JOURNAL OF SPACECRAFT AND ROCKETS
Vol. 32, No. 6, November–December 1995

Editorial: Clementine Mission

IN 1989, when I started work at the Ballistic Missile Defense Organization (then the Strategic Defense Initiative Organization [SDIO]), there was a strong emphasis on the development of a missile defense architecture that merged space and ground defenses. However, by 1991 the development of most of the space systems was terminated and SDIO was refocused on a ground missile defense system. From the viewpoint of technology, I thought that this shift of emphasis would be very detrimental to the U.S. space program. No spacecraft were going to be built and flown that would take advantage of the many advanced lightweight components that had been developed for small space-based interceptors and surveillance systems. Therefore some of us decided that a low-cost space mission should be built, demonstrating the usefulness of the newly developed technology. Thus the Clementine Program was born.

The Clementine mission was to flight qualify 23 advanced, lightweight technologies, using three celestial bodies (the Earth, the moon, and a near Earth asteroid [Geographos]) as targets. The Earth observations were necessary to calibrate the sensors against a known target. The moon was selected because it provided a thermally stressing test environment similar to what would be required for a space surveillance mission. And an asteroid was selected as a target, providing a realistic test of the functions required to intercept a missile in midcourse at real orbital velocities. Since it was not performing any lunar or asteroid missions at that time, NASA agreed to become a cooperative partner, providing a Science Team and tracking facilities. The NASA partnership significantly strengthened the mission, as NASA lunar and asteroid scientists reviewed all aspects of the project and provided suggestions that enhanced the scientific value.

The Clementine mission was approved by the SDIO Director in January 1992, and I was appointed Mission Director. One of the first steps to be accomplished was determining (in conjunction with the SDIO Program Managers) which developed technologies needed to be flight qualified. During early 1992, technology workshops were conducted on each of the major spacecraft subsystems and the major technology decisions were made. In March 1992 the U.S. Naval Research Laboratory was selected as the lead agency to design, build, and launch Clementine, with the Lawrence Livermore National Laboratory selected to integrate the payload, a sensor suite of six cameras comparable to those that were planned for use in the now-defunct Brilliant Pebbles program. On Jan. 25, 1994, the Clementine spacecraft was launched from Vandenberg Air Force Base on a Titan IIG refurbished booster.

This special issue discusses the spacecraft technologies, system integration issues, and actual experimental results from the historical flight of the Clementine spacecraft. Every one of the selected 23 advanced lightweight technologies performed properly. With the successful flight qualification of these technologies aboard Clementine, most of them have been incorporated in many other commercial and military missions. I hope that this special issue encourages space scientists and engineers to select the most advanced, high-performance technologies for their spacecraft.

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