Creation of an Artificial Atmosphere at Orbital Altitudes To Combat Space Debris

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There are over one hundred million pieces of space debris in low Earth orbit (LEO) at least one millimeter in diameter. Absent a mechanism to remove this debris, a phenomenon known as Kessler Syndrome will occur, producing a positive feedback loop of space debris creation. The proposed system consists of injecting LEO with a large volume of N_2 gas orbiting retrograde to a cluster of space debris to decrease the velocity of the debris, thus expediting atmospheric reentry. A computer simulation in C++ which iterates time is developed to model the atmospheric reentry of a hypothetical piece of space debris with starting orbital altitudes ranging from 800 km to 1000 km. Entered into the program is the factor by which atmospheric density is increased by the artificial atmosphere, the density increase factor (DIF), and the ranges of altitudes (km) which the artificial atmosphere orbits. The simulation determined a 33% reduction in time-to-reentry (TTR) when the DIF was 2 for artificial atmospheres of 50 km thickness, with larger reductions for artificial atmospheres of greater thicknesses, a 50% reduction in TTR when the DIF was 2 or greater for artificial atmospheres of 100 km thickness, a 28% reduction in TTR when the DIF was 1.2, and a 69% reduction in TTR when the DIF was 2 for artificial atmospheres of 200 km in thickness. Given that a 10% reduction in orbital lifetime (TTR) is considered significant, an artificial atmosphere deployed in LEO would be able to successfully combat space debris.

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