

# THE NEAR EARTH ASTEROID RENDEZVOUS MISSION

Edited by

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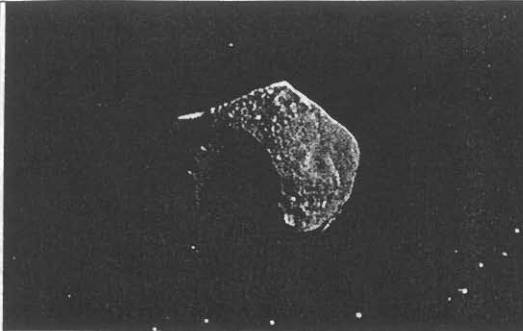
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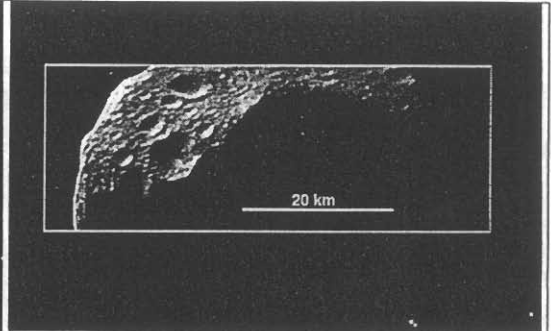


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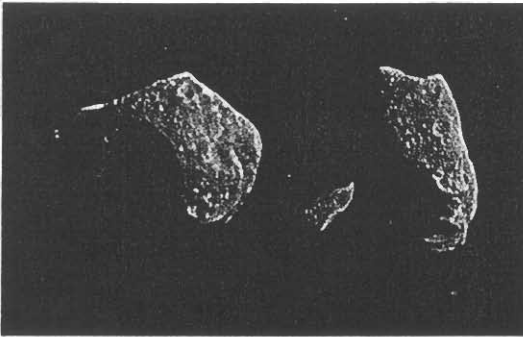
NEAR-MATHILDE ENCOUNTER



First Global Image Mosaic of 253 Mathilde



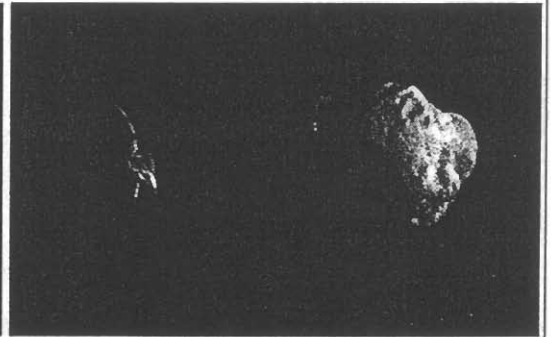
Portion of Closest Approach Mosaic



Mathilde

Gaspra

Ida



Mathilde: Approach and Departure

*Legends to this figure:*

Views of asteroid 253 Mathilde obtained by the NEAR spacecraft on June 27, 1997. Upper left panel shows a mosaic of four images taken at 2400 kilometers. Sunlight is from upper right. Details as small as 380 meters across can be discerned. Lower left panel compares, on same scale, Mathilde with asteroids Gaspra (middle) and Ida (right) earlier imaged by the Galileo spacecraft. The visible part of Mathilde measures 59 by 47 kilometers. Upper right panel shows Mathilde at closest approach (1200 kilometers). Illumination is from upper left. Lower right panel shows two additional views of Mathilde at phase angles of 136° (left) and 43° (right).

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## FOREWORD

Even before the present Administrator of NASA, Daniel Goldin, made the phrase 'better, faster, cheaper' the slogan of at least the Office of Space Science, that same office under the Associate Administrator of Lennard Fisk and its Division of Solar System Exploration under the direction of Wes Huntress had begun a series of planetary spacecraft whose developmental cost, phase C/D in the parlance of the trade, was to be held to under \$150M. In order to get the program underway rapidly they chose two missions without the open solicitation now the hallmark of the program. One of these two missions, JPL's Mars Pathfinder, was to be a technology demonstration mission with little immediate science return that would enable later high priority science missions to Mars. Many of the science investigations that were included had significant foreign contributions to keep NASA's cost of the mission within the Discovery budget. The second of these missions and the first to be launched was the Near Earth Asteroid Rendezvous mission, or NEAR, awarded to Johns Hopkins University's Applied Physics Laboratory. This mission was quite different than Mars Pathfinder, being taken from the list of high priority objectives of the science community and emphasizing the science return and not the technology development of the mission. This mission was also to prove to be well under the \$150M phase C/D cap.

NEAR was launched on February 17, 1996 passing by asteroid 253 Mathilde on June 27, 1997, and is scheduled to reach and orbit 433 Eros in January 1999. Eros was discovered by G. Witt in 1898 and was the first known asteroid to cross both the orbits of Mars and the Earth. Thus it is most appropriate that it be the first asteroid to be orbited and that this encounter take place in 1999, shortly following the 100th anniversary of its discovery. The asteroid, Eros, was named after the son of Aphrodite, whose mortal wife, Psyche, was forbidden to gaze upon him by the light of day. Even though scientists have no such restriction to pique their curiosity and even though Eros, the asteroid, may not prove to be as pleasing to the eye as Eros, the god, they are still intensely eager to examine it and have installed six scientific instruments on NEAR with which to 'view' the asteroid: a multispectral imager, a near-infrared spectrometer, an X-ray spectrometer, a gamma-ray spectrometer, a laser range finder and a fluxgate magnetometer.

In this volume we describe the various elements of the mission. We begin with an overview of the mission by the project scientist A. F. Cheng. This overview is followed by a series of articles on the instruments by those most familiar with the development of these 'facility' instruments that were well into construction prior to the selection of the science teams associated with each. The first instrument paper by S. E. Hawkins et al. describes the multispectral imager. It is followed by a description of the near-infrared spectrometer authored by J. W. Hawkins and colleagues. The X-ray and the gamma-ray spectrometers are described in the same

paper by J. O. Goldsten et al. The laser altimeter is described by T. D. Cole et al. and the magnetometer by D. A. Lohr and colleagues. The final paper by K. Heeres et al. describes the NEAR Science Data Center.

The successful construction, launch, and initial operation have been due to the heroic efforts of many individuals. Two notable individuals in addition to the authors of the articles included herein are the project manager, T. B. Coughlin, and the mission director, R. W. Farquhar. Since shortly before launch the science team has gradually begun to take a greater role in the science planning for the mission. The NEAR science team consists of J. Veverka, J. F. Bell III, C. R. Chapman, M. C. Malin, L. A. McFadden, M. S. Robinson, P. C. Thomas, J. I. Trombka, W. V. Boynton, J. Bruckner, S. W. Squyres, M. H. Acuna, M. T. Zuber, D. K. Yeomans, J.-P. Barriot, A. S. Konopliv, A. F. Cheng and C. T. Russell.

The articles in this volume have all been refereed by two experts on the subject matter of each article. Generally one of these persons was familiar with the NEAR mission and the other was learning about the mission for the first time. To these referees we owe a debt of gratitude for their diligence in helping to make these articles both readable and informative. The authors too deserve our thanks for their efforts undertaken at a very busy time for the mission. Finally I would like to express my thanks to Anne McGlynn who assisted me with the editorial duties for this volume.

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