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PRELIMINARY DESIGN OF PRIMAVERA: PRELIMINARY INVESTIGATION MISSION TO ACHIEVE VENUSIAN RECONNAISSANCE IN ATMOSPHERE

Abstract

PRIMAVERA, or the Preliminary Investigation Mission to Achieve Venusian Reconnaissance in Atmosphere, is a Phase 0/A study for a spacecraft developed by 30 students during the week-long 2024 Concurrent Engineering Workshop hosted by the European Space Agency (ESA) in Transinne, Belgium. The mission objective was to develop a spacecraft to deliver a floating platform payload into the Venusian atmosphere where it would take in situ measurements in order to study the Venusian clouds. PRIMAVERA would be launched on an Ariane 64, and a gradual Hohmann transfer was planned to take the single-thruster spacecraft to its final circular, equatorial Venusian orbit at 5,000 km. There, the payload consisting of a gondola with instrumentation attached to a helium variable-altitude balloon would descend to its operational altitude between 50 and 65 km. An iterative approach was taken for system design while following concurrent engineering principles. Students from ESA member states, Canada, and Slovakia were divided into teams of 2-4 members for each of the following subsystems: structures, configuration, thermal, power, communications and data handling, attitude and orbital control systems, propulsion, trajectory analysis, ground segment, and cost engineering. Subsystems were worked on simultaneously and parameters were tracked using ESA's Concurrent Model-based Engineering Tool (COMET software). This paper details the results of the preliminary design of PRIMAVERA.

Declaration on the use of Generative AI and AI-assisted Technologies in the writing process

Not applicable.