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MISSION AND SYSTEM DEFINITION OF THE INNOVATOR CUBESAT FOR GRAVITY AND ATMOPSHERIC SCIENCE

Abstract

The INNOVATOR (INtersatellite liNk fOr graVity and ATmOspheRic science) mission, funded by the Italian Space Agency (ASI) under the national CubeSat program ALCOR, aims to the in-orbit testing of an innovative payload, allowing very accurate radio science observations to enable space experiments in the field of gravity science (determination of planetary masses and gravity fields) and atmospheric science (determination of the properties of neutral and ionized atmospheres). The payload consists of an Inter-Satellite Link Transceiver (ISL-T) incorporating tracking, telemetry and control, as well as ranging and range-rate measurement functions. The in-orbit validation will foresee the launch of two 6U CubeSats, to be placed on the same Low Earth Orbit (LEO), with a relative variable distance depending on the phase of scientific observations. The two CubeSats will be constantly connected via radio by the ISL-T measurements, allowing gravity and high-altitude atmospheric profiling in LEO to experiment and validate the performance of the ISL-T payload.

The operations phase is supposed to last one year. In the first six months, the two CubeSats will fly at relative distances of approximately 30-50 km. Here, the ISL-T will be mainly used for ranging and range-rate measurements and to carry out short-range radio occultations to make atmospheric measurements at high altitudes, currently not available in Earth atmosphere models. In the second half of the operations phase, the two CubeSats will be gradually moved away so that the chord of the line of sight between them may reach the Earth surface. In this second phase, the science will focus on accurate radio occultations at increasingly lower altitudes to observe the Earth atmosphere properties with excellent spatial and temporal continuity.

INNOVATOR is undergoing the definition phase and is expected to achieve phase B1 goals in Q2 2024. In the final paper, the INNOVATOR mission and system definition status will be described by sharing the main outcomes achieved at the System Requirements Review (SRR) for both space and ground segments. The perspectives of future developments across the design and verification phases will be also presented in detail, with focus on planned breadboarding activities.