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DESIGN AND DEVELOPMENT OF A DEBRIS REMOVAL SYSTEM EMPLOYING DEORBETING  
MODULES FOR DEAD SATELLITES CLEAN-UP**Abstract**

It is requisite in developing innovative concepts to remove satellite debris, since they are in an alarming state of posing serious threat to current and future space operations substantially in the low earth orbit. From the research it is observed that the fragmentation debris can be prevented from collision with operational spacecrafts using shielding techniques. In case of large pieces of debris or dead satellites, although they can be tracked and maneuvered around, they are still at a great risk of causing serious damages to operational spacecrafts as compared to fragmentation debris. This paper will address the design and development of a debris removal concept which employs deorbiting modules to clean-up the dead satellite junks.

This debris removal system incorporates a main vehicle called debris clearance platform and an array of deorbiting modules to capture, deorbit and disintegrate large debris including non operational satellites. The debris clearance platform is the part of the debris removal system that moves the deorbiting modules close to the debris that is targeted for deorbiting and rendezvous itself with the target at a lower altitude parking orbit. The debris clearance platform uses ground based tracking as well as the debris surveillance system incorporated in it to determine the location of a non-operational satellites and junks. Next, the one of the deorbiting module is ejected from the array, which tracks the targeted debris, and attaches to it. After attaching with the debris, the deorbiting module performs its preset attitude controlling and deorbits the large debris, thus the debris gets disintegrated while reentry along with the deorbiting module. This process is repeated in the same manner for different orbital junks.

In a typical mission, the system has the ability to deorbit 30 large pieces of orbital debris or dead satellites. One mission will take approximately 8 months until the next array of deorbiting modules are resupplied to the debris clearance platform by an unmanned payload launcher. The detailed mission architecture design and systems engineering process for this space debris removal concept have been developed and the technical, programmatic and operational mission feasibility is discussed in this paper.