Supersonic Parachute Aerodynamic Testing and Fluid Structure Interaction Simulation

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The ESA Aerodynamics of Download Systems: Parachutes program aims to expand the knowledge of parachute inflation and flying characteristics in supersonic flows using wind tunnel testing and fluid structure interaction to develop new inflation algorithms and aerodynamic databases.

The ESA Aerodynamics of Download Systems: Parachutes program aims to expand the knowledge of parachute inflation and flying characteristics in supersonic flows. Wind tunnel tests have been conducted to extend the available database and increase understanding of parachute performance at supersonic velocities, varying parameters in a systematic way. Scaled model parachutes were tested in the CNRC 1.5 m by 1.5 m Trisonic wind tunnel in Ottawa, Canada.

The tests gathered data on inflation, inflation stability, drag coefficient and general flight stability at Mach numbers between 1.6 and 2.2 in the wake of a probe of similar configuration to Stardust. Parachute forces were measured and visual data obtained using high speed, standard video and Schlieren.

The model Disk-Gap-Band (DGB) parachutes had diameters of 1.5 and 3.0 times the probe diameter and were flown at trailing distances ranging from 7.5 to 10.5 forebody diameters.

In support of the post-test analysis and evaluation of the parachute flying characteristics, fluid structure interaction (FSI) simulations of some of the tests have been performed to reconstruct and aid understanding of parachute performance.

The paper will detail the wind tunnel tests conducted and present the results obtained. The results are compared to results from supersonic wind tunnel testing of the same parachute configuration conducted for the ESA ExoMars mission at the 10’ x 10’ NASA Glenn tunnel. FSI simulations will be described and results presented.

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