

SPACE PROPULSION SYMPOSIUM (C4)
New Missions Enabled by New Propulsion Technology and Systems (6)

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RAM-EP SYSTEM CONCEPT FOR VERY LOW EARTH ORBIT MISSIONS

Abstract

The RAM-EP concept consists of a spacecraft equipped with a collection system (collector) for capturing the rarefied flow and an electric propulsion thruster for generating the required thrust. This combination is suggested for very low altitude applications where the atmospheric density might still represent a suitable source to limit or completely replace the propellant needs. The concept has been already investigated in past ESA studies but is now object of new ESA research programmes showing the renewed interest on this subject motivated by the progression in the performance of the electric propulsion systems. The most relevant advantage enabled by a RAM-EP system would be the extension of the lifetime of low orbiting Earth observation missions which could be capable of compensating drag during low altitude operation for an extended period of time. Nonetheless, a spacecraft equipped with a RAM-EP system should be designed to reduce as much as possible the effect of the atmospheric drag, whereas the need of gathering the propellant imposes a spacecraft architecture with a large frontal particle collector. The presence of the intake radically modifies the spacecraft geometry, imposing a number of different constraints and limitations related both to the attitude stability of the satellite and to the availability of a sufficient amount of surface for the solar arrays mounting. Accordingly, the identification of suitable space architecture represents one of the stepping stones towards the design of a representative RAM-EP system and test setup. The paper presents the most relevant mission and system aspect to estimate the advantages of a RAM-EP system able of exerting a significant thrust using the molecules available in the surrounding atmosphere. The reduction, or even complete elimination, of the propellant stored on-board will allow indeed allocating an higher amount of mass to other subsystems and to the payload avoiding at the same time the definition of a propellant limited mission lifetime. The study aims at prove that the RAM-EP concept provides a promising innovative solution to implement very low altitude (below 250km) and/or long lifetime LEO missions; the combination intrinsically relies on electric propulsion systems and could not be implemented by classical chemical means.