

### Calender of Forthcoming AIAA Meetings

| Date            | Meeting                                                                                  | Location                       | Abstract Deadline |
|-----------------|------------------------------------------------------------------------------------------|--------------------------------|-------------------|
| Aug. 19-21      | Astrodynamics Conference <sup>1</sup>                                                    | New Haven, Conn.               | Past              |
| Aug. 26-28      | Simulation for Aerospace Flight Conference <sup>1</sup>                                  | Columbus, Ohio                 | Past              |
| Aug. 26-28      | Conference on Physics of Entry into Planetary Atmospheres <sup>2</sup>                   | Cambridge, Mass.               | Past              |
| Sept. 23-27     | 1st International Telemetering Conference                                                | London, England                | Past              |
| Sept. 26-Oct. 1 | XIVth International Astronautical Congress <sup>3</sup>                                  | Paris, France                  | Past              |
| Sept. 30-Oct. 1 | AIAA-NASA Engineering Problems of Manned Interplanetary Exploration Meeting <sup>1</sup> | Palo Alto, Calif.              | Past              |
| Nov. 4-6        | Vehicle Design and Propulsion Meeting <sup>1</sup>                                       | Dayton, Ohio                   | Past              |
| Nov. 19-21      | ASM-AIAA Conference on Stratosphere-Mesosphere Structure <sup>4</sup>                    | El Paso, Texas                 | Past              |
| Dec. 4-6        | AIAA-Air Force Testing of Manned Flight Systems                                          | Edwards Air Force Base, Calif. | Past              |
| Dec. 11-13      | Heterogeneous Combustion <sup>5</sup>                                                    | Palm Beach, Fla.               | Past              |
| Jan. 20-22      | Aerospace Sciences Meeting <sup>6</sup>                                                  | New York, N. Y.                | Oct. 14           |
| Jan. 29-31      | Solid Propellant Rocket Conference <sup>5</sup>                                          | Palo Alto, Calif.              | Past              |
| March 9-10      | AIAA-U.S. Navy Aerodynamic Testing Conference                                            | Washington, D. C.              | Sept. 10          |
| April 1-3       | Fifth Annual Structures and Materials Conference <sup>7</sup>                            | Palm Springs, Calif.           | Aug. 23           |
| May 4-6         | Aerospace Propulsion Meeting <sup>4</sup>                                                | Cleveland, Ohio                | Past              |

<sup>1</sup> Flyer with additional program details available from AIAA New York office.

<sup>2</sup> Call for papers in February, March, and April issues. Flyer with additional program details available from AIAA New York office.

<sup>3</sup> Call for papers in January and April issues.

<sup>4</sup> Call for papers in July issue.

<sup>5</sup> Call for papers in May issue.

<sup>6</sup> Call for papers in May and July issues.

<sup>7</sup> Call for papers in this issue.

Except when program chairman is known, abstracts should be mailed to Robert R. Dexter, Director of Technical Services, American Institute of Aeronautics and Astronautics, 500 Fifth Avenue, New York 36, N. Y.

The Society welcomes suggestions from individual members on subjects that would be appropriate for specialist meetings or for special sessions at the Annual Meetings. Such suggestions should be supported in writing by evidence of broad interest in the subject and by the willingness of at least one organization to serve as host. The Meetings Manager will forward such suggestions to the appropriate Technical Committee for consideration.

## Technical Literature Digest

M. H. Smith, Associate Editor

The James Forrestal Research Center, Princeton University

### Propulsion and Power (Combustion Systems)

Segmented Rocket Motor Case Program, R. G. Carpenter and T. R. Jeffus. Quart. Progr. Rept. 3, Oct. 15, 1962-Jan. 15, 1963, Douglas Aircraft Co. Rept. SM-42911, Jan. 15, 1963, 54 pp.

Propulsion and Propellants, M. J. Zucrow, edited by C. D. Fitz. Army Ordnance Corps PT ORDP-20-282, May 1960, 95 pp. (Ordnance Eng. Design Handbook, Ballistic Missile Series).

Advances in the Astronautical Sciences (American Astronautical Society, Proceedings, Aug. 4-5, 1960) (Plenum Press, New York, 1961), Vol. 7, 454 pp.

Determination of Rocket Engine  $I_{sp}$  from Inverse Acceleration, W. R. Davis, pp. 77-84.

Space Flight Report to the Nation, edited by J. Grey and V. Grey (Basic Books Inc., New York, 1962), 224 pp.

Chemical Rocket Propulsion, M. Summerfield, pp. 69-74.

Propulsion Systems for Civil Aircraft, S. H. Rolle and H. D. Hoekstra. Inst. Aerospace Sci. Paper 63-39, Jan. 1963, 47 pp.

Some Characteristics of Rectangular Multi-Shock and Isentropic External Compression Intakes at a Mach Number of 2.9, R. A. Dutton and E. L. Goldsmith. Gt. Brit. Aeronaut. Res. Council Current Paper 630, 1963, 33 pp.

Ballistic Design, Loading, Inspection and Handling of High Strength Solid Propellant Rocket Motor Assemblies, A. E. Hornsey. Thiokol Chemical Corp., Wasatch Div., AFSC-TR-62-3, Dec. 1962, 22 pp.

Advances in Astronautical Propulsion, Proceedings (Seminar on Astronautical Propulsion, Milan, 1960), edited by C. Casci (Pergamon Press, New York, 1962), 366 pp.

Design and Application of Large Solid-Propellant Propulsion Systems, J. Buchanan, pp. 47-62.

Physico-chemical Problems Related to Solid Propellant Propulsion (Abstract), M. Summerfield, pp. 63-70, 27 refs.

Design, Development and Operation of Liquid Rocket Vehicles, A. O. Tischler, pp. 71-106, 220 refs.

Horizons in Liquid-Propellant Rocket Propulsion, S. S. Penner and L. L. Bixson, pp. 107-146.

### Propulsion and Power (Noncombustion)

Mars Capabilities for Electrical, Nuclear, and Chemical Propulsion Systems, A. D. Cohen and L. S. Beers. Inst. Aerospace Sci. Paper 62-120, June 1962, 32 pp.

Dual Electric-Nuclear Rockets for Interplanetary Missions, M. Levoy. Inst. Aerospace Sci. Paper 62-117, June 1962, 17 pp.

Two-Dimensional Criticality Calculations of Gaseous-Core Cylindrical-Cavity Reactors, R. E. Hyland, R. G. Ragsdale, and E. J. Gunn. NASA TN D-1575, March 1963, 28 pp.

Secondary Space Power from Nuclear Radiation, B. Raab. Inst. Aerospace Sci. Paper 62-121, June 1962, 25 pp.

Dynamic Engines Versus Fuel Cells for Space Power Systems, R. W. McJones and W. A. Bass. Inst. Aerospace Sci. Paper 62-119, June 1962, 19 pp.

Parametric Design Study for a 1500 Watt Solar Thermionic Orbital Power System, T. J. McCusker. Inst. Aerospace Sci. Paper 62-118, June 1962, 22 pp.

EDITOR'S NOTE: Contributions from Professors E. R. G. Eckert, E. M. Sparrow, and W. E. Ibele of the Heat Transfer Laboratory, University of Minnesota, are gratefully acknowledged.

**Power for Spacecraft (NASA-University Conference on the Science and Technology of Space Exploration, Chicago, Nov. 1962).** Papers from the Conference Proceedings, NASA SP-11, Vol. 2, pp. 125-150, NASA SP-21, Dec. 1962, 26 pp.

**The Validity of Ballistic Pendulum Measurement with Pulsed Plasma Accelerators,** D. L. Clingman and T. L. Rosebrock. General Motors Corp., Allison Div. Eng. Dept. Rept. 3158, Jan. 1963, 7 pp.

**Advances in the Astronautical Sciences (American Astronautical Society, Proceedings, Aug. 4-5, 1960)** (Plenum Press, New York, 1961), Vol. 7, 454 pp.

**Ion Engine Development I: Diffusion Type Ion Sources,** R. J. Sunderland, J. R. Radbill, and R. D. Gilpin, pp. 148-172.

**Operation of an Electric Ramjet in a Planetary Atmosphere,** E. P. French, pp. 421-436.

**Space Flight Report to the Nation,** edited by J. Grey and V. Grey (Basic Books Inc., New York, 1962), 224 pp.

**Advanced Propulsion,** R. W. Bussard, pp. 75-89.

**Fuel Cells (Symposium held by the American Chemical Society, Divisions of Fuel Chemistry and Petroleum Chemistry, 140th National Meeting, Chicago, 1962),** edited by G. J. Young (Reinhold Publishing Corp., New York, 1963), Vol. II, 225 pp.

**Recent Development in High-Temperature Fuel-Cell Research in the Netherlands,** G. H. J. Broers and M. Schenke, pp. 6-23.

**High-Temperature Methane Fuel Cells,** E. B. Schultz Jr., K. S. Vorres, L. G. Marianwski, and H. R. Linden, pp. 24-36.

**Solid Oxide Electrolyte Fuel Cells,** J. Weissbart and R. Ruka, pp. 37-49.

**An Outline of the Economics of a Domestic Fuel Cell System,** C. G. von Fredersdorff, pp. 50-67.

**Radiation-Induced Activation of Oxygen Electrodes in Fuel Cells,** K. Schwabe, pp. 68-76.

**Theory of Polarization of Porous Gaseous-Diffusion Electrodes,** H. B. Urbach, pp. 77-94.

**Polarization at Diffusion Electrodes,** L. G. Austin, pp. 95-112.

**Potential Distribution and Internal Resistance in Electrochemical Matrix Cells with Discontinuous Contacts,** M. Eisenberg and L. Fick, pp. 113-132.

**DSK Electrodes for the Cathodic Reduction of Oxygen,** H. M. Dittmann, E. W. Justi, and A. W. Winsel, pp. 133-142.

**Ion Exchange Membranes in Hydrogen-Oxygen Fuel Cells,** R. M. Lurie, C. Berger, and R. J. Shuman, pp. 143-152.

**Preliminary Appraisal of the Ammonia Fuel Cell System,** R. A. Wynveen, pp. 153-167.

**Description of a Fuel-Cell Power Pack Operating on Hydrogen and Ambient Air,** E. A. Oster and L. E. Chapman, pp. 168-181.

**The Electrochemical Oxidation of Hydrocarbons in a Fuel Cell,** C. E. Heath and C. H. Worsham, pp. 182-189.

**Fuel Cell Intermediates and Products,** M. J. Schlatter, pp. 190-215.

**Low Temperature Electrochemical Oxidation of Hydrocarbons,** G. J. Young and R. B. Rozelle, pp. 216-224.

**Research on the Oscillating-Electron Plasma Source,** J. W. Davis, A. W. Angel-

beck, and E. A. Pinsley. Air Force Aeronaut. Res. Labs. ARL 62-471, Dec. 1962, 159 pp.

**NASA Research on Resistance Heated Hydrogen Jets,** J. R. Jack. Preprint, Symposium on Advanced Propulsion Concepts, 3rd, Cincinnati, Oct. 2-4, 1962, 18 pp.

**Test Results for a Cesium Electron Bombardment Ion Motor,** R. C. Speiser, W. D. Kilpatrick, and G. R. Reid. Inst. Aerospace Sci. Paper 63-75, Jan. 1963, 20 pp.

**Electrostatic Acceleration of Neutral Plasmas-Momentum Transfer Through Magnetic Fields,** G. S. Janes and T. Wilson. Preprint, Symposium on Advanced Propulsion Concepts, 3rd, Cincinnati, Oct. 2-4, 1962, 27 pp.

**Quest for Heavy Particle Propulsion,** R. E. Hunter. Preprint, Symposium on Advanced Propulsion Concepts, 3rd, Cincinnati, Oct. 2-4, 1962, 18 pp.

**Feasibility of Applying Field-Ion Emission to Electrostatic Rocket Engines,** N. Stankiewicz. NASA TN D-1563, Jan. 1963, 21 pp.

**Perigee Propulsion for Orbital Launch of Nuclear Rockets,** P. G. Johnson and F. E. Rom. NASA TR R-140, 1962, 24 pp.

**Space Age Astronomy, Symposium (International) . . . Aug. 7-9, 1961, Calif. Inst. Tech., Pasadena,** edited by A. J. Deutsch (Academic Press, New York, 1962), 531 pp.

**The Electric Engine as a Propulsion System for the Exploration of Space,** G. B. Heller, pp. 288-307.

**Auxiliary Power Units for Space Applications,** A. B. Martin, pp. 323-334.

**Propulsion Developments,** D. W. Hege, pp. 501-506.

**Advances in Astronautical Propulsion, Proceedings (Seminar on Astronautical Propulsion, Milan, 1960),** edited by C. Casci (Pergamon Press, New York, 1962), 366 pp.

**Introductory Remarks on Space Propulsion Problems,** T. von Kármán, pp. 3-10.

**Mechanics of Space Propulsion,** L. Crocco, pp. 11-46. In Italian.

**Nuclear Rockets in Space Flight,** E. Sanger, pp. 147-164.

**Nuclear Fission Rockets: Problems, Progress and Promise,** R. W. Bussard, pp. 165-220, 37 refs.

**Magneto-Fluid Dynamics Problems Related to Space Propulsion,** M. Abele, pp. 221-236, 8 refs.

**Electro-gas-dynamical Consideration of a Pulsed Plasma Pinch Engine,** A. E. Kunen, pp. 235-236.

**Electric Power Generation in Space by Solar and Other Means,** A. E. von Doenhoff, pp. 237-259.

**Requirements for Propulsion and Guidance in Aerospace Trajectories,** L. Broglio, pp. 289-312. In Italian.

**Spacecraft Propulsion Requirements for Lunar Exploration Missions,** R. R. Breshears. Inst. Aerospace Sci. Paper 63-76, Jan. 1963, 38 pp.

**Space Propulsion Component Research,** E. E. Stein. Inst. Aerospace Sci. Paper 63-64, Jan. 1963, 17 pp.

**Advances in Electronic and Electron Physics,** edited by L. Marton (Academic Press, New York, 1962), Vol. 17, 451 pp.

**Thermionic Energy Conversion,** J. M. Houston and H. F. Webster, pp. 125-206.

**Thermoelectricity,** F. E. Jaumot Jr., pp. 207-243.

**Condensation Colloid Propellants for Electrostatic Propulsion,** L. A. Cox. Preprint, Symposium on Advanced Propulsion Concepts, 3rd, Cincinnati, Oct. 2-4, 1962, 23 pp.

**Nuclear Rocket Reactor Analysis,** R. W. Deutsch. Inst. Aerospace Sci. Paper 63-68, Jan. 1963, 37 pp.

**Statistical Estimation of Nuclear Reactor Dynamic Parameters,** J. D. Cummins. United Kingdom Atomic Energy Authority, Reactor Group Rept. AEEW-R 179, Feb. 1962, 86 pp.

## Propellants and Combustion

**Heterogeneous Combustion in a System Containing Condensed Components,** N. N. Bakhman and D. P. Polikarpov. Air Force Systems Command, Foreign Tech. Div. FTD-TT-62-709, June 1962, 17 pp.; transl. from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk Energ. i Avtomat., no. 4, 37-42 (1961).

**A Research Study to Advance the State-of-the-Art of Solid Propellant Grain Design,** Quart. Progr. Rept. 2, Oct. 1, 1962-Jan. 1, 1963. Thiokol Chemical Corp., Elkton Div. Rept. E 13-63, March 8, 1963, 58 pp.

**Advanced Test Methods for Determining Operational Characteristics of Propellants,** G. A. Mead Jr. Air Reduction Co. Quart. Progr. Rept. 6, Sept.-Nov. 1962, 21 pp.

**The Effects of RF Energy on the XM6 and XM8 EBW Squibs,** D. L. Thomson, J. W. Vann, and W. L. Strickland. Army Missile Command, Directorate Res. Dev. RK-TR-63-1, Jan. 15, 1963, 10 pp.

**Research and Technologic Work on Explosives, Explosions, and Flames: Fiscal Year 1960,** R. F. Brinkley and R. W. Dolah. Bur. Mines Info. Circ. 8106, 1962, 39 pp.

**Proposal for Determining the Mass of Liquid Propellant Within a Space Vehicle Propellant Tank Subjected to a Zero Gravity Environment,** R. L. Evans and J. R. Olivier. NASA TN D-1571, March 1963, 10 pp.

**Advances in the Astronautical Sciences (American Astronautical Society, Proceedings, Aug. 4-5, 1960)** (Plenum Press, New York, 1961), Vol. 7, 454 pp.

**Cryogenic Propellant Storage Parameters on Moon,** C. C. Love Jr., pp. 295-315.

**On the Mechanism of Bluff Body Flame Stabilization at Low Velocities,** T. Maxworthy. Calif. Inst. Tech., Jet Propulsion Lab. TR 32-183, Dec. 1962, pp. 233-244; reprinted from Combust. Flame 6 (Dec. 1962).

**Experimental Effect of Gas Flow Transients on the Heat Release of Burning Liquid Drops in a Rocket Combustor,** M. F. Heidmann. NASA TN D-1576, March 1963, 19 pp.

**The Effects of Moisture on the Dynamic Mechanical Properties of Ammonium Perchlorate-Polyurethane Propellants,** R. F. Landel and B. G. Moser. Calif. Inst. Tech., Jet Propulsion Lab. TR 32-389, Feb. 26, 1963, 16 pp.

**A Method of Conformal Mapping and the Determination of Stresses in Solid-Propellant Rocket Grains,** H. B. Wilson Jr. and C. C. Fretwell. Rohm & Haas Co. Rept. S-38, April 1, 1963, 183 pp.

**Theoretical and Experimental Investigation of Supersonic Combustion,** A. Ferri, P. A. Libby, and V. Zakkay. Air Force Aeronaut. Res. Labs ARL 62-467, Sept. 1962, 118 pp. (also Brooklyn Polytech. Inst. PIBAL Rept. 713).

Spectroscopy (Institute of Petroleum Conference, London, 1962), edited by M. J. Wells. Report of the Hydrocarbon Group . . . held March 1962 (Institute of Petroleum, London, 1962), 305 pp.

The Spectrophotometry of Free Radicals in Flames, T. M. Sugden, pp. 137-148.

Initiation of Detonation Resulting from Combustion Instabilities, F. C. Gibson, R. W. Watson, C. R. Summers, and F. H. Scott. Bur. Mines Quart. Rept., Aug.-Oct. 1962, 18 pp.

Relative Ignitability of Typical Solid Propellants with Chlorine Trifluoride, H. Allen Jr. and M. L. Pinns. NASA TN D-1533, Jan. 1963, 23 pp.

Effect of the Acceleration Disturbances Encountered in the MA-7 Spacecraft on the Liquid-Vapor Interface in a Baffled Tank During Weightlessness, D. A. Petrash, R. C. Nussle, and E. W. Otto. NASA TN D-1577, Jan. 1963, 14 pp.

Effect of Surface Energy on the Liquid-Vapor Interface Configuration During Weightlessness, D. A. Petrash, T. M. Nelson, and E. W. Otto. NASA TN D-1582, Jan. 1963, 32 pp.

Fundamentals of Liquid Propellant Sensitivity, T. A. Erikson and E. L. Grove. Ill. Inst. Tech., Armour Res. Inst. Rept. ARF 3197-15 (Final), Nov. 26, 1962, 62 pp.

Combustion of Metals, G. H. Markstein. Project Squid TR CAL-86-P, Nov. 1962, 50 pp., 77 refs.

Detonability of Nitrous Oxide at Elevated Initial Pressures and Temperatures, J. A. Laughrey, L. E. Bollinger, and R. Edse. Air Force Aeronaut. Res. Labs. ARL 62-432, Sept. 1962, 20 pp.

Development and Functional Characteristics of the XM8 Squib, R. E. Betts and W. P. Williams. Army Missile Command RK-TR-62-6, Oct. 24, 1962, 32 pp.

## Materials and Structures

Measured and Calculated Subsonic and Transonic Flutter Characteristics of a 45° Sweptback Wing Planform in Air and in Freon-12 in the Langley Transonic Dynamics Tunnel, E. C. Yates Jr., N. S. Land, and J. T. Foughner Jr. NASA TN D-1616, March 1963, 43 pp.

Effects of External Force Excitation of Panel Flutter, E. F. E. Zeydel and D. R. Kobett. Midwest Research Inst. (AFOSR TR), Dec. 1962, 54 pp.

On the Use of a Spring-Mass to Approximate a Bar-Mass System Subjected to a Rectangular-Force Pulse, A. E. Seigel and R. H. Waser. Naval Ordnance Lab. NOL TR 62-148, Sept. 20, 1962, 28 pp.

Plastic Deformation of Thin Brazed Joints in Shear, C. W. Shaw, L. A. Shepard, and J. Wulff. Mass. Inst. Tech., Aeroelastic and Structures Res. Lab. ASRL TR 94-3, Nov. 1962, 45 pp.

Buckling of a Thin-Walled Circular Cylindrical Shell Heated Along an Axial Strip, N. J. Hoff, C. C. Chao, and W. A. Madsen. Stanford Univ., Dept. Aeronaut. Astronaut. SUDAER 142, Sept. 1962, 21 pp.

Random Excitation of a Simple Panel; Some Experimental Results, J. F. Wilby. Southampton Univ., Dept. Aeronaut. Astronaut. AASU Rept. 231, Jan. 1963, 12 pp.

Measurements of Total Emittance of Several Refractory Oxides, Cermet, and Ceramics for Temperatures from 600° to 2,000°F, W. R. Wade and W. S. Slomp.

NASA TN D-998, March 1962, 35 pp.

Mathematical Theories of Plastic Deformation under Impulsive Loading, J. A. Simmons, F. Hauser, and J. E. Born. Calif. Univ. Publs. Eng. 5, 177-229, 93 refs. (Feb. 8, 1962).

The Buckling of Plates Tapered in Thickness, G. G. Pope. Gt. Brit. Aeronaut. Res. Council R&M 3309, Oct. 1961, 1963, 16 pp.

An Experimental Method to Measure the Strain Energy Function  $W$ , A. San Miguel. Calif. Inst. Tech., Jet Propulsion Lab. TR 32-365, Dec. 20, 1962, 21 pp.

Structures for Space Operations (NASA-University Conference on the Science and Technology of Space Exploration, Chicago, Nov. 1962). Papers from the Conference Proceedings, NASA SP-11, Vol. 2, pp. 487-532, NASA SP-28, Dec. 1962, 46 pp.

Explosion Welding (Svarka Vzryvom), V. S. Sedykh, A. A. Deribas, Ye. I. Bichenkov, and Yu. A. Trishin. NASA Tech. Transl. F-140, March 1963, 12 pp.

A Contribution to the Theory of Deformation in Expandable Structures with a Particular Application to Toroidal Shells, H. U. Schuerch and G. M. Schindler. Inst. Aerospace Sci. Paper 62-108, June 1962, 24 pp.

Thermal Buckling of Annular Plates, J. Fernandez-Sintes, W. H. Horton, and N. J. Hoff. Stanford Univ., Dept. Aeronaut. Astronaut. SUDAER 143, Dec. 1962, 60 pp.

Symposium on the Rare Earths and Related Elements, Chicago, 1959, The Rare Earths, edited by F. H. Spedding and A. H. Deane (John Wiley & Sons Inc., New York, 1961), 641 pp.

Historical Introduction to the Rare Earths, F. H. Spedding, pp. 3-8.

Chemistry of the Rare Earths, T. Moeller, pp. 9-28.

Separation of Rare Earths by Fractional Crystallization, R. M. Healy and H. E. Kremers, pp. 29-37.

Separation of Rare Earths by Liquid-Liquid Extraction, D. F. Peppard, pp. 38-54.

Separation of Rare Earths by Ion Exchange, J. E. Powell, pp. 55-76.

Preparation of the Rare-Earth Fluorides, O. N. Carlson and F. A. Schmidt, pp. 77-88.

Rare-Earth and Yttrium Halides for Metal Production, Chlorides, Bromides, Iodides, F. E. Block and T. T. Campbell, pp. 89-101.

Metallothermic Preparation of Rare-Earth Metals, A. H. Deane, pp. 102-112.

Metallothermic Preparation of Yttrium Metal, O. N. Carlson and F. A. Schmidt, pp. 113-125.

Rare-Earth Electrolytic Metals, E. Morrice and R. G. Knickerbocker, pp. 126-144.

Refining and Purification of Rare-Earth Metals, C. L. Huffine and J. M. Williams, pp. 145-162.

Mechanical Fabrication of Rare-Earth Metals, K. M. Bohlander, pp. 163-176.

Physical Properties of the Rare-Earth Metals, A. H. Deane, pp. 177-189.

Crystallography of the Rare-Earth Metals, K. A. Gschneidner Jr., pp. 190-214.

Metallography of the Rare-Earth Metals, B. Love, pp. 215-223.

Rare-Earth Metal Phase Diagrams, C. E. Lundin, pp. 224-385.

Principles of the Alloying Behavior of

Rare-Earth Metals, K. A. Gschneidner Jr. and J. T. Waber, pp. 386-427.

The Mechanical Properties of Yttrium, Scandium, and the Rare-Earth Metals, C. R. Simmons, pp. 428-454.

Rare-Earth Metals in Magnesium Technology, T. E. Leontis, pp. 455-498.

Applications of Rare Earths to Ferrous and Nonferrous Alloys, J. F. Collins, V. P. Calkins, and J. A. McGurty, pp. 499-511.

Nonnuclear Nonmetallic Uses of Rare Earths, M. M. Woyski and W. J. Silvernail, pp. 512-521.

Nuclear Applications of Yttrium and the Lanthanons, W. K. Anderson, pp. 522-569.

Analytical Chemistry of the Rare Earths, C. V. Banks and D. W. Klingman, pp. 570-593.

Analytical Spectroscopy of the Rare-Earth Elements, V. A. Fassel, p. 594.

Advances in the Astronautical Sciences (American Astronautical Society, Proceedings, Aug. 4-5, 1960) (Plenum Press, New York, 1961), Vol. 7, 454 pp.

Foamed-in-Place Structures for Space Vehicles and Stations, C. C. Osgood, pp. 99-110.

Spectrochemical Analysis of High-Purity Titanium, R. J. Wells and L. Carpenter. Bur. Mines Rept. of Investigations 6105, 1962, 23 pp.

CsCl-Type Compounds in Binary Alloys of Rare Earth Metals with Gold and Silver, C. C. Chao, H. L. Luo, and P. Duwez. Calif. Inst. Tech., W. M. Keck Lab. Eng. Materials TR 12, Feb. 1963, 8 pp.

A Photogrammetric Method of Determining the Mode Shapes of Vibrating Objects, and Results for a Thin Wing, L. H. Ohman and M. C. van Wijk. Can. Natl. Res. Council NRC LR-362, Nov. 1962, 14 pp.

Observations on the Role of Nonlinearity in Random Vibration of Structures, R. H. Lyon. NASA TN D-1872, March 1963, 41 pp.

Postbuckling Effects on the Flutter of Simply Supported Rectangular Panels at Supersonic Speeds. R. W. Fralich. NASA TN D-1615, March 1963, 30 pp.

Ames Tests on the Flutter of Cylindrical Shells, R. O. Stearman, M. H. Lock, and Y. C. Fung. Calif. Inst. Tech., Graduate Aeronaut. Labs. Rept. SM-62-37, Dec. 1962, 41 pp.

The Effect of an Idealized Boundary Layer on Flutter of Cylindrical Shells in Supersonic Flow, W. J. Anderson and Y. C. Fung. Calif. Inst. Tech., Graduate Aeronaut. Labs. Rept. SM-62-49, Dec. 19, 1962, 61 pp.

The Explorer XVI Micrometeoroid Satellite, Supplement I: Preliminary Results for the Period Jan. 14, 1963-March 2, 1963, E. C. Hastings Jr. NASA Tech. Memo. X-824, April 1963, 14 pp.

Stress Distribution in a Pressurized Thick Walled Toroidal Shell, A. Kornecki. Cranfield, England, College of Aeronaut. CoA Note 137, Jan. 1963, 16 pp.

Room-Temperature Shear and Compression Tests of Stiffened Panels with Integral or Attached Cooling Circuits, M. B. Dow and R. O. Whitley. NASA TN D-1499, March 1963, 43 pp.

Analysis of Helicopter Aeroelastic Characteristics in High-Speed Flight, W. Gerstenberger and E. R. Wood. Inst. Aerospace Sci. Paper 63-72, Jan. 1963, 71 pp.

Strength of Filamentary Sheets with One or More Fibers Broken, G. W. Zender

and J. W. Deaton. NASA TN D-1609, March 1963, 8 pp.

**Sonic Fatigue Life Determination by Siren Testing**, P. W. Smith Jr. and C. I. Malme. Air Force Aeronaut. Systems Div. ASD-TR-61-639, May 1962, 87 pp.

**Materials and Components in Space Environments**, F. J. Clauss. Inst. Aerospace Sci. Paper 63-58, Jan. 1963, 30 pp.

**Thermal Radiative Properties of Selected Materials**, Vols. 1 and 2, W. D. Wood, H. W. Deem, and C. F. Lucks. Battelle Memorial Inst., Defense Metals Info. Center DMIC Rept. 177, Nov. 15, 1962, 470 pp.

**A Dynamic Thermal Vacuum Technique for Measuring the Solar Absorptance and Thermal Emittance of Spacecraft Coatings**, W. B. Fussell, J. J. Triolo, and J. H. Henninger. NASA TN D-1716, March 1963, 27 pp.

**Optical Properties of Satellite Materials: The Theory of Optical Infrared Properties of Metals** (NASA George C. Marshall Space Flight Center, Res. Projects Div.). NASA TN D-1523, March 1963, 253 pp.

**Spectrochemical Analysis of High-Purity Beryllium**, R. W. Lewis, C. F. Earl, J. L. Potter, and R. Fehler. Bur. Mines Rept. of Investigations 6108, 1962, 15 pp.

**Experimental Panel Flutter Results for Some Flat and Curved Titanium Skin Panels at Supersonic Speeds**, J. G. Presnell Jr. and R. L. McKinney. NASA TN D-1600, Jan. 1963, 16 pp.

**Several Techniques for Flight Flutter Testing**, Parts I, II, and III. NATO, AGARDograph 56, 1960, 81 pp., 35 refs.

**A Review of Flight Flutter Testing Techniques in Great Britain**, M. O. W. Wolfe and W. T. Kirkby, pp. 1-36.

**Utilization of Electrodynamical Vibrators for In-Flight Measurement of the Response of an Aircraft Wing to Harmonic Excitation**, G. de Vries, pp. 37-56.

**Some Recent Developments in the Art of In-Flight Vibration Testing**, W. R. Laidlaw and W. T. Butterworth, pp. 57-81.

**Structural Aspects of Acoustic Loads**, B. L. Clarkson. NATO, AGARDograph 65, 1960, 115 pp., 91 refs.

**Structural Stability of Conical and Spherical Thin Shells**, W. Thielmann. NATO, AGARD Bibliog. 4, Sept. 1961, 31 pp., 168 refs.

**Thermal Stresses and Deflections in Rectangular Panels: The Analysis of Rectangular Panels with Three-Dimensional Heat Inputs**, M. Newman and M. J. Forray. Air Force Aeronaut. Systems Div., Flight Dynamics Lab. ASD-TR-61-537, Part II, Oct. 1962, 48 pp.

**The Kinetics of Thermal Degradation of Charring Plastics. I: Glass Reinforced Phenolformaldehyde**, H. L. Friedman. General Electric Co., Missile and Space Div. TIS R62SD145, Aug. 1961, 30 pp.

**The Pyrolysis of Plastics in a High Vacuum Arc Image Furnace II**, H. L. Friedman. General Electric Co., Missile and Space Div. TIS R62SD57, Dec. 1962, 23 pp.

**The Leading-Edge Buckling of a Thin Built-Up Wing Due to Aerodynamic Heating**, K. I. McKenzie. Gt. Brit. Aeronaut. Res. Council R&M 3295, Feb. 1961, 24 pp.

**A Matrix Method for the Analysis of the Buckling of Structural Panels Subjected to Creep Environments**, D. S. Warren. Air Force Aeronaut. Systems Div. ASD-TDR-62-740, Final Rept., Nov. 1962, 181 pp., 22 refs.

**Development and Evaluation of a High Temperature Photoelastic Coating**, H. J. Sweet and B. P. Flowers. Air Force Aeronaut. Systems Div. ASD-TDR-62-469, Final Rept., Oct. 1962, 62 pp., 7 refs.

**Tensile Properties and Sheet-Bending Fatigue Properties of Some Refractory Metals at Room Temperature**, L. R. Foster Jr. and B. A. Stein. NASA TN D-1592, Jan. 1963, 31 pp.

**Studies in Biaxial Creep**, E. Z. Stowell and R. K. Gregory. Air Force Aeronaut. Res. Labs. ARL 62-434, Sept. 1962, 15 pp.

**Effect on Hull Vibrations of Various Bow Anti-pitching Fin Configurations**, G. P. Stefum and F. M. Schwartz. David Taylor Model Basin Rept. 1659, Nov. 1962, 48 pp.

## Fluid Dynamics, Heat Transfer, and MHD

**Aerodynamic Characteristics at a Mach Number of 6.77 of a 9° Cone Configuration, with and without Spherical Afterbodies, at Angles of Attack up to 180° with Various Degrees of Nose Blunting**, L. Neal Jr. NASA TN D-1606, March 1963, 24 pp.

**Viscous Effects on Zero-Lift Drag of Slender Blunt Cones**, J. D. Whitfield and B. J. Griffith. Arnold Eng. Dev. Center AEDC-TDR-63-35, March 1963, 48 pp.

**Factors Affecting Lift-Drag Ratios at Mach Numbers from 5 to 20**, T. P. Goebel, J. J. Martin, and J. A. Boyd. Inst. Aerospace Sci. Paper 62-115, Jan. 1962, 42 pp., 38 refs.

**Experimental Study of Cylinder and Sphere Wakes at a Mach Number of 3.7**, J. M. Kendall Jr. Calif. Inst. Tech., Jet Propulsion Lab. TR 32-363, Nov. 13, 1962, 17 pp., 15 refs.

**Nose and Inlet Shapes of Minimum Drag in Supersonic Flow**, K. G. Guderley, J. V. Armitage, and E. M. Valentine. Inst. Aerospace Sci. Paper 62-116, Jan. 1962, 19 pp.

**Pressure Measurements on a Cone-Cylinder-Flare Configuration at Small Incidences for  $M_\infty = 5.8$** , J. G. Woodley. Gt. Brit. Aeronaut. Res. Council Current Paper 632, March 1961, 1963, 14 pp.

**Gas Dynamics in Space Exploration** (NASA-University Conference on the Science and Technology of Space Exploration, Chicago, Nov. 1962). Papers from the Conference Proceedings, NASA SP-11, Vol. 2, pp. 251-301, NASA SP-24, Dec. 1962, 51 pp.

**Incompressible Flow About Bodies of Arbitrary Shape**, A. M. O. Smith. Inst. Aerospace Sci. Paper 62-143, June 1962, 26 pp.

**Compressible Turbulent Boundary Layers**, A. Walz. Reprinted from Colloq. Intern. Mecan. Turbulence, Marseille (Aug. 28-Sept. 2, 1961), France, Centre Natl. Rech. Sci., Paris, 1962, pp. 299-353, 44 refs. In English.

**Experimental Investigation of Boundary Layer Transition on a Flat Plate with a Point Heat Source at the Leading Edge**, W. J. McCroskey. Princeton Univ., Dept. Aeronaut. Eng. Rept. 623, Aug. 1962, 25 pp.

**A Preliminary Study of the Rate of Growth and Decay of Blowing-Jet-Induced Circulation on Two-Dimensional Profiles**, D. C. Hazen and F. C. Karins. Princeton Univ., Dept. Aeronaut. Eng. Rept. 632, Dec. 1962, 40 pp.

**Qualitative Solution of the Stability Equation for a Boundary Layer in Contact with Various Forms of Flexible Surface**,

T. Nonweiler. Gt. Brit. Aeronaut. Res. Council Current Paper 622, March 1961, 1963, 75 pp.

**A Study of Velocity Profiles in the Momentum Integral Method with Slip Boundary Conditions**, K. J. Touryan. Atomic Energy Commission SC-4752 (RR), Feb. 1963, 16 pp. (Sandia Corp.).

**An Analysis of the Delta-Wing Hypersonic Stability and Control Behavior at Angles of Attack Between 30° and 90°**, D. E. Fettermand and L. Neal Jr. NASA TN D-1602, March 1963, 58 pp.

**A Theoretical and Experimental Study of Oscillating Wedge Shaped Aerofoils in Hypersonic Flow**, R. A. East. Southampton Univ., Dept. Aeronaut. Astronaut. AASU Rept. 228, Nov. 1962, 59 pp.

**Off-Design Aerodynamic Characteristics at Mach Numbers 1.61 and 2.20 of a Series of Highly Swept Arrow Wings Designed for Mach Number 2.0 Employing Various Degrees of Twist and Camber**, W. D. Middleton and R. B. Sorrells. NASA TN D-1630, March 1963, 19 pp.

**An Experimental Investigation of Free Molecule Momentum Transfer Between Gases and Metallic Surfaces**, R. E. Stickney. Calif. Univ., Inst. Eng. Res. TR HE-150-182, Jan. 25, 1962, 138 pp. (Ph.D. Thesis).

**Radiant Heat Transfer to Absorbing Gases Enclosed in a Circular Pipe with Conduction Gas Flow and Internal Heat Generation**, T. H. Einstein. NASA TR R-156, 1963, 47 pp.

**Effect of Surface Distortions on the Heat Transfer to a Wing at Hypersonic Speeds**, M. H. Bertram and M. M. Wiggs. Inst. Aerospace Sci. Paper 62-127, June 1962, 23 pp.

**Destruction of the Leading Edge of a Delta Wing in Hypersonic Flow**, G. A. Tirskey. Air Force Systems Command, Foreign Tech. Div. FTD-TT-62-338, Sept. 15, 1962, pp. 33-53; transl. from Zh. Prikl. Mekhan. i Tekhn. Fiz., no. 6 (1961) (ASTIA AD 280,360).

**On Surface Mass Transfer Effects in a Binary Fluid**, A. N. Tifford. Inst. Aerospace Sci. Paper 62-126, June 1962, 45 pp.

**Some Aerothermodynamic Considerations for Martian Entry and Heat Shield Design**, M. G. Boobar and R. M. Foster. Inst. Aerospace Sci. Paper 62-163, June 1962, 19 pp., 17 refs.

**Glide Vehicle Thermal Protection Performance—Analytical and Hypothermal Wind Tunnel Evaluation**, H. Hurwicz, T. Munson, R. Mascola, and J. Cordero. Inst. Aerospace Sci. Paper 62-173, June 1962, 44 pp.

**Solution for the Transient One-Dimensional Heat Conduction in an Infinite Slab**, J. T. Miller. Arnold Eng. Dev. Center AEDC-TDR-63-43, March 1963, 20 pp.

**Cryopumping Characteristics of Shielded Low Temperature Surfaces**, W. G. Kirby. Arnold Eng. Dev. Center AEDC-TDR-63-28, March 1963, 57 pp.

**On the Flow of a Conducting Fluid of Small Viscosity**, S. Childress. Calif. Inst. Tech., Jet Propulsion Lab. TR 32-351, Jan. 31, 1963, 19 pp.

**The Transient Interaction of a Transverse Magnetic Field with Fluid in Couette Flow**, F. H. Shair. General Electric Co., Missile and Space Div. Rept. R63SD16, Feb. 1963, 56 pp.

**Theoretical and Experimental Study of the Interaction of Free-Surface Waves on Liquid Metals with Transverse Magnetic Fields (One-Dimensional Unsteady Waves)**, V. J. Rossow. NASA TR R-161, 1963, 111 pp.

Compressible Free Shear Layer with Finite Initial Thickness, M. R. Denison and E. Baum. *Inst. Aerospace Sci. Paper* 62-125, June 1962, 23 pp.

Wind Tunnel Studies of Booster Base Heating, M. A. Beheim and L. J. Obery. *Inst. Aerospace Sci. Paper* 62-166, June 1962, 24 pp.

Navier-Stokes Calculations of Argon Shock Wave Structure, L. M. Schwartz and D. F. Hornig. *Princeton Univ., Frick Chem. Lab. TR* 5, March 1, 1963, 29 pp.

Experimental Investigation of the Structure of Vortices in Simple Cylindrical Vortex Chambers, C. duP. Donaldson and R. S. Snedeker. *Aeronaut. Res. Associates of Princeton ARAP Rept.* 47, Dec. 1962, 43 pp.

Thermodynamic Properties of Carbon-Dioxide and Nitrogen Mixtures Behind a Normal Shock Wave, H. T. Woodward. *NASA TN D-1553*, March 1963, 28 pp.

Vibrational Nonequilibrium with Nitrogen in Low-Density Flow, A. D. Lewis and G. D. Arney Jr. *Arnold Eng. Dev. Center AEDC-TDR-63-31*, March 1963, 34 pp.

Characteristic Calculation of Nonequilibrium Flows, R. Sedney, J. C. South, and N. Gerber. *Aberdeen Proving Ground, Ballistic Res. Labs. BRL Rept.* 1173, April 1962, 36 pp.

Research on Rarefied Gasdynamics and Plasmadynamics, R. L. Chuan. *Southern Calif. Univ., Eng. Center USCED Rept.* 83-101, Sept. 1962, 118 pp., 106 refs.

Problems of Low Temperature Physics and Thermodynamics (International Institute of Refrigeration, Commission 1, Eindhoven, 1960), *Proceedings*, edited by A. Van Itterbeek (Pergamon Press, New York, 1962), Vol. 2, 298 pp.

Thermodynamic Properties of Mixtures at Low Temperatures, J. J. M. Beenaker, H. F. P. Knaap, and C. M. Knobler, pp. 163-167.

On the Thermodynamic Properties of Fluids, E. H. Brown, pp. 169-178.

A Dynamical Method for Measuring the Thermal Conductivity of Solids at Low Temperatures, F. X. Eder, pp. 257-260.

Introduction to a Discussion on "The Enthalpy of Gas Mixtures," P. J. Haringhuizen, pp. 273-276.

Enthalpy of Gaseous Mixtures, Z. Dokupil, pp. 277-280.

The Enthalpy of Gas and Liquid Mixtures, F. Din, pp. 281-286.

The Enthalpy Ignorance, Summary of Discussion on Enthalpies of Mixtures, M. Ruhemann, pp. 295-298.

Resonance Tubes in a Supersonic Flow Field, T. Vrebalovich. *Calif. Inst. Tech., Jet Propulsion Lab. TR* 32-378, July 30, 1962, 51 pp.

Reports on Progress in Physics (Institute of Physics and the Physical Society), edited by A. C. Strickland (Institute of Physics and the Physical Society, London, 1961), Vol. XXIV, 424 pp.

The Dynamics of High Temperature Plasmas, W. B. Thompson, pp. 363-424.

Reports on Progress in Physics (Institute of Physics and the Physical Society), edited by A. C. Strickland (Institute of Physics and the Physical Society, London, 1962), Vol. XXV, 529 pp.

Magnetohydrodynamics, T. G. Cowling, pp. 244-286.

Shock Waves in Gases, H. J. Pain and E. W. E. Rogers, pp. 287-336.

An Experimental Investigation of the Characteristics of Some Plane and Cambered 65° Delta Wings at Mach Numbers

from 0.7 to 2.0, L. C. Squire, J. G. Jones, and A. Stanbrook. *Gt. Brit. Aeronaut. Res. Council R&M* 3305, July 1961, 1963, 83 pp.

The Inviscid Hypersonic Flow on the Windward Side of a Delta Wing, H. Kennet. *Inst. Aerospace Sci. Paper* 63-55, Jan. 1963, 49 pp., 27 refs.

Conical Flow Parameters for Air and Nitrogen in Vibrational Equilibrium, P. D. Kelly. *Aberdeen Proving Ground, Ballistic Res. Labs. BRL Rept.* 1164, March 1962, 54 pp.

The Dynamics of a Thermally Radiating Gas in a Rarefied Atmosphere, L. Trilling. *Inst. Aerospace Sci. Paper* 63-54, Jan. 1963, 33 pp.

Viscous and Non-viscous Hypersonic Flows with Finite-Rate Chemical Reactions, J. J. Brainerd and E. S. Levinsky. *Inst. Aerospace Sci. Paper* 63-63, Jan. 1963, 46 pp.

The Condensation of Air in a Hypersonic Wind Tunnel, F. L. Daum. *Inst. Aerospace Sci. Paper* 63-53, Jan. 1963, 33 pp.

The Effect of Ambient Dissociation and Species Diffusion on Non-equilibrium Shock-Layers, W. Gibson. *Inst. Aerospace Sci. Paper* 63-70, Jan. 1963, 98 pp.

Hypersonic Shock-Heated Flow Parameters for Velocities to 46,000 Feet per Second and Altitudes to 323,000 Feet, P. W. Huber. *NASA TR R-163*, 74 pp.

Nonequilibrium Flow Over a Cone, R. Sedney and N. Gerber. *Inst. Aerospace Sci. Paper* 63-71, Jan. 1963, 24 pp.

Pressure Distribution on Three Rigid Wings Simulating Parawings with Varied Canopy Curvature and Leading-Edge Sweep at Mach Numbers 2.29 to 4.65, P. G. Fournier. *NASA TN D-1618*, April 1963, 113 pp.

A Comparison of Experimental and Theoretical Results for the Compressible Turbulent-Boundary-Layer Skin Friction with Zero Pressure Gradient, J. B. Peterson Jr. *NASA TN D-1795*, March 1963, 55 pp.

Evaluation of Suction Requirements for Maintenance of Full-Chord Laminar Boundary Layers on Swept and Tapered Airfoil Surfaces, W. G. Wheldon. *Inst. Aerospace Sci. Paper* 63-52, Jan. 1963, 23 pp.

The Use of Conical Camber to Produce Flow Attachment at the Leading Edge of a Delta Wing and to Minimize Lift-Dependent Drag at Sonic and Supersonic Speeds, J. H. B. Smith and K. W. Mangler. *Gt. Brit. Aeronaut. Res. Council R&M* 3289, Sept. 1957, 1963, 31 pp.

Theoretical Comparison of the Flow Over a Flat Delta Wing and a Rectangular Pyramid, E. Eminto. *Gt. Brit. Aeronaut. Res. Council Current Paper* 637, 1963, 22 pp.

Pressure Measurements at Supersonic Speeds on Three Uncambered Conical Wings of Unit Aspect Ratio, J. W. Britton. *Gt. Brit. Aeronaut. Res. Council Current Paper* 641, May 1962, 1963, 43 pp.

Optical Free-Flight Wake Studies, B. Dayman Jr. *Calif. Inst. Tech., Jet Propulsion Lab. TR* 32-364, Nov. 1, 1962, 23 pp.

A Study of Optimum Slender Bodies in Hypersonic Flow with a Variable Friction Coefficient, A. Miele and J. Cole. *Boeing Sci. Res. Labs. DL-82-0223*, Jan. 1963, 35 pp.

The Flow Field about a Hemisphere-Cylinder Body at a Mach Number of 7.3, P. G. Wilby. *Sweden Inst. Aeronaut. Res. FFA Rept.* 92, Nov. 1962, 14 pp.

Favorable Wing-Body Interference for Aircraft at Supersonic Speed: an Analytic Study of Design Parameters, R. C. Meyer. *Grumman Aircraft Eng. Corp.*, Aug. 9, 1962, 135 pp.

An Experimental Evaluation of Aerodynamic Damping Moments of Cones with Different Centers of Rotation, W. R. Wehrent Jr. *NASA TN D-1768*, March 1963, 52 pp.

The Reaction Rate of Hydrogen and Deuterium as Measured in a Chemical Quench Tube, B. C. Swanson. *Cornell Univ., Graduate School of Aerospace Eng.*, 1963, 29 pp.

Computer Solutions to the Problem of Vibrational Relaxation in Hypersonic Nozzle Flows, J. L. Stollery and C. Park. *Imperial College of Sci. and Technol., London, Aeronaut. Dept. Rept.* 115, Jan. 1963, 40 pp.

Flow Visualization and Quantitative Gas Density Measurements in Rarefied Gas Flows, R. C. McArthur, L. M. Stevenson, and J. Budell. *Air Force Aeronaut. Systems Div. ASD-TDR-62-793*, Dec. 1962, 34 pp.

Diffusion and Chemical Relaxation in Free Mixing, M. H. Bloom and M. H. Steiger. *Inst. Aerospace Sci. Paper* 63-67, Jan. 1963, 42 pp.

Stagnation Point Heat Transfer Measurements in Partially Ionized Air, P. H. Rose and J. O. Stankevics. *Inst. Aerospace Sci. Paper* 63-61, Jan. 1963, 31 pp.

Experimental Pressures and Turbulent Heat-Transfer Coefficient Associated with Sinusoidal Protuberances on a Flat Plate at a Mach Number of 3, C. P. Shore, S. C. Dixon, and G. E. Griffith. *NASA TN D-1626*, March 1963, 28 pp.

Radiation Slip, R. F. Probst. *Mass. Inst. Tech., Dept. Mech. Eng., Fluid Mech. Lab. Publ.* 63-2, Feb. 1963, 10 pp.

Energy Transfer in a Dense Plasma, J. A. Fay. *Mass Inst. Tech., Dept. Mech. Eng., Fluid Mech. Lab. Publ.* 63-1, Jan. 1963, 16 pp.

Rayleigh's Problem in Magnetogasdynamics, P.-C. Lu. *Case Inst. Tech.*, 1963, 140 pp.

A Tabulation of the Thermodynamic Properties of Normal Hydrogen from Low Temperatures to 300°K and from 1 to 100 Atmospheres, J. W. Dean. *Natl. Bur. Std. TN* 120, Nov. 1961, 711 pp.

Effects of Air Content and Water Purity on Liquid Tension at Incipient Cavitation in Venturi Flow, R. S. Ruggeri and T. F. Gelder. *NASA TN D-1459*, March 1963, 45 pp.

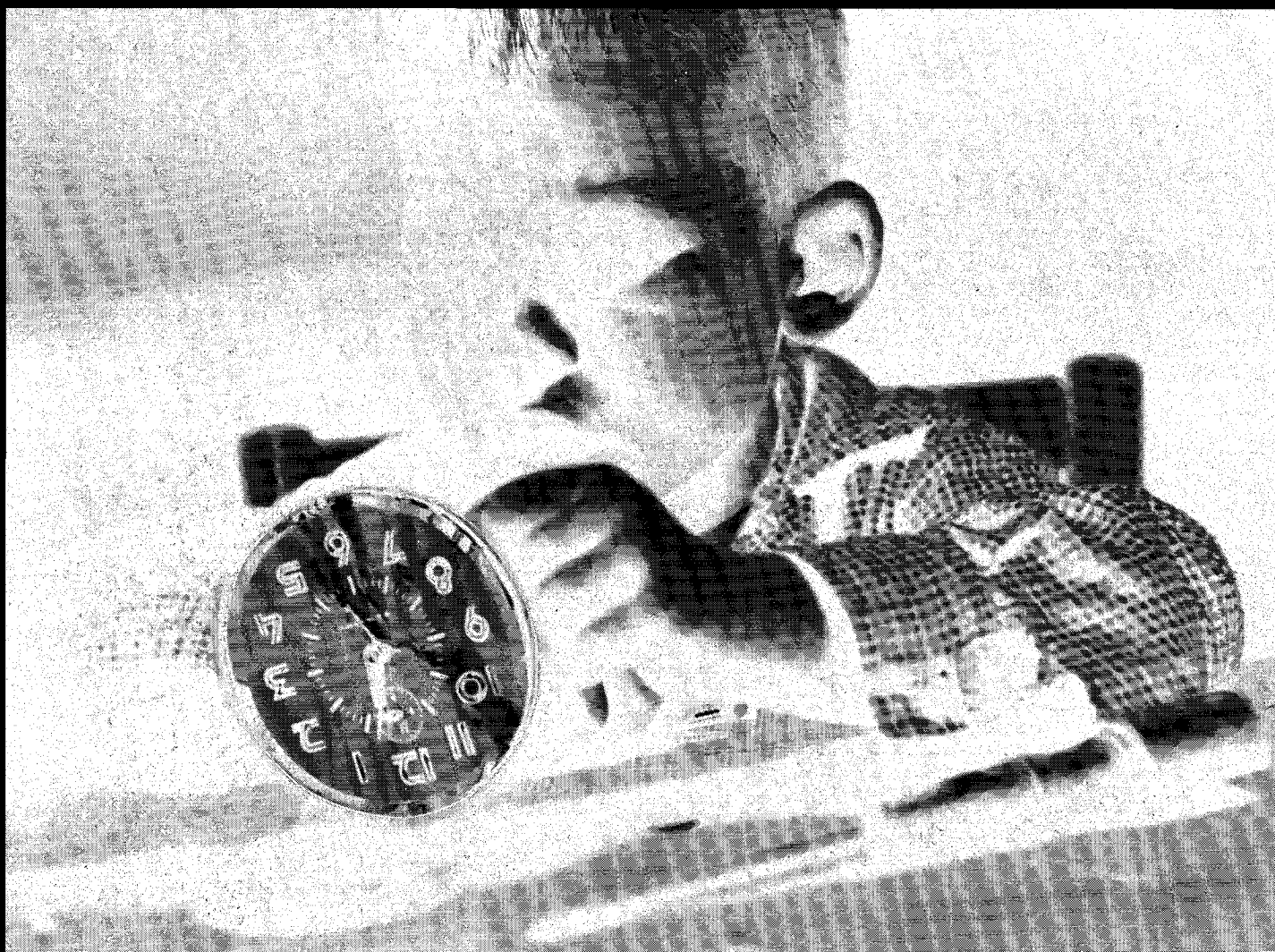
Subcooled Boiling Heat Transfer Under Forced Convection in a Heated Tube, S. S. Papell. *NASA TN D-1583*, March 1963, 22 pp.

Turbulent Mixing of Axisymmetric Compressible Jets (in the Half-Jet Region) with Quiescent Air, R. C. Maydew and J. F. Reed. *Atomic Energy Commission SC-4764 (RR)*, March 1963, 55 pp. (Sandia Corp.).

Surface Pressure Distributions Induced on a Flat Plate by a Cold Air Jet Issuing Perpendicularly from the Plate and Normal to a Low-Speed Free-Stream Flow, R. D. Vogler. *NASA TN D-1629*, March 1963.

Digital Program to Calculate Surface Heat Fluxes from Internal Temperatures in Heat-Conducting Bodies, J. V. Beck and H. Wolf. *Air Force Ballistics Systems Div. TR RAD-TR-62-27*, Aug. 20, 1962, 70 pp.

The Aerodynamic Design of Wings with Cambered Span Having Minimum In-



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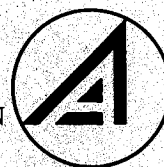
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duced Drag, C. D. Cone Jr. NASA TR R-152, 1963, 63 pp.

An Experimental Study of the Pressure and Heat-Transfer Distribution on a 70 Sweep Slab Delta Wing in Hypersonic Flow, M. H. Bertram and P. E. Everhart. NASA TR R-153, 1963, 122 pp.

Inviscid and Viscous Hypersonic Nozzle Flow with Finite Rate Chemical Reactions, E. S. Levinsky and J. J. Brainerd. Arnold Eng. Dev. Center AEDC-TDR-63-18, Jan. 1963, 53 pp., 19 refs.

The Use of Conical and Contoured Expansion Nozzles in Hypervelocity Facilities, A. F. Burke and K. D. Bird. Cornell Aeronaut. Lab. CAL Rept. 112 (2nd National Symposium on Hypervelocity Techniques, Denver, Colo., March 19-20, 1962), revised July 1962, 49 pp.

The Hypersonic Environment-Heat Transfer in Multicomponent Gases, S. M. Scala. General Electric Co., Missile and Space Div. TIS R62SD987, Dec. 1962, 56 pp., 110 refs.

Chemical Nonequilibrium Effects in Hypersonic Pure Air Wakes, M. Lenard, M. E. Long, and K. S. Wan. General Electric Co., Missile and Space Div. TIS R62SD989, Dec. 1962, 46 pp.

Macroscopic Equations Governing the Interaction of Electromagnetic Waves with Non-Uniform Plasma Flows, K. T. Yen. General Electric Co., Missile and Space Vehicle Dept. TIS R62SD14, Sept. 1962, 16 pp.

On the Molecular Interactions Between Gases and Solids, F. C. Hurlbut. Calif. Univ., Berkeley, Inst. Eng. Res. TR HE-150-208, Nov. 15, 1962, 31 pp., 48 refs.

Research at the National Physical Laboratory on the Properties of Gases at High Temperatures Preliminary Spectrographic Measurements, K. C. Lapworth. NATO, AGARD Rept. 322, 1959, 30 pp., 29 refs.

Research at the National Physical Laboratory on the Ionization Properties of Gases at High Temperatures, D. L. Schultz. NATO, AGARD Rept. 321, 1959, 16 pp., 16 refs.

A One Dimensional Mathematical Model for the Boltzmann Equation, J. J. Smolderen. Belgium Training Center for Exptl. Aerodynamics TCEA TN-10, Oct. 1962, 56 pp.

Effect of Shock Attenuation on Reflected Shock Waves, G. Kamimoto, T. Akamatsu, and T. Hasegawa. Kyoto Univ., Dept. Aeronaut. Eng. Current Paper 2, Oct. 1962, 32 pp.

Thermodynamic and Transport Properties of High Temperature Air, C. F. Hansen. NATO, AGARD Rept. 323, 1959, 26 pp., 30 refs.

Chemistry, Ionization and Radiation in the Non-Equilibrium Front of Normal Shocks in Air, B. Kivel. NATO, AGARD Rept. 326, 1959, 22 pp., 12 refs.

Gas-Plasma Research at the Institute for Thermodynamics, Braunschweig, F. Bosnjakovic, W. Sprunge, and K. F. Knoche. NATO, AGARD Rept. 320, 1959, 13 pp., 11 refs.

The Flow over a Cylinder with Various Nose Shapes at Zero Angle of Attack at Hypersonic Speeds, C. C. Horstman. Air Force Aeronaut. Res. Labs. ARL 63-14, Jan. 1963, 30 pp.

A Study of Slender Shapes of Minimum Drag Using the Newton-Busemann Pressure Coefficient Law, A. Miele. Inst. Aerospace Sci. Paper 63-51, Jan. 1963, 40 pp.

A Unified Analysis of Supersonic Nonequilibrium Flow Over a Wedge, R. S.

Lee. Inst. Aerospace Sci. Paper 63-40, Jan. 1963, 32 pp.

Convective Diffusion as an Intruder in Kinetic Studies of Surface Catalyzed Reactions, D. E. Rosner. AeroChem Res. Lab. TP-63, March 4, 1963, 68 pp.

Interferometric Measurement in a Shock Tube of Dissociation Rates for Air and Its Component Gases, S. Byron. NATO, AGARD Rept. 328, 1959, 13 pp.

A Study of Strong Shock Waves Produced in a Magnetogasdynamic Shock Tube, A. Tate. NATO, AGARD Rept. 329, 1959, 10 pp., 7 refs.

Determination of Short-Range Intermolecular Forces, J. T. Vanderslice. NATO, AGARD Rept. 331, 1959, 15 pp., 17 refs.

Methods for the Calculation of High-Temperature Gas Transport Properties, E. A. Mason. NATO, AGARD Rept. 330, 1959, 16 pp., 39 refs.

Recombination of Oxygen Atoms at Surfaces, J. C. Greaves and J. W. Linnett. NATO, AGARD Rept. 332, 1959, 9 pp., 19 refs.

A Method of Forming Continuous Empirical Equations for the Thermodynamic Properties of Air from Ambient Temperatures to 15,000°K, with Applications, M. Grabau. NATO, AGARD Rept. 333, 1959, 20 pp., 7 refs.

Experimental Measurements of Temperature and Relaxation Times Behind Shock Waves, A. G. Gaydon and I. Hurle. NATO, AGARD Rept. 327, 1959, 12 pp., 8 refs.

Nitrogen and Oxygen Atom Recombination at Oxide Surfaces and Effect of a Tesla Discharge on Recombination Heat Transfer, G. M. Prok. NASA TN D-1567, Jan. 1963, 18 pp.

Effect of Heat Transfer on Flow Field at Low Reynolds Numbers in Vertical Tubes, E. M. Rosen and T. J. Hanratty. Ill. Univ. TR 8, Oct. 1959, 248 pp.

Interaction of the Separation at the Trailing Edge and From the Leading Edge in Three-Dimensional Flow, E. A. Eichelbrenner. NATO, AGARD Rept. 275, 1962, 10 pp. In French.

Wind-Tunnel Calibration Techniques, A. Pope. NATO, AGARDograph 54, 1961, 131 pp., 69 refs.

Seaplane Impact—A Review of Theoretical and Experimental Results, T. Arlotte, P. W. Brown, and P. R. Crewe. Gt. Brit. Aeronaut. Res. Council R&M 3285, Dec. 1958, 1962, 80 pp., 70 refs.

Stagnation Point Fluctuations and Boundary Layer Stability for Bodies of Revolution with Hemispherical Noses, A. M. Kuethe, W. W. Willmarth, and G. H. Crocker. NATO, AGARD Rept. 267, 1960, 35 pp.

Turbulence and Perturbations in the Boundary Layer of a Flat Plate, A. Favre and J. Gaviglio. NATO, AGARD Rept. 278, 1960, 54 pp., 21 refs. In French.

Experimental and Theoretical Studies of the Effects of Camber and Twist on the Aerodynamic Characteristics of Parawings Having Nominal Aspect Ratios of 3 and 6, E. C. Polhamus and R. L. Naeseth. NASA TN D-972, Jan. 1963, 36 pp.

An Assessment of the Errors Involved in Thick-Film Heat Transfer Measurements, P. A. Ross and E. A. Brown Jr. Boeing Co. D2-22006, 47 pp.

The Viscosity of Nitrogen, Helium, Neon, and Argon from -78.5°C to 100°C Below 200 Atmospheres, G. P. Flynn, R. V. Hanks, N. A. Lemaire, and J. Ross. Project Squid TR BRN 3-P, Nov. 1962, Dec. 1962, 44 pp.



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An Integral Equation Relating the General Time-Dependent Lift and Downwash Distributions on Finite Wings in Subsonic Flow, J. A. Drischler. NASA TN D-1521, Jan. 1963, 18 pp.

Hypersonic Research Project, C. B. Millikan and L. Lees. Semi-Annual Tech. Summary Rept. 1, April 1-Sept. 30, 1961, Calif. Inst. Tech., Guggenheim Aeronaut. Lab., Hypersonic Res. Project, 11 pp.

Hypersonic Research Project, C. B. Millikan and L. Lees. Semi-Annual Tech. Summary Rept. 2, October 1, 1961-March 31, 1962, Calif. Inst. Tech., Guggenheim Aeronaut. Lab., Hypersonic Res. Project, 9 pp.

Sphere Drag in a Low Density Supersonic Flow, J. Aroesty. Calif. Univ., Berkeley, Inst. Eng. Res. TR HE-150-192, Jan. 3, 1962, 147 pp. (Ph.D. Thesis).

Free-Flight Measurements of Pressure Distribution at Transonic and Supersonic Speeds on Bodies of Revolution Having Parabolic Afterbodies, C. Kell. Gt. Brit. Aeronaut. Res. Council R&M 3290, April 1958, 1962, 22 pp.

Approximate Flow Characteristics in the Base Region of a Hypersonic Axisymmetric Body, K. S. Wan. General Electric Co., Missile and Space Div. TIS R6SD16, Sept. 1962, 29 pp.

Jet Effects on Annual Base Pressure and Temperature in a Supersonic Stream, M. A. Beheim, J. L. Klann, and R. A. Yeager. NASA TR R-125, 1962, 25 pp.

On the Design of Wing-Body Combinations of Low Zero-Lift Drag Rise at Transonic Speeds, W. T. Lord. Gt. Brit. Aeronaut. Res. Council R&M 3279, Oct. 1959, 1962, 46 pp.

An Experimental and Theoretical Investigation of Second-Order Wing-Body Interference at High Mach Number, P. G. Wilby. Sweden Aeronaut. Res. Inst., FFA Rept. 91, Aug. 1962, 16 pp.

Advances in Chemical Physics, edited by I. Prigogine (Interscience Publishers, New York, 1962), Vol. 4, 400 pp.

One-Dimensional Plasma, S. Prager pp. 201-244, 2 refs.

Advances in Astronautical Propulsion, Proceedings (Seminar on Astronautical Propulsion, Milan, 1960), edited by C. Casci (Pergamon Press, New York, 1962), 366 pp.

A Survey of Heat Transfer Problems Connected with Space Vehicle Reentry, P. A. Libby, pp. 313-342, 53 refs.

Method for Design of Pump Impellers Using a High-Speed Digital Computer, N. O. Stockman and J. L. Kramer, NASA TN D-1562, Jan. 1963, 35 pp.

Heat Transfer in a Rarefied Gas Between Parallel Plates at Large Temperature Ratios, D. R. Willis. Princeton Univ., Dept. Aeronaut. Eng. Rept. 615, Oct. 1962, 30 pp.

## Flight Mechanics

Considerations of the Motion of a Small Body in the Vicinity of the Stable Libration Points of the Earth-Moon System, W. H. Michael Jr. NASA TR R-160, 1963, 37 pp.

Nonequatorial Launching to Equatorial Orbits and General Nonplanar Launching, R. P. Haviland and C. M. House. Inst. Aerospace Sci. Paper 62-147, June 1962, 34 pp.

Design Analysis of Earth-Lunar Trajectories; Launch and Transfer Character-

istics, J. E. Michaels. Inst. Aerospace Sci. Paper 62-148, June 1962, 24 pp.

Optimum Launching of a Satellite by Two Impulses of Unequal Specific Impulse, L. Ting and M. Pierucci. Brooklyn Polytech. Inst. PIBAL Rept. 762, Nov. 1962, 19 pp.

Advances in the Astronautical Sciences (American Astronautical Society, Proceedings, Aug. 4-5, 1960) (Plenum Press, New York, 1961), Vol. 7, 454 pp.

Optimization of Three-Dimensional Boost-Turn, H. J. Kelley and H. K. Hinz, pp. 72-76.

Kinematics of Orbital Motion, G. S. Gedeon, pp. 87-98.

Motion of a Dumbbell Satellite, H. R. Rosner, pp. 125-137.

Escape from an Oblate Planet, M. L. Anthony, G. E. Fosdick, and L. M. Perko, pp. 175-194.

Use of Perigee Propulsion for Orbital Launch of Nuclear Rockets, P. G. Johnson and F. E. Rom, pp. 195-218.

Stochastic Dynamics of Rocket-Powered Flight, R. E. Ross, pp. 280-291.

Direct Re-entry at Escape Velocity, B. A. Galman, pp. 373-388.

Longitudinal Aerodynamic Characteristics at Mach Numbers from 0.40 to 1.10 of a Blunted Right-Triangular Pyramidal Lifting Re-entry Configuration Employing Variable-Sweep Wing Panels, B. Spencer Jr. NASA TN D-1518, March 1963, 69 pp.

Attitude Stability of Articulated Gravity-Oriented Satellites, Part I: General Theory and Motion in Orbital Plane, B. Etkin. Toronto Univ., Inst. Aerophys. UTIA Rept. 89, Nov. 1962, 38 pp.

Experimental Investigation of the Dynamic Stability of a Towed Parawing Glider Model, R. E. Shanks. NASA TN D-1614, March 1963, 14 pp.

Aerodynamic Drag and Stability Characteristics of Towed Inflatable Decelerators at Supersonic Speeds, J. T. McShera Jr. NASA TN D-1601, March 1963, 23 pp.

A Variational Method for the Optimization of Interplanetary Round-Trip Trajectories, J. S. MacKay and L. G. Rossa. NASA TN D-1660, March 1963, 32 pp.

The Critical Inclination Problem in Satellite Orbit Theory, W. A. Mersman. NASA TR R-148, 1962, 29 pp.

Experimental Planetary Entry Research for Mars and Venus—1962, T. K. Pugmire. General Electric Co., Missile and Space Div. R62SD84, Oct. 1962, 204 pp., 40 refs.

The N-Body Code—A General Fortran Code for Solution of Problems in Space Mechanics by Numerical Methods, W. C. Strack, W. F. Dobson, and V. N. Huff. NASA TN D-1455, Jan. 1963, 92 pp.

An Analytic Representation of Musen's Theory of Artificial Satellites in Terms of the Orbital True Longitude, A. E. Bailie and D. Fisher. NASA TN D-1468, Jan. 1963, 20 pp.

Optimum Low-Acceleration Trajectories for Interplanetary Transfers, A. V. Zimmerman, J. S. MacKay, and L. G. Rossa. NASA TN D-1456, Jan. 1963, 40 pp.

Spin Dynamics of Manned Space Stations, P. R. Kurzhals and C. R. Keckler. NASA TR R-155, 1963, 58 pp.

Space Age Astronomy, Symposium (International) . . . Aug. 7-9, 1962, Calif. Inst. Tech., Pasadena, edited by A. J. Deutsch (Academic Press, New York, 1962), 531 pp.

The Hyperbolic Case of Artificial Satellite Motion, G.-I. Hori, pp. 353-356.

Dynamical Astronomy and Artificial Members of the Solar System, P. J. Message, pp. 357-361.

Advances in Astronautical Propulsion, Proceedings (Seminar on Astronautical Propulsion, Milan, 1960), edited by C. Casci (Pergamon Press, New York, 1962), 366 pp.

The Reentry from Space Flight into the Earth's Atmosphere, A. Ferri, pp. 261-288.

## Vehicle Design, Testing, and Performance

Optimization Logic for Aerospace Vehicle Design, F. L. Ryder. Inst. Aerospace Sci. Paper 63-33, Jan. 1963, 21 pp.

Performance and Some Design Aspects of the Four-State Solid-Propellant Rocket Vehicle Used in the Ram A1 Flight Test, J. Levine. NASA TN D-1611, March 1963, 49 pp.

Wind-Tunnel Tests of Two VTOL Propellers in Descent, P. F. Yaggy and K. W. Mort. NASA TN D-1766, March 1963, 26 pp.

Approaches to High Performance Rotary Wing Aircraft, L. Celniker, C. H. Christenson, and R. Scherrer. Inst. Aerospace Sci. Paper 62-144, June 1962, 15 pp.

Design Requirements of Helicopter and VTOL Commercial Transports, E. F. Katzenberger, H. D. Ulienik, P. J. Williams, and A. A. Wolf. Inst. Aerospace Sci. Paper 62-142, June 1962, 37 pp.

The Dynamic Interface Vehicle, D. E. Walters, E. G. Stout, T. P. Higgins Jr., and J. R. Brown. Inst. Aerospace Sci. Paper 62-140, June 1962, 11 pp.

Stability and Control Experiments on Annular Jet Models of Rectangular Planform Over a Large Range of Height and Speed, B. H. Carmichael and D. E. McNay. Inst. Aerospace Sci. Paper 62-139, June 1962, 23 pp.

Theoretical Analysis of Jet-Ground Plane Interaction, Y. C. Shen. Inst. Aerospace Sci. Paper 62-144, June 1962, 20 pp.

The Potential Use of Helicopters for the Transportation of Logs, A. D. Wood. Can. Natl. Res. Council NRC LR-363, Nov. 1962, 21 pp.

Laboratory Techniques in Space Environment Research (NASA-University Conference on the Science and Technology of Space Exploration, Chicago, Nov. 1962). Papers from the Conference Proceedings, NASA SP-11, Vol. 2, pp. 385-435, NASA SP-26, Dec. 1962, 51 pp.

Criteria and Techniques for Maintenance, Repair and Assembly in Manned Orbital Operations, L. W. Warzecha and E. J. Merrick. Inst. Aerospace Sci. Paper 62-136, June 1962, 20 pp.

Engineering Design of Manned Orbital Space Stations, G. R. Arthur, J. F. Slomski, and H. D. Thompson. Inst. Aerospace Sci. Paper 63-34, Jan. 1963, 65 pp.

Reusable - Manned - Nuclear Orbital Carrier, R. L. Gervais, G. Markus, and R. G. Riedesen. Inst. Aerospace Sci. Paper 63-32, Jan. 1963, 47 pp.

The One-Way Manned Space Mission, J. M. Cord and L. M. Scale. Inst. Aerospace Sci. Paper 62-131, June 1962, 37 pp.

Manned Lunar Vehicles, G. R. Arthur. Inst. Aerospace Sci. Paper 62-134, June 1962, 31 pp.

The Space Vehicle—Manned Versus

Unmanned, D. G. Starkey. Inst. Aerospace Sci. Paper 62-153, June 1962, 23 pp.

Prelaunch Dynamic Loads on Space Vehicles Launched from Ships, D. H. Mitchell. Inst. Aerospace Sci. Paper 62-138, June 1962, 25 pp.

An Analysis and Comparison of Land and Water Launch Systems, D. R. Johnson. Inst. Aerospace Sci. Paper 62-132, June 1962, 29 pp.

Design Considerations for Boost Phase Abort of Manned Space Flights, E. S. Miller and H. L. Bloom. Inst. Aerospace Sci. Paper 62-133, June 1962, 85 pp.

A Consideration of Lunar Surface Ballistics and the Hazards Associated with Spacecraft Landing or Launch Operations, D. C. Cramblit. NASA TN D-1526, March 1963, 31 pp.

Metalastic Wheels for Lunar Locomotion, E. G. Markow. Inst. Aerospace Sci. Paper 62-135, June 1962, 22 pp.

Annotated Bibliography of Lunar Properties, Geology, Vehicles, and Bases, Part II: Vehicles, Trajectories, and Landings, A. A. Beltran, J. B. Goldmann, and E. E. Graziano. Lockheed Missiles and Space Div. Special Bibliog. SB-61-67, Part II, Rept. 5-53-61-2, Dec. 1961, pp. 171-296 (ASTIA AD 271,033).

Development of Sounding Rockets in Japan, edited by K. Itokawa. NASA Tech. Transl. TT F-87, March 1963, 156 pp.

From the Pencil Rocket to the Kappa-8, H. Itokawa, pp. 28-54.

The Rockoon, O. Hirao and T. Okamoto, pp. 55-74.

The Electronics of the Kappa Rocket, N. Takagi and T. Nomura, pp. 75-96.

The Construction of the Kappa Rockets, with Special Consideration of the K-8, D. Mori, pp. 110-121.

Aerodynamics of the Kappa Rocket, A. Tamaki, pp. 122-132.

Sounding Rocket Management and Administration, J. Shimomura, pp. 149-156.

High-Performance Ships (Symposium on Naval Hydrodynamics, 3rd, Scheveningen, Sept. 19-22, 1960), edited by S. W. Doroff. Office of Naval Res., ACR-65 (U. S. Government Printing Office, Washington, D. C., 1962), 613 pp.

The Hydrodynamics of High-Speed Hydrofoil Craft, M. P. Tulin, pp. 121-146.

On the Hydrofoils Running Near a Free Surface, S. Schuster and H. Schwanecke, pp. 147-190.

The Effect of Size on the Seaworthiness of Hydrofoil Craft, A. Hadjidakis, pp. 191-204.

Design and Initial Test of ONR Supercavitating Hydrofoil Boat XCH-6, G. J. Wennagel, pp. 205-232.

Design and Operating Problems of Commercial Hydrofoils, H. von Schertel, pp. 233-270.

Ground Effect Machine Research and Development in the United States, H. R. Chaplin, pp. 271-306.

Hydrodynamic Aspects of a Deep-Diving Oceanographic Submarine, P. Mandel, pp. 307-340.

Advances in the Astronautical Sciences (American Astronautical Society, Proceedings, Aug. 4-5, 1960) (Plenum Press, New York, 1961), Vol. 7, 454 pp.

A Conceptual Design for a Manned Mars Vehicle, P. Bono, pp. 25-42.

Considerations Affecting the Design of a Mars Probe, W. A. Webb and J. A. Harder, pp. 316-324.

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A Parametric Examination of Re-entry Vehicle Size and Shape for Return at Escape Velocity, E. F. Styer, pp. 389-406.

Motion Picture Simulation of Unmanned Lunar Spacecraft Approaches to the Moon, R. L. Peterson, pp. 437-454.

Space Flight Report to the Nation, edited by J. Grey and V. Grey (Basic Books Inc., New York, 1962), 224 pp.

Sounding Rockets and Scientific Satellites, H. Friedman, pp. 8-13.

Space Vehicle Systems, W. M. Hawkins, pp. 58-68.

Launch Operations, K. H. Debus, pp. 96-106.

Space Age Astronomy, Symposium (International) . . . Aug. 7-9, 1961, Calif. Inst. Tech., Pasadena, edited by A. J. Deutsch (Academic Press, New York, 1962), 531 pp.

NASA Launch Vehicle Development Program, A. Hyatt, pp. 26-49.

Advanced Concepts of Stochastic Processes and Statistics for Flight Vehicle Vibration Estimation and Measurement, J. S. Bendat, L. D. Enochson, H. G. Klein, and A. G. Piersol. Air Force Aeronaut. Systems Div. ASD-TDR-62-973, Dec. 1962, 498 pp.

Vehicle Design Considerations, A. J. Steels and H. F. Plank. Inst. Aerospace Sci. Paper 63-69, Jan. 1963, 16 pp.

Cryogenic Tank Thermal Design for Planet Missions, C. C. Love Jr. Inst. Aerospace Sci. Paper 63-37, Jan. 1963, 38 pp.

In Flight Measurement of Helicopter Rotor Shaft Loads Under Control Cyclic Trim Variations, R. G. Ricks, P. Shyprykevich, R. Gabel, and D. J. Smyers. Air Force Aeronaut. Systems Div. ASD-TR-61-523, June 1962, 126 pp. (Boeing Co. Vertol Div. R-262; ASTIA AD 285,586).

Results of Wind-Tunnel Measurements on a Helicopter Rotor Operating at Extreme Thrust Coefficient and High-Tip-Speed Ratios, G. E. Sweet and J. L. Jenkins Jr. Inst. Aerospace Sci. Paper 63-73, Jan. 1963, 16 pp.

Study of Helicopter Rotor-Rotor Interference Effects on Hub Vibration, J. F. Duvivier. Air Force Aeronaut. Systems Div. ASD-TR-61-601, June 1962, 79 pp.

On Gyroscopic Inherent Stability of VTOL Aircraft Near the Hover Condition, J. C. Vrana. Can. Aeronaut. Space J. 6, 29-30 (Jan. 1963).

Wind Tunnel Correlation Study of North American Tilt-Wing Model Tested in the Nacal 14' x 16' Tunnel and the Airship Model Test Facility, P. O. Erlandson, J. G. Barcaro, and J. W. Olcott. Naval Air Station, Lakehurst, N. J., Jan. 1963, 260 pp.

Hypervelocity Launchers, Part I: Simple Launchers, I. I. Glass. Toronto Univ., Inst. Aerophys. UTIA Review 22, Jan. 1963, 68 pp.

Launch Deflector Design Criteria and Their Application to the Saturn C-1 Deflector, R. L. Evans and O. L. Sparks. NASA TN D-1275, March 1963, 38 pp.

Surface Pressures and Structural Strains Resulting from Fluctuations in the Turbulent Boundary Layer of a Fairey Delta 2 Aircraft, D. R. B. Webb, A. R. Keeler, and G. R. Allen. Gt. Brit. Aeronaut. Res. Council Current Paper 638, 1963, 31 pp.

Effect of Cross-Section Shape on the Aerodynamic Characteristics of Bodies at Mach Numbers from 2.50 to 4.63, D. E. Fuller, D. S. Shaw, and D. L. Wassum.

NASA TN D-1620, March 1963, 30 pp.

Nike Apache Performance Handbook, R. B. Jenkins. NASA TN D-1699, March 1963, 23 pp.

On Three-Dimensional Bodies of Delta Planform Which Can Support Plane Attached Shock Waves, D. H. Peckham. Gt. Brit. Aeronaut. Res. Council Current Paper 640, 1963, 22 pp.

Flight Vibration Survey of B-58 Aircraft, H. K. Reich. Air Force Aeronaut. Systems Div. ASD-TDR-62-384, April 1962, 68 pp.

Flight Vibration Survey of C-133 Aircraft, P. G. Bolds. Air Force Aeronaut. Systems Div. ASD-TDR-62-383, April 1962, 31 pp.

Development of a Propulsion System for Powering a Self-Propelled GETOL Model Aircraft, R. C. Radford. Toronto Univ., Inst. Aerophys. UTIA TN 64, Dec. 1962, 13 pp.

Solar Simulation in Space Environment, A. D. LeVantine and R. P. Lipkis. Inst. Aerospace Sci. Paper 63-57, Jan. 1963, 16 pp.

Simulation of Deep Space Environment for Working Vehicles, M. P. Hnilicka and K. A. Geiger. Inst. Aerospace Sci. Paper 63-56, Jan. 1963, 27 pp.

Handling Qualities in Single-Loop Roll Tracking Tasks: Theory and Simulator Experiments, T. S. Durand and H. R. Jex. Air Force Aeronaut. Systems Div. Rept. ASD-TDR-62-507, Nov. 1962, 77 pp., 18 refs.

Charts of Peak Amplitudes in Incidence and Sideslip in Rolling Manoeuvres Due to Inertia Cross Coupling, W. J. G. Pinsker. Gt. Brit. Aeronaut. Res. Council R&M 3293, April 1958, 1962, 81 pp.

Aerodynamic Characteristics of Four-Duct Tandem VTOL-Aircraft Configurations, W. A. Newson Jr. NASA TN D-1481, Jan. 1963, 151 pp.

Aerodynamic Characteristics in Ground Effect of a Large-Scale Model with a High Disk-Loading Lifting Fan Mounted in the Fuselage, R. A. deSavigny and D. H. Hickey. NASA TN D-1557, Jan. 1963, 51 pp.

Ground Effect Experiments on a Fan-in-Wing Configuration at Zero Forward Speed, W. Grabe. Can. Natl. Res. Council Test Rept. MET 369, Sept. 1962, 31 pp.

Investigation of the Contamination of Reflector Surfaces of Infrared Radiators to be Used in Space Simulators, F. G. Sherrell. Arnold Eng. Dev. Center AEDC-TDR-62-233, Dec. 1962, 34 pp.

Space Age Astronomy, Symposium (International) . . . Aug. 7-9, 1961, Calif. Inst. Tech., Pasadena, edited by A. J. Deutsch (Academic Press, New York, 1962), 531 pp.

The Orbiting Astronomical Observatory, W. H. Scott Jr., pp. 55-61.

The Role of Balloon Techniques in Space Age Astronomy, J. B. Rogerson, pp. 73-80.

Capabilities of Advanced Vehicles for Astronomical Research, M. W. Hunter and D. S. Merrilees, pp. 308-322.

Remarks on a Comet Probe, H. C. Corben, pp. 380-382.

Problems of Cost and Complexity, R. Smelt, pp. 494-497.

Advances in Astronautical Propulsion, Proceedings (Seminar on Astronautical Propulsion, Milan, 1960), edited by C. Casci (Pergamon Press, New York, 1962), 366 pp.

Future Exploration and Utilization of Outer Space, H. L. Dryden, pp. 343-366.

Problems in the Design of Unmanned Spacecraft for Planetary and Interplanetary Exploration, J. R. Miles Sr. Inst. Aerospace Sci. Paper 63-36, Jan. 1963, 18 pp.

Space Station Escape Vehicle, R. F. Brodsky. Inst. Aerospace Sci. Paper 63-35, Jan. 1963, 26 pp.

The Physical Performance of Telstar in Orbit, E. F. O'Neill. Inst. Aerospace Sci. Paper 63-65, Jan. 1963, 18 pp.

Space Environment Simulation System Management, F. C. Foshag, D. Grady, D. E. Lee, and R. S. Hostetter. Inst. Aerospace Sci. Paper 63-59, Jan. 1963, 38 pp.

## Guidance and Control

Engineering Analysis Methods for Linear Time Varying Systems, D. Graham, E. J. Brunelle Jr., W. Johnson, and H. Passmore III. Air Force Aeronaut. Systems Div. ASD-TDR-62-362, Jan. 1963, 259 pp., 126 refs.

A Ground Support Control Center for Deep Space Probes, P. J. Daniel and R. R. Segel. Inst. Aerospace Sci. Paper 62-137, June 1962, 46 pp.

Pulse Envelope Correlation Air Navigator, J. Salerno. Inst. Aerospace Sci. Paper 62-150, June 1962, 25 pp.

A Survey of Advanced Mosaid Guidance, E. F. Lally and M. Penberg. Inst. Aerospace Sci. Paper 62-151, June 1962, 46 pp.

Application of the Jacobi Integral to Space Navigation, C. C. Wan. Inst. Aerospace Sci. Paper 62-149, June 1962, 18 pp.

A Magnetic Support for Floated Inertial Instruments, P. J. Gilinson Jr., W. G. Denhard, and R. H. Frazier. Inst. Aerospace Sci. Sherman M. Fairchild Fund Paper FF-27, May 1960, 126 pp., 12 refs.

Feedback Design and Optimal Control Theory, J. C. Truxal and P. Dorato. Polytech. Inst. Brooklyn, Microwave Res. Inst. Memo. 52, Oct. 22, 1962, 8 pp. (PIB MRI-1095-62).

Final Report on Computer Controlled and Model-Referenced Adaptive Feedback Control Systems, J. J. Bongiorno Jr. Polytech. Inst. Brooklyn, Microwave Res. Inst. PIB MRI-1085-62, Oct. 31, 1962, 28 pp.

An Analytical Study of a Simple Attitude Control System for a Finned Vehicle, J. E. Harris. NASA TN D-1608, March 1963, 34 pp.

Performance Criteria for Linear Constant-Coefficient Systems with Random Inputs, R. Magdaleno and J. Wolkovitch. Air Force Aeronaut. Systems Div. ASD-TDR-62-470, Jan. 1963, 128 pp., 56 refs.

Preliminary Orbit Determination from Angular Observations, P. E. Koskela. Inst. Aerospace Sci. Paper 62-174, June 1962, 15 pp.

Development of Sounding Rockets in Japan, edited by H. Itokawa. NASA Tech. Transl. TT F-87, March 1963, 156 pp.

Optical Tracking of Rockets, T. Maruyasu and T. Uemura, pp. 142-148.

Extremal Control Systems—USSR (Joint Publications Research Service, JPRS: 16,837). Washington, D. C., Office Tech. Services, PB 63,13639, 1962, 34 pp.

Dynamic Regimes of Step Control Systems, P. Y. Akinin, pp. 2-11.

Auto-Oscillations in a Relay Extremal System, B. O. Aref'yev, pp. 12-19.

Experimental Investigation of Self-

Ajdusting (Extremal) Systems with a Transitory Memorizing of the Extremum, V. O. Mitroshyn and P. I. Chinayev, pp. 20-34.

Advances in the Astronautical Sciences (American Astronautical Society, Proceedings, Aug. 4-5, 1960) (Plenum Press, New York, 1961), Vol. 7, 454 pp.

Transfer Between Noncoplanar Orbits with Minimum Velocity Requirements, W. E. Brunk, pp. 111-124.

Rendezvous with Satellites in Elliptical Orbits with Low Eccentricity, P. W. Soule, pp. 138-147.

The Spacing of Corrective Thrusts in Interplanetary Navigation, J. V. Breakwell, pp. 219-235.

Preliminary Considerations for Attitude Control of Space Vehicles, R. L. Stafford, pp. 250-267.

Space Vehicle Attitude Dynamics During Velocity Corrections, J. Marino, pp. 268-279.

Reaction Controls for Re-entry Vehicles, G. W. Freeman, pp. 407-420.

Space Flight Report to the Nation, edited by J. Grey and V. Grey (Basic Books Inc., New York, 1962), 224 pp.

Guidance and Control, C. S. Draper, pp. 90-95.

An Emergency Midcourse Navigation Procedure for a Space Vehicle Returning from the Moon, C. D. Havill. NASA TN D-1765, March 1963, 31 pp.

Pilot-Controlled Simulation of Rendezvous Between a Spacecraft and a Commanded Module Having Low Thrust, G. P. Beasley. NASA TN D-1613, March 1963, 16 pp.

Sensitivity and Modal Response for Single-Loop and Multiloop Systems, D. T. McRuer and R. L. Stapleford. Air Force Aeronaut. Systems Div. ASD-TDR-62-812, Jan. 1963, 105 pp.

A Method for Computing the Effect of an Additional Observation on a Previous Least-Squares Estimate, P. A. Gainer. NASA TN D-1599, Jan. 1963, 16 pp.

A Study of Guidance to Reference Trajectories for Lifting Re-entry at Supercircular Velocity, R. C. Wingrove. NASA TR R-151, 1963, 64 pp.

Design, Development, and Flight Research of an Experimental Adaptive Control Technique for Advanced Booster Systems, L. T. Prince. Air Force Aeronaut. Systems Div. ASD-TDR-62-178, Part I, Nov. 1962, 197 pp., 7 refs.

Study of an Automatic System for Control of the Terminal Phase of Satellite Rendezvous, E. C. Lineberry Jr. and E. C. Foudriat. NASA TR R-128, 1962, 17 pp.

Mathematical Analysis for the Orientation and Control of the Orbiting Astronomical Observatory Satellite, P. B. Davenport. NASA TN D-1668, Jan. 1963, 16 pp.

Optimization of Stochastic Final Value Control Systems Subject of Constraints, R. J. Oxford. Ph.D. Dissertation, Polytech. Inst. Brooklyn, 1962, Ann Arbor, Mich., Univ. Microfilms Inc., LC. Card 62-5651, 1962, 227 pp.

Space Age Astronomy, Symposium (International) . . . Aug. 7-9, 1961, Calif. Inst. Tech., Pasadena, edited by A. J. Deutsch (Academic Press, New York, 1962), 531 pp.

Stabilization and Orientation Control of Large Orbital Telescopes, R. A. Nidey, pp. 246-252.

Guidance and Navigation Problem Areas for Interplanetary Missions, B. P. Blasingame, pp. 510-514.

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### Instrumentation and Communications

Bibliography: Radio Telemetry to Survive High Accelerations, P. L. Clemens. Arnold Eng. Dev. Center AEDC-TDR-63-36, Feb. 1963, 30 pp.

The Derivation of Network Functions from Phase Functions, S. Deutsch. Polytech. Inst. Brooklyn, Microwave Res. Inst. PIB MRI-1006-62, March 6, 1962, 21 pp. (AFOSR 2406).

Inherent Limitations of Accelerometers for High-Frequency Vibration Measurements, F. Schloss. David Taylor Model Basin Rept. 1698, Jan. 1963, 6 pp.

Underwater Sound Transmission, H. W. Marsh and M. Schulkiu. Avco Corp., Marine Electronics Off., New London, Conn., Nov. 1962, 95 pp., 132 refs.

Development of Sounding Rockets in Japan, edited by H. Itokawa. NASA Tech. Transl. TT F-87, March 1963, 156 pp.

Low Noise Amplifier for Radar, S. Saito and J. Hamazaki, pp. 133-141.

Stars and Stellar Systems, Vol. II: Astronomical Techniques, edited by W. A. Hiltner (University of Chicago Press, Chicago, 1962), 635 pp.

The Detection and Measurement of Faint Astronomical Sources, W. A. Baum, pp. 1-33.

Spectrographs, I. S. Bowen, pp. 34-62.

Radial-Velocity Determinations, R. M. Petrie, pp. 63-82.

Spectrophotometry, K. O. Wright, pp. 83-106.

Measurement of Stellar Magnetic Fields, H. W. Babcock, pp. 107-125.

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Instrumentation for Infrared Astrophysics, J. Strong and F. R. Stauffer, pp. 256-280.

Direct Recording of Stellar Spectra, A. D. Code and W. C. Liller, pp. 281-301.

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Astrometry with Astrographs, A. Konig, pp. 461-486.

Astrometry with Long-Focus Telescopes, P. van de Kamp, pp. 487-536.

Advances in the Astronautical Sciences (American Astronautical Society, Proceed-

ings, Aug. 4-5, 1960) (Plenum Press, New York, 1961), Vol. 7, 454 pp.

Scientific Goals of Radar Astronomy, V. R. Eshleman, pp. 43-54.

Analysis of Minimal Data Orbit Determination by a Single Radar Site, E. W. Radany, pp. 55-71.

Sun Tracker with Moon and Planet Modifications, D. K. Wilson and R. Wuensch, pp. 236-249.

Space Flight Report to the Nation, edited by J. Grey and V. Grey (Basic Books Inc., New York, 1962), 224 pp.

Communications Applications, J. R. Pierce, pp. 26-30.

Symposium on Communications Satellites, London, 1961, Proceedings . . . edited by L. J. Carter (Academic Press, New York, 1962), 202 pp.

The Engineering and Economics of Satellite Communications Systems, G. K. C. Pardoe, pp. 1-16.

Satellite Communications System Providing Channel Dropping, E. K. Sandeman, pp. 17-74.

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Some Practical Problems of Satellite Communication, J. R. Pierce, pp. 85-94.

Communications Satellite Systems Suitable for Commonwealth Telecommunications, W. F. Hilton, pp. 95-112.

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The Courier Satellite, P. W. Siglin and G. Senn, pp. 185-197.

The Calibration of a 60° Cone to Measure Mach Number Total Pressure and Flow Angles at Supersonic Speeds, D. R. Andrews and W. G. Sawyer. Gt. Brit. Aeronaut. Res. Council Current Paper 628, June 1962, 1963, 28 pp.

Experimental Investigation of the Impact Probe Method for Determining Local Skin Friction in the Presence of an Adverse Pressure Gradient for a Range of Mach Numbers from 1.70 to 2.75, O. Hill. Texas Univ., Defense Res. Lab. DRL-498, Jan. 1963, 101 pp. (CF-3010) (M.S. Thesis).

A Differential Radiometer, N. E. Hager. Intern. Inst. Refrigeration Meeting, Washington, D. C., Aug. 20-25, 1962, 12 pp. (Bull. de l'Institut International de Froid, Supplement).

The Application of Statistics to the Flight Vehicle Vibration Problem, J. S. Rendat, L. D. Enochson, H. C. Klein, and A. G. Piersol. Air Force Aeronaut. Systems Div. ASD-TDR-61-123, Dec. 1961, 1 Vol. (ASTIA AD 271,913).

On the Possible and Impossible in Optics, G. G. Slyusarev. Air Force Systems Command, Foreign Tech. Div. FTD-TT-62-175, July 1962, 163 pp.; transl. from *O Vozmozhnom i Nevozmozhnom v Optike*, G. G. Slyusarev (Gosudarstvennoye Izdatel'stvo Fiziko-Matematicheskoy Literatury, Moscow, 1960), pp. 1-190 (ASTIA AD-281,847).

A Vacuum Ultraviolet Photoionization Detector, A. K. Stober, R. Scolnik, and J. P. Hennes, NASA TN D-1715, March 1963.

Falling-Sphere Experiment for Upper-Air-Density: Instrumentation Developments, N. F. Schulte, D. A. Robinson, and J. L. Wagener. Michigan Univ., Dept. Aeronaut. Astronaut. Eng. Final Rept. 03558-6-F, April 1962, 51 pp.

Analysis of the Effect of Altimeter-

System Accuracy on Collision Probability, W. Gracey. NASA TN D-1627, March 1963, 9 pp.

Air Traffic Control Procedures. Federal Aviation Agency, Air Traffic Service AT F-7110, 1A (formerly ATS-2-A), July 1, 1962, with additions and changes through March 15, 1963, 1 Vol.

Performance of Electrical-Resistance Strain Gages at Cryogenic Temperatures, A. Kaufman. NASA TN D-1663, March 1963, 21 pp.

Apparatus for the Measurement of Transport Properties of Polar Semiconductors, M. M. Sokoloski and F. E. Geiger. NASA TN D-1695, March 1963, 11 pp.

Permanent Magnets as Precision Instrument Elements, W. L. Zingery. North American Aviation Inc., Autonetics Div. Rept. PUB 552-A-12, Aug. 1962, 63 pp.

A Detector for Low Energy Gamma-Ray Astronomy Experiments, K. J. Frost and E. D. Rothe. NASA TN D-1693, March 1963, 7 pp.

The Statistical Accuracy of Measurements of Fluctuating Quantities in Pulsed Devices, M. G. Rusbridge. United Kingdom Atomic Energy Authority, Res. Group Rept. CLM-4 22, July 1962, 16 pp.

Modulation Techniques for Orbiting Dipole Scatter Communication, W. E. Morrow Jr. Inst. Aerospace Sci. Paper 63-66, Jan. 1963, 15 pp.

An Evaluation of a Resonant Microwave Probe for Re-entry Plasma Diagnostics, J. D. Laird. Mass. Inst. Tech., Dept. Aeronaut. and Astronaut., Aug. 17, 1962, 47 pp. (M.S. Thesis, Mass. Inst. Tech.).

Tables of the Blackbody Radiation Function for Wavenumber Calculations, R. G. Walker. Air Force Cambridge Res. Labs. AFCRL-62-877, Sept. 1962, 178 pp.

Space Age Astronomy, Symposium (International) . . . Aug. 7-9, 1961, Calif. Inst. Tech., Pasadena, edited by A. J. Deutsch (Academic Press, New York, 1962), 531 pp.

A Program for Astronomical Studies by Rocket-Borne Instruments, R. L. F. Boyd, pp. 62-72.

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Stereoscopy from Space Satellites, D. H. Menzel and G. Moreton, pp. 412-413.

Space Electronics, S. Sternberg, pp. 507-509.

Asymptotic Theory of Spherical Electrostatic Probes in a Slightly Ionized, Collision Dominated Gas, I. M. Cohen. Princeton Univ., Plasma Phys. Lab. MATT-153, Nov. 1962, 37 pp.

A Central Facility for Recording and Processing Transient-Type Data, R. L. Smith, C. W. Mealey Jr., L. G. Kee, C. F.

Kadow, A. D. Brenza, R. N. Bell, J. C. Sturman, and A. L. Perry. NASA TN D-1320, Jan. 1963, 81 pp.

Aliasing Errors in Sampled Data Systems, A. J. Mallinckrodt. NATO, AGARD Rept. 316, 1961, 21 pp.

Use of a Sealed Silver-Cadmium Battery of Explorer XII, T. J. Henningan and A. O. Apelt. NASA TN D-1543, Jan. 1963, 6 pp.

Preliminary Report on the Single Station Doppler Rocket Tracking Technique, J. C. Seddon. NASA TN D-1344, Jan. 1963, 30 pp.

Calibration Tests of a Litton Conical Air Data Probe at Mach Numbers of 2 to 8, S. R. Mallard. Arnold Eng. Dev. Center AEDC-TDR-62-186, Oct. 1962, 30 pp., 4 refs.

The Nimbus Spacecraft and Its Communication Systems as of September 1961, R. A. Stampfl. NASA TN D-1422, Jan. 1963, 48 pp.

The Impedance of an Electrically Short Antenna in the Ionosphere, H. A. Whale. NASA TN D-1546, Jan. 1963, 8 pp.

Irradiation Effects of 40 and 440 Mev Protons on Transistors, W. C. Honaker and F. R. Bryant. NASA TN D-1490, Jan. 1963, 42 pp.

Delineation of Tracks of Heavy Cosmic Rays and Nuclear Processes within Large Silver Chloride Crystals, C. B. Childs and L. M. Slifkin. NASA TN D-1547, March 1963, 8 pp.

## Atmospheric and Space Physics

A Far Infrared Radiation Model of the Earth, R. A. McGee. Inst. Aerospace Sci. Paper 62-146, June 1962, 12 pp.

Laboratory Investigation of "Moon-Soils," J. D. Halajian. Inst. Aerospace Sci. Paper 62-123, June 1962, 61 pp.

A Study of the Free Oscillations of the Earth, G. J. F. MacDonald and N. F. Ness. NASA TR R-136, 1962, 46 pp.

Project HARP (High Altitude Research Program) Description and Status. McGill Univ., Dept. Mech. Eng. Rept. 62-5, 1962, 51 pp.

Annotated Bibliography of Lunar Properties, Geology, Vehicles, and Bases, Part I: Known and Conjectured Properties, A. A. Beltran, J. B. Goldmann, and E. E. Graziano. Lockheed Missiles and Space Div. Special Bibliog. SB-61-67, Part I (Rept. 5-53-61-2), Dec. 1961, 170 pp. (ASTIA AD 271,941).

Lunar Atmosphere and Surface Conditions, an Annotated Bibliography (Jan. 1959-May 1961), G. R. Evans. Lockheed Missiles and Space Div. Special Bibliog. SB-61-22, May 1961, 27 pp., Rept. LMSD 3-10-61-1, 63 refs. (ASTIA AD-258,377).

Annotated Bibliography of Lunar Properties, Geology, Vehicles and Bases, Part III: Lunar and Arctic Exploration and Habitation, A. A. Beltran, J. B. Goldman, and E. E. Graziano. Lockheed Missiles and Space Div. Special Bibliog. SB-61-67, Rept. 5-53-61-2, Feb. 1962, pp. 297-640 (includes subject index to Parts I-III), 1662 refs., pp. 593-640 (ASTIA AD 273,136).

Ranger Preflight Science Analysis and the Lunar Photometric Model, A. G. Harriman, H. W. Washburn, and D. E. Willingham. Calif. Inst. Tech., Jet Propulsion Lab. TR 32-384, Jan. 7, 1963, 38 pp.

Development of Sounding Rockets in Japan, edited by K. Itokawa. NASA Tech. Transl. TT F-87, March 1963, 156 pp.

Investigation of the Upper Atmosphere

by Rocket Sounding, K. Maeda, pp. 97-109.

International Symposium on Chemical Reactions in the Upper Atmosphere, Proceedings . . . Arranged by Stanford Research Institute, San Francisco, Calif., April 18-20, 1961 (John Wiley & Sons Inc., Interscience Publishers Div., New York, 1962), 390 pp.

Photochemical Reactions in Contaminated Atmospheres: A Survey, P. A. Leighton, pp. 1-14.

The Atmospheric Photooxidation Trans-Butene-2 and Nitric Oxide, C. S. Tuesday, pp. 15-50.

The Photochemical Olefin-Nitrogen Oxides Reaction, E. R. Stephens, pp. 51-70.

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Some Observations on Oxides and Hydrides of Nitrogen and Sulfur in Flame Gases Containing Atomic Hydrogen, Atomic Oxygen, and Hydroxyl Radicals, T. M. Sugden, E. M. Bulewicz, and A. Demerdache, pp. 89-108.

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On the Determination of Upper-Atmosphere Composition from Satellite Measurements, L. D. Kaplan, pp. 269-274.

Phenomena of the Auroral-Zone Ionosphere, C. T. Elvey, pp. 275-286.

The Reaction of Active Nitrogen with Molecular Oxygen, C. Mavroyannis and C. A. Winkler, pp. 287-302.

Nitrogen and Oxygen Atomic Reactions in the Chemosphere, C. A. Barth, pp. 303-326.

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Atomic Collision Processes Involving Electrons and Ions in Atmospheric

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Space Flight Report to the Nation, edited by J. Grey and V. Grey (Basic Books Inc., New York, 1962), 224 pp.

Solar System Exploration, W. H. Pickering, pp. 14-18.

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Wind Flow in the 80-400 KM Altitude Region of the Atmosphere, G. C. Ragsdale and P. E. Wasko. NASA TN D-1573, March 1963, 36 pp.

Preliminary Measurements of Temperatures and Winds Above 50 KM Over Wallops Island, Virginia, W. Nordberg and W. Smith. NASA TN D-1694, March 1963, 12 pp.

First Topside Sounding of the Ionosphere, J. E. Jackson, R. W. Knecht, and S. Russell. NASA TN D-1538, March 1963, 15 pp.

Energy Spectrum of Electrons in the Outer Radiation Belt, W. N. Hess and J. A. Poirier. NASA TN D-1717, March 1963, 15 pp.

The Low Frequency Power Spectrum of Cosmic-Ray Variations During IGY, D. Stern. NASA TN D-1684, March 1963, 19 pp.

Electron Density Distribution in the Upper F-Region, S. Chandra. NASA TN D-1751, March 1963, 9 pp.

The Magnetic Field of the Quiet-Time Proton Belt, S.-I. Akasofu, J. C. Cain, and S. Chapman. NASA TN D-1674, March 1963, 4 pp.

Protons from 0.1 to 5 Mev and Electrons of 20 Kev at 12 Earth Radii During the Sudden Commencement of September 30, 1961, R. A. Hoffman, L. R. Davis, and J. M. Williamson. NASA TN D-1700, March 1963, 7 pp.

Gravitational Radiation, F. A. E. Pirani. Air Force Aeronaut. Res. Labs. ARL 62-455, May 1962, 33 pp.

The Characteristics of Distant Comets, B. Donn. NASA TN D-1671, March 1963, 7 pp.

International Geophysical Year Bibliography of Literature Published in Russian in 1960, R. F. Zatrutina and L. S. Rubina. NASA Tech. Transl. F-109, March 1963, 189 pp.

Remarks on Hill's Lunar Theory, Part I, K. Stumpff. NASA TN D-1540, March 1963, 13 pp.

Remarks on Hill's Lunar Theory, Part II, K. Stumpff. NASA TN D-1541, March 1963, 12 pp.

Thermal Properties of a Simulated Lunar Material in Air and in Vacuum, E. C. Bennett, H. L. Wood, L. D. Jaffe, and H. E. Martens. Calif. Inst. Tech., Jet Propulsion Lab. TR 32-399, Feb. 16, 1963, 16 pp.

A Catalog of Microstructures Observed in Carbonaceous Chondrites, G. Mami-kunian and M. H. Briggs. Calif. Inst. Tech., Jet Propulsion Lab. TR 32-398, March 15, 1963, 75 pp.

The Role of Soil Science in Space Exploration, R. E. Cameron. Calif. Inst. Tech., Jet Propulsion Lab. TR 32-399, Feb. 16, 1963, 16 pp.

Free Oscillations of a Gravitating Solid Sphere, Part II: Spheroidal Oscillations, R. E. Carr. Calif. Inst. Tech., Jet Propulsion Lab. TR 32-372, Jan. 15, 1963, 24 pp.

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The Action of a Hypersonic Jet on a Dust Layer, L. Roberts. Inst. Aerospace Sci. Paper 63-50, Jan. 1963, 50 pp.

Bibliography of Lunar and Planetary Research, 1961, J. W. Salisbury, R. A. Van Tassel, and J. E. M. Adler. Air Force Cambridge Res. Labs. AFCRL-62-676, July 1962, 81 pp.

Bibliography of Lunar and Planetary Research—1960 (with Annotations), J. W. Salisbury and L. T. Salisbury. Air Force Cambridge Res. Labs. AFCRL 684, July 1961, 54 pp. (GRD Res. Note 62).

Reports on Progress in Physics (Institute of Physics and the Physical Society), edited by A. C. Strickland (Institute of Physics and the Physical Society, London, 1962), Vol. XXV, 529 pp.

Geophysical Results Obtained from Satellite Orbits, G. E. Cook, pp. 63-98.

Solar Observations Obtained from Vertical Sounding, H. Friedman, pp. 163-217.

Committee on Extension of the Standard Atmosphere, U. S. Standard Atmosphere, 1962; ICAO Standard 32 Kilometers; Tables and Data to 700 Kilometers. Prepared under the sponsorship of NASA, U. S. Air Force, and Weather Bureau (U. S. Government Printing Office, Washington, D. C., Dec. 1962), 278 pp.

Measurement of Solar Flare Produced Cosmic Radiation, deP. J. Corkhill. Aeromedical Res. Lab. ARL-TDR-62-24, Oct. 1962, 71 pp.

Direct Measurements of Cosmic Dust Showers, M. Dubin, W. M. Alexander, and O. E. Berg. NASA TN D-1544, Jan. 1963, 9 pp.

Aerodynamic Analysis of Tektites and Their Parent Bodies, E. W. Adams and

R. M. Huffaker. NASA TR R-149, 1962, 43 pp.

September 26, 1960 Solar Cosmic Ray Event, C. E. Fichtel, D. A. Kniffen, and K. W. Ogilvie. NASA TN D-1675, Jan. 1963, 6 pp.

On Lagrange's Theory of the Three-Body Problem, K. Stumpff. NASA TN D-1417, Jan. 1963, 12 pp.

The Effect of Vacuum on the Penetration Characteristics of Projectiles into Fine Particles, L. V. Clark and J. L. McCarty. NASA TN D-1519, Jan. 1963, 26 pp.

The Atmosphere as a Part of the Space Environment, R. A. Hord, W. B. Huston, and H. B. Tolefson. NASA TN D-1387, Jan. 1963, 96 pp.

Environmental Problems of Space Flight Structures, II: Meteoroid Hazard, J. R. Davidson and P. E. Sandorff. NASA TN D-1493, Jan. 1963, 71 pp.

Survey of Activities on Space Research by the Netherlands P.T.S., L. D. de Feiter. NATO, AGARD Rept. 384, 1961, 7 pp.

Gravitation: an Introduction to Current Research, edited by L. Witten (John Wiley & Sons Inc., New York, 1962), 481 pp.

Experiments on Gravitation, B. Bertotti, D. Brill, and R. Krotkov, pp. 1-48.

Exact Solutions of the Gravitational Field Equations, J. Ehlers and W. Kundt, pp. 49-101.

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Space Age Astronomy, Symposium (International) . . . Aug. 7-9, 1961, Calif. Inst. Tech., Pasadena, edited by A. J. Deutsch (Academic Press, New York, 1962), 531 pp.

The Astronomical Objectives of Space Research, H. C. Van De Hulst, pp. 3-8.

Current Objectives of Astronomical Space Research (from Gamma to Infra-red Radiation), P. Swings, pp. 9-25.

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The Physical Environment of Venus: Models and Prospects, C. Sagan, pp. 430-443.

Radiation Belts of Venus and of Mars (with Consideration of Sweeping Effect of Phobos), S. F. Singer, pp. 444-461.

Exploration of the Moon in the U.S.S.R., A. A. Mikhailov, pp. 462-475.

The Exploration of the Moon, the Planets, and Interplanetary Space, A. R. Hibbs, pp. 476-493.

Problems of Surface Exploration of the Moon and the Planets, R. K. Roney, pp. 498-500.

## Human Factors and Bioastronautics

Design and Initial Operation of JPL 25-ft Space Simulator, H. D. Strong Jr. Inst. Aerospace Sci. Paper 62-122, June 1962, 26 pp.

The Future Stature of Life Support Systems, N. Belasco. Inst. Aerospace Sci. Paper 62-170, June 1962, 52 pp.

Muscle Tonus Under Conditions of Weightlessness, E. M. Yuganov, I. I. Kas'han, and V. I. Tazdovskiy. NASA Tech. Transl. F-131, March 1963, 8 pp.

Postural Reflexes in Intact Animals Under Conditions of Weightlessness, V. I. Yazdovskiy, E. M. Yuganov, and I. I. Kas'yan. NASA Tech. Transl. F-130, March 1963, 7 pp.

Advances in the Astronautical Sciences (American Astronautical Society, Proceedings, Aug. 4-5, 1960) (Plenum Press, New York, 1961), Vol. 7, 454 pp.

A Life Support System for a Near Earth or Circumlunar Space Vehicle, G. B. Whisenhunt Jr., pp. 325-348.

Habitability and Maintenance of Human Performance in Long-Duration Space Missions, J. T. Celentano and B. B. Adams, pp. 349-361.

Trends in Human Performance Augmentation, A. T. Fomfield, pp. 362-369.

Space Flight Report to the Nation, edited by J. Grey and V. Grey (Basic Books Inc., New York, 1962), 224 pp.

Manned Space Flight, R. R. Gilruth, pp. 31-57.

Astronomical Aspects of the Emergence of Intelligence, S.-S. Huang and R. H. Wilson Jr. Inst. Aerospace Sci. Paper 63-48, Jan. 1963, 15 pp.

Extra-Terrestrial Intelligence and Stellar Evolution, L. Motz. Inst. Aerospace Sci. Paper 63-49, Jan. 1963, 16 pp.

Space Age Astronomy, Symposium (International) . . . Aug. 7-9, 1961, Calif. Inst. Tech., Pasadena, edited by A. J. Deutsch (Academic Press, New York, 1962), 531 pp.

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