

# Aerospace Europe Conference 2023

## Joint 10<sup>th</sup> EUCASS – 9<sup>th</sup> CEAS Conference

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Abstract #XXX (to be filled by the organizers)

Preferred Topics: REUSYS (several papers for ReFEx are were submitted – a dedicated session would be great)

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Type: Oral / ~~Poster~~ (select)

Status of corresponding author: Regular / ~~Student~~ (select)

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3AF / AAAR / AIAE / AIDAA / CzAeS / DGLR / FTF / NVvL / PSAA / RAeS / SVFW / EUROAVIA

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### Title

## ReFEx: Reusability Flight Experiment – A Demonstration Experiment for Technologies for Aerodynamically Controlled RLV Stages

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### Abstract

In November 2021 the ReFEx project passed the Critical Design Review (CDR) and is undergoing final integration and testing at the Institute of Space Systems in Bremen. The German Aerospace Center (DLR) is developing this flight experiment since 2018 as a technology demonstrator for aerodynamically controlled RLV stages. The flight experiment will take place in 2024 from Koonibba Test Range (KTR) in Southern Australia using a VSB-30 sounding rocket. It will inject ReFEx into a trajectory typical of returning stages.

Since the main means of control are aerodynamic actuators only (contrary to classical propulsive means of stage return) several specific technologies required for this type of reusable stage will be tested. This includes the demonstration of a heading change of more than 30°, providing not only valuable flight data at the other end of the spectrum for RLVs (Reusable Launch Vehicle) from propulsive return flights [1], but also added capability with very flexible divert capabilities.

The dimensions of ReFEx are a length of 2.7 m, a wingspan of 1.1 m, a mass of approx. 400 kg and is very densely packed with internal systems [1]. In addition, the vehicle features articulated main wings folded under a main fairing. Only these special adaptations allow the use of the cost effective unguided VSB-30 sounding rocket.

This paper provides an update of the flight experiment since its last presentation at the EUCASS in 2019, highlighting the main mission goals, challenges in terms of mission planning as well as the AIV activities currently underway at the Institute of Space Systems in Bremen. In addition, light will be shed on the procedures used to estimate the reliability of the experimental vehicle. The result of this analysis leads to failure response modes, which are a key factor in the flight safety analysis, which is described in more detail in a dedicated paper.

### References

[1] Bauer, W., Rickmers, P., Kallenbach, A., Stappert, S., Wartemann, V., Merrem, C. H-J., Schwarz, R., Sagliano, M., Grundmann, J. T., Flock, A., Thiele, T., Kiehn, D., Bierig, A., Windelberg, J., Ksenik, E., Bruns, T., Ruhe, T., Elsässer, H.: DLR Reusability Flight Experiment ReFEx, *Acta Astronautica* 168 (2020) 57–68, <https://doi.org/10.1016/j.actaastro.2019.11.034>