EGU22-11858, updated on 14 Aug 2022
https://doi.org/10.5194/egusphere-egu22-11858
EGU General Assembly 2022

An unmanned aircraft system for (offshore) wind energy research

Ines Weber[1], Andreas Platis[1], Kjell zum Berge[1], Martin Schön[1], Jakob Boventer[1], Bughsin Djath[2], Johannes Schulz-Stellenfleth[2], and Jens Bange[1]

[1]University of Tuebingen, ZAG, Environmental Physics, 72076, Tuebingen, Germany
[2]Helmholtz-Zentrum Hereon, Institute of Coastal Systems - Analysis and Modeling, 21502 Geesthacht, Germany

The Multipurpose Airborne Sensor Carrier (MASC) is a fixed-wing unmanned aircraft system (UAS) that has been continuously developed and used for in-situ, high-resolution flight measurements of atmospheric variables such as wind, temperature, humidity as well as trace gas and particle concentrations by the Environmental Physics group at University of Tübingen. The most recent innovation in the MASC-series is the MASC-V type vertical takeoff and landing UAS. It has been designed in cooperation with ElevonX d.o.o.. Compared to its predecessor, MASC-3, it can automatically takeoff and land on small patches of land while carrying an identical atmospheric measurement payload. This capability, complemented by an enhanced safety and operational concept, allows for deployment in offshore applications. Particularily, MASC-V has demonstrated safe operation beyond visual line of sight (BVLOS) from the remote safety pilot in offshore applications within the EUs new legal framework introduced in 2020.

Before its first offshore mission, MASC-V underwent a full system validation against a meteorological tower at the German Weather Service (DWD) Observatory site at Falkenberg, Germany. Offshore measurements were conducted from the German offshore island Heligoland at the Testfield for Maritime Technologies in cooperation with the Fraunhofer Institute for Applied Material Science in September 2021. The goal of the Heligoland campaign was to validate the remote sensing of sea surface wind measurements by Synthetic Aperture Radar (SAR) satellites of the Sentinel-1 formation at low flight altitudes (20 m - 30 m). SAR satellites can deliver detailed wind data over large areas such as the German Bight including for example wind farm wake effects. Direct validation of these results is difficult with other in-situ techniques. Buoys and measurement towers or platforms can provide stationary data. Aerial measurements with manned aircraft are only possible at higher altitudes. The new UAS data provide the first aerial in-situ SAR validation measurement at low altitude. Additionally, we have demonstrated the capabilities of VTOL fixed-wing UAS for vertical profiling as well as to operate tens of kilometers away from ground personell over open water.