

MICROGRAVITY SCIENCES AND PROCESSES (A2)
Microgravity Processes onboard Large Space Platforms (7)

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IRENE - ITALIAN RE-ENTRY NACELLE FOR MICROGRAVITY EXPERIMENTS

Abstract

IRENE project it is an Italian Space Agency (ASI) programme, now at its 0 phase, aimed to design and develop a small re-entry domestic spacecraft, realized by Italian SME (joined in the ALI consortium with the participation of Telespazio). The IRENE capsule main features are:

- a light weight (200 Kg at launch and 120 kg at re-entry)
- a recoverable and reusable re-entry module
- a large payload cargo capacity down to Earth (up to 40% of its re-entry mass)
- a very low ballistic coefficient and "wing" load
- a two parts heat shield composed by:
 - a fixed nose (made by Carbon-carbon or other equivalent TPS)
 - a deployable aero-brake (umbrella-like, made by special multi-layered fabric)

The phase 0 of the IRENE program encompasses: missions scenario definition, mission requirements definition, mission analysis, re-entry issues analysis, preliminary system and sub-systems requirements and design, aero-thermo-fluid dynamics analysis of re-entry phase, capsule stability analysis, preliminary TPS materials selection, TPS and aero-brake subsystem analysis, functional-technological demonstrator requirements definition, design and realization , to validate the proposed concept, ascertain its feasibility, define RTL. Among the possible mission scenarios independent scientific microgravity/EO mission, re-entry of scientific payloads from ISS, tethered satellite mission, were identified. The TPS materials were tested in the SPES hypersonic wind tunnel of Napoli University DIAS (Aerospace Engineering Department) in Italy, the demonstrator shall be tested in the SCIROCCO PWT (Plasma Wind Tunnel) at CIRA (Centro Italiano Ricerche Aerospaziali), Capua, Italy. The 0 phase IRENE programme is still ongoing at present, the latest activities successfully define a preliminary architecture for both the spacecraft and the scale model demonstrator, as well as the materials to be used as TPS (Thermal Protection System), respecting the project time. The purpose of the wind tunnel test campaigns is to verify and qualify a new re-entry methodology exploiting a deployable heat shield, allowing to reduce launch mass, launch volume, the re-entry heating and thermal protection issues. If successful this methodology

could have a relevant impact in the development and realization of future mini and micro satellites with re-entry capabilities.