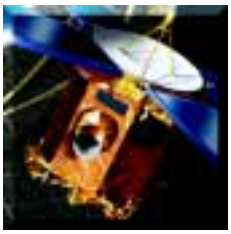

The NEAR Mission: Guest Editor's Introduction

Thomas B. Coughlin

During the first quarter of 1991, APL performed a funded study for NASA Headquarters for a mission to rendezvous with and orbit a near-Earth asteroid. At the same time, the Jet Propulsion Laboratory in Pasadena, California, was funded for a similar study. In April 1991, both studies were presented to Wesley T. Huntress, Solar System Exploration Director at NASA Headquarters, and members of his staff. In March 1992, NASA awarded APL with the Near Earth Asteroid Rendezvous (NEAR) mission. NEAR was to be the first in a new series of missions called Discovery.

Discovery was envisioned by Huntress as a program for faster, better, and cheaper planetary scientific missions. Two members of the team assisting him were Stamatios M. Krimigis, Head of the APL Space Department, and Joseph Veverka of Cornell University, Head of the NEAR Imaging Team. The projects would be cost capped during the development phase at $150M in FY '92 dollars. The development phase would also be limited to less than 36 months. To limit the overall project cost, the launch vehicle was prescribed to be a Delta II vehicle or smaller. The mission operations and data analysis would eventually be limited to $35M in FY '92 dollars, thereby establishing limits on the complete project cycle.

Robert Farquhar derived a unique mission design that provided a launch opportunity in February 1996. This work is discussed in the first article by Cheng et al. After funding was provided by NASA Headquarters in December 1993, APL initiated a 27-month schedule for developing a science payload (instruments), spacecraft, Mission Operations Center, and Science Data Center. This was an unprecedented timetable for developing a planetary mission.

The target asteroid for the February 1996 launch was 433 Eros, one of the largest of the near-Earth asteroids. A near-Earth asteroid is defined as one that comes inside the orbit of Mars. The main belt of asteroids is that between the orbits of Mars and Jupiter.

Funding and management were provided directly by NASA Headquarters. The Laboratory was essentially acting as a NASA field center. This was the first time NASA had operated in this manner. The development phase was completed in 27 months and $42M under the aforementioned cost cap.

This issue of the *Technical Digest* is the first of two issues on the NEAR mission and primarily discusses the development of the instruments and spacecraft subsystems. The second issue, in approximately two years, will report on the flight operations and scientific results. In June 1997, the first scientific result was obtained—a flyby of a main-belt asteroid called Mathilde. The flyby is not described herein, however, as most of the articles were prepared before this

event. The flyby was performed flawlessly by all elements of the NEAR team with excellent results. It was the most difficult of any flyby ever attempted, primarily because of the lack of definitive tracking of Mathilde until several hours before the flyby, which was accomplished at 10 km/s. The NEAR navigation team at the Jet Propulsion Laboratory played a significant role in this event, as well as throughout the development phase.

The NEAR spacecraft was launched successfully on a Delta II 7925 vehicle on 17 February 1996, the second day of a 12-day launch window. The window each day was 1-min in duration. The launch was scrubbed on the first day because of range problems. To date, approximately eight small trajectory correction maneuvers and a major deep space maneuver have been performed. An Earth swingby will occur in January 1998, and the NEAR spacecraft will finally arrive at Eros in January 1999.

NEAR's suite of instruments will provide the data needed to better understand this primitive asteroid. The instrumentation includes the Multispectral Imager, Near-Infrared Spectrometer, X-Ray/Gamma-Ray Spectrometer, Magnetometer, and Laser Rangefinder. APL played a significant role in the development of each instrument. In certain cases, the responsibility was shared with an industry partner or the Goddard Space Flight Center. The articles by Hawkins, Peacock et al., Goldsten, Lohr et al., Cole, and Hersman et al. discuss the development of the instrument suite.

The articles by Hartka and Persons, Mosher and Wiley, Ercol and Krein, Jenkins et al., Strikwerda et al., Bokulic et al., Stott et al., and Burek discuss the spacecraft subsystems. The primary author of each article is the lead engineer of the subsystem discussed.

One of the most satisfying aspects of the development phase was the significant cooperation of several APL Departments. The most notable effort was that of the Technical Services Department in the fabrication of the NEAR hardware. This work is described in the article by Dettmer, who led the fabrication effort.

Whitworth et al. discuss the development of the Mission Operations Center, which had to be connected to the spacecraft during integration and test at APL, to Cape Kennedy during launch operations, to the Deep Space Network, and to the Science Data Center at APL. Finally, Heeres et al. provide a look at the Science Data Center. This facility was not needed to support the launch; its development will continue throughout the 3-year cruise phase.

After the spacecraft arrives at Eros in January 1999, it will reduce its altitude above the surface from approximately 100 km to 12 km over the 1-year orbital phase. Significant results are anticipated from this first-ever orbit of a small body. The NEAR science team, which includes people from many universities and government agencies across the country, is now in the final phase of planning the year at Eros. In February 2000, the NEAR spacecraft will land on the surface of Eros, completing an extremely challenging mission. We look forward to the scientific rewards.

THE AUTHOR

THOMAS B. COUGHLIN holds a B.S.M.E. from the University of Maryland and an M.S.M.E. in aeronautical design from the Drexel Institute of Technology. He has served as NEAR Project Manager throughout the development, launch, and mission phase of this initial "faster, better, and cheaper" Discovery program. He is also the Programs Manager for APL's Space Department. Mr. Coughlin has participated in several fast-track SDI programs, and for those efforts he was awarded the Distinguished Public Service Medal. His e-mail address is tom.coughlin@jhuapl.edu.