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FIRST FLIGHT OF RAFTI ORBITAL REFUELING INTERFACE

Abstract

This paper presents data and results from the first flight of Orbit Fab's Rapidly Attachable Fluid Transfer Interface (RAFTI). The RAFTI service valve is a drop-in replacement for existing spacecraft fill/drain valves and enables in-orbit grapple/attachment and fuel transfer. The development of a robust orbital propellant supply chain is critical to accelerating the growth of government and commercial space activities. Widespread availability of spacecraft refueling has the potential to provide a number of revolutionary benefits. Existing high-value space assets could have their operational lives extended, as they will no longer be constrained by running out of propellant for maneuvering, and on-orbit servicing missions would become more efficient as servicing vehicles can be repeatedly reused after refueling between missions. A large orbital propellant supply would also enable cheaper mobility for spacecraft, allowing new missions and business models based on operational flexibility and frequent maneuvering. RAFTI is a key enabler for refueling as it provides a reliable interface for fuel transfer.

The RAFTI architecture has three main components. The RAFTI Service Valve (SV), which is the primary subject of this paper, serves as a passive fill/drain and orbital refueling valve. It is complemented by the RAFTI Space Coupling Half (SCH), which is a combined fluid transfer interface and grapple feature that attaches to the RAFTI service valve in space to enable fuel transfer, and the RAFTI Ground Coupling Half (GCH), which is used for ground fueling. The RAFTI SV is flying for the first time aboard Orbit Fab's Tanker 001 Tenzing spacecraft. Launching no earlier than June 1 2021, Tenzing is the world's first orbital propellant tanker and a testbed for key orbital refueling technologies. Tenzing is a 35 kg small satellite with a bus provided by Astro Digital carrying a supply of storable monopropellant, High Test Peroxide (HTP). Tenzing carries two RAFTI service valves, one for the spacecraft's primary propellant storage tank and one for the spacecraft's propulsion system. This paper presents information on RAFTI, its role in the Tenzing mission architecture, and data showing RAFTI's performance from flight and pre-flight testing.