PLANETARY ATMOSPHERE PROBE DESCENT MODULES FOR GAS AND ICE GIANT MISSIONS.

Michael J. Amato[1], A.L. Jones[1], D.W Robinson[1], and A. Jabola[2], [1]NASA Goddard Space Flight Center (GSFC), Greenbelt MD 20771, [2]SARATECH/NASA Goddard Space Flight Center (GSFC), Greenbelt MD 20771.

Introduction: Planetary probes capable of in-situ measurements within the atmospheres of gas and ice giants enable critical science measurements that are needed to answer unresolved science questions. There is critical science data that is not measureable from orbit or from other remote sensing approaches. Much of the needed constituent, chemical and dynamic information requires in situ measurements. Models for solar system formation and the evolution of atmospheres depend on measurements probes can deliver, as do comparisons between the gas and ice giants and comparisons to extrasolar solar systems. [1]

A significant number of the science requirements for a Saturn or a Uranus probe mission can be met with an in situ probe with only a few instruments. The science and mission concepts for both Saturn and Uranus probe were highly recommended in the latest NASA Planetary Decadal results, Saturn as a recommended New Frontiers target. For Saturn, the primary driver is measuring the composition of the mixed atmosphere. The need is to determine the noble gas abundances such as He, Ne, Ar, Kr, Xe and their isotopes, to measure heavy elements such as H, C, S, N, and O and to measure other isotope rations such as D/H [1,2]. These measurements in Saturn's atmosphere can be done with a probe with a heritage mass spectrometer. The mass spectrometer can also address other composition, structure, light element, and water abundance questions. Needed atmosphere structure, winds, density measurements are made by an atmospheric structure instrument (ASI). Additional desired measurements and clarity are added by linking a tunable laser spectrometer addition to the mass spectrometer and including a simple modern net flux radiometer.

The payload packages mentioned above lend themselves to probe decent modules of reasonable size and power using achievable approaches and reasonable technology development needs. The Galileo Jupiter probe approach had some advantages and disadvantages which we have analyzed. The probe, launched in 1989, uses some electrical, thermal, assembly and other approaches that are not emulated in our probe designs. Deeper atmosphere probes require very different approaches than shallow probes like Galileo. We have been working on updated and new designs for probe modules for various depths.

Packaging, thermal and pressure control, materials trades, aerodynamics, communication links, testing approaches and heat shield materials challenges drive design options and are also linked to higher level mission flight dymincs decisions. Probe decent module designs and approaches can trade multiple science measurement and size options at a reasonable cost. The analysis and prototype work being done by our team hopes to rapidly advance the design maturity to a level allowing lower cost probe missions to be strongly considered.

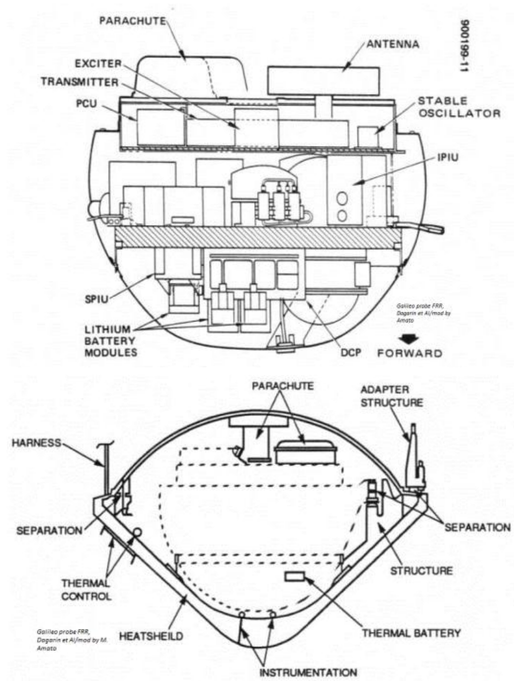

Figure 1 - Galileo Probe descent module and entry and descent system. [3]

References: [1] Beebe R., Dudzinski L, et al. (2010) S*aturn Atmospheric Entry Probe Mission Study, Section 1*. [2] Atkinson D, et al. (2009) *Entry Probe Missions To Giant Planets,* [3] Dagarin B. P., et Al, (1990) *Galileo Probe F.P.R. 3-6, 3-149*, 900199.