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Microgravity Experiments from Sub-Orbital to Orbital Platforms (3)

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MISTRAL -MICRO-SATELLITE WITH REENTRY CAPABILITY FOR AIR LAUNCH: A TINY SPACECRAFT FOR SEVERAL MISSIONS IN LEO

Abstract

MISTRAL fits into the broader range of re-entry systems for recovery and return on Earth of samples and others materials from space, that may become of great importance in the future. Indeed, with the recent conclusion of the NASA Space Shuttle program, this activity will depend in the near future only on the Russian Soyuz TMA capsule and to the quite new commercial Space-X Dragon Capsule, thus putting limits and economic constraints to space activities. In this scenario, the development of a low cost, easy to use, small capsule could be a convenient alternative for different scientific and technological missions. The payload should be in the order of 3 Kg and will be located into a pressurized canister, to ensure suitable conditions also for Life Science samples. The standard utilization could be sample return from ISS, using existing satellite jettison devices available in the JAXA experimental module (JEM Small Satellite orbital Deployer, JSSOD). The Small spacecraft (volume in the order of 30x30x40cm and 20-30 kg mass) will be transported into the ISS with the HTV, the ATV or the Dragon; it will be loaded with the sample to be returned to earth, installed in J-SSOD by crewmembers and passed with a Multi-Purpose Experiment Platform through the JEM airlock for retrieval by a small arm that supports capture, orientation and deployment operations. Other mission could be as a stand alone spacecraft launched in Low Earth Orbit, equipped with a small autonomous payload, exploiting the capability to return back to Earth. The capsule has a deployable structure that will be used both as an aero-breaking device for controlled orbital decay, and heat shield during the most demanding reentry phase. The deployable aerobrake will be modulated with autonomous on-board capabilities, for guidance and drag-modulated control in the orbital decay phase, to ensure the right approach to the atmosphere aero-capture point. The deployable "umbrella-like" structure will be integrated with other functional elements, such as solar cells, antennas, etc. Despite the domestic industry has in the past participated in activities aimed at developing re-entry spacecraft, so far a capsule with similar characteristics has never been developed, either in Italy or in Europe. The project will be carried out by a cluster including large industries, SMEs, research organizations and universities based in Campania Region (South Italy) to get the necessary know-how to plan the industrialization phase of the product, qualified and suitable for commercial applications.