Operation of an ultralight weightshift aircraft for environmental research: Properties, advantages and lessons learned

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The KIT Institute for Meteorology and Climate Research (IMK-IFU) operates an ultralight aircraft for investigations of climate relevant processes in the lower troposphere, the smallest unit in the European Fleet for Airborne Research (www.EUFAR.net). The aircraft, a double seater is able to carry a scientific payload of about 50 kg instead of the passenger. The instrumentation is powered from a slightly enlarged generator providing up to 800 W for the science payload. Instrumentation is installed in instrument pods (15 kg each) hooked up to the open nacelle on both sides of the pilots seat, in the nose of the nacelle, under the pilots seat, or on a gimbaled platform on top of the wing. The whole package contains instruments for spectrally resolved radiation fluxes, (micro)meteorology, trace gas measurements, size resolved aerosol measurements and aerosol optical properties. Typical applications are 3 dimensional regional scale studies of climate relevant air pollution including vertical profiles up to FL 140.

The aircraft is equipped with the required aviation instrumentation necessary for controlled VFR flights in all airspaces accessible under VFR rules, where it can be flown with a JAR-FCL private pilots licence. German rules allow explicitely the use of ultralight aircraft for such scientific operations. This is not the case in all foreign countries, e.g. Italy recently put new rules into force prohibiting all activities except sport and recreation for ultralight aircraft even when they are registered outside of Italy. Prior to operation in a foreign country typically special permits are required to operate from large regional or international airports. Nevertheless several campaigns were flown in many European countries and also overseas in Mexico (MILAGRO) and in China (Inner Mongolia).

Certification for instrumentation is necessary as with all other aircraft, however the requirements are relatively easy to fulfill as even external payloads do not change the flying properties of the aircraft. However certain limitations are obvious. Due to the low cruise speed of ~ 50 kts operation is limited to low wind situations and crosswind for landing should not exceed 15 kts. As the aircraft has an open nacelle operation is also limited to fair weather conditions. However, as the aircraft turned out to be a suitable mobile platform for measurements within the boundary layer.