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Dr. Bard is currently working on system performance measurement and evaluation. He has been with IBM since 1957 and has worked on the development of computer applications in the field of multicomponent distillation, nonlinear programming, mathematical model fitting and optimal control. He received a B.S. in 1954 from the University of Pennsylvania and an M.S. and a Ph.D. in chemical engineering in 1956 and 1966, respectively, from Columbia University.

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Dr. Casey has been working on the design of large data base systems since 1970. After joining IBM in 1963, he worked on pattern recognition problems at the Thomas J. Watson Research Center in Yorktown Heights, New York. He received a B.E.E. from Manhattan College in 1954 and an M.S. and an Eng. Sc.D. in 1965, both from Columbia University. From 1957 to 1958 he was a Teaching Assistant at Columbia University, and from 1958 to 1963 he investigated radar data processing techniques at the Columbia University Electronics Research Laboratories. While on leave of absence from IBM in 1969, he taught at the University of Florida. Dr. Casey is a member of the Association for Computing Machinery and the New York Academy of Science.

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Dr. Chamberlin is currently working on the design of large data base applications. Since joining IBM in 1971 he has worked on the design and development of time-sharing operating systems. His education includes a B.S. from Harvey Mudd College, Claremont, California, in 1966, and an M.S., 1967, and a Ph.D., 1971, in electrical engineering, both from Stanford University. He is a member of the Institute of Electrical and Electronics Engineers and the Association for Computing Machinery.

Dale L. Critchlow

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Dr. Critchlow is manager of a solid-state electronics group at the Thomas J. Watson Research Center. He served as Assistant Professor in electrical engineering at Carnegie Institute of Technology from 1956 to 1958 and joined the IBM Research Laboratory in 1958 to work on magnetic logic devices. Subse-

quently he worked in the development of data transmission techniques in the Advanced Systems Development Division and the World Trade Corporation. He has been involved in various areas of LSI logic and memory including FET device and circuit design since 1964. He received the B.S. degree in electrical engineering from Grove City College, Grove City, Pennsylvania, in 1953, and the M.S. and Ph.D. degrees from Carnegie Institute of Technology in 1954 and 1956, respectively.

Claude Delobel

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Dr. Delobel has been the manager of the education department Management Data Processing at the University of Grenoble, France, since October 1972. His education, all obtained at the University of Grenoble, includes an M.S. in applied mathematics and an Engineer Diploma in computer science in 1963, and a Thesis in economy in 1965. He worked at the Carpano et Pons Company from 1967 to 1968. In 1969 he joined the Conservatoire National des Arts et Metiers as manager of the computer center. Since that time he has been interested in the application of computer science to management. In 1971 he was with IBM as a visiting scientist in the San Jose Research Laboratory.

Robert H. Dennard

Research Division, Yorktown Heights, New York

In 1971 Dr. Dennard became the manager of a semiconductor device design group at the Thomas J. Watson Research Center. This group is concerned with miniaturization of MOS devices and circuits using new high-resolution pattern formation methods. He joined IBM in 1958 with B.S. and M.S. degrees in electrical engineering from Southern Methodist University in 1954 and 1956, respectively, and a Ph.D. from Carnegie Institute of Technology in 1958. His experience has included study of new devices and circuits for logic and memory applications and development of advanced data communication techniques. In 1964 he began work in a group that pioneered in the concepts of large-scale integration (LSI). Dr. Dennard's contributions were in the development of cost and yield models, MOS-FET device and integrated circuit chip design, and FET memory cells and organizations. He is a member of the Institute of Electrical and Electronics Engineers.

Wilm E. Donath

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Dr. Donath has been a member of a design automation group at the Research Center since 1963. His education includes a B.S. in Chemical Engineering, 1954, Carnegie Institute of Technology and a Ph.D. in Physical Chemistry, 1958, University of California at Berkeley. He joined IBM in 1959 at the IBM Watson Laboratory in New York City and worked until 1963 on the computation of properties of atoms and molecules. Since then he has been working on both the theoretical and practical aspects of design automation problems. Dr. Donath received an Outstanding Contribution Award for work on a light table artwork generation system in 1968. He is a member of the Institute of Electrical and Electronics Engineers, the Society for Industrial and Applied Mathematics, and the American Mathematical Society and is a Fellow of the American Institute of Chemists.

Samuel H. Fuller

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Dr. Fuller is an Assistant Professor of computer science and electrical engineering at Carnegie-Mellon University. During the summer of 1971 he worked at the IBM Thomas J. Watson Research Center in Yorktown Heights, New York. Dr. Fuller received his B.S.E. degree from the University of Michigan in 1968 and his M.S. and Ph.D. degrees from Stanford University in 1969 and 1972, respectively. He is an editor of the Computer Systems Department of the *Communications of the ACM* and is a member of the Institute of Electrical and Electronics Engineers, the Association for Computing Machinery, Tau Beta Pi, Sigma Xi, Phi Kappa Phi, and Eta Kappa Nu.

Alan J. Hoffman

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Dr. Hoffman is manager of the combinatorial studies group of the Mathematical Sciences Department at the Thomas J. Watson Research Center. He received his A.B. and Ph.D. degrees from Columbia University in 1947 and 1950. He joined IBM in 1961 after being a member of the Institute for Advanced Study, a mathematician at the National Bureau of Standards, scientific liaison officer at the London branch office of the Naval Research Laboratory, and a member of Management Consultation Services of the General Electric Company. Since 1965 he has been Adjunct Professor of mathematics at the Graduate Center of the City University of New York and has held similar positions at Columbia University, New York University, American University, the University of California at Santa Barbara, Yeshiva University, and the Technion. He is currently on the editorial board of the *Journal of Combinatorial Theory*, *Linear Algebra and its Applications*, and the *Naval Research Logistics Quarterly*, and has previously served on the boards of several other professional journals.

Erik Klokholm

System Products Division, Yorktown Heights, New York

Dr. Klokholm is manager of a group working on thin films and thin-film recording heads in the Manufacturing Research Laboratory at the Thomas J. Watson Research Center. He assumed this position in 1973 after working as a staff member at the Research Center since 1962. During the academic year 1961 to 1962, he was an Associate Professor in physics at the College of Ceramics, Alfred University, Alfred, New York. From 1959 to 1961 he was with the Central Research Laboratories of the American Machine and Foundry Company, and from 1951 to 1959, with the Franklin Institute Laboratories for Research and Development. He received his B.S. in physics from Massachusetts Institute of Technology in 1951 and a Ph.D. degree in physics from Temple University, Philadelphia, in 1960. Dr. Klokholm is a member of the American Physical Society, the American Crystallographic Association, and the American Institute of Mining and Metallurgical Engineers, Institute of Metals Division.

Hisashi Kobayashi

Research Division, Yorktown Heights, New York

Dr. Kobayashi is the manager of a system measurement and modeling group in the computer sciences department at the Thomas J. Watson Research Center. He joined IBM Research in 1967 as a member of the applied research department where he was involved in seismic signal processing, data communication theory, digital magnetic recording theory and image data

compaction. In 1971 he moved to the computer sciences department and since then, has been concerned with the development of general theory and methodologies for computer system performance evaluation. From 1963 to 1965 he worked at the Toshiba Electric Company, Tokyo, where he was engaged in the research and development of advanced radar systems. From 1969 to 1970 he was a Visiting Assistant Professor at the Department of System Science, University of California at Los Angeles, where he taught courses in probability and statistics, information theory and signal detection theory. He holds B.S. and M.S. degrees in electrical engineering, obtained in 1961 and 1963, respectively, from the University of Tokyo; and M.A. and Ph.D. degrees in electrical engineering both received in 1967 from Princeton University. He is a member of Eta Kappa Nu, the Institute of Electrical and Electronics Engineers, the Association for Computing Machinery, the Institute of Electronics and Communication Engineers of Japan, and the Information Processing Society of Japan. He was awarded the RCA David Sarnoff Scholarship in 1960 and the Orson Desaix Munn Fellowship in 1965.

Leonard Y. Liu

Research Division, San Jose, California

Dr. Liu manages research efforts in user-oriented systems, information systems and storage systems. He has been with IBM since 1969. His education includes a B.S. degree in electrical engineering from National Taiwan University in 1963, and a Ph.D. in computer sciences from Princeton University in 1968. He has been involved in research activities in supervisory programs for multiprocessing systems, data base systems and application systems. Dr. Liu is a member of the Institute of Electrical and Electronics Engineers and the Association for Computing Machinery.

Steven Magdo

System Products Division, East Fishkill, New York

Dr. Magdo is an advisory engineer in a device design group at the IBM laboratory in East Fishkill, where he is currently engaged in the development of space-charge-limited transistors on high-resistivity substrates. Before joining IBM in 1967 he worked for two years with the General Electric Company on development and application of GaAs and Nd:YAG lasers and light-emitting diodes. He had previously worked on electron-tube development at the Bell Telephone Laboratories in Allentown, Pennsylvania and at the United Incandescent Lamp and Electrical Company in Budapest, Hungary. From 1952 to 1956, he also did research on electron-tube theory as a Fellow of the Hungarian Academy of Sciences. His degrees include the Diplom Ingenieur in electrical and mechanical engineering from the Technical University of Budapest, 1950, an M.S., 1962, and a Ph.D., 1964, in electrical engineering from Lehigh University, Bethlehem, Pennsylvania. Dr. Magdo is a member of the Institute of Electrical and Electronics Engineers.

John W. Matthews

Research Division, Yorktown Heights, New York

Dr. Matthews is a member of the thin films and metallurgy group at the Thomas J. Watson Research Center. He has been with IBM since 1969. He obtained his Ph.D. in physics at the University of the Witwatersrand in Johannesburg, South Africa, and became a member of the faculty there in 1959. At the time

of his departure in 1969 he was a reader in the Physics Department and director of the university's electron microscope unit. He has spent short periods at the Cavendish Laboratory in Cambridge, England, and with Siemens and Halske in Berlin. From 1963 to 1964 he was on leave at the Physics Department of the University of Virginia in Charlottesville.

Thomas S. Plaskett

Research Division, Yorktown Heights, New York

Dr. Plaskett is a staff member in the crystal synthesis group at the Thomas J. Watson Research Center, where his current interest is liquid-phase epitaxial growth of magnetic oxide materials for bubble-domain devices. Since joining IBM in 1962 he has studied the growth of dislocation-free, float-zoned silicon and the growth and growth-related defects in III-V and alloy compounds. From 1959 to 1962 he worked as a physical metallurgist at the Department of Mines and Technical Surveys, Ottawa, Canada. He received his B.A.Sc. and M.A.Sc. degrees in metallurgical engineering in 1955 and 1957, respectively, and his Ph.D. in physical metallurgy in 1959, all from the University of Toronto. Dr. Plaskett is a member of the Electrochemical Society, the American Institute of Metallurgical Engineers, and the American Association for Crystal Growth.

Stanley E. Schuster

Research Division, Yorktown Heights, New York

Mr. Schuster works on integrated circuits and systems in an applied research group at the Thomas J. Watson Research Center. His activities at IBM have also included line control and error recovery procedures for communications systems. Before joining IBM in 1965 he worked at the Bendix Corporation from 1962 to 1963 and served as an officer in the U.S. Army Signal Corps from 1963 to 1965. He received his B.S. and M.S. degrees in electrical engineering from New York University in 1962 and 1969, respectively. He is a member of Eta Kappa Nu, Tau Beta Pi, and the Institute of Electrical and Electronics Engineers.

Harvey F. Silverman

Research Division, Yorktown Heights, New York

Dr. Silverman is currently working in a speech processing group at the Thomas J. Watson Research Center. His education includes a B.S. in engineering, 1965, and a B.S.E., 1966, both from Trinity College in Hartford, Connecticut; and an Sc.M., 1968, and a Ph.D., 1970, in electrical sciences, both from

Brown University. He joined IBM in 1970. He had previously worked as a Research Associate at the Gerber Scientific Instrument Company, developing logic and control circuits for large digital plotting systems from 1964 to 1966. He was also a part-time consultant to the Raytheon Company Submarine Signal Division, working on applications of fast Fourier transform techniques and was a Teaching Assistant at Brown University (in addition to his National Science Foundation Traineeship for four years) from 1966 to 1970. Dr. Silverman is a member of the Association for Computing Machinery, the Institute of Electrical and Electronics Engineers, and Sigma Xi.

Donald T. Tang

Research Division, Yorktown Heights, New York

Dr. Tang works in the Computer Sciences Department at the Research Center on the evaluation and optimization of computer/communication systems. He received his B.E. in electrical engineering at the Taiwan University in 1953 and his Ph.D. in electrical engineering at the University of Illinois in 1960. A research staff member since 1960, his activities include error control coding for communication systems and magnetic recording systems, and communication network analysis and design. During 1965 to 1966 he was a Visiting Professor of Electrical Engineering at the National Taiwan University. He is a member of Eta Kappa Nu, Sigma Xi, the Association for Computing Machinery and the Institute of Electrical and Electronics Engineers.

Po Cheung Yue

Research Division, Yorktown Heights, New York

Dr. Yue has worked primarily in the areas of system performance evaluation, workload characterization, and analytical modeling since joining IBM at the Thomas J. Watson Research Center, Yorktown Heights, N.Y., in 1970. His education includes a B.S. degree from McGill University in 1964, an M.S. from Stanford University in 1965, both in electrical engineering, and a Ph.D. in system science from the University of California at Los Angeles in 1970. He is a member of the Institute of Electrical and Electronics Engineers, the Association for Computing Machinery, the Society of Industrial and Applied Mathematics, and the American Statistical Association.

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