Volume 2

APPLIED PHYSICS AND ENGINEERING

An International Series

Re-entry and Planetary Entry Physics and Technology

Re-entry and Planetary Entry Physics and Technology

I / Dynamics, Physics, Radiation, Heat Transfer and Ablation

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To

PRESIDENT JOHN F. KENNEDY
for his decision to land men on the moon
in this decade

and

NASA ADMINISTRATOR JAMES E. WEBB
for his achievements
to carry out our national goal in space

Preface

During the last decade, a rapid growth of knowledge in the field of re-entry and planetary entry has resulted in many significant advances useful to the student, engineer and scientist. The purpose of offering this course is to make available to them these recent significant advances in physics and technology.

Accordingly, this course is organized into five parts: **Part 1, Entry Dynamics, Thermodynamics, Physics and Radiation; Part 2, Entry Ablation and Heat Transfer; Part 3, Entry Experimentation; Part 4, Entry Concepts and Technology;** and **Part 5, Advanced Entry Programs.** It is written in such a way so that it may easily be adopted by other universities as a textbook for a two semesters senior or graduate course on the subject. In addition to the undersigned who served as the course instructor and wrote Chapters, 1, 2, 3 and 4, guest lecturers included: Prof. FRANKLIN K. MOORE who wrote Chapter 5 *"Entry Radiative Transfer,"* Prof. SHIH-I PAI who wrote Chapter 6 *"Entry Radiation-Magnetogasdynamics,"* Dr. CARL GAZLEY, Jr. who wrote Chapter 7 *"Entry Deacceleration and Mass Change of an Ablating Body,"* Dr. SINCLAIRE M. SCALA who wrote Chapter 8 *"Entry Heat Transfer and Material Response,"* Mr. DAVID G. STONE who wrote Chapter 9 *"Entry Flight Research and Experimentation,"* Dr. JOSEPH G. LOGAN who wrote Chapter 10 *"Lifting Re-entry Concepts,"* Dr. JOHN F. MCCARTHY, Jr. who wrote Chapter 11 *"Earth Entry from Lunar and Planetary Missions,"* Dr. KRAFFT A. EHRICKE who wrote Chapter 12 *"Braking Entry of Mars and Venus,"* Dr. ROBERT W. BUSSARD who wrote Chapter 13 on *"Entry Propulsion and Power Technology,"* Dr. ROBERT C. DUNCAN who wrote Chapter 14 *"Entry Guidance and Control Technology,"* Dr. WILLIAM T. THOMSON who wrote Chapter 15 *"Dynamics Problem of Planetary Approach,"* and Dr. JOSEPH F. SHEA who wrote Chapter 16 *"Entry Programs Management."* The material in Setion 8 of Chapter 3 on *"High Temperature Properties of Gases"* was written by Dr. KENNETH G. SEWELL of LTV Research Center and the material in Section 2 of Chapter 4 on *"Orbital Maneuver"* was written by Dr. GEZA S. GEDEON of TRW Systems.

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