

## THE DEEP SPACE 1 EXTENDED MISSION

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The primary mission of Deep Space 1 (DS1), the first flight of the New Millennium program, completed successfully in September 1999, having exceeded its objectives of testing new, high-risk technologies important for future space and Earth science missions. DS1 is now in its extended mission which plans to take advantage of the advanced technologies, including solar electric propulsion, to conduct an encounter with Comet P/Borrelly in September 2001. During the extended mission, the spacecraft's commercial star tracker failed, leaving only a Sun sensor and gyros for attitude sensing which were not sufficient for 3-axis attitude control or knowledge. A two-phased approach to recovering from the loss of the star tracker was undertaken. The first involved devising a new method of pointing the high-gain antenna to Earth using the received radio signal at the Deep Space Network as an indicator of spacecraft attitude. The second was the development of new flight software that allowed the spacecraft to return to 3-axis operation without substantial ground assistance. The principal new feature of the software is the use of the science camera as an attitude sensor; to accomplish this, the new system builds upon some of the software used by the autonomous optical navigation system that was tested and used operationally during the primary mission. The differences between the science camera and the star tracker have important implications not only for the design of the new software but also for the methods of operating the spacecraft. The software was loaded in June 2000 and initial results from in-flight testing, which is underway at the time this abstract is submitted, are very encouraging. This paper will describe the conclusion of the primary mission, the new operational techniques and how they are incorporated into the mission, and the plans for exploiting the new technologies to explore the comet.