The Cassini-Huygens Mission

Orbiter Remote Sensing Investigations

Editor: C.T. Russell

Springer

THE CASSINI-HUYGENS MISSION

Orbiter Remote Sensing Investigations

Volume 3

Edited by

CHRISTOPHER T. RUSSELL
University of California, California, U.S.A.

Reprinted from *Space Science Reviews*, Volume 115, Nos. 1–4, 2004

KLUWER ACADEMIC PUBLISHERS
DORDRECHT / BOSTON / LONDON

A.C.I.P. Catalogue record for this book is available from the Library of Congress

ISBN: 1-4020-3147-5

Published by Kluwer Academic Publishers
P.O. Box 17, 3300 AA Dordrecht, The Netherlands

Sold and distributed in North, Central and South America
by Kluwer Academic Publishers,
101 Philip Drive, Norwell, MA 02061, U.S.A.

In all other countries, sold and distributed
by Kluwer Academic Publishers,
P.O. Box 322, 3300 AH Dordrecht, The Netherlands

Printed on acid-free paper

Cover illustration: Courtesy of ESA

All Rights Reserved
© 2004 Kluwer Academic Publishers
No part of the material protected by this copyright notice may be reproduced or
utilised in any form or by any means, electronic or mechanical,
including photocopying, recording or by any information storage and
retrieval system, without written permission from the copyright owner

Printed in the Netherlands

TABLE OF CONTENTS

Foreword

At this writing the Cassini spacecraft has fired its engine and successfully inserted itself and its precious cargo of scientific instruments into orbit, the first step of its exploration of the Saturnian system. The suspense is not over, however. While exciting images of the rings have been captured, an exotic composition of Phoebe sensed by the mapping spectrometer and unexpected panoply of magnetic waves and plasma dynamics encountered on the incoming trajectory and initial orbit, the Huygens probe is still on board and the first close flyby of Titan has not taken place. Not until Christmas Day will the probe be released. Navigators are still checking their calculations, worrying about known unknowns like the mass of Saturn's moons that could cause ever so small a deviation from the planned trajectory of the probe. The orbiter investigators are also anxious but they get their taste of Titan earlier, on October 26. How well will they detect the surface? How thick is the atmosphere? Does Titan have a magnetic field? Is there lightning in the atmosphere of Titan? While terrestrial and Hubble Space Telescope pictures have improved greatly over the years, they cannot match the resolution obtainable from orbit about the planet, and much of the data is simply unobtainable without direct in situ sensing.

Volume 1 of this three volume set described the Cassini/Huygens mission, its scientific objectives and the Huygens probe that will soon enter the Titan atmosphere. Volume 2 described the in situ investigations on the orbiter. In this, the third and final volume of the compendium, we describe the remote sensing investigations: radio science, radar, visible and infrared spectroscopy, thermal infrared studies, ultraviolet spectroscopy and visible imagery.

This volume completes our description of this most ambitious mission. For the editor, this has been a very ambitious task, extending over an eight-year period. We trust that the reader will find these pages beneficial, gaining insight into the how and why of the Cassini investigations and allowing the broader scientific community to share in the advance in our understanding that the mission brings. As with Volumes 1 and 2, this volume is due to the efforts of many individuals especially the referees and authors who have helped produce a very readable and complete descriptions of the investigations. We especially wish to thank Anne McGlynn who assisted in the initial stage of the assembly of this collection and Marjorie Sowmendran who completed the effort upon Anne's retirement. Lastly, none of this would have been possible without the years of labor by the women and men of the Cassini/Huygens project who built the spacecraft, tested it, programmed the software, and navigated and operated the spacecraft so flawlessly.

C. T. Russell
University of California
Los Angeles, CA
September 2004

Space Science Reviews **115:** vii, 2004.
© 2004 *Kluwer Academic Publishers. Printed in the Netherlands.*

The Cassini-Huygens Mission

Orbiter Remote Sensing Investigations

Editor: C.T. Russell

The joint NASA-ESA Cassini-Huygens mission is a splendid example of how international cooperation can return a wealth of scientific return that could not be afforded by the programs of any partner alone. ESA contributed the Titan atmosphere entry probe and NASA the orbiter spacecraft, the launch and operations. Various national agencies contributed to the payloads of both the orbiter and the entry probe. Cassini will return much more information than the Galileo mission. While Saturn is further from the Sun than Jupiter, with less illumination and a colder environment, Saturn's weaker radiation belt permits longer periods of observation close to Saturn than were possible with Galileo at Jupiter. Cassini provides shorter period orbits, closer images of the rings and the atmosphere, and many more satellite encounters, in fact 44 encounters with Saturn's largest moon, Titan, in the first four years in orbit. This greater number of observations provides a rich scientific bonanza for the remote sensing instruments on Cassini.

This book is the third and last volume of this compendium on the Cassini-Huygens mission. This volume describes the remote sensing investigations on the Cassini orbiter: radio science, radar, visible and near infrared spectroscopy, far infrared spectroscopy, ultraviolet spectroscopy and visible imagery. This book is of interest to all potential users of the Cassini-Huygens data, to those who wish to learn about the planned scientific return from the Cassini-Huygens mission and those curious about the processes occurring on this most fascinating planet.

Reprinted from *Space Science Reviews*, volume 115, nos. 1-4, 2004.

ISBN 1-4020-3147-5

9 781402 031472

springeronline.com