Atmospheric Science Payloads for Suborbital Flights. C. Lockowandt and S Grahn, Swedish Space Corporation, Solna strandväg 86, 17104 Solna, Sweden, christian.lockowandt@ssc.se, sven.grahn@ssc.se

Introduction: The upcoming suborbital flights will offer a new possibility to perform experiments at an altitude around 100 km and in microgravity for approximately 3 minutes. The new concept also offers the possibility to repetitive flights, perhaps with two flights per day. The complexity of the experiment payloads could be compared with facilities used on parabolic flights and sounding rockets. Swedish Space Corporation is developing and operating experiment payloads for parabolic flights and sounding rockets since 30 years.

Atmospheric studies

Atmospheric physics studies from suborbital vehicles are nowadays often performed by optical means. Even the local environment is sampled by directing a beam of light (broadband or narrowband spectrum) into a volume outside the bow shock of the vehicle. A photometer or spectrometer on the vehicle then detects the response from the illuminated volume. In this way disturbing effects from the vehicle itself, including the inevitable out gassing from the rocket motor, can be avoided. Similar methods and precautions need to be taken when using piloted suborbital vehicles for atmospheric physics. The attitude of the vehicle needs to be controlled during the exoatmospheric portion of the flight to point the optical instruments in the appropriate direction.

These optical methods are often sensitive to sunlight or moonlight. Therefore measurements need to be taken during the night when the Moon is below the horizon. Aurora, if not the objective of the experiment, also needs to be absent. Mass spectrometers have successfully been flown on sounding rockets for atmospheric compositions studies and they are a good candidate to fly on piloted suborbital vehicles and are not as sensitive to illumination conditions as purely optical methods. However, mass spectrometers must still be protected from out gassing from the vehicle and be pointed along the direction of flight.

Synoptic atmospheric measurements at several places around the world will by definition require that the piloted suborbital vehicle can operate in all kinds of illumination conditions: night, day and twilight.

Studying short-lived phenomena in near-earth space

Using piloted suborbital vehicles for investigating very short-lived phenomena in the near-earth environment may present new challenges. Very often sounding rockets studying ionospheric or magnetosopheric phenomena are held in readiness for long periods awaiting the correct scientific conditions. Even so, the time-of-flight needed to reach the appropriate altitude may still be such that the phenomena of interest has vanished by the time the rocket reaches its target position in space.