Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Numerical flow simulation of a reusable sounding rocket during nose-up rotation KAZUTO KUZUU, KEIICHI KITAMURA, KEIICHIRO FUJIMOTO, EIJI SHIMA, Researcher — Flow around a reusable sounding rocket during nose-up rotation is simulated using unstructured compressible CFD code. While a reusable sounding rocket is expected to reduce the cost of the flight management, it is demanded that this rocket has good performance for wide range of flight conditions from vertical take-off to vertical landing. A rotating body, which corresponds to a vehicle's motion just before vertical landing, is one of flight environments that largely affect its aerodynamic design. Unlike landing of the space shuttle, this vehicle must rotate from gliding position to vertical landing position in nose-up direction. During this rotation, the vehicle generates massive separations in the wake. As a result, induced flow becomes unsteady and could have influence on aerodynamic characteristics of the vehicle. In this study, we focus on the analysis of such dynamic characteristics of the rotating vehicle. An employed numerical code is based on a cell-centered finite volume compressible flow solver applied to a moving grid system. The moving grid is introduced for the analysis of rotating motion. Furthermore, in order to estimate an unsteady turbulence, we employed DDES method as a turbulence model. In this simulation, flight velocity is subsonic. Through this simulation, we discuss the effect on aerodynamic characteristics of a vehicle's shape and motion.

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Date submitted: 03 Aug 2010 Electronic form version 1.4