

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

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A BRIEF BUT POIGNANT FLIGHT IN SPACE: THE MASER-12 SOUNDING ROCKET

Abstract

Five experiments on a MASER sounding rocket were launched from ESRANGE in northern Sweden on 13 February 2012 in a slightly overcast sky, with a ground temperature of -15°C. Faster than most people take a coffee break, MASER-12 travelled 260 km upwards, provided six precious minutes of weightlessness, and landed safely back on Earth assisted by its parachutes. It took only 45 seconds for MASER-12 to leave the atmosphere. Once it ran out of propellant and the motor thrust exhausted, the mission had only just begun for the scientists watching on ground. They had about six minutes to run their experiments and collect data during the ballistic free fall. On this mission, MASER-12 felt the heat: one experiment used a furnace to melt a metal alloy to 700°C. At this temperature the mixture of aluminium and copper turned liquid before being chilled down and solidifying into crystal clusters. A live X-ray camera captured this dramatic experiment for analysis. MASER-12 also featured experiments in molecular biology. The weightless behaviour of human immune-cells was compared with that of their counterparts on ground. Another experiment looked at how blood transports cells in a bio-mimetic liquid. By observing how cells behave in microgravity, scientists gain a better understanding of how they work on Earth. Lastly, a pure inert mixture of liquid and gaseous Fluor-Ethane was observed to help understand boiling and heat transfer in fuel tanks for the future generation of cryogenic upper stage motors. In the vast wilderness of northern Sweden, it helps that a sat-navigation device comes as standard. The retrieval team pinpointed the landing site and the experiments were returned by helicopter within a couple of hours after touchdown. The unpopulated area around ESRANGE means that rockets can descend with no danger of causing harm. Despite its remote location, the town of Kiruna is only 45 km away, providing the logistic support needed for a launch site. Conducting research in microgravity is an important task for ESA. The information from the superheated metal experiment, for example, will bring us closer to creating lighter materials for use in automotive industries or as bone implants. The paper presents the main technical features of the MASER-12 mission and some of the achieved results. It also 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 boundaries.