

MICROGRAVITY SCIENCES AND PROCESSES (A2)
Microgravity Experiments from Sub-orbital to Orbital Platforms (3)

Author: Mr. Antonio Verga
European Space Agency (ESA), The Netherlands

SOUNDING ROCKETS: A SPECIAL PLATFORM FOR MICROGRAVITY RESEARCH

Abstract

ESA's scientific programme of Life and Physical Sciences in Space (ELIPS) includes a set of scientific investigations that do not require long microgravity periods but often special experimental boundary conditions. To this specific class of experiments ESA is offering a relatively fast access to microgravity flight opportunities by means of ballistic rockets that, thanks to their almost vertical ascent and plunge trajectory, draw a free-fall narrow parabola that may last either six or twelve minutes, depending on the kind of used rocket motor. Nowadays, TEXUS and MASER rockets both use a two-stage, solid-propellant motor (VSB30) produced in Brazil that can propel the payload of 400kg up to an altitude of 250km, out of which 280kg are typically assigned to modules for scientific research. MAXUS, the largest within ESA's family of sounding rockets uses a powerful single-stage, solid-propellant motor (Castor IVB) produced in USA that can reach altitudes as high as 750km with a total payload mass of 800kg, almost 500kg for science modules. ESA participated so far in more than 70 European Sounding Rocket missions for microgravity research with minimum residual accelerations of 10-5g in the fields of fundamental physics, combustion, materials processing and biology. The results have been of undisputed scientific value and have begun new roadmaps for more extensive science programs. ESA has developed increasingly complex and unique experiment modules (high temperature furnaces, in-situ x-ray modules, etc) for Sounding Rocket missions which allow unique experiments in space. Also the mission boundary conditions with excellent pre-/post-flight access, low safety requirements, real-time video and full telecommanding allow the implementation of extremely challenging technology and research pathfinder experiments. The paper presents the main features and some of the latest results of ESA's Sounding Rocket missions, and addresses the challenge of developing and operating payloads to meet a wide range of scientific objectives in both life and physical sciences within the given technical and logistical boundary conditions.