

IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)  
Future Space Transportation Systems Verification and In-Flight Experimentation (6)

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THE REUSABILITY FLIGHT EXPERIMENT – REFEX: AGILE AIV PROCESSES FOR  
PROTOTYPE FLIGHT EXPERIMENTS**Abstract**

In November of 2021 ReFEx passed the CDR close-out and progressed into the final phase before flight, assembly integration and verification (AIV). The experiment has been under development at the German Aerospace Center (DLR) since 2018 and is a technology demonstrator for aerodynamically controlled RLV stages. It will be launched in 2023 on a VSB-30 sounding rocket, which will inject ReFEx into a trajectory typical of such stages. The launch site will be Koonibba Test Range (KTR) in Southern Australia.

Several key technologies required for future reusable stages that rely heavily on aerodynamic means of control will be tested. This includes the demonstration of a heading change of more than 30 degrees, providing not only valuable flight data at the other end of the spectrum for RLVs (Reusable Launch Vehicle) from propulsive return flights, but also added capability with very flexible divert capabilities [1].

To be able to use the VSB-30 the vehicle needed to be compact to remain within the limited volume available. As such it has 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]. The paper will give an update of the flight experiment and will focus on the AIV methods used. Key challenges in this regard are the employed model philosophies and corresponding validation steps. The hybrid approach taken could be an interesting template for other flight experiments aiming to strike a balance between suitable reliability and the unknowns of a prototype technology demonstrator. To aid in this the AIV processes are augmented with a novel information management system, robotically assisted integration, core avionics test benches and augmented reality applications. ReFEx is the first flight system to be assembled in the DLR Bremen making use of these new approaches. As such the processes will be monitored throughout against key performance indicators to improve process efficiency for future projects.

[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>