SPRITE: A TPS TEST BED FOR GROUND AND FLIGHT

D. K. Prabhu, P. Agrawal, K. Peterson, G. Swanson, K. Skokova and N. Mangini
ERC, Inc.
NASA Ames Research Center, Moffett Field, CA
dinesh.k.prabhu@nasa.gov

D. M. Empey and S. Gorbunov
Sierra Lobo, Inc.
NASA Ames Research Center, Moffett Field, CA
daniel.m.empey@nasa.gov

E. Venkatapathy
Entry Systems and Technology Division
NASA Ames Research Center, Moffett Field, CA
ethiraj.venkatapathy-1@nasa.gov

Engineers in the Entry Systems and Technology Division at NASA Ames Research Center developed a fully instrumented, small atmospheric entry probe called SPRITE (Small Probe Reentry Investigation for TPS Engineering). SPRITE, conceived as a flight test bed for thermal protection materials, was tested at full scale in an arc-jet facility so that the aerothermal environments the probe experiences over portions of its flight trajectory and in the arc-jet are similar. This ground-to-flight traceability enhances the ability of mission designers to evaluate margins needed in the design of thermal protection systems (TPS) of larger scale atmospheric entry vehicles.

SPRITE is a 14-inch diameter, 45° sphere-cone with a conical aftbody and designed for testing in the NASA Ames Aerodynamic Heating Facility (AHF). The probe is a two-part aluminum shell with PICA (phenolic impregnated carbon ablator) bonded on the forebody and LI-2200 (Shuttle tile material) bonded to the aftbody. Plugs with embedded thermocouples, similar to those installed in the heat shield of the Mars Science Laboratory (MSL), and a number of distributed sensors are integrated into the design. The data from these sensors are fed to an innovative, custom-designed data acquisition system also integrated with the test article.

Two identical SPRITE models were built and successfully tested in late 2010-early 2011, and the concept is currently being modified to enable testing of conformable and/or flexible materials.

Figure 1: SPRITE model prior to testing in a plasma flow
Figure 2: SPRITE model in a plasma flow
Figure 3: SPRITE model after exposure to plasma flow