WHITE PAPERS FOR THE NEXT DECADAL SURVEY: THERMAL PROTECTION SYSTEMS AND INSTRUMENTATION.

M. J. Gasch[1], H. H. Hwang[1], D. T. Ellerby[1], E. Venkatapathy[1], [1]NASA Ames Research Center, Moffett Field, CA, USA (matthew.j.gasch@nasa.gov)

Introduction: NASA is anticipated to commission the next Planetary Science Decadal Survey (PSDS) with preparation expected in early calendar year 2020. The new PSDS will outline the priorities of science missions for the decade spanning 2023-2032. For the previous PSDS [1], the science and technology communities have been invited to submit white papers to the PSDS sub-panels as background information to guide the PSDS recommendations. The National Research Council has previously stated that white papers that represent the opinion of many authors from different institutions carried more significance and weight, and the recommendations from the previous PSDS attempted to reflect more of a consensus opinion.

In 2009, a total of 4 white papers were submitted to the PSDS panels regarding thermal protection system (TPS) readiness for missions [2] – [5], as well as one on TPS instrumentation [6]. The TPS readiness papers were co-authored by 90 individuals from many institutions. These white papers surveyed the TPS materials for both forebody and afterbody of a probe and analyzed the suitability of materials for missions to each destination. In addition, each paper outlined the ground testing required and ongoing technology development. Recommendations were provided for further technology development and ground test capability in order to fulfill future missions.

Planning for Venus and the next PSDS: Many changes have occurred in the past 10 years with regard to TPS materials and instrumentation in support of Venus missions. After a long period of absence of US Venus missions, fully dense Carbon-Phenolic materials were allowed to atrophy. Qualified raw materials are no longer available and fabrication skills have not been maintained, thus heritage Carbon-Phenolic for a blunt body aeroshell is no longer available.

However, new materials and systems have been developed and tested, such as the high density material Heatshield for Extreme Entry Environment Technology (HEEET), and new capabilities for ground testing for high heating and high pressures have been added. The 3-inch nozzle at the Ames arc jet can now test at heat fluxes and pressures for most proposed Venus trajectories which will enable entry system certification. NASA has also flown several TPS instrumentation suites, such as MEDLI and EFT-1.

In order to provide the PSDS sub-panels with the most current information about the state-of-the-art suitability for TPS materials for Venus entry missions, we are beginning to update and draft a new white paper that will consider TPS materials for both atmospheric probes and large aeroshells for landers. We will present the outline for material to be covered in the white papers, and we invite all VEXAG attendees to particiate in co-authoring these papers.

References: [1] S. Squyres et al., "Vision and Voyages for Planetary Science in the Decade 2013-2022," National Academies Press (2011). [2] E. Venkatapathy et al., "Thermal Protection System Technologies for Enabling Future Venus Exploration," *White Paper to the NRC Decadal Survey Inner Planets Sub-Panel* (2009). [3] E. Venkatapathy et al., "Thermal Protection System Technologies for Enabling Future Sample Return Missions," *White Paper to the NRC Decadal Survey Primitive Bodies Sub-Panel* (2009). [4] E. Venkatapathy et al., "Thermal Protection System Technologies for Enabling Future Mars/Titan Science Missions," *White Paper to the NRC Decadal Survey Sub-Panels Mars & Outer Planet Satellites/Primitive Bodies* (2009). [5] E. Venkatapathy et al., "Thermal Protection System Technologies for Enabling Future Outer Planet Missions," *White Paper to the NRC Decadal Survey Outer Planets Sub-Panel* (2009). [6] E. R. Martinez and R. V. Frampton, "Thermal Protection System Sensors," *White Paper to the NRD Decadal Survey Mars and Outer Planets Sub-Panels* (2009).