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# DESIGNING AND FLYING THE FIRST UNIVERSITY LUNAR ROVER

**Abstract**

Although it never got the chance to land on the Moon, Carnegie Mellon University's Iris Lunar Rover stands as a groundbreaking achievement, marking the first non-governmental, university-led lunar rover mission to journey to and drive in cislunar orbit. This paper offers a broad overview of Iris, focusing on its system design, development, testing, and mission execution, setting a precedent for future student-led planetary rover endeavors.

The paper begins by highlighting Iris's flight milestones and mission objectives, showcasing its pivotal role as the first university rover in space. The rover was designed to be a proof of technology and to conduct crucial mobility testing for future lunar rovers of low size, weight, power, and cost (low SWaP-C). Although the Peregrine Mission I lander was unable to soft-land on the Moon, Iris completed a subset of system validation tests onboard the lander. The topline outcomes of Iris's mission in this new operational context are explored, setting the stage for a detailed analysis of its system design, development, and results.

A system overview details the Iris rover configuration, specifications, and intended concept of operations (ConOps). It also outlines the phases of development, integration, and mission. The rest of the paper examines each subsystem in turn: structures, thermal, mobility, avionics, software, and ground control. Each section addresses the driving factors of the subsystem's design, the specifications from modeling and terrestrial testing, and the outcomes on-mission. Thermomechanical examples include the use of carbon fiber for its chassis and bottlecap-shaped wheels, processes for thermal modeling and validation, low-cost lunar-environment simulation tools for mobility offloading and surface operations testing, and drop deployment mechanisms and modeling. Embedded system distinctions include a single-board computer, custom power management, and implementation of JPL's F Prime architecture in flight software. Ground control features include adaptable control software as well as an accelerated operator training program. These and other examples provide insight into the challenges, innovations, and outcomes of the first university rover in space.