

# metrication

*—Managing the Industrial Transition*

Liptai/Pearson

STP 574



**AMERICAN SOCIETY FOR TESTING AND MATERIALS**

# METRICATION—MANAGING THE INDUSTRIAL TRANSITION

A symposium  
presented at the  
Seventy-seventh Annual Meeting  
and sponsored by the ASTM  
Standing Committee on Publications  
AMERICAN SOCIETY FOR  
TESTING AND MATERIALS  
Washington, D.C., 24–25 June 1974

ASTM SPECIAL TECHNICAL PUBLICATION 574  
R. G. Liptai and J. W. Pearson, editors

List price \$30.00  
04-574000-34



AMERICAN SOCIETY FOR TESTING AND MATERIALS  
1916 Race Street, Philadelphia, Pa. 19103

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Library of Congress Catalog Card Number: 74-28981

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The Society is not responsible, as a body,  
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# Foreword

The importance of standards activities to metrication, and the importance of metrication to standards activities is documented many times in this special technical publication. The existence of metric standards in other countries influences industrial decisions on metrication, and metrication influences the standards activities in this country.

This interaction between standards activities and metrication has long been recognized by ASTM. As long ago as 1920, the Board of Directors of ASTM ruled that, "...units of measurement shall be in both English and metric units, if in the judgement of the (technical) committee it is desirable!!!."

More recently, but still some time ago, in 1962, the Board of Directors formed an ad hoc committee to review the use of the metric system in ASTM, and, following the recommendations of that committee, in 1963 adopted a resolution: "It shall be the policy of ASTM to work toward simplified units of measurement. The Society shall take a leadership role in working with other groups toward the adoption of a common system of units." Later, in 1971, the Board of Directors revised this resolution to specify that the "...common system of units..." would be SI.

The activities of ASTM in metrication did not consist only of adopting resolutions. In 1963, the ad hoc committee formed in 1962 was changed to the Special Committee on Metric Practice. This committee had had an important effect on metrication within ASTM. It developed the Standard E 380, "Metric Practice Guide," which is included in this volume. In addition, the committee wrote guidelines for use by technical committees for the "soft" conversion of standards to metric units. This "soft" conversion is now practically complete, and almost all ASTM standards are provided with metric equivalents. The longer and more difficult task of "hard" conversion of ASTM standards to define the manufacture and sale of products in preferred SI units will occupy the Society in the future.

Because of this long background and interest in metrication, when J. W. Pearson and R. G. Liptai, the organizers of the symposium whose proceedings appear in this STP, approached ASTM about holding the symposium and publishing the results as an STP, they were greeted with enthusiasm. The importance of describing the industrial experience in metrication is very great, and the Standing Committee on Publications of ASTM was urged by the Special Committee on Metric Practice to work with Pearson and Liptai on the symposium and on the publication of this STP. The Standing Committee on Publications is pleased to have done so, and this STP, describing as it does the industrial experience in metrication, will help to carry out the resolution of the Board of Directors of ASTM to "...work toward the adoption of SI..."

*Elio Passaglia*

Chairman, ASTM Standing Committee on  
Publications, and chief, Metallurgy Division,  
National Bureau of Standards.

## **Related ASTM Publications**

**ASTM Conversion Slide Rule, U.S. Customary to SI Units, and Metric  
Practice Guide, Standard E 380-74, \$5.25, PCN 12-503801-00**

## A Note of Appreciation to Reviewers

This publication is made possible by the authors and, also, the unheralded efforts of the reviewers. This body of technical experts whose dedication, sacrifice of time and effort, and collective wisdom in reviewing the papers must be acknowledged. The quality level of ASTM publications is a direct function of their respected opinions. On behalf of ASTM we acknowledge with appreciation their contribution.

*ASTM Committee on Publications*

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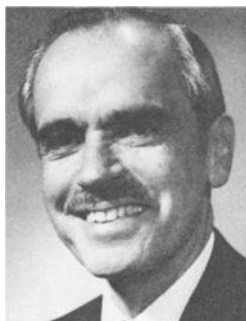
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## Biographical Profiles



**Betsy Ancker-Johnson**, author of "A Decision Whose Time Has Come," received a B. A. in physics with high honors from Wellesley in 1949 and a Ph.D., cum laude, also in physics, from Tuebingen University, Germany, in 1953. In 1973, Dr. Ancker-Johnson became Assistant Secretary of Commerce for Science and Technology, responsible for the 7000 employees and \$200 million budget of the Patent Office, National Bureau of Standards, National Technical Information Service, Office of Telecommunications, Office of Environmental Affairs, and Office of Product Standards. Dr. Ancker-Johnson is a member of the Federal Council on Science and Technology and chairman of its Committee on Government Patent Policy. She is chairman of the Commerce Technical Advisory Board as well. As a member of the Joint U.S./U.S.S.R. Commission on Science and Technology, she headed the U.S. group responsible for the Intellectual Property Agreement signed in Moscow in December 1973. She also headed the U.S. Patent Management and Licensing Delegation under the U.S./U.S.S.R. Agreement on Exchange.



**Louis E. Barbrow**, author of "The Changeover to Metric—Timetable and Government Role," received a B.S. in physics from Carnegie Institute of Technology (now Carnegie Mellon University) in 1926 and joined the staff of the National Bureau of Standards (NBS) in 1927. His professional career from 1927 to 1969 was dedicated to the field of measurement of radiation, light, and color. He served successively as chief of the Photometry and Colorimetry Section and chief of the Optics Metrology Branch of the Metrology Division. His contribution that has received major worldwide recognition is the development with three colleagues at NBS of the primary standard of light, a blackbody at the freezing point of platinum, in terms of which the SI unit of luminous intensity, the candela, has been defined since 1948. From 1969 to 1971 Mr.

Barbrow was involved in the Metric Study conducted by NBS under Public Law 90-472, and served during the last year of the Study as manager of the Manufacturing Industry Survey, a service that culminated with publication of the U.S. Metric Study Report on the Manufacturing Industry.



**Richard B. Belford**, author of "The Fastener Success Story," received his B.S. in civil engineering from the University of Toronto, Toronto, Canada, in 1944. He joined the staff of Industrial Fasteners Institute in 1950. Presently he is technical director, and, in this capacity, serves as his industry's technical liaison in all of its interests in standardization, research, and other technical activities. He is member of over 40 national and international technical committees, serving as either chairman or secretary of many. He is currently a member of the ANSI Executive Standards Council, the ASTM Special Committee on Metric Practices, and the ANSI Special Committee to study development of an Optimum Metric Fastener System. He has been a delegate to over 25 ISO meetings, serving as leader of the U.S. delegation at most.

**Arthur Clarke**, author of "Metrication in the United Kingdom Construction Industry," is secretary to the British Metrication Board and head of its Industries Division. Mr. Clarke was educated at the Lawrence Sheriff School, Rugby, and London and Leicester Universities where he obtained an honours degree in modern history. Mr. Clarke entered the Civil Service in 1952, joining the Board of Trade which became a part of the Department of Trade and Industry in 1970. He worked in divisions dealing with promotion of exports, location of industry, regional development, investment grants, management services within the Department, and prices and incomes. In 1973 Mr. Clarke joined the Metrication Board. In his capacity as head of Industries Division, he is concerned with the programs for the changeover to metrication in agriculture, for-

estry, fisheries, and land; engineering industries; fuel and power; industrial materials and construction industries; and transport and communication industries.



**Donald W. Darrone**, author of "Metrication in the Contract Tooling and Machining Industry," is chairman of the Metric System & Standards Committee of the National Tool, Die & Precision Machining Association, and is a graduate of New York State College of Forestry at Syracuse University. In 1937, Mr. Darrone became employed by the Allen Tool Corporation, Syracuse, N.Y. In 1954, Mr. Darrone became president-treasurer of the company. Mr. Darrone is a member of the President's Association of the American Management Association, the American Welding Society, American Society of Metals, the American Ordnance Association, and the Syracuse Technology Club. He has special interests in the areas of metrication and apprentice training techniques and programs. Mr. Darrone is a past president of NTDPMA (1966-67) and is a member of the Society of Manufacturing Engineers' Metric Committee, and the Metric Association. He is currently NTDPMA's representative to the Industrial Products Sector Committee of the American National Metric Council.



**Daniel V. De Simone**, author of "Background and Perspective," is deputy director of the Office of Technology Assessment, Congress' new agency for appraising technological issues. Before appointment to this position in December 1973, he served as executive director of the Federal Council for Science and Technology in the Executive Office of the President. From 1969 to 1971, he organized and directed the U.S. Metric Study for Congress, assessing the social, economic, and national security implications of the worldwide change to the metric system and the consequences of alternative courses of action open to the United States. In 1972 he was selected to receive the National Civil Service League Award for outstanding achievement in the Federal service.



**James E. Doebereiner**, author of "Going Metric—To What Standard," is supervising engineer of Product for The Timken Company. In 1960 he was graduated with an Engineering Technician Certificate. In 1970 he was named Standards and Patents engineer and in 1972 was named to his present position. Mr. Doebereiner received a B. S. in mechanical engineering from Tri-State College in 1970. A representative of the American Society of Mechanical Engineers to the American National Standards Institute, Mr. Doebereiner is The Timken Company representative to the Anti-Friction Bearing Manufacturers Association. U.S. delegate and secretariat of Sub-Committee 9 of Technical Committee Four of the International Organization for Standardization, he is also the U.S. delegate to three other Working Groups of the ISO, dealing with International Standards. He is also a member of the Advisory Board to the Center for Metric Education, Western Michigan University.



**G.B.R. Feilden**, CBE MA DSc D Tech CEng FRS, is director general of the British Standards Institution and author of "Metrication in the United Kingdom—The Industrial Bonus." He joined BSI in 1968. He graduated with honors in both mechanical sciences and economics at Cambridge. Dr. Feilden has served on a number of Government and other committees, prominent among which was his chairmanship of the DSIR Committee on Engineering Design which issued The Feilden Report in 1963. He has been a member of the Central Advisory Council for Science and Technology and is chairman of the Engineering Design Advisory Committee of the Design Council. A former vice-president of the Royal Society, Dr. Feilden has served for several years as a member of the Council.



**Lowell W. Foster**, author of "Case History, Honeywell Inc.," is director of Corporate Standardization Services for Honeywell Inc. He has been with Honeywell for 28 years in tool design, production, process, standardization, design engineering, line managerial, and staff capacities. He has been active in national and international standards work. In 1967 he was a U.S. delegate to the ABC Conference in Ottawa, Canada, and in 1969 the ABC Conference in London, England. He has traveled all over the industrial world serving as an ANSI ISO TCIO representative and as a consultant in design and engineering practices. He has authored many papers on design practices, some of which have been translated for use in Japan.



**John D. Graham**, author of "The International System of Units (SI)," graduated from St. Ambrose College in Davenport, Iowa, in 1935 and started with International Harvester the same year. After 31 years of materials work, he was appointed manager of Engineering Research in 1966. One of his functions is direction of his company's standards program, and, in this capacity, he has organized preparation for the use of metric units. He is chairman of both the SAE and ASTM Metric Committees.



**Alec F. King**, author of "Metrication at Vauxhall Motors Limited England," was matriculated at Cedars School, Leighton Buzzard. He joined Vauxhall Motors in 1936, and was appointed manager, work standards, in 1954. He was appointed production manager—Vauxhall Luton Car and Van Plant in 1966 and was appointed manager, work standards, plant layout, materials handling, and forward planning, in 1968. He is a chartered engineer and member of the Institution of Production Engineers.



**Joe G. Langenstein**, coauthor of "Metrication Experience at Caterpillar Tractor Co.," graduated from Indiana Institute of Technology in 1961 with a B. S. in mechanical engineering. He joined Towmotor, a subsidiary of Caterpillar Tractor Co., in 1966, and worked on changing Towmotor to Caterpillar engineering standards. In August 1971, he became involved with the Caterpillar metric program. Mr. Langenstein is a member of the American Society of Mechanical Engineers Metric Committee.



**Ming-Yu Li**, author of "Metric Packaging" and a native of Canton, China, received his B.S. in 1947 from the University of Nanking, majoring in agronomy. He came to the United States in 1949 and received his Ph.D. in weed control from Rutgers, the State University of New Jersey, in 1959. He is presently a faculty member of the Department of Environmental Toxicology at Davis Campus of the University of California. He became the deputy coordinator of the U. C. Davis Packaging Program in 1970 and has been directly responsible for the continuing education activity and the Packaging Documentation and Information Service. Dr. Li served as a consultant to the Rockefeller Foundation in 1967, to the Protein Advisory Group of the United Nations in 1968, and to the U.S. Environmental Protection Agency in 1971. He is a member of the Computer in Weed Science Committee of the Weed Science Society of America and the chairman of the Packaging Information and Work-Documentation Group of the World Packaging Organization.



**Robert G. Liptai**, symposium cochairman, is presently associated with the University of California Lawrence Livermore Laboratory as associate program manager in the Environmental Studies Group. Dr. Liptai's educational background includes studies in metallurgy, mechanics, and mechanical engineering. He received his B.S. and M.S. from the University of Missouri at Rolla and was awarded a Ph.D. in 1963 from Michigan State University. He has authored over 60 tech-

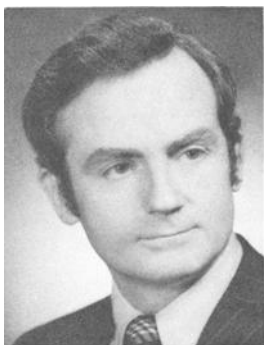
nical papers on various aspects of metallurgy and mechanical engineering and is listed in *American Men and Women of Science*, *International Scholars Dictionary*, and *Who's Who in the West*. In addition to interests in acoustic emission, the mechanical and fracture behavior of material, and technology utilization, he is a consultant on scientific accident reconstruction and product liability.



**Stanley E. Mallen**, author of "A Metrication Case History of Ford" and metrication planning associate in the Metrication Planning Office of Ford Motor Company's Product Planning and Research Staff, started with Ford in 1951 as a product planning analyst. He advanced to assistant manager of Lincoln-Mercury Division's Programming Department in 1955. Subsequent promotion advanced him to manager, Product Analysis Department, Engineering Staff, in 1962, and material standards and standard parts manager in 1968. He became fastener engineering manager in the Product Development Group in 1971. He received a mechanical engineering degree in 1942 from Carnegie Institute of Technology, graduating with honors. In 1947, he received a master's degree in business administration from Harvard Graduate School of Business Administration. He has served on the part-time teaching staffs of the University of Illinois, Lawrence Institute of Technology, and Henry Ford Community College.

**Philip A. Markstrom**, author of "One Electronic Company's Approach to Metrication," joined International Business Machines Corporation as a manufacturing engineer in July 1962 and was promoted to program manager Corporate Standards in December 1967 and then program manager metrication in January 1972. He is currently responsible for the implementation of SI-Metric in IBM.





**Malcolm E. O'Hagan**, author of "Metric Conversion in the United States—Coordinating the Change," came to the United States from Ireland in October 1962 to study at the George Washington University in Washington, D.C., where he received a doctor of science degree in 1966. He spent two years at the National Bureau of Standards as a guest worker and did doctoral research there. During the U.S. Metric Study (1969-71), he acted as special assistant to the chairman of the National Metric Advisory Panel and was intimately involved in the study and in subsequent metric activities. He joined the American National Standards Institute in 1973 to serve as executive director of the newly formed American National Metric Council.



**Jack W. Pearson** is metric project officer for the Lawrence Livermore Laboratory of the University of California and is author of the "Livermore Plan" which is becoming widely used as a guide to managing transition. He is a member of the California Metric Committee, consultant to the State Department of Education and the State legislative assembly on matters-metrication, consultant to the American Welding Society on metric practices, and chairman of the Energy Resources & Development Agency Task Group on Metrication.



**Donald L. Peyton**, author of "International Standards—Impact on American Metrication," assumed the position of managing director, American National Standards Institute (ANSI), on 1 Sept. 1966. Mr. Peyton came to ANSI from the Chamber of Commerce of the United States where he held the position of Government Relations general manager. He was formerly secretary of the Chamber's Committee on Science and Technology. In 1968, Mr. Peyton was elected to the Executive Committee of the International Organization for Standardization (ISO)—the 67-country non-treaty organization developing international standards. ANSI is the U.S. member of ISO.



**Victor W. Schellschmidt**, coauthor of "Metrication Experience at Caterpillar Tractor Co.," is the supervising engineer in the Manufacturing General Offices of Caterpillar Tractor Co. He received his B. S. from Illinois Institute of Technology. Mr. Schellschmidt has experience in setting up manufacturing operations in several metric countries.



**George H. Spencer**, author of "The Canadian Picture: Managing the Conversion of Standards in Canada" and director of Metric Conversion, Standards Council of Canada, joined the Council in 1972 after distinguished service with the Canadian Armed Forces where he attained the rank of major general. His experience includes senior executive tasks related to both national and international standardization activities. He has been responsible for the development of Canada's program for conversion of standards to SI since its inception and is coordinating its implementation.



**L. R. Strang**, coauthor of "Metrication Experience at Caterpillar Tractor Co.," joined Caterpillar Tractor Co. in 1942. In 1953 he joined the Engineering Standards Division and is presently supervising engineer of Basic Standards including responsibility for metrication. He is the engineering representative on the Corporate Metric Advisory Committee. He is active on national standards committees serving on ANSI B1 Screw Threads Committee, ANSI B14 Drafting Committee, ANSI Special Committee to Study Development of an Optimum Metric Fastener System, SAE Fasteners Committee, Ad Hoc Metric Study Group of SAE Off-Road Vehicle Council, and SAE Metric Advisory Committee.



**Edward J. Streichert**, author of "Metric Conversion at General Motors Corporation," attended Western Reserve University, Cleveland, Ohio, graduating with a B.S. in 1951. He has been with GM for 21 years at the Cadillac Motor Division (Tank Plant), Terex Division, and GM Engineering Staff. Presently he is a staff materials engineer. He was chief metallurgist at Terex and held various laboratory positions prior to that time. He is a member of the American National Standards Institute, American National Metric Council, International Organization for Standardization committees on metric conversion, American Society for Metals, and American Society for Testing and Materials.