quacy of available techniques in a series of test vehicle flights has been started.

INFORMATION ACTIVITIES — Upwards of 60 formal regular technical reports and 290 informal reports, most of them classified, were prepared by the Reports Office to record the work of the Laboratory.

The formal and informal reports mentioned above form only a fraction of the total documentation issued by the Laboratory. For example, some 139 reports issued by the Polaris Division are not included. The preparation of documents and illustrations, including films, for presentations to the Navy, the Department of Defense, and other agencies has also become an important and time-consuming activity. Another example is the Handbook of Supersonic Aerodynamics, this year's publication being Volume 6, Section 17, on *Ducts, Nozzles, and Diffusers.*

Some 71 inventions were disclosed to the Department of the Navy, 30 patent applications were filed during the year, and 29 patents were granted. . . .

Members of the Laboratory staff published 76 papers in scientific journals or technical books. . . .

During the past year 83 staff members presented 98 papers before scientific, engineering, and lay societies of which 6 were given at meetings held abroad.

Chemical Propulsion Information Agency.—The Federal Government's increased emphasis on solving the problems in information exchange have resulted in the recent issue of a Department of Defense Instruction establishing a number of Centers for Analysis of Scientific and Technical Information. The Chemical Propulsion Information Agency, formerly the Solid Propellant Information Agency, which has been operated by the Laboratory for approximately sixteen years, has been designated as the Center for Chemical Propulsion Information. The principal increased responsibilities of the CPIA, as result of this directive, are the coverage of the world's literature in the field rather than only government-sponsored work, the publication of critical reviews on subjects in the field, and the periodic publication of lists of new and significant publications in the field, reflecting an evaluation of the published work. . . .

Administrative Operations

MCCOY COLLEGE PROGRAM AT APL—For a number of years, both graduate and undergraduate scientific courses have been taught at the Laboratory through McCoy College. This year, a new educational program has been initiated. The University decided to expand the program at the Applied Physics Laboratory at Howard County to include a complete curriculum of study leading to the degree of Master of Science in Electrical Engineering and to open the program to all qualified applicants. The expanded program is scheduled to start in September 1964 with two courses each being offered in mathematics, physics, and electrical engineering. This represents a continuing and deepening involvement of the Laboratory in the educational and research missions of the University. . . .

R. E. GIBSON
Director

ADDRESSES

The listing below comprises the principal recent addresses made by APL staff members to groups and organizations outside the Laboratory.

R. A. Freiberg, "Nuclear Radiation on Thin-Film-Microelectronics," *I.E.E.E. Tenth National Communications Symposium,* Rome, N. Y., Oct. 5, 1964.

S. D. Bruck, "Thermally Stable Synthetic and Pyrolytic Polymers," *Society of Plastic Engineers,* Baltimore-Washington Section, Baltimore, Oct. 13, 1964.

D. W. Fox, Lecture Series on "Bounds for Eigenvalues of Self-Adjoint Operators" (4 lectures), *University of Maryland, Computer Science Center,* Nov. 13 and 20, Dec. 4 and 11, 1964.

Jane Olmer, "A Practical Document-Data Retrieval System," *Data Processing Management Association,* Washington, D. C., Nov. 18, 1964.

R. R. Newton, "Measurements of the Doppler Shift in Satellite Transmissions and Their Use in Geometrical Geodesy" and "Characteristics of the GEOS-A Spacecraft," *Centre National d'Etudes Spatiales* and *L'Institut Geographique National,* Symposium on The Establishment of a European Geodetic Network by Artificial Satellites, Paris, France, Dec. 14–16, 1964.

R. McDowell, "Analog-to-Digital Data Conversion," *The Johns Hopkins University,* Computer Sciences Meeting, Dec. 17, 1964.

G. L. Weaver (APL) and C. H. Weaver (University of Maryland), "Speech Communication and Information Theory," *1964 Speech Association of America Convention,* Chicago, Dec. 27–30, 1964.

E. A. Bunt, "Plasma Arc Heating for Hypersonic Flight Simulation," *University of Delaware,* Department of Mechanical Engineering Seminar, Jan. 7, 1965.

D. J. Williams, "Temporal and Spatial Variations of Outer-Zone Electrons at 1100 KM," *NASA Goddard Space Flight Center,* Weekly Colloquium, Jan. 12, 1965.

R. E. Fischell, "The Scientific Uses of Earth Satellites," *U. S. Naval Propellant Plant,* Scientists and Engineers Club, Indian Head, Md., Jan. 13, 1965.

J. R. Apel and A. M. Stone, "Investigations of Growing Waves Excited in a Plasma by an Electron Stream," *A.I.A.A. Aerospace Sciences Meeting,* New York, Jan. 25–27, 1965.

ADDRESSES *(continued)*

J. H. Morgenthaler, "Supersonic Mixing of Hydrogen and Air," *A.I.A.A. Aerospace Sciences Meeting,* New York, Jan. 25–27, 1965.

W. H. Guier, "Recent Progress in Satellite Geodesy," *I.E.E.E. 1965 National Winter Convention on Military Electronics,* Los Angeles, Feb. 3–5, 1965; and *Aerospace Corp.,* Symposium, Los Angeles, Feb. 4, 1965.

PUBLICATIONS

The following list is a compilation of recently published books and technical articles written by APL staff members.

L. M. Spetner, "Natural Selection: An Information-Transmission Mechanism for Evolution," *J. Theoret. Biol.,* **7**, 1964, 412–429.

I. B. Irving and W. J. Billerbeck, "Les problèmes thermiques en simulation spatiale," *Le Vide* (France), **19**, Sept.-Oct. 1964, 302–326.

E. A. Mason (University of Maryland) and L. Monchick (APL), "Supernumerary Rainbows in Molecular Scatterings," *J. Chem. Phys.,* **41**, Oct. 1, 1964, 2221–2222.

N. W. Bazley (Institut Batelle, Geneva) and D. W. Fox (APL), "Improvement of Bounds to Eigenvalues of Operators of the Form T*T," *J. Res. Nat. Bur. Standards,* **68**, Oct.-Dec. 1964, 173–183.

C. S. Leffel, Jr. "Counting 100-V Electrons with a Crossed Field Electron Multiplier," *Rev. Sci. Instruments,* **35**, Nov. 1964, 1614–1615.

F. J. Adrian, "Theory of the Nuclear Magnetic Resonance Chemical Shift of Xe in Xenon Gas," *Phys. Rev.,* **136**, Nov. 16, 1964, A980–A987.

L. L. Perini, W. E. Wilson, R. E. Walker, and G. L. Dugger, "Preliminary Study of Air Augmentation of Rocket Thrust," *J. Spacecraft and Rockets,* **1**, Nov.-Dec. 1964, 626–634.

R. G. Bartlett, Jr. and C. J. Swet, "The Cornucopia Two-Gas Atmosphere System for Man in Space," *Aerospace Medicine,* **35**, Dec. 1964, 1179–1183.

F. T. Heuring, "The Analytic Description of the Geomagnetic Field at Satellite Altitudes," *J. Geophys. Res.,* **69**, Dec. 1, 1964, 4959–4968.

S. D. Bruck, "Thermal Degradation of an Aromatic Polypyromellitimide in Air and Vacuum II: The Effect of Impurities and the Nature of Degradation Products," *Polymer* (London), **6**, Jan. 1965, 49–61.

S. D. Bruck, "Thermally Stable Polymeric Materials," *J. Chem. Ed.,* **42**, Jan. 1965, 18–24.

B. S. Walker, "Writing Non-Theatrical Films," *Writers Digest,* **45**, Jan. 1965, 25–27, 38–39.

C. O. Bostrom and D. J. Williams, "Time Decay of the Artificial Radiation Belt," *J. Geophys. Res.* **70**, Jan. 1, 1965, 240–242.

F. W. Schenkel, "Thin-Film Capacitance Elements: Which is Best for Your Purpose?" *Electronics,* **38**, Jan. 25, 1965, 67–72.

D. J. Williams and A. M. Smith, "Daytime Trapped Electron Intensities at High Latitudes at 1100 Kilometers," *J. Geophys. Res.,* **70**, Feb. 1, 1965, 541–556.

D. J. Williams and W. F. Palmer, "Distortions in the Radiation Cavity as Measured by an 1100–Kilometer Polar Orbiting Satellite," *J. Geophys. Res.,* **70**, Feb. 1, 1965, 557–568.

APL COLLOQUIA

Feb. 5—"Radar Scattering from Turbulent Wakes," by J. Jarem, Drexel Institute of Technology.

Feb. 12—"A Scientist Looks at Faith," by Rev. E. A. Bonney, Arlington Presbyterian Church, Baltimore.

Feb. 19—"Gravity Research at Princeton," by P. J. Peebles, Princeton University.

Feb. 26—"The Planning Process—In Columbia, Maryland," by J. W. Rouse, Community Research and Development Co.

Mar. 5—"Energy Relationships in the Thermosphere," by N. W. Spencer, Goddard Space Flight Center.

Mar. 12—"Formula Manipulation on Computers," by A. J. Perlis, Carnegie Institute of Technology.

Mar. 19—"Ultrastable Quartz Crystal Oscillators," by W. J. Spencer, Bell Telephone Laboratories.

HONORS AND APPOINTMENTS

S. D. Bruck, a member of the staff of the Research Center Chemical Research Group, has been named a Fellow in the Washington Academy of Sciences.

D. W. Fox, Supervisor of the Aeroelasticity and Vibration Analysis Project of the Bumblebee Engineering Group, received the 1964 Award for Scientific Achievement in Mathematics, from the Washington Academy of Sciences. Dr. Fox's citation was ". . . for research in estimating lower bounds to eigenvalues and related studies."

W. A. Good, Supervisor of the Bumblebee Controls Group, has been elected President of the Committee for International Aeromodeling. This committee, with its headquarters in Paris, and comprised of members from 50 nations, establishes international regulations for model airplane flying and for world-record competitions.

WITH THE AUTHORS

W. H. Guier, a native of Wichita, Kansas, is the author of "Satellite Geodesy." He received his B.S. degree in physics, his M.S. degree in experimental physics, and, in 1951, his Ph.D. degree in theoretical physics from Northwestern University as an AEC Predoctoral Fellow. Prior

to joining the staff at APL, Dr. Guier was employed, during summers, by the Westinghouse Electric Corp. in Pennsylvania, and by the Los Alamos Scientific Laboratories in New Mexico. He joined APL in 1951 as a physicist in the Research Center, working on wide-spectrum problems in statistical mechanics, quantum mechanics, radar tracking, and guidance. Working later in various areas related to missile guidance, Dr. Guier and a co-worker developed the technique of doppler tracking of satellites, followed by application of this technique in a satellite navigation system. In connection with this work, he received the "Outstanding Young Scientist Award," given by the Maryland Academy of Sciences in 1959. He is now Supervisor of the Space Analysis and Computing Group. He is a member of the American Physical Society and the Washington Academy of Sciences.

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R. P. Rich, co-author of "An Application of Digital Filtering," was born in Lowville, New York. He received his A.B. degree in Latin from Hamilton College in 1941 and his Ph.D. degree in mathematics from The Johns Hopkins University in 1950. Dr. Rich came to APL in 1950 as a specialist in mathematics and operations analysis. After several years as a mathematician in the Assessment Division, he became Supervisor of the Bumblebee Computing Center. He organized and developed the large-scale digital computing center, then centralized all APL data processing activities into the Computing Center, of

which he is Supervisor. In 1961 Dr. Rich was also appointed Director of the University Computing Center of The Johns Hopkins University. He is a member of the American Mathematical Society, the Operations Research Society of America, the Association for Computing Machinery, the Society of Industrial and Applied Mathematics, the American Association for the Advancement of Science, and the Maryland Academy of Sciences.

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H. Shaw, Jr., co-author of "An Application of Digital Filtering," is a native of Miami, Florida. He received his B.A. degree in mathematics from Emory University in 1949 and his M.S. degree in mathematics from the University of Miami in 1951, and continued advanced studies at the Universities of North Carolina and Maryland from 1950-1956. He joined the APL staff in 1956 after five years as a mathematics instructor, teaching assistant, and research assistant at Marion Institute, the University of North Carolina, and the University of Maryland. As a specialist in mathematics related to the use of automatic digital computers, he was assigned to the staff of the Computing Center, Mathematical Analysis

Project. Mr. Shaw is a member of the American Mathematical Society, the Society for Industrial and Applied Mathematics, and the Association for Computing Machinery.