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VENUS HIGH TEMPERATURE ATMOSPHERIC DROPSONDE AND EXTREME-ENVIRONMENT SEISMOMETER (HADES)

Abstract

The atmospheric composition and geologic structure of Venus have been identified by the National Research Council's Decadal Survey for Planetary Science as priority targets for scientific exploration, however the extreme temperature and pressure at the surface, along with the highly corrosive chemistry of the Venus atmosphere, present significant obstacles to spacecraft design that have severely limited the operational lifetime of past and proposed landed missions. Following the methodology of the NASA Innovative Advanced Concepts (NIAC) and Collaborative Modeling and Parametric Assessment of Space Systems (COMPASS) design protocol, this paper presents a conceptual study and initial feasibility analysis for a Discovery-class Venus lander capable of a long-duration mission at ambient temperature and pressure, incorporating emerging technologies within the field of high temperature electronics in combination with novel configurations of proven, high Technology Readiness Level (TRL) systems. Radioisotope Thermal Power (RTG) systems configuration and silicon carbide communications and data handling are examined in detail, and key high-temperature instruments are proposed, including a seismometer and an advanced photodiode imager. The study combines this technological analysis with proposals for a descent instrument package and a relay orbiter to demonstrate the feasibility of an integrated atmospheric and in-situ geologic exploratory mission. This original work differs from previous proposals in that the mass, power requirements, and cost of the mission are greatly reduced while maintaining high scientific value, and this paper has not been presented to any previous meeting or publication.