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DAWN AT CERES: THE FIRST EXPLORATION OF THE FIRST DWARF PLANET

Abstract

Dawn began its Ceres approach phase in December 2014, more than two years after escaping from Vesta. It is on course and on schedule to enter orbit in March 2015 for 16 months of intensive operations. Investigating Ceres promises to provide a uniquely detailed view of the first dwarf planet discovered. It is the largest body between the Sun and Pluto that has not yet been visited by a spacecraft. With a mean diameter of 950 kilometers, Ceres contains about 30% of the mass in the entire main asteroid belt. Ceres may have a substantial inventory of water, mostly in the form of ice, but there may be reservoirs of liquid as well, perhaps even including a subsurface ocean. Dawn will conduct its observations from four circular polar orbits ranging in altitude from 13,500 km to 375 km. 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. We have detailed plans that include healthy margin for completing the rest of the mission and accomplishing all of the original Ceres objectives, plus some new ones added in 2014, even without the two operable wheels. This paper will describe the completion of Dawn's interplanetary cruise, including contingency operations following a double anomaly in September 2014 that led to a significant change in the geometry of the approach phase. We also will present the progress in Ceres exploration and the plans for completing the primary mission in 2016.