

# **STUDY OF PLANETARY ENTRY PROBES (PEP) FOR VENUS AND OUTER PLANETS: SATURN, URANUS AND NEPTUNE**

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## **ABSTRACT**

So far the Concurrent Design Facility (CDF) and other ESA studies have concentrated on entry at Earth, Mars, Jupiter and Titan. The aim of the Planetary Entry Probe Investigation (PEPI) CDF is to study the entry conditions for Venus (CO<sub>2</sub> dominated atmosphere with small amount of nitrogen), Saturn, Uranus and Neptune within the same study, as significant commonalities exist, in particular for the outer giant planets (all have an H and He dominated atmosphere like Jupiter). Study heritage exists for the outer planets, (e.g. CDF Jupiter Entry Probe or Tandem for Titan) and shall be re-used as far as possible for PEP and scaled to the actual case. The Jupiter entry provides the worst case conditions concerning e.g. entry velocity and heat load, hence the JEP design can be used as a good starting point and probe sizing case.

It is expected that all entry probes show a good degree of similarity, with major cases on the Entry and Descent System (EDS) – in particular for what concerns the Thermal Protection System (TPS) due to different heat loads.

An orbiter (or carrier) fly-by scenario with hyperbolic deployment is used as reference scenario for all cases. In the case of Venus, a Venus Gravity assist scenario with a piggyback probe is assessed (e.g. Laplace mission drops a probe during 1st GAM).

The focus of the activity shall be on the estimation of the Entry and Decent System (EDS) system for an overall probe mass of 200 to 300 kg (tbc), on the estimation of the mass ratio between EDS and overall probe and on the overall mission profile.

The aim of the study shall be the basic design of each probe system, highlighting commonalities, similarities, differences. Finally it is required to produce an overview of the concerning entry conditions and main design constraints for all relevant targets in our solar system, including the 4 studied here and the comparison with Mars, Earth, Jupiter, Titan.