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Author: Prof. Bingyan Chen
China Academy of Aerospace Aerodynamics (CAAA), China, chen_bingyan@hotmail.com

AERODYNAMIC DATABASE DESIGN AND FLIGHT DATA ANALYSIS OF A WAVERIDER
VEHICLE

Abstract

Waverider configuration has been studied intensively since the concept was introduced by Nonweiler in 1959. Waverider is believed to be the ideal hypersonic vehicle configuration due to its high lift-to-drag ratio characteristics. However, application of waverider configuration in practical vehicles has yet to be seen. A waverider vehicle was developed as a flight test demonstrator for practical waverider configuration. One of the main purposes of the flight test project is to demonstrate the feasibility of waverider configuration in practical hypersonic applications. The demonstrator was boosted by a solid rocket to hypersonic speed. When the preset flight test window conditions were met, the demonstrator was released to free flight after the cowling ejection and stage separation. The demonstrator then performed a predesigned flight trajectory with its automated control system. A reliable and accurate aerodynamic database is the key to ensure the demonstrator flies along the predesigned trajectory. In this paper the methodology of the establishment of the aerodynamic database of the waverider vehicle is introduced. The aerodynamic data was mainly obtained with CFD simulations. Wind tunnel experiments were conducted at selected -conditions for the validation of the CFD data. Post-fly data analysis was conducted and the analysis results show that the real flight data falls within the uncertainty band given by the aerodynamic database.