Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Naphthalene Planar Laser-Induced Fluorescence Imaging of Orion Multi-Purpose Crew Vehicle Heat Shield Ablation Products[1]
CHRISTOPHER S. COMBS, NOEL T. CLEMENS, The University of Texas at Austin, PAUL M. DANEHY, NASA Langley Research Center — The Orion Multi-Purpose Crew Vehicle (MPCV) calls for an ablative heat shield. In order to better design this heat shield and others that will undergo planetary entry, an improved understanding of the ablation process is required. Given that ablation is a multi-physics process involving heat and mass transfer, codes aiming to predict heat shield ablation are in need of experimental data pertaining to the turbulent transport of ablation products for validation. At The University of Texas at Austin, a technique is being developed that uses planar laser-induced fluorescence (PLIF) of a low-temperature sublimating ablator (naphthalene) to visualize the transport of ablation products in a supersonic flow. Since ablation at reentry temperatures can be difficult to recreate in a laboratory setting it is desirable to create a limited physics problem and simulate the ablation process at relatively low temperature conditions using naphthalene. A scaled Orion MPCV model with a solid naphthalene heat shield has been tested in a Mach 5 wind tunnel at various angles of attack in the current work. PLIF images have shown high concentrations of scalar in the capsule wake region, intermittent turbulent structures on the heat shield surface, and interesting details of the capsule shear layer structure.

[1]This work was supported by a NASA Office of the Chief Technologist's Space Technology Research Fellowship (NNX11AN55H)

Christopher Combs
The University of Texas at Austin

Date submitted: 30 Jul 2013 Electronic form version 1.4