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HYPERSONIC FLIGHT EXPERIMENT REFEX: STATUS AND FUTURE PERSPECTIVES

Abstract

The hypersonic flight experiment ReFEx (Reusability Flight Experiment) is currently under development at the German Aerospace Center (DLR). The project passed the preliminary design review in 2019 and several subsystem CDRs will be completed this year. The hypersonic demonstrator is to be launched on a VSB-30 sounding rocket using Brazilian solid motors with the flight being scheduled for 2022. The main goals of the ReFEx-project are the demonstration of a controlled autonomous re-entry flight from hypersonics down to subsonics, spanning the typical range of winged RLV-booster stages. Several key technologies required for future reusable winged first stage systems are to be tested in flight [1].

The experimental hypersonic re-entry segment has a length of 2.7 m, a wingspan of 1.1 m, a mass of approx. 400 kg, and is accommodating all subsystems in a densely integrated fuselage [1, 2]. Subsystem definitions are progressing and many of the designs can be frozen and their manufacturing and assembly starts.

The paper summarizes the latest status of major characteristics of ReFEx, the planned reentry corridor, flight and range safety considerations and assessments on the vehicle's controllability. Examples of the numerical and experimental aerodynamic configuration analyses will be shown.

The second part of the paper investigates potential next demonstration steps for winged RLV. Intermediate steps on larger and more powerful launch systems are evaluated with the aim of having a liquid-rocket powered demonstrator stage with multiple-flight reusability ready before the end of this decade. A preliminary version of the technology development roadmap will be presented.

[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 [2] Bauer, W., Schorr, E.; Rittweger, A.; Rickmers, P.: Numerical Crash Simulation of the Reusability Flight Experiment ReFEx, IAC-19-D2.6.4, 70th International Astronautical Congress (IAC), Washington D.C., United States, 21-25 October 2019