2012 DECADAL SURVEY GIANT PLANET ENTRY PROBE SCIENCE

Thomas R. Spilker[(1)], David H. Atkinson[(2)]

[(1)]Jet Propulsion Laboratory, California Inst. of Tech., MS 301-170S, 4800 Oak Grove Drive, Pasadena, CA 91109, USA, Email: Thomas.R.Spilker@jpl.nasa.gov
[(2)]Univ. of Idaho, Dept. of Electrical & Computer Eng., Moscow, ID 83844, USA, Email: atkinson@uidaho.edu

On March 7, 2011 the US National Research Council released the draft report of the results of its 2012 Planetary Science Decadal Survey (PSDS). Atmospheric entry probes to the giant planets were well-represented in the PSDS, with addition of a Saturn Probe mission to the list of recommended NASA New Frontiers Program missions, inclusion of an entry probe along with an orbiter in a new Uranus mission concept, and recommendations for technology development leading to a mission with a Neptune orbiter and entry probe for the following decade (2023-2032). This follows closely the recommendations of the 55-author PSDS white paper, "Entry Probe Mission to the Giant Planets." Studies conducted for the PSDS suggest that under the usual New Frontiers Program approach for budget reserves, it might be possible to add Tier 2 science investigations and instrumentation to a Saturn entry probe, enhancing the science return beyond the Tier 1 objectives. The Uranus mission would most likely be a small flagship-class mission. Studies indicate that for the most probable entry geometries for a Uranus probe mission conducted in the PSDS time frame, an entry system designed for a Saturn probe mission could also be used for a Uranus probe, without excessive margin in the design. Significant overlap of the Tier 1 science objectives at Saturn and Uranus also provides an opportunity for use of common instruments. A descent module (including instrumentation) for Uranus would be well suited for a Neptune mission, though the Neptune system presents some unique issues for the entry system. A prograde entry at Neptune would have an atmosphere-relative entry speed significantly slower than that of a Uranus probe, so the Uranus entry system might be overdesigned for Neptune, while a retrograde entry would have an atmosphere-relative entry speed significantly faster than that of a prograde Saturn probe, requiring a higher-performance entry system.

As discussed in the giant planet entry probe white paper, this series of entry probe missions would complete the initial *in situ* exploration of all four of our solar system's giant planets, thereby allowing comparison of gas giants (Jupiter and Saturn) to ice giants (Uranus and Neptune) and comparisons within those classifications These comparisons are expected to yield significant progress in understanding formation processes and time scales for the giant planets, and for the solar system as a whole. Such understanding would help to understand the formation of other planetary systems, and the tremendous variation in the architectures of exoplanetary systems now being discovered.

This presentation will summarize the science described in the PSDS for these future mission concepts, and some of the instrumentation options for implementing them. It will also discuss the programmatic environment for each mission concept, describing decisions and events that might lead to their implementation as flight projects.