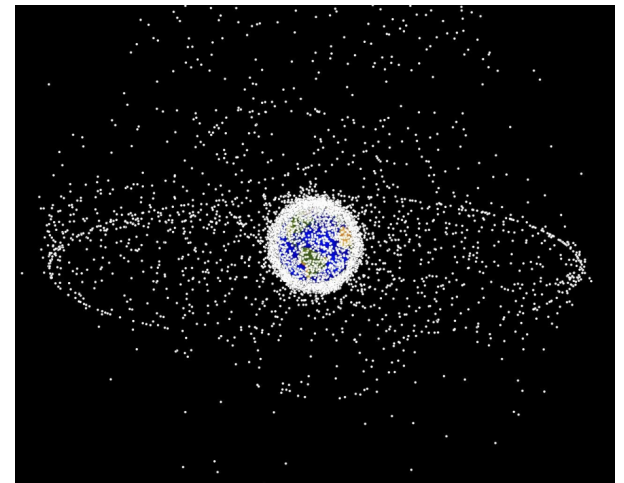


- Orbital Debris
 - The collection of man-made objects in orbit around the Earth that no longer serve any purpose
- NASA estimates about 500,000 debris objects in orbit
 - This number does not account for debris having dimensions < 10 cm
- Objects are concentrated in Low-Earth Orbit (LEO) and Geosynchronous Orbit (GEO)

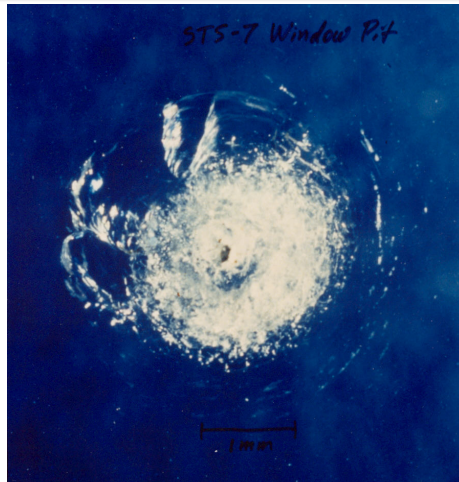


Background

- The orbital debris problem is a growing concern
- Created from:
 - Old inactive satellites
 - Collisions between existing debris particles
 - Rocket stages
 - Miscellaneous nuts and bolts from satellite deployments
- It is a serious threat to existing space infrastructure:
 - LEO satellites
 - Communication satellites
 - International Space Station

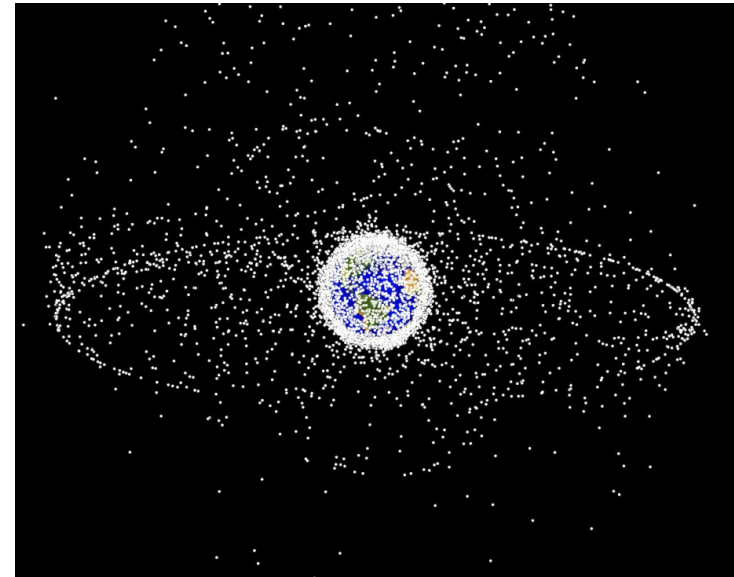


Problem



- Debris travel at orbital velocities (roughly 7 km/s)
 - Average impact velocity is roughly 11 km/s
- International Space Station conducts maneuvers
 - Encounters several debris scares per month
- Refuge taken by astronauts 5 times- Most recent is a remnant of rocket motor travelling at 19,800 mph
- Long Duration Exposure Facility (LDEF)
 - 20,000 documented impacts during 5.7 years of its space time

Big Problem



Debris Mitigation : Methods



- Current solution: maneuvering in orbit around debris in the presence of a threat
- Most solutions attempt to slow debris and have them de-orbit
- Previously proposed solutions for removal of debris:
 - Sail Sweep
 - Water Spray
 - Net Structures and
 - High Precision Lasers from ground/in-orbit satellite
- Disadvantages
 - Limited Impact area
 - Very large drag coefficient
 - Requires unreplenishable fuel
 - Limited orbital lifetime
 - Stringent pointing required
 - High energy consumption

