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IN-SPACE SERVICES USING REVOLUTIONARY SMALL SATELLITE DESIGN

Abstract

Typical geostationary communication satellites includes its own propulsion system allowing it to maintain its orbital position typically for 15 years. When satellites deplete their entire on-board fuel, they are decommissioned even if they are still fully functional and a replacement satellite needs to take their place. Effective Space Solutions Limited has developed a viable cost effective small satellite system called SPACE DRONE (TM) for providing in-space services such as life extension to host satellites reaching their end-of-life. These new capabilities provide Satellite Operators the leverage of postponing the need for a replacement satellite by extending the life of an operational satellite. The SPACE DRONE (TM) small in-orbit service spacecraft is designed to weigh 400kg at launch. This weight includes the satellite structure, docking payload and an electric propulsion system with sufficient amount of fuel to perform orbital controls for the joint stack. Up to four light weight SPACE DRONE (TM) spacecrafts can be launched as a ride share on a single launcher, making it a very economical solution.In order to achieve a highly economical service solution, the SPACE DRONE (TM) spacecraft is designed to service different host satellites reaching their end of life. The design calls for a universal Docking System that can attach to different launch vehicle's adapter ring located on the host satellite. Furthermore, the SPACE DRONE(TM) spacecraft includes its own highly efficient electric propulsion system allowing it to perform various maneuvers that normally the host satellite would have been required to perform. In order for the SPACE DRONE (TM) spacecraft to accommodate a range of host satellites, each having its own weight and dimensions, the SPACE DRONE (TM) spacecraft incorporates a versatile thrust method.Results will show that the unique thrust method using four independent electric propulsion thrusters do not require periodic calculation of the change in the joint center of mass of the joint stack due to the different sizes of the host satellites and the depletion of fuel usage during the service period. The thrust method has shown resilience to other errors while maintaining a highly efficient fuel consumption. SPACE DRONE (TM) spacecraft provides complete orbital positioning and attitude control as well as the removal of any induced torques generated by external forces acting on both satellites while they are jointly stacked.