

IAF SPACE PROPULSION SYMPOSIUM (C4)  
New Missions Enabled by New Propulsion Technology and Systems (9)

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## SITAEEL'S ACTIVITIES ON THE DEVELOPMENT OF AIR BREATHING TECHNOLOGY

### Abstract

Since 2016, SITAEEL has been developing an Air-Breathing Electric Propulsion (RAM-EP) system. This innovative system allows to generate thrust in the upper atmosphere of either the Earth or other suitable celestial bodies without any need of on-board propellant. This result is obtained with a spacecraft flying at very low altitude (160-250 km for the Earth) where the incoming flow is collected by a collection stage and then accelerated by an electric thruster. The dissipative drag force caused by the surrounding atmosphere on the spacecraft can therefore be efficiently counteracted with a comparable level of thrust removing the main limitation on the mission lifetime as function of the stored propellant, critical for these mission scenarios. The possibility to operate in Very Low Earth orbits (VLEO) offers the opportunity to open new mission scenarios for space applications. This class of orbits could further strengthen the benefits of LEO thanks to the closer proximity to Earth's surface. In addition to the improved resolution of observation payloads, a VLEO mission would enable the investigation of the lower layers of Earth's atmosphere, provide more detailed information about Earth's gravitational field and open a brand new market niche for ultra-high speed telecommunication applications, IoT connections and more. Nonetheless, the possibility of an efficiently adoption of this system poses significant technological challenges among which: the design of an air breathing electric thruster compatible with atmospheric gas operation, the testing of the full system in a relevant environment reproducing the flight conditions on-ground. SITAEEL is actively working on the RAM-EP concept in a framework of two development programmes. The AETHER project (GA number 870436), funded by the European Commission through an

H2020 programme, has the main objective of developing an air breathing propulsion system able to maintain a spacecraft at very low altitude for extended time. In parallel, the national funded CLOSE project (ARS01\_0141) *aimsto investigate possible design of a platform based on this peculiar propulsion technology with a particular fo*