

Cupid's Arrow – a Small Interplanetary Probe Concept

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Cupid's Arrow is a small atmospheric probe concept designed to measure noble gases and their isotope ratios in the atmosphere of Venus. The Venus Exploration Analysis group (VEXAG) has placed a high priority on such measurements in its "Goals, Objectives, and Investigations" document (2014). Since noble gases are tracers of processes affecting planetary evolution, determining their concentration and isotope ratios in Venus atmosphere answers questions on how Venus has evolved. By comparing the values for Earth, Mars, and primitive bodies, these data can provide clues on why Earth and Venus, two planets with similar composition, size, and distance to the Sun, have evolved so differently.

The nominal Cupid's Arrow mission assumes that the probe is targeted to Venus and carries a Solid Rocket Motor (SRM) that puts it into orbit around with periapsis below the homopause where noble gases are well mixed within the CO₂-N₂ atmosphere. Four samples of the Venus atmosphere can be captured at each pass. Each sample is then analyzed by a miniaturized Quadripole Ion Trap Mass Spectrometer (QITMS) developed at JPL. A calibrant tank provides a reference for calibration. Data are transmitted to Earth during the long apoapsis segment of the orbit. The study estimates the mass of the dry probe as 70 kg, including margins.

This paper will address the design of the Cupid's Arrow mission and spacecraft concept.

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