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SYMPOSIUM ON TECHNOLOGICAL REQUIREMENTS FOR FUTURE SPACE ASTRONOMY AND SOLAR-SYSTEM SCIENCE MISSIONS (A7)
Scientific Motivation and Requirements for Future Space Astronomy and Solar System Science Missions (2)

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A NOVEL ORBITER MISSION CONCEPT FOR VENUS WITH THE ENVISION PROPOSAL

Abstract

In space exploration, planetary orbiter missions are essential to gain insight into planets as a whole, and to help uncover unanswered scientific questions. In particular, the planets closest to the Earth have been a privileged target of the world's leading space agencies. EnVision is a mission proposal with the objective of studying one of these planets. Designed for Venus and competing for ESA's next launch opportunity, the proposal already went through the selective technical review for the M4 launch opportunity, and will now be submitted for the M5 call, incorporating feedback from ESA.

This proposal follows ESA's Venus Express mission to pursue its findings and research. Venus Express raised significant new challenges, one of the most intriguing being the possibility of recent volcanism. The mission revealed significant changes in mesospheric sulphur dioxide indicators, dark lava surrounding volcanoes, and surface temperature variations that suggest volcanic activity.

EnVision's main goal is to outline the state of geological activity on Venus and its relation to the atmosphere. It will also provide gravity and geoid data, as well as new spin rate measurements, and new insight into the planet's interior. The volume of data produced by EnVison will be unprecedented for an interplanetary mission and consequently well-established multiple-bit encoding techniques used by Earth-orbiting telecommunications satellites will be applied.

Essentially, EnVision will provide global imaging, topographic and subsurface data with a better resolution than previous missions, and may uncover the reasons for the radically different evolution of Venus and Earth.

To achieve these goals, the operational orbit selection is a fundamental element of the mission design process. The design of an orbit around Venus faces specific challenges, such as the impossibility of choosing Sun-synchronous orbits. In this paper, an innovative genetic algorithm optimization was applied to select the optimal orbit based on the parameters with more influence in the mission planning, in particular mission duration and the coverage of sites of interest on the Venusian surface.

In conclusion, after presenting the Envision proposal's revolutionary mission concept for Venus, the optimization and innovation of the operational orbit design will be analyzed in terms of its benefits to the mission.