

IAF SPACE SYSTEMS SYMPOSIUM (D1)  
Cooperative and Robotic Space Systems (6)

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THE SPACE DRONE<sup>TM</sup> ADAPTABLE SERVICING SPACECRAFT

**Abstract**

In Orbit Services is a rising potential market, both in GEO and in LEO orbits, creating baseline technologies for active debris removal missions. Life extension, inspection, refueling, last-mile logistics and tug services are a few of the ideas that have been mentioned. The business feasibility is reflected also in the new Satellite Servicing Vehicle Concept within ESA's Clean Space Initiative.

Effective Space Solutions is developing the SPACE DRONE<sup>TM</sup> spacecraft to provide station-keeping, relocation or deorbiting services for Geostationary communication satellites. The first two SPACE DRONE<sup>TM</sup> satellites are intended to provide in orbit services and post mission disposal to satellites close to their End of Life in the GEO ring by 2020. The SPACE DRONE<sup>TM</sup> Spacecraft has a launch mass of about 400 kg and deploys a highly efficient electric propulsion system. The SPACE DRONE<sup>TM</sup> Spacecraft is designed to be a semi-autonomous satellite, with multiple docking/undocking operations using four docking arms, and to provide full orbit and attitude control for the joint stack. A total mission life time of more than 15 years is offered by the SPACE DRONE<sup>TM</sup> Spacecraft for a typical 2 ton GEO satellite.

By incorporating some innovating technologies and operational solutions the SPACE DRONE<sup>TM</sup> Spacecraft can service host satellites ranging from less than 1000kg to 4000kg of dry mass. A non-intrusive (patent pending) docking system was developed allowing the SPACE DRONE<sup>TM</sup> Spacecraft to dock to the launch adapter ring of the host satellite.

System constraints, such as maintaining station keeping while handling the SPACE DRONE<sup>TM</sup> and host satellite shadowing on each other have been incorporated in the design. Joint operations of two co-joined bodies have been designed. Method for station keeping (patent pending) using four electric propulsion Arclight thrusters to be mounted on four deployable thruster arms provides all orbit maneuvers with high efficiency.

The SPACE DRONE<sup>TM</sup> Spacecraft can be adapted for providing orbit services in LEO orbit, servicing Post Mission Disposal for LEO satellites and Mega constellations. The SPACE DRONE<sup>TM</sup> Spacecraft can provide orbit disposal and orbit re-location for stranded satellites due to launch errors. With minor changes, the satellite can be also used for Active Debris Removal, utilizing many of the previously developed technologies and lessons learned.

In this presentation the SPACE DRONE<sup>TM</sup> design and system constraints will be presented. Analysis done towards joint stack operations will be shown as well as the different mission concepts that can be performed using the SPACE DRONE<sup>TM</sup> concept.