

## ICE GIANT SYSTEMS 2020 - LONDON

**Title of Contribution:** Enabling Entry Technologies for Ice Giant Missions

E. Venkatapathy\*, A. Austin, A. Cassell, D. Ellerby, E., P. Gage, P., D. Prabhu, and P. Wercinski

Lead Author Email: [Ethiraj.Venkatapathy-1@nasa.gov](mailto:Ethiraj.Venkatapathy-1@nasa.gov)

**Preference for Presentation:** Poster (Monday Evening)

### **Main Text of Abstract:**

The proposed poster will highlight two NASA developed entry technologies that are enablers for Ice Giant Missions. They are: (1) Heat-shield for Extreme Entry Environment Technology (HEEET), and (2) Adaptable, Deployable, Entry, and Placement Technology (ADEPT), a mechanically deployable entry system. HEEET development is complete and is at TRL 6. HEEET is ready for Ice Giant in situ probe missions, and HEEET is an enabler for either direct ballistic entry or entry from Orbit. NASA plans to sustain the HEEET capability as it is needed for Venus, Saturn and higher speed sample return missions in addition to Ice Giant Missions.

The emerging recognition among the scientific community that by delivering the probe from orbit will allow for simultaneous in-situ and orbital measurement can be enabled by aerocapture using ADEPT. The drag modulated aerocapture (DMA) with ADEPT is the simplest approach that can deliver an orbiter and probe together and without the significant penalty associated with propulsive insertion. Studies performed by JPL and NASA Ames teams point to this very promising possibility. Numerous DMA with ADEPT studies point to its applicability to small spacecraft missions as well as Ice Giant missions.

The poster will present the current state of readiness of HEEET, ADEPT and DMA.

### **Optional Further Reading:**

On HEEET:

<https://www.lpi.usra.edu/opag/meetings/feb2018/presentations/Venkatapathy.pdf>

The following presentations :

- [Technology Readiness Assessment for HEEET TPS GAGE.pdf](#)  
from <https://pub-lib.jpl.nasa.gov/docushare/dsweb/View/Collection-1933>

On DMA-ADEPT:

<https://www.lpi.usra.edu/opag/meetings/apr2019/posters/Prabhu.pdf>

Optional Figures:

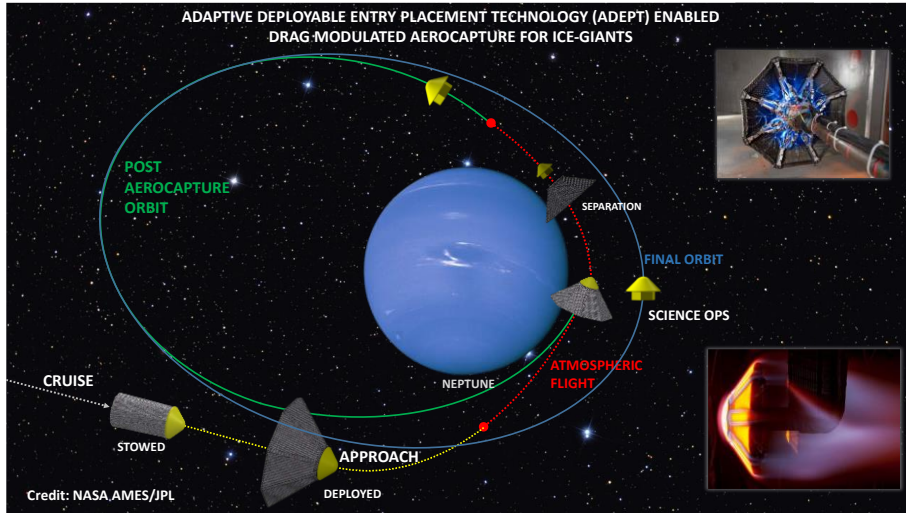


Figure 1. Benefit utilizing Drag Modulated Aerocapture (DMA) with ADEPT can deliver large spacecraft along with Probes into Neptune (or Uranus) Orbit.

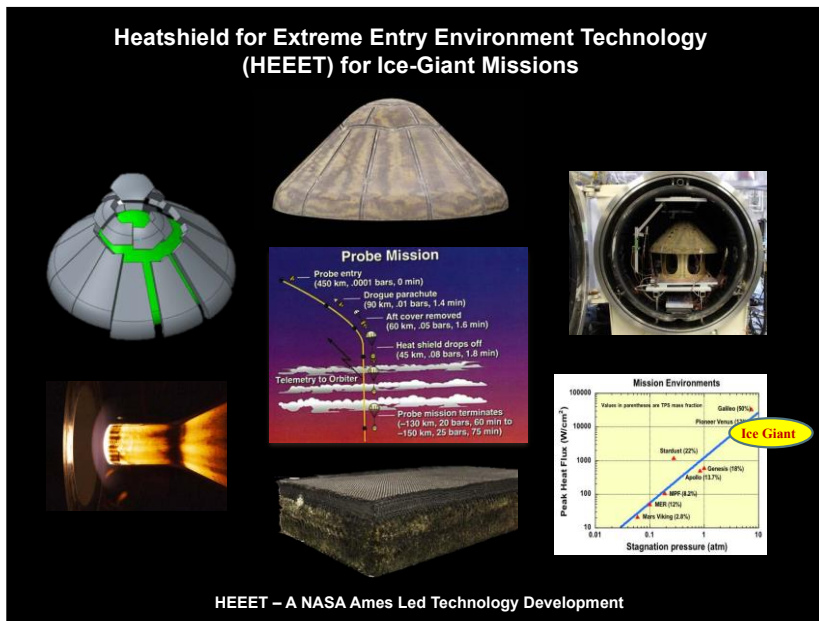


Figure 2. Heatshield for Extreme Entry Environment Technology is a 3-D Woven ablative TPS system demonstrated at TRL 6 and capable of Ice Giant Probe missions.