Kessler Syndrome: The Space Debris Cascade

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Background: The CRASH (Collision Realization and Significant Harm) Clock recently flagged a heightened risk of collision cascades in Earth's orbit, reviving concerns over the Kessler Syndrome.

Basics:

- Definition: A theory proposed by Donald Kessler (1978) stating that the density of objects in Low Earth Orbit (LEO) could become so high that a single collision triggers a self-sustaining chain reaction of fragments.
- Mechanism: Each collision creates "space junk," which then strikes other satellites, eventually making certain orbits (like those used for GPS and telecommunications) unusable for centuries.
- India's Response: India's Project NETRA and the SPADEX mission (Space Docking Experiment) are efforts to track debris and develop mitigation technologies.

Significance for UPSC: Relevant for Space Sustainability. It necessitates discussions on Space Traffic Management (STM) and the "Active Debris Removal" (ADR) technologies needed to protect global digital infrastructure.

Kamaraj IAS Academy
Plot A P.127, AF block, 6 th street, 11th Main Rd, Shanthi Colony, Anna Nagar, Chennai, Tamil Nadu 600040
Phone: **044 4353 9988 / 98403 94477** / Whatsapp : **09710729833**