Contributors to This Issue

KENNETH BULLINGTON, B.S., University of New Mexico, 1936; M.S., Massachusetts Institute of Technology, 1937; Bell Telephone Laboratories, 1937–. Mr. Bullington's first work with the Laboratories was on systems engineering on wire transmission circuits, and since 1942 he has been concerned with transmission engineering on radio systems, particularly over-the-horizon radio propagation. In 1956, he was awarded the Morris Liebmann Memorial Prize of the I.R.E. and the Stuart Ballentine Medal from the Franklin Institute for contributions in tropospheric transmission and the application of those contributions to practical communication systems. He is a Fellow of the I.R.E., and a member of Phi Kappa Phi, Sigma Tau and Kappa Mu Epsilon.

ARTHUR B. CRAWFORD, B.S.E.E. 1928, Ohio State University; Bell Telephone Laboratories 1928–. Mr. Crawford has been engaged in radio research since he joined the Laboratories. He has worked on ultra short wave apparatus, measuring techniques and propagation; microwave apparatus, measuring techniques and radar; microwave propagation studies and microwave antenna research. He is author or co-author of articles which appeared in the Bell System Technical Journal, Proceedings of the I.R.E., Nature and Bulletin of the American Meteorological Society. He is a Fellow of the I.R.E. and a member of Sigma Xi, Tau Beta Pi, Eta Kappa Nu, and Pi Mu Epsilon.

HAROLD E. CURTIS, B.S. and M.S., Massachusetts Institute of Technology, 1929; Department of Development and Research of the American Telephone and Telegraph Company, 1929; Bell Telephone Laboratories, 1934–. Mr. Curtis has been concerned with transmission problems related to multi-channel carrier telephony. He has also been engaged in studies of transmission engineering aspects of the microwave radio relay system. His work at the Laboratories has also included pioneering transmission studies of the coaxial cable, the shielded pair and quad, and the waveguide. Mr. Curtis holds ten patents relating to carrier telephony.

HARALD T. FRIIS, E.E., 1916, D.Sc., 1938, Royal Technical College (Copenhagen); Western Electric Company, 1919; Bell Telephone Lab-

emphasis on methods of computing modulation products. Since 1935 he has served as a consultant on mathematical problems and in investigations of the telephone transmission theory, including noise theory, and applications of electromagnetic theory. Fellow of the I.R.E.

J. W. SCHAEFER, B.M.E., Ohio State University, 1941; Bell Telephone Laboratories, 1940–. Mr. Schaefer has worked on dial design and dial test equipment, and during the war years contributed to the design and development of anti-aircraft fire control equipment and guided missiles. After the war, Mr. Schaefer proposed a means of steering missiles from which evolved NIKE. He is now working on anti-aircraft guided missile systems. He is a member of A.S.M.E., the Army Ordnance Association, Tau Beta Pi and Sigma Xi.

BERNARD SMITH, B.S., City College of New York, 1948; A.M., 1951, and Ph.D., 1954, Columbia University; Lecturer, City College of New York, 1948–1954; Bell Telephone Laboratories, 1954–. In addition to the transmission studies in which he has been engaged since joining the Laboratories, his present duties include teaching information theory in the Communications Development Training Program. He is a member of the American Physical Society, Phi Beta Kappa, Sigma Xi and Kappa Delta Pi.

JAMES L. SMITH, B.S., Newark College of Engineering, 1956; Bell Telephone Laboratories, 1941–. Mr. Smith worked on problems concerned with relay contact erosion as a technical aide, and in 1956 began his work on solid state switching networks. He is a member of the A.I.E.E. and Tau Beta Pi.

MARK A. TOWNSEND, B.S., Texas Technological College, 1936; M.S., Mass. Institute of Technology, 1937; Bell Telephone Laboratories, 1945–. Mr. Townsend's early work with the Laboratories was on the development of gas discharge tubes for use in telephone switching systems. More recently, his work has been in the exploratory development of systems for digital data transmission and of a small electronic switching system. He is a member of the A.I.E.E., and senior member of the I.R.E.

GERD F. WEISSMANN. Dipl.–Ing. Technical University of Berlin, 1950; M.S. Pennsylvania State University, 1953; Bell Telephone Laboratories, 1953–. Mr. Weissmann's work at the Laboratories has been in stress analysis, engineering mechanics, strain measurements, soil mechanics and metals properties and testing. He also has worked with outside plant problems and metallurgical engineering.

oratories, 1930–. Dr. Friis, Director of Research in High Frequency and Electronics, has made important contributions on ship-to-shore radio reception, short-wave studies, radio transmission (including methods of measuring signals and noise), a receiving system for reducing selective fading and noise interference, microwave receivers and measuring equipment, and radar equipment. He has published numerous technical papers and is co-author of a book on the theory and practice of antennas. The I.R.E.'s Morris Liebmann Memorial Prize, 1939, and Medal of Honor, 1954. Valdemar Poulson Gold Medal by Danish Academy of Technical Sciences, 1954. Danish "Knight of the Order of Dannebrog," 1954. Fellow of I.R.E. and A.I.E.E. Member of American Association for the Advancement of Science, Danish Engineering Society and Danish Academy of Technical Sciences. Served on Panel for Basic Research of Research and Development Board, 1947–49, and Scientific Advisory Board of Army Air Force, 1946–47.

Lester H. Germer, B.A., Cornell, 1917; M.A., Columbia, 1922; Ph.D., Columbia, 1927; Western Electric Co., 1917–24; Bell Telephone Laboratories, 1925–. With the Research Department, Dr. Germer has been concerned with studies in electron diffraction, structure of surface films, thermionics, contact physics, order-disorder phenomena, and physics of arc formation. He has published about seventy papers and has three patents. In 1931 he received the Elliott Cresson medal of the Franklin Institute. He is a member of the American Physical Society, Sigma Xi, the New York Academy of Sciences, the A.A.A.S., and the American Crystallographic Society of which he served as president in 1944.

David C. Hogg, B.S., University of Western Ontario, 1949; M.S. and Ph.D., McGill University, 1950 and 1953; Bell Telephone Laboratories, 1953–. Mr. Hogg has been engaged in studies of artificial dielectrics for microwaves, antenna problems, and over-the-horizon and millimeter wave propagation as a member of the Radio Research Dept. During World War II, Mr. Hogg served with the Canadian Army in Europe and from 1950–51 did research for the Defense Research Board of Canada. He is a member of Sigma Xi, and a senior member of the I.R.E.

Stephen O. Rice, B.S., Oregon State College, 1929; California Institute of Technology, Graduate Studies, 1929–30 and 1934–35; Bell Telephone Laboratories, 1930–. In his first years at the Laboratories, Mr. Rice was concerned with the non-linear circuit theory, with special