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THE 50 PARABOLIC FLIGHT CAMPAIGNS OF THE EUROPEAN SPACE AGENCY TO CONDUCT
SHORT DURATION MICROGRAVITY RESEARCH EXPERIMENTATION

Abstract

Aircraft parabolic flights provide repetitively up to 20 seconds of reduced gravity during ballistic flight manoeuvres. Parabolic flights are used to conduct short microgravity investigations in Physical and Life Sciences and in Technology, to test instrumentation prior to space flights and to train astronauts before a space mission. The use of parabolic flights is complementary to other microgravity carriers (drop towers, sounding rockets), and preparatory to manned space missions. The European Space Agency (ESA) has organized since 1984 fifty parabolic flight campaigns for microgravity research experiments utilizing six different airplanes. 600 experiments were successfully conducted during more 4500 parabolas, representing a cumulating time of 25 h of weightlessness, equivalent to more than 16.6 low Earth orbits. The experiments spanned several fields in Physical Sciences and Life Sciences, namely Fluid Physics, Combustion Physics, Material Sciences, fundamental Physics and Technology tests, Human Physiology, cell and animal Biology, and technical tests of Life Sciences instrumentation. Since 1997, the Airbus A300 'Zero G' is used in Europe for short microgravity investigations by ESA, the French space agency CNES, the German Space Agency DLR, the Japanese Space Agency JAXA and by industrial customers. The Airbus A300 is the largest airplane in the world used for this type of experimental research flight. This paper presents the short duration microgravity research programme of ESA. The experiments conducted during these campaigns are summarized, and the different airplanes used by ESA are shortly presented. The technical capabilities of the presently used aircraft by ESA, the Airbus A300 Zero-G, are addressed. Some of the Physical Science and Technology experiments performed during the last ESA campaigns are presented to show the interest of this unique microgravity research tool to complement, support or prepare microgravity physical investigations during space flights.