Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Fluid-thermal validation of a high-fidelity multi-physics computational tool[1] CHRISTOPHER OSTOICH, DANIEL BODONY, PHILIPPE GEUBELLE, University of Illinois at Urbana-Champaign — In order to efficiently design any vehicle, a detailed knowledge of the potential conditions it will see during operation is essential, especially for sustained hypersonic flight. Traditionally, experimental research supplemented with semi-analytical modeling provided the necessary, reliable information to create effective designs. Recently, designs are being pushed outside the existing experimental datasets available for model calibration and there exists debate whether new experiments are possible. There is thus more emphasis being placed on computation-based investigations of the performance of various subsystems. Without sufficient experimental evidence to validate the numerical models, it is difficult to place the necessary confidence in the computational results needed to produce feasible designs. Research is underway to produce a high-fidelity, multi-physics validated computational tool to make predictions of structural-thermal response in the hypersonic regime. To validate the accuracy of the new code, a coupled fluid-thermal simulation is being conducted to reproduce results from an experiment in the NASA Langley 8-foot high-temperature tunnel.

[1]Supported by the U.S. Air Force Research Laboratory Air Vehicles Directorate under contract number FA8650-06-2-3620.

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Date submitted: 02 Aug 2010 Electronic form version 1.4