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CONCEPTUAL DESIGN OF A SPACE TUG MODULE FOR SMALL SATELLITES IN LOW EARTH  
ORBIT

**Abstract**

The increasing demand for low-cost remote sensing has led to an expeditious growth in the number of small satellites being launched into low earth orbit lately. However, despite their relatively small size, these satellites are required to incorporate on board attitude control mechanisms which occupy a big fraction of the designated volume budget, thereby increasing the overall mass and effective cost of the satellite to a great extent. This is even more pronounced in satellites that are a part of large constellations such as Starlink, where the effects get compounded. This paper attempts to explore a feasible solution to this issue through the conceptual design and development of a compact space tug module that would act as an in-orbit service module for small satellites. The proposed design would consist of a solar electric propulsion system that would aid in orbital corrections and orbit control mechanisms for attitude correction. The design also explores the possibility for incorporating a universal docking mechanism for the module to enhance its accessibility and applications. A comparative study has also been presented to understand the difference between the proposed design with other pre-existing or already conceptualized designs of space tugs by various international organizations.