

An Assessment of the Thermal Protection System Technology for In-Situ Science Missions to Mars, Venus, Outer Planet and Sample Return to Earth

by

*Ethiraj Venkatapathy**

Chief Technologist, Entry Systems and Technologies Division

NASA Ames Research Center, Moffett Field, CA

(*Representing 90 Co-Authors representing 18 organizations)

Four white papers were submitted in response to the call from the NRC Decadal Survey by the TPS technology community. More than ninety individuals representing 18 different organizations in the US collaborated and the white paper represents the community consensus regarding the current state of the technology readiness to meet future planetary mission needs. The four white papers targeted Mars, Venus and Outer Planet in-situ missions and Sample Return from Asteroids, Comets and Mars. Our intent in submitting this abstract to the IPPW7 is to engage the international community via Planetary Probe Workshop. We plan to present the state of the art in TPS Technology, gaps that exist today and the community consensus recommendations. The planetary Probe Community due to the international participation is another avenue for us to inform and obtain feedback and also assess the current state-of-the-art in TPS technologies outside US. In the case of future international collaboration, such as those that are under discussion between US and ESA on Mars Exploration, the international Probe Community members will then be best prepared to advise their individual organizations and support investments in technology development as appropriate and in a timely manner.

In the IPPW7 presentation, we will start with a summary of potential architectures for each of the destinations and the entry requirements that the TPS has to be capable of protecting the science payload. We will follow this up with current TPS Technology capabilities based on the anticipated entry. We will then identify gaps in TPS Technology and the mission architectures that cannot be supported and then present the community recommendation on what to do.

TPS is an enabling system and it is a single point failure system as well. Direct entry missions that explore Venus, Outer Planets and fast Sample Return missions require higher density ablative TPS systems such as Carbon Phenolic. The Carbon Phenolic that enabled Pioneer-Venus and Galileo missions have not been in production for over 40 years and the challenge is to ensure either the availability of TPS derived from flight proven TPS or to develop more robust and cost effective alternate.

We look forward to engaging the International community at the IPPW7 on the TPS technology that is needed and seek to engage future mission planners, proposal teams and technologists.