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NOVESPACE'S AIRBUS A310 ZERO G: A STATE-OF-THE-ART RESEARCH FACILITY FOR EASY ACCESS TO SCIENCE IN MICROGRAVITY

Abstract

Microgravity is a unique environment for studying physical, biological and chemical phenomena that are usually masked or modified by Earth's 1g environment. The work carried out by scientists in microgravity enriches fundamental knowledge in various disciplines, and has innovative applications in technological fields, industrial processes and medicine for everyone on Earth.

To conduct research in microgravity, scientists have access to different infrastructures: drop towers, parabolic flight aircraft, sounding rockets, space capsules, ISS, etc. These facilities each offer different levels of quality and duration of microgravity, for a cost of access which varies from a few thousand to several million euros. Therefore, choosing the right platform is essential for scientists.

For more than 30 years, Novespace, a subsidiary of CNES (French space agency), has been operating parabolic flights for the scientific community on board its successive aircraft: a Caravelle, an Airbus A300 and nowadays the Airbus A310 Zero G. This aircraft has been specially set up to offer zero or partial gravity flights. It features an experimental area with a surface of $100m^2$, which can accommodate 40 scientists and 12 experiments, for a total payload mass of 4 metric tons. Standardized electrical panels, mechanical interfaces and vent lines allow researchers to carry out experiments in extremely varied disciplines: physiology, combustion, cold plasmas, quantum physics, etc. The pilots are specifically trained to perform the parabolic maneuver, which allows scientists to benefit from excellent levels of microgravity.

This oral presentation offers an informed comparison of the different ways to perform experiments in microgravity in terms of cost, ease of access and performance. It details more specifically the characteristics of the Airbus A310 Zero G and the different programmatic approaches for accessing Novespace's reduced-gravity flights by laboratories, private entities and even students. It also gives concrete examples of experiments that have recently flown on board, to illustrate the liveliness and diversity of current microgravity research. Finally, it draws some lessons from 30 years of parabolic flights in Europe and provides an outlook on the future and the evolution of scientific research in weightlessness.