Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Flow structure and unsteadiness in the supersonic wake of a generic space launcher[1] ANNE-MARIE SCHREYER, SÖREN STEPHAN, ROLF RADESPIEL, TU Braunschweig — At the junction between the rocket engine and the main body of a classical space launcher, a separation-dominated and highly unstable flow field develops and induces strong wall-pressure oscillations. These can excite structural vibrations detrimental to the launcher. It is desirable to minimize these effects, for which a better understanding of the flow field is required. We study the wake flow of a generic axisymmetric space-launcher model with and without propulsive jet (cold air). Experimental investigations are performed at Mach 2.9 and a Reynolds number $Re_D = 1.3 \cdot 10^6$ based on model diameter D. The jet exits the nozzle at Mach 2.5. Velocity measurements by means of Particle Image Velocimetry and mean and unsteady wall-pressure measurements on the main-body base are performed simultaneously. Additionally, we performed hot-wire measurements at selected points in the wake. We can thus observe the evolution of the wake flow along with its spectral content. We describe the mean and turbulent flow topology and evolution of the structures in the wake flow and discuss the origin of characteristic frequencies observed in the pressure signal at the launcher base. The influence of a propulsive jet on the evolution and topology of the wake flow is discussed in detail.

[1]The German Research Foundation DFG is gratefully acknowledged for funding this research within the SFB-TR40 "Technological foundations for the design of thermally and mechanically highly loaded components of future space transportation systems."

Anne-Marie Schreyer
TU Braunschweig

Date submitted: 22 Jul 2015 Electronic form version 1.4