

IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Interactive Presentations - IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS
SYMPOSIUM (IPB)

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VERTUE, AN INNOVATIVE ORBITAL MODULE TO MEET THE DEMAND FOR IN-ORBIT
SERVICING

Abstract

Since the Sputnik era, spacecraft are designed as self-sustained systems, required to perform without external interventions. As a result, the established approach to spacecraft design discards the so-called In-Orbit Servicing (IOS), ranging from inspection and maintenance to tugging and towing. However, favourable conditions seem to be setting for IOS to disrupt the space ecosystem in a foreseeable future and to shift the traditional paradigm of mission design and operations. The number of objects orbiting Earth is dramatically increasing, following the blossoming of private initiatives. In the next ten years, mega-constellations are predicted to crowd the already congested low-Earth environment. In this regard, active debris removal (ADR) as part of IOS might answer the urgent call for long-term sustainability in LEO. Considering the geostationary belt, a significant number of satellites will reach EOL over the next decade. In this case, life-extension services by means of refuelling would maximize the return from GEO missions. As announcements for new generation launch systems adopting a TSTO architecture increase, so does the need for Last Mile Delivery (LMD) services. ADR, life-extension, and LMD services represent addressable markets with expected revenues in the order of billions of USD by the half of the thirties. Projecting several years from now, in a scenario where dedicated spacecraft operate on satellites designed to be serviced and reconfigured, IOS would enable the repurposing of a mission instead of launching a new one. Overall, IOS is an emerging business opportunity, that anticipates a potentially booming market against the background of a flexible and sustainable space. Finis Terrae, an innovative start-up based in Rome, is eager to seize this opportunity. A green orbital propulsion module, *Vertue*, is under development to meet the demand for IOS, leveraging access to space through the Vega family of European small launchers. Within the standard of the Vega Space System— a modular evolution of Vega capable of tailoring the launcher to different missions— the *Vertue* module will provide IOS capability. The present paper reviews the up-to-date market analyses focused on IOS, identifying needs and suitable use cases. An overview of *Vertue* in the context of the Vega Space System is provided together with high-level system engineering results. The non-waterfall approach to the project, based on the lean, risk-driven development cycle is outlined as the key to a short time to market. Finally, the status of the project and future plans of development are presented.