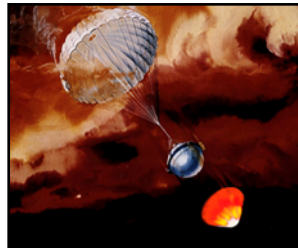
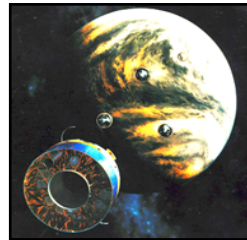




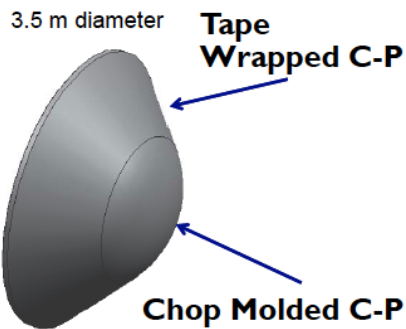
# Need for High TRL Alternate Entry Technologies



GALILEO



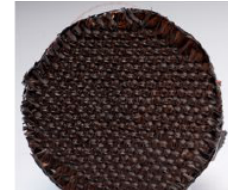
PIONEER-VENUS



Rigid Aeroshell using Heritage Carbon Phenolic (Tape Wrapped and Chop Molded)

## Rigid Aeroshell using Alternate TPS

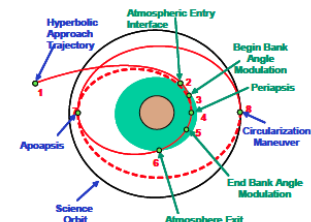
- Alternate CP
- Woven TPS
- Flexible TPS



Woven TPS

## Alternate Architectures

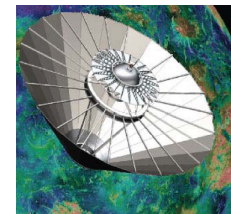
- Aerocapture Entry
- Direct Lifting Entry
- Low and Mid L/D
- ADEPT
- HIAD
- SIAD
- Ballutes
- Asymmetric Capsule Vehicle (ACV)



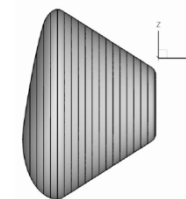
Aerocapture



HIAD



ADEPT



ACV



# Need for High TRL Alternate Entry Technologies

- Planetary Sciences Decadal Survey (PSDS) identified a lander mission to Venus as a candidate mission concept for the next New Frontiers AO
- Risks identified with availability of Heritage Carbon Phenolic (HCP), G-Loads qualification of instruments, and environmental testing needed to qualify various components for mission success
- Tasked by ISPT – EVT to perform study to define capabilities requirements for enabling missions to Venus and Saturn given that the heritage technology is no longer available.
- Analysis performed to understand design space/constraints for using HCP on rigid aeroshell, defined performance requirements for alternative (mid density) TPS, and identified limits on trajectory space in order to use existing TPS for a Venus lander, based on Decadal Study (VISE)
- Compared ballistic entry of a rigid aeroshell with HCP against an aerocapture entry of a low L/D and mid L/D probe with PICA.
- Papers on methodology and results of trajectory analysis performed will be presented at IEEE in March and IPPW-10 in June. Data can be used to help define requirements and key performance parameters towards technology maturation.
- Study team comprised of Dinesh Prabhu, Joseph Garcia, Tom Spilker, John Karcz, Helen Hwang, Bob Moses, Gary Allen, Kathy McGuire, and Loc Huynh, Jeff Bowles, Bernie Laub, Brandon Smith, Raj Venkatapathy, Kristina Skokova, Mairead Stackpoole