

Foreword

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When Christopher Columbus set off for his new world in 1492, he took three ships—the Nina, Pinta and Santa Maria—to mitigate the risk of such a perilous journey. Such a mission into the unknown requires much self-confidence. Will the promise of the journey be fulfilled? What if there is no short cut to China? Will the Queen be angry? Will we ever return to find out?

We still are explorers today but the stage has moved from the surface of the ocean to the vastness of space. The Queen no longer funds missions to foreign lands, but the individuals who are in charge of the public purse must be convinced of the worthiness of such adventures. Making the case for their expenditures requires promises of bountiful rewards of knowledge, if not gold, silk and spices. It also requires lots of self-confidence to counteract one's own creeping doubts. Can we really "travel back in time" by exploring asteroids that have been bombarded by collisions for 4.56 billion years? What if the new world is boring? When the Dawn mission to Vesta and Ceres was proposed we had meteorites we believed came from Vesta but none from Ceres. We were moderately sure we had the right instruments for Vesta, but were we carrying the right instruments for Ceres? And could we achieve everything we promised?

It is a long way to the heart of the asteroid belt and a very risky journey. To mitigate risk Dawn has redundancy. Most of the spacecraft systems are redundant and the propulsion system itself like Columbus's ships, is triply redundant. But not all the payload is redundant. Fortunately we know, as this volume is being completed, that Dawn has successfully reached Vesta but we do not know what will befall the mission in the months and years ahead. The spacecraft has proven to be remarkably robust but there is much still to be done and a long time to spend in space as the mission heads for Ceres. Hopefully we have planned and executed well.

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This volume describes the Dawn mission to the two most massive asteroids 4 Vesta and 1 Ceres. This mission is the first to attempt to orbit one, let alone two, main belt asteroids. Each of these bodies are small planets, or protoplanets, that exhibit many of the properties and processes that we find on other larger planets including Mercury, and Mars. The ability to orbit one, leave it and go to and orbit the second is not science fiction. It is science reality enabled by the ion propulsion system.

The papers in this volume include the scientific background to understand the rationale for and objectives of the mission. Articles also describe the instruments and the flight system, the operations and the education and public outreach program.

The success of this volume is due to many people. We thank first of all the authors who distilled the information that formed the basis for these articles. We are grateful to Ayako Matsuoka who stepped in to edit the article for which the two editors were conflicted. The editors also benefited from an excellent group of referees who acted as test readers, and helped refine the articles provided by the authors. These referees included:

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