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

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THE VERTUE ORBITAL PROPULSION MODULE AND THE EVOLVING LANDSCAPE OF THE IOS MISSIONS IN THE "NEW SPACE ECONOMY" FRAMEWORK

Abstract

Since the dawn of the 21st century, the paradigm of the "New Space Economy" has paved the way for a multitude of innovative economic activities and opportunities. The markets for active debris removal, life-extension, and Last Mile Delivery services are poised for substantial growth, with anticipated revenues reaching into the billions of US Dollars (USD) by the mid-2030s. Furthermore, the realm of in-orbit operations offers a plethora of possibilities, encompassing in-space manufacturing and assembly, satellite inspection and maintenance, tugging and towing, and payload download services—both within and beyond Earth's orbit. Looking ahead, activities in the cislunar and Martian regions are set to foster a deep space economy.

Finis Terrae, an innovative startup headquartered in Rome, is poised to take advantage of this opportunity by developing the Vertue Orbital Propulsion Module (OPM), a cutting-edge "green" orbital propulsion system currently designed to cater to the growing demand for in-orbit operations. This groundbreaking module harnesses the accessibility of space through the Vega family of European small launchers, providing a dependable gateway to space. The Vertue OPM represents a significant leap forward in space technology, serving as a "green" propulsion powerhouse for different missions - from in-orbit servicing to deep space exploration and landing. Its ingenious design, incorporating advanced composite materials and an intelligent tank arrangement, yields a remarkable enhancement in structural efficiency, surpassing current market competitors by up to 60%. This efficiency breakthrough translates into a substantial increase in payload mass for the same velocity increment. The foundation of the OPM's design and development rests on flexibility and modularity - key pillars that support a wide variety of sizes and propellant loadings. This adaptability allows the OPM to meet diverse customer requirements in terms of ΔV and payload mass, ensuring full compatibility with standard payload adapters from existing launchers in the market. These robust pillars position the Vertue OPM to undertake missions previously deemed unattainable for medium-small launchers currently available in the market, propelling it towards becoming a global benchmark in the sector.

In the final paper, through in-depth mission analyses, the anticipated performances, encompassing payload mass and velocity increment, will be outlined for the most promising scenarios. Special emphasis will be placed on addressing the constraints posed by the potential presence of spacecraft solar arrays, underscoring the adaptability of the Vertue OPM, even in the face of the most demanding missions within the New Space Economy framework.