Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Visualization of Capsule Reentry Vehicle Heat Shield Ablation using Naphthalene Planar Laser-Induced Fluorescence Imaging[1]
CHRISTOPHER COMBS, NOEL CLEMENS, The University of Texas at Austin, PAUL DANEHY, NASA Langley Research Center — NASA has continued interest in the study of ablation owing to the need to develop suitable thermal protection systems for spacecraft that undergo planetary entry. Ablation is a complex multi-physics process, and codes that predict it require a number of coupled submodels, each of which requires validation. For example, Reynolds-averaged Navier Stokes (RANS) and large-eddy simulation (LES) codes require models of the turbulent transport of ablation products under variable compressibility and pressure gradient conditions. A new technique has been developed at The University of Texas at Austin that uses planar laser-induced fluorescence (PLIF) of a low-temperature sublimating ablator (naphthalene) to enable visualization of the ablation products as they are transported in a boundary layer. While high temperature ablation is extremely difficult to recreate in a laboratory environment, low temperature ablation creates a limited physics problem that can be used to simulate the ablation process. In the current work a subscale capsule reentry vehicle model with a solid naphthalene heat shield is tested in a Mach 5 wind tunnel. PLIF imaging reveals the distribution of the ablation products as they are transported into the boundary layer and over the capsule shoulders.

[1]Work supported by NASA Space Technology Research Fellowship Program under grant NNX11AN55H.

Christopher Combs
The University of Texas at Austin

Date submitted: 04 Aug 2012 Electronic form version 1.4