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Small Next-generation Atmospheric Probe (SNAP) Concept

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Abstract

A concept is presented for a small, atmospheric entry probe designed to be added as a secondary payload to future giant planet missions. The main science objectives of the Small Next-generation Atmospheric Probe (SNAP) are to determine the distribution of clouds and cloud-forming chemical species, thermal stratification, and wind speed as a function of depth. As a case study, we present the advantages, cost and risk of adding SNAP to a future Uranus Orbiter and Probe flagship mission. In combination with the mission's primary entry probe, SNAP would perform atmospheric in-situ measurements at a second location, and thus enable and enhance the scientific objectives recommended by the 2013-2012 Planetary Science Decadal Survey and the 2014 NASA Science Plan to determine atmospheric spatial variabilities.
The primary goal of the SNAP concept development is to achieve the science objectives with a 30-kg entry probe ~0.5m in diameter (less than half the size of the Galileo probe) that could reach a pressure of 5-bars and return data to the Carrier spacecraft prior to downlink to Earth. The probe baseline instrument payload comprises an Atmospheric Structure Instrument (ASI) to measure entry and descent accelerations and the altitude profile of temperature and pressure, a carbon nanotube-based NanoChem atmospheric composition sensor, and UltraStable Oscillators (USO) on both the probe and the Carrier spacecraft to conduct a Doppler Wind Experiment (DWE). Although the current SNAP concept is developed as a possible element for a future Uranus Orbiter and Probe flagship mission, the probe conceptual design and mission architecture will maintain flexibility so as to be easily adapted to other giant planets.