Orbital debris is uncontrollable litter left in orbit. 21,000 debris objects are larger than a softball...inactive satellites, rocket stages, and fragments created by collisions, explosions and normal operations. 100 million shrapnel pieces are smaller than a centimeter. With relative velocities higher than 26,000 mph, debris as small as half a centimeter can take out spacecraft. The number of objects *larger than* a centimeter will reach 1 million by 2020.

NASA estimates there will be a catastrophic collision every five to nine years and the pace will accelerate. Some believe that we have reached a “tipping point,” whereby debris in Low Earth Orbit is colliding in a *runaway cascading debris-generation scenario*...the Kessler syndrome seen in the film Gravity. This would make spacecraft viability impossible and prove a barrier to space.

Orbital debris is an ever-growing hazard to the International Space Station *and* satellites that provide communications for television, radio, GPS, pagers, cell phone applications, navigation, search and rescue, weather and climate reporting and national defense.

Future large structures such as commercial space stations, hotels, space solar power satellites, multi-satellite platforms, and settlements will also be vulnerable. Insurance companies claims have reached $800 million.

Most tracked objects are defunct satellites or 9-ton rocket bodies and 5-ton satellites, approximately 6300 tons in all. There are more than 1300 multi-ton objects in GEO, 70% are not operating and are uncontrollable and subject to gravitational perturbations that increase orbital eccentricity leading to dangerously high velocities crossing the operational torus of satellites.

They’re hard to find and track, tumbling through orbits and moving fast. The U.S. Naval Research Laboratory has recently developed an Optical Orbital Debris Spotter, that throws up a laser light sheet to detect debris as small as one hundredth of a centimeter.

Many technologies have been proposed to remove debris and repurpose, refuel or repair defunct satellites. You can nudge them with ground-based pulsed-lasers.Space-based lasers might be more geopolitically palatable if civilian and international. Small debris removal using laser ablation could also be directed from the Space Station.

Spacecraft could simply grab on and plunge to deorbit. Rocket-propelled spacecraft would need enough fuel to repeatedly match the speed and direction of debris. which is not economically feasible. Propellantless or solar electric propulsion would be needed.

Darpa’s Phoenix Project proposes to attach nano-satellites to retired satellites, making the debris a resource. Nano-spacecraft would be launched as secondary payloads. A service-tender spacecraft would be tele-robotically directed to attach miniature devices to dead satellites to provide power, communications, and attitude control to produce working satellites at a fraction of the cost of new ones launched from Earth.

DARPA’s approach is not the only game in town. A spacecraft could direct a beam of electrons to an object. The beam would impart an electrostatic charge. Earth’s magnetic field would exert a force on the charged debris crossing its field. Over time, the orbit would become elliptical and intersect the atmosphere until friction brings it down.

A spacecraft could generate an electron beam, imparting a negative potential on the object while the spacecraft remains positive. The spacecraft could then tug defunct satellites to a disposal orbit or remanufacturing plant.

The Space Station has a large power-generation capacity and is already in LEO. An electron beam device could be deployed avoiding the need to develop and launch a new spacecraft.

Maritime Salvage Law dating back to the ancient Greeks givessomeone who preserves any vessel, cargo, freight, or other salvage from danger a reward. Protection of the environment is part of salvage, awarding a salvor who prevents pollution, for example, special compensation termed *liability salvage* instead of *property salvage*.

The amount of space debris is not just a liability, it is a gold mine. Lifted to orbits at $10,000 a kilo it is worth $330 billion dollars as feed stock alone. Large objects such as rocket bodies could be used to build space stations, while a space salvage company could repair, repurpose, remove, deorbit and collect feedstock for a solar oven and 3D printer to turn dangerous space debris into space solar components.