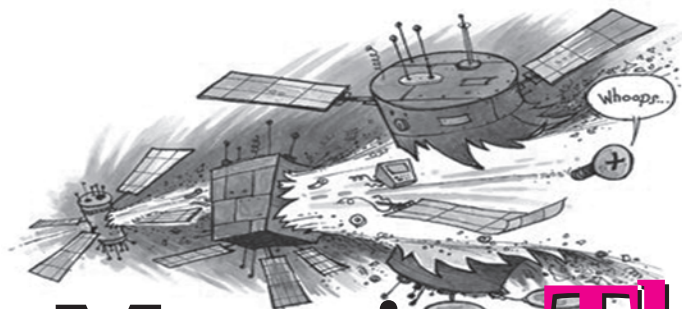




Mounting Threat of Space Debris

Junk in outer space is threatening space missions like never before. And scientists are coming up with really innovative solutions to clear the mess created up there.

In late September this year, the six tonne class Upper Atmosphere Research Satellite (UARS) of the National Aeronautics and Space Administration (NASA) of USA disintegrated and fell back to earth over a location that could not be identified. In fact, the reason why the exact spot of a satellite crash is hard to predict is because the density of the atmosphere, especially in the upper regions, fluctuates violently, producing different amounts of drag.

This satellite, which ran out of onboard fuel in 2005, was launched way back in 1991 with the objective of measuring ozone levels, wind speeds and temperatures in the stratosphere. But the extent of debris it has contributed to the space pollution belt in the near earth orbit is yet to be quantified. All said and done, the disintegration of UARS was a grim reminder to the ground reality that pollution is not an exclusive problem nagging our spaceship earth.

For quite some time now, most space agencies have been expressing serious concern over the mountain of debris in outer space posing a threat to multi-million dollar satellite missions. Not surprisingly then, a meeting of the Inter Agency Space Debris Coordination Committee (IADC) held in Berlin earlier this year came to the conclusion that extraction of up to five larger debris each year would be essential to keep outer space safe for operational satellites. As pointed out by Matthew Hoeg, Director of the US-based Military Space Transparency Project (MSTD), "In terms of clean up, it is critical that military forces,

government agencies and the private sector work together as part of a broad based international coalition." In the ultimate analysis, there is unanimity of view on the need to actively remove some debris from orbit.

Since the ushering in of the space age more than five decades back, an exponential growth in launch activities has resulted in the littering of near earth orbit with fragmented parts of satellites and launch vehicles on a sustained basis. According to one estimate, there are now more than 22,000 objects in the space junkyard that are big enough to be tracked. They travel at speeds up to 17,500 miles per hour and could easily damage an operational satellite. In addition, there are countless smaller objects that are not amenable to tracking. Nicholas Johnson, NASA chief scientist for orbital debris points out, "The greatest risk to space missions comes from non trackable debris."

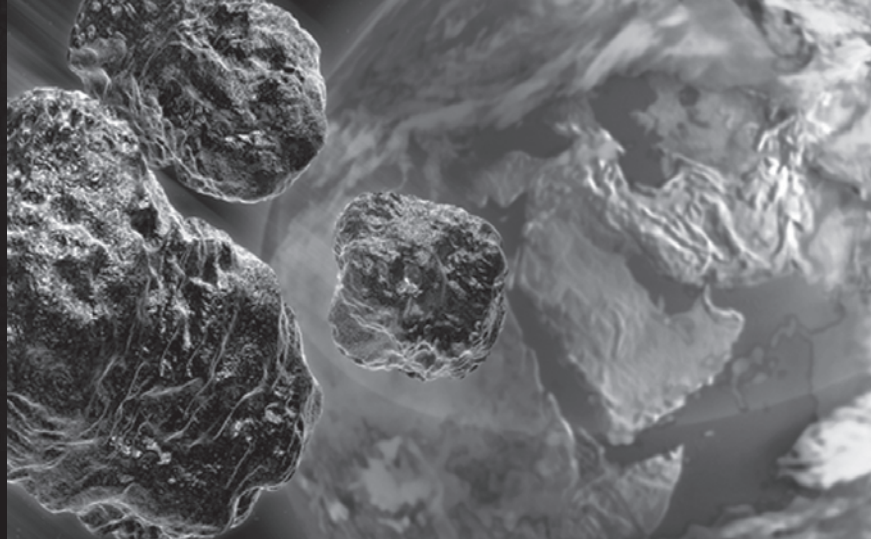
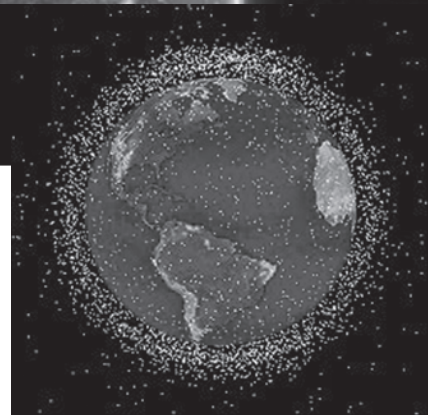
In the rapidly piling up mountain of space debris can be found nuts, bolts, electrical and electronic devices from disintegrated satellites and launch vehicles as well as cameras, screw drivers, food cans and oxygen cylinders left behind by astronauts. Not surprisingly then, space experts are a worried lot over the threat posed by space debris to the multi-million dollar satellite missions and manned probes.

There is no denying the fact that space junk is a risk factor for more than 1,000 operational commercial, military and civilian satellites orbiting the earth. Indeed, a fact-filled study by the National

Research Council (NRC) of US points out that the growing volume of space junk in near earth orbit has reached a "tipping point" for collision. As such, the NRC report makes a strong case for the space agencies to devise new and innovative strategies for mitigating the hazard posed by space debris. Of course, experts who have called for cleaning up the "dirt and debris" in near earth orbit, are exploring various strategies to realize the objective.

Researchers say that many pieces of satellites and launch vehicles continues to stay in orbit indefinitely if they attain what is called the first cosmic speed. Only objects that slip below an altitude of 120-150 km re-enter the atmosphere to blaze down as unidentifiable pieces on earth. The collision hazard posed by the space





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debris is mainly due to the high-energy impact caused by its rapid acceleration.

Significantly, the first confirmed collision between two catalogued objects took place in July 1996 when the gravity gradient altitude control boom of the French defence satellite *Cerise* was damaged by a fragment from an Ariane launch vehicle of the European space transportation company, Arianespace. However, the first ever "smash up" in outer space occurred in 2009 when a fully operational American communications satellite *Iridium* was destroyed following its collision with a defunct Russian satellite designated *Cosmos-2251*. This space mishap, which took place 789 km over Siberia, generated thousands of pieces of debris. And in March this year, the International Space Station (ISS) narrowly escaped being hit from the debris of this 2009 collision.

According to US Space Surveillance Network, the early 2007 anti satellite test by China, which involved the destruction of an aging weather watch satellite *FENGYUN-1* by means of a medium range ballistic missile, contributed in a substantial manner to the space junkyard. The NRC report also drives home the point that computer models have gone to show that the amount of orbital debris has "reached a tipping point" for collisions and create even more debris and in the process

enhance the risk of spacecraft failure. "The current space environment is growing increasingly hazardous to spacecraft and astronauts," points out Donald Kessler, the former head of the orbital debris programme office of NASA. On the other hand, the NRC report notes, "the problem of space debris is similar to a host of other environmental problems and public concerns characterized by possibly significant differences between the short and long range damage occurring to the society".

Nonetheless there is a growing worry over the possibility of the space debris problem getting more pronounced in the context of increasing launch activities. According to space industry estimates, while an average of 76 satellites per year were launched over the last ten years, in the coming decade the activity, would grow by 50%. According to an analysis by Euroconsult, some 1,145 satellites would be built for launch between 2011 and 2020.

What is more, the hazardous aspect of space continues to engage the attention of the global space agencies. Indeed, the dangers involved in space exploration were conspicuously highlighted by the melodrama that accompanied the uncontrolled descent of the American *Skylab*. This episode triggered a sort of global panic. Luckily, and to the great relief of the earthlings, the *Skylab* made a soft landing in the waters off the Australian coast in July 1979. Quite recently, in February 2008, an American defence satellite that had lost its orientation and started tumbling menacingly towards the earth was destroyed in mid space by a missile fired from a US naval vessel.

Overcrowding is another worrisome problem plaguing outer space. The vital slots in the so called geostationary orbit—36,000 km above the equator where a satellite appears stationary in relation to earth—often referred to as a real estate of the final frontiers, are fast getting filled, thereby raising the serious issue of interference between the satellites. Not long back, a couple of Latin American countries had staked their claim on many slots in this prized orbit for the simple reason that they were located right above their geographical expanse.

Meanwhile many innovative ideas are being mooted to clean up the fast piling volume of debris in outer space. One idea is to launch robotic missions directed at realizing a controlled re-entry of individual pieces of debris including dead satellites. Similarly, suggestions such as deploying large nets to collect debris or firing harpoons into defunct satellites to drag them back to earth are yet to take off. The European Commission on its part has mooted a space policy aimed at setting up of an autonomous European space situational awareness system to track debris.

Pointing to the various suggestions made for removing debris from outer space, Hugh Lewis of the aerospace engineering department of Southampton University in UK observes, "I think we are a long way off from having something which is reliable, relatively risk free and relatively low cost. There are a number of outstanding and fundamental issues that we still have to resolve."

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