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PREPARING FOR DAWN'S MISSION AT CERES: CHALLENGES AND OPPORTUNITIES IN THE EXPLORATION OF A DWARF PLANET

Abstract

After escaping from Vesta in 2012, Dawn is continuing its 2.5-year flight to dwarf planet Ceres. Investigating this second destination promises to provide a view of an intriguing world of ice and rock, likely displaying fascinating geology entirely unlike any body yet orbited by a spacecraft. Dawn spends the significant majority of the time thrusting with its ion propulsion system to deliver the 3.5 km/s required to rendezvous with Ceres. Meanwhile, the operations team has been developing the sequences that will be used there. Following orbit capture in March 2015, Dawn will fly to a series of four circular polar science orbits. The orbits, ranging from about 13,500 km to 375 km in altitude, are designed to optimize the scientific observations. The overall strategy for exploring Ceres is based strongly on the extremely successful 16 months of Vesta operations, during which Dawn met or exceeded all of its objectives. Nevertheless, the loss of two of the spacecraft's four reaction wheels has necessitated some important changes. Based on a very productive hydrazine-conservation campaign in the interplanetary cruise and the development of new hydrazine-efficient methods of operating at Ceres, there is good reason to expect that Dawn will be able to accomplish all of its objectives regardless of the health of the reaction wheels. This paper will describe the progress in traveling to Ceres as well as the plans for exploring this giant, icy world.