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ReFEx

Reusability Flight Experiment

Brief description

The Reusability Flight Experiment is a technology demonstrator for future winged reusable stages. The model shows ReFEx in its re-entry configuration after being deployed from its carrier rocket. The flight experiment will increase DLRs know how of RLV (Reusable Launch Vehicles).

Goals

Reusable space transportation systems represent the future of access to space. ReFEx is a technology demonstrator for a winged reusable stage. The aerodynamic design as well as the autonomous guidance from hypersonic- down to subsonic velocities are of special interest in the project.

Involved

Multiple DLR Institutes
External Partner (Launchsite):
Southern Launch, Australia

Application

- Reusable space transportation systems
- Advanced guidance, navigation and control
- Special aerodynamic design for a wide velocity envelope
- Advanced sensors for health monitoring

Perspectives

- Reducing space transportation costs
- Unique know-how gained by DLR
- Invaluable knowledge for helping to choose the future European reusable space transportation system.

Facts and figures

- **Project duration:** 8 years
- **Launch:** 2026 in South Australia
- **Length:** 2,7 m **Span:** 1,05 m
- **Mass:** 450 kg
- **Apogee:** ≈130 km
- **Velocity:** Mach 5 down to 0,5
- **Subsystems:** Autonomous GNC, Reaction Control System, specialized actuators, Flush-Air-Data-System, high speed data acquisition, compact Data Handling System und Telecommunication.

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Reusability Flight Experiment

The Reusability Flight Experiment (ReFEx) is being developed by DLR to provide flight and design data on, as well as operational experience with, aerodynamically controlled reusable stages. As such ReFEx will be a small technology demonstrator and is slated for launch in 2025. The experiment will be launched on a VSB-30 sounding rocket to altitudes and velocities similar to a first staging event and will then attempt a return flight along a trajectory comparable to a returning winged first stage RLV, transitioning from hypersonic speeds down to subsonic flight.

ReFEx is about 2.7 m in length, has a wingspan of about 1.1 m and has a mass of approx. 450kg. It is controlled by a nitrogen cold gas reaction system (RCS) while outside the atmosphere and shall transition to aerodynamic control surfaces (canards and rudder) when atmospheric effects come into play. The maximum Mach number reached during the re-entry maneuver is about Mach 5. Besides being able to fly an optimized trajectory (generated autonomously on-board) to reduce the thermal and mechanical loads, ReFEx shall demonstrate maneuverability by flying a turn of at least 30° with respect to the original heading measured from entry interface. The entry interface was placed at 60 km altitude for the purposes of this experiment, as the effects of the atmosphere become significant at this altitude for the foreseen trajectory.

The key technologies demonstrated in this vehicle are, amongst others: aerodynamic design of a vehicle capable of stable flight through many flow regimes, guidance, navigation and control (GNC) capable of on board generation of an optimized trajectory, the seamless transition between extra- and intra-atmospheric flight controls and health monitoring of the vehicle status during flight using advanced sensors such as Fiber Optic Sensors (FOS) and Flush Air Data System (FADS).