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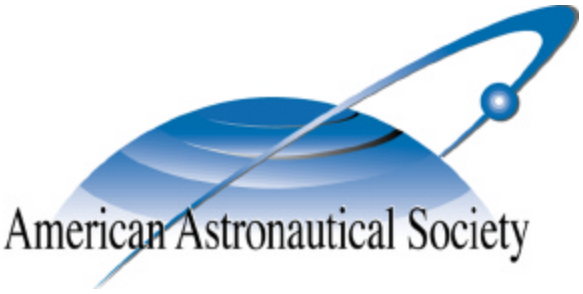
Front Cover Illustration:

HAYABUSA Spacecraft Sailing Toward Asteroid ITOKAWA With Ion Engines' Small But Powerful Thrust (Photo: Courtesy of ISAS/JAXA).



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Takashi Nakajima

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FOREWORD

This proceedings volume, which consists of one hard cover bound volume and a CD ROM supplement, includes the available papers presented at the Tenth International Space Conference of Pacific-basin Societies (ISCOPS, formerly PISSTA), December 10-12, 2003, Tokyo, Japan. This sequence of ISCOPS volumes is usually published as a part of the AAS *Advances in the Astronautical Sciences* series. Earlier ISCOPS proceedings volumes are available through the American Astronautical Society as follows:

(1) The first symposium was held December 15-19, 1985 in Honolulu, Hawaii and was published as Volume 60, *Advances in the Astronautical Sciences* titled **Space Exploitation and Utilization**.
(2) The second symposium was held June 7-10, 1987 in Beijing, China. This publication was published in China and titled **Proceedings of the Pacific Basin International Symposium of Advances in Space Science Technology and its Applications**.
(3) The third symposium was held November 6-8, 1989 in Los Angeles, California and was published as Volume 73, *Advances in the Astronautical Sciences* titled **Space Utilization and Applications in the Pacific**.
(4) The fourth symposium was held November 17-20, 1991, Kyoto, Japan and was published as Volume 77, *Advances in the Astronautical Sciences* titled **International Space Year (ISY) in the Pacific Basin**.
(5) The fifth symposium was held June 6-9, 1993, Shanghai, China. This volume was published in China (not available through the AAS).
(6) The sixth symposium was held December 6-8, 1995, Marina Del Rey, California, U.S.A. and was published as Volume 91, *Advances in the Astronautical Sciences* titled **Strengthening Cooperation in the 21st Century**.
(7) The Seventh symposium was held July 15-18, 1997, Nagasaki, Japan, and was published as Volume 96, *Advances in the Astronautical Sciences* titled **Space Cooperation into the 21st Century**.
(8) The eighth symposium was held June 23-26, 1999, Xian, China. This volume was published in China (not available through AAS).
(9) The ninth symposium was held November 14-16, 2001, Pasadena, California, U.S.A. and was published as Volume 110, *Advances in the Astronautical Sciences* titled **Space Development and Cooperation Among All Pacific Basin Countries**.

Several other sequences or subseries have been established in the *Advances in the Astronautical Sciences* series. Among them are: Astrodynamics (published for the AAS every second year), Spaceflight Mechanics (annual), Guidance and Control (annual), and AAS Annual Conference proceedings. Proceedings volumes for earlier conferences are still avail-

able either in hard copy or in microfiche form. The appendix at the end of this volume lists proceedings available through the American Astronautical Society.

In proceedings volumes of the American Astronautical Society the technical accuracy and editorial quality are essentially the responsibility of the authors because the papers are essentially composed of camera-ready copy provided by the authors. The reader should bear in mind that for an international conference, such as the Tenth ISCOPS, many papers were prepared by authors whose native language is not English. The session chairmen and our editors do not review all papers in detail; however, format and layout are improved when necessary by our editors. In some cases the English is improved so it reads better. For this conference, the many authors whose native language is not English are to be congratulated on the quality of material submitted and are to be thanked for their significant contributions to this English-language volume. The editors wish to express their thanks to all those who have contributed to the success of this conference and to authors for their efforts in finalizing material for publication.

Robert H. Jacobs
Series Editor
Advances in the Astronautical Sciences

PREFACE

The Tenth International Space Conference of Pacific-basin Societies (10th ISCOPS) was held at the Tokyo International Exchange Center, Tokyo, Japan on December 10 to 12, 2003. The theme was "Space Activities and Cooperation Contributing to All Pacific Basin Countries." This symposium was the tenth in a continuing series of biennial conferences co-sponsored by the American Astronautical Society (AAS), the Chinese Society of Astronautics (CSA), and the Japanese Rocket Society (JRS).

The conference was originally planned to be held in May 2003 in Nagoya, Japan. However, due to the indication of sweeping of SARS (Severe Acute Respiratory Syndrome) in the world, especially in eastern Asia, the organizer determined to shift the period of the conference to December, based on the discussion with the technical co-chairpersons of AAS and CSA.

In total, 129 attendees from six countries (China, U.S.A., Korea, Canada, India, Germany) and Japan were registered and 92 papers were presented in the National/International Space Program session, the International Student Conference and Competition, and eight technical sessions. This proceedings volume includes most of the presented technical papers plus remarks made in the Opening Ceremony by the representatives of the AAS, CSA, and the JRS. The eight technical session topics include: astrodynamics, guidance and control (including space robotics and ground operations); satellite communications, broadcasting and TT&C; satellite remote sensing, meteorology, small satellite systems/constellations etc.; manned space flight, space station, and pacific space ports (including lunar research and exploration); materials and structures; space transportation and propulsion; micro-gravity sciences and life science; and space debris and environment.

The 10th ISCOPS acknowledges the support of the Japanese Aerospace Exploration Agency (JAXA) for providing an excellent technical tour in Tsukuba Space Center.

The technical support and coordination provided by Prof. Peter M. Bainum and Ms. Li Furong are greatly acknowledged. Finally appreciation is extended to Ms. Ruriko Kinoshita for her excellent coordination of the conference in the secretariat of the 10th ISCOPS.

The 11th ISCOPS is scheduled to be hosted by the CSA in China in 2005. We look forward to working again with our colleagues from the Pacific-basin to ensure the success of the 11th ISCOPS.

Prof. Takashi Nakajima
JRS Technical Co-Chairperson,
10th ISCOPS

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