NOMINEES FOR OFFICERS AND DIRECTORS APPROVED

At its meeting on October 9, 1977, the Board of Directors approved the report of the Nominating Committee naming the following candidates for election as officers for the 1978-1980 term and directors for the 1978-1981 term.

According to the By-Laws, the President-Elect, Mr. Franc Grum, OSA, SPSE, succeeds to the office of president and is not, therefore, elected at this time. The candidates for officers are:

Dr. William D. Schaeffer, GATF, for President-Elect,

Dr. Fred W. Billmeyer, Jr., ACHS, AIC, IMG, SPE, for Secretary,

Mr. S. Leonard Davidson, ACHS, FSCT, IMG, for Treasurer.

Candidates for directors are:

Ms. Bonnie Bender, IMG, NPCA,

Dr. Stephen F. Bergen, ACP, IMG,

Mr. Edward L. Cairus, IMG, NAPIM.

This is the official notice of the report of the Nominating Committee, which is required by the By-Laws to be sent to the voting delegates at least 30 days before the election in January. Biographical information on the new officers and directors will appear in a later issue of the Newsletter.

Inter-Society Color Council Newsletter

NUMBER 250

SEPTEMBER-OCTOBER

1977

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NUMBER 250, September-October 1977

COVER DESIGN – DONALD M. GENARO AND VALERIE PETTIS OF HENRY DREYFUSS ASSOCIATES, NEW YORK CITY
COVER PRINTED BY PROGRESSIVE COLOR CORPORATION, ROCKVILLE, MARYLAND
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CONSULTANT – MIMEOFORM SERVICE, INC., WASHINGTON, D.C.

ERRATUM

The previous issue of the *Newsletter* (No. 249, July-August 1977) printed a rather longish item titled "Recommended Practices Governing the Godlove Award Committee." Unfortunately, this is not the final version of the document. The Board of Directors has not yet approved a set of recommended practices, and the chances are that the final version will be somewhat different from the draft that you had the misfortune to see in print.

Ed.

BOARD OF DIRECTORS MEETING, OCTOBER 9, 1977

APPLICATIONS APPROVED FOR INDIVIDUAL MEMBERSHIP

Miss Paula Jean Alessi 25 Kimberly Road Pittsford, New York 14534	AATCC, ACHS. Color as related to chemistry; color measurement. Graduate student (M.Sc.) at Rensselaer Polytechnic Institute
Mr. William A. Balloon 1551 Thread Valley Holly, Michigan 48442	Styling and color tolerances (E.I. du Pont de Nemours & Co., Fabrics & Finishes Department)
Mr. Gary G. Carr 34 Gates Lane Worcester, Massachusetts 01603	Color matching, visual and instrumental in plastics (Hammond Plastics Co.)
Mr. Andrew N. Chalmers Department of Electrical Engineering University of Natal King George V Avenue Durban 4001, Rep. of South Africa	IES, OSA. Colour reproduction systems, colour in lighting, colorimetric instrumentation, education. (Member The Colour Group Great Britain), the IES (London, etc.)
Mr. Matthew J. Cyronak General Foods Technical Center 555 S. Broadway Tarrytown, New York 10562	ACHS, IFT. Developing natural colorants and colorant systems for food products
Dr. Julio Jorge D'Albuquerque Lossio Rua Tres Rios 363-Materiais Dentarios 01123 Sao Paulo SP, Brazil	Behavior of dental materials; clinical aspects.
Dr. Austin B. DeFreece, Jr. V. A. Hospital 4435 Beacon Avenue South Seattle, Washington 98108	Color as used in the fabrication of maxillofacial prostheses. (Member American Dental Association and several related societies)
Ms. Joan De Katch DeKatch Enterprises Inc. 25 West 36th Street New York, New York 10018	Seeing color, applying color into visual expression in art forms, which in turn permit the viewer of art to enjoy both visual and emotional experiences. (Member Artists Guild of New York, Canadian Society for Color)
Mr. Robert Feledy A B Alfort & Cronholm Box 45006 10430 Stockholm Sweden	All applications of color science related to paint. Responsible for color control and computer color matching since 1973. (Member, Svenska Färggruppen.)
Mr. Edward J. Flax F. Weber Co. Wayne and Windrim Avenue Philadelphia, Pennsylvania 19144	Manufacturer of fine art colors —paints and inks. (Member National Art Materials Trade Association, Hobby Industry Association)
Mr. Milo D. Folley 106 Sun Harbor Drive Liverpool, New York 13088	Retired from major architectural engineering firm; delegate from AIA for many years.
Mr. Richard M. Gallas 491 Columbia Avenue Holland, Michigan 49423	Paint formulation and color matching (Chemetron Pigments)
Mr. Arthur Lee Graham 460 West 34th Street New York, New York 10001	Application of color as paint by artists and the manufacture of artists colors. (M. Grumbacher, Inc.)
Mr. Murray Greenberg 411 Mountain View Road Englewood, New Jersey 07631	Formulation of paints and related products. New applications of pigments in both art and coatings fields. (M. Grumbacher, Inc.)
Mr. Robert W. Harper, Jr. Monsanto Co., Textiles Div. P.O. Box 2204 Decatur, Alabama 35601	All aspects of textile coloring
Mr. Martin Hershenson 145-04 34th Avenue Flushing, New York 11354	SPSE. Process control in color photography (densitometry and sensitometry); color viewing standards, fluorescence of various materials relating to color photography; problems attendant to anomalous reflection in color photography; metamerism.

Mr. Richard D. Ingalls
E. 1104 57th Street
Spokane, Washington 99203
Controlling and perfecting color printing, and the preparation of materials for color printing, (with Mrs. Marjorie Ingalls, IMG, owners and publishers of Tourmaps.)

Mr. James G. King
E.I. du Pont de Nemours & Co.
Troy R&D Laboratory
945 Stephenson Highway
Troy, Michigan 48084
Color of paints: pigments, new esthetic effects, etc. Color perception: tolerances, etc. Color measurement and instrumentation. Color photography: limitations of the medium.

Ms. Aurora S. Kostyla
Dept. of Food Science & Nutrition
University of Massachusetts
Amherst, Massachusetts 01003
IFT. Psychophysical aspects of color and taste attributes; impact of color in industry

Mr. Kwok Ching Lau
Color Science Lab., Bldg. No. 7
Lehigh University
Bethlehem, Pennsylvania 18015
AATCC. Light scattering in turbid media; radiative transfer theory. (Member, Society of Dyers and Colourists.)

Mr. Bruce Macphail
Hunt Manufacturing Co.
1405 Locust Street
Philadelphia, Pennsylvania 19102
Manufacture and marketing of artists' colors. Also a practicing artist in his own right, painting in oils, acrylics, and water colors.

Mr. E. T. Manning
972 E. Broadway
Stratford, Connecticut 06497
Development of instrumentation for producing specific colors; a rational system for presenting juxtaposed color masses that are aesthetically pleasing; systems for converting black and white programs to color.

Mr. Kent H. McKnight
4108 Stoconga Drive
Beltsville, Maryland 20705
Color as data in classification of fungi. (Member of American Institute of Biological Sciences; Mycological Society of America)

Mr. Richard C. Mendriski
9205 W. Sally Lane
Schiller Park, Illinois 60176
FSCT. Plant shading of latex paints (De Soto, Inc.), laboratory formulating problems such as colorant compatibility in various paint systems, color theory, formulation of shading pastes.

Mr. Joe A. Morford
E.I. du Pont de Nemours & Co.
P.O. Box 1217
Parkersburg, West Virginia 26101
Commercial color difference standards, metamerism scales, etc. (Plastics Products & Resins Division of du Pont.)

Mr. Dale H. Mosier
14542 Peppertree Circle
Tustin, California 92680
SPE. Color measurement, both on-line and off-line, in a wide variety of industrial applications.

Miss Diane Nadler
12 Remsen Street
Brooklyn Heights, New York 11201
APA. Color from the standpoint of the artist; human response to color; consumer color choice; color reproduction in the graphic arts.

Mr. Don O. Ocampo
Stauffer Chemical Co.
216 Du Pont Avenue
Newburgh, New York 12550
Color development and quality assurance in plastics and inks.

Mr. Jeffrey E. Parker
Tupperware Company
Box 751
Woonsocket, Rhode Island 02895
AATCC, ACHS, ASTM, SPE. Color control in manufacturing, color tolerances, instrumentation. (Also member of the Society of the Plastics Industry.)

Mrs. Zora Sweet Pinney
11706 San Vicente Blvd.
Los Angeles, California 90049
The Zora Gallery, retail artists' materials establishment; Mr. and Mrs. Pinney are active conservators of paintings and papers. (Member of National Art Materials Trade Association; American Institute of Conservation.)

Mr. Ken G. Probst
3300 Narvaez Avenue, #7
San Jose, California 95136
FSCT. Education in color matching in surface colors. (Member American Vocational Association.)

Mr. Daniel T. Roberts, Jr.
Chemetron Corporation
Coatings & Plastics Technical Service
491 Columbia Avenue
Holland, Michigan 49423
ACHS. Technical service, pigment manufacture, paint formulation, pigment research, instrumental color measurement.

Mr. Albert L. Spizzo
Hunt Manufacturing Co.
Speedball Road
Statesville, North Carolina 28677
FSCT. Technical considerations (related to paint, textiles, and photography): toxicity, hazards, truth in labeling

Mrs. Judy Steeves
Radiant Color Planning
#209 - 1600 West 6th Avenue
Vancouver, B.C. V6J 1R3 Canada
Color with light emitting properties; color in fashion; GOLD TERTIARIES; KINETIC COLOR.

Mrs. Evelyn Stephens
Fashion Institute of Technology
227 West 27th Street
New York, New York 10001
General interest in the practical application of color as applied to various areas of the fashion world. (Member American Physical Society, AAAS, American Association of Physics Teachers, others.)

Miss Helen D. Vincent
45 Tudor City Place
ASID. Home furnishings color forecasting. Accuracy of fore-

New York, New York 10017 — casting, painting, forecasting systems (cyclic) for corporations. (Former ISCC member being reinstated; also a member of Fashion Group, National Home Fashion League, Society for the Investigation of Recurring Events.)

Mr. N. William Wagar
235 Johnston Road
Pittsburgh, Pennsylvania 15241
— ACERS, ACHS, SPE. Development and application of pigments for ceramics, coatings, and plastics. (Imperial Colors, div. Hercules, Inc. Delegate from ACERS for many years.)

Mr. Robert Waltke
39-32 215th Place
Bayside, New York 11361
— ACERS, ASTM. Color standards for the dental industry.

Mr. John Wolff
M. Grumbacher, Inc.
460 West 34th Street
New York, New York 10001
— All phases of the manufacturing of art materials

Dr. James P. Woolf
Belle Haven Professional Bldg.
1451 Belle Haven Road
Alexandria, Virginia 22307
— Human tooth color and porcelain dental prostheses. (Member American Dental Association)

FOR INFORMATION ONLY:
NEW DELEGATE

Mr. Gerald I. Nass, NAPIM/C
United States Printing Ink Corp.
343 Murray Hill Parkway
East Rutherford, New Jersey 07072
— GATF, NAPIM. Research in printing inks and printing. (Member of New York Printing Ink Production Club.)

OBITUARIES

Isadore Nimeroff

Isadore Nimeroff, an active, long-time member of the ISCC, died suddenly on May 7, 1977. He was 60 years of age. He is recognized for his work in optics and in color, especially in metamerism and colorimetry.

Nimeroff received a degree B.S. in Physics from George Washington University and a post-graduate diploma from the Imperial College of London following a year of sabbatical study.

His professional career was with the National Bureau of Standards (NBS). He joined NBS in 1941, served in the Army during World War II, and returned to NBS, where he remained until his retirement in 1976. During his career he conducted research on such subjects as color vision, colorimetry, and gloss measurements. He became Chief of the Colorimetry Section, which was later renamed Office of Colorimetry. He served on numerous technical committees and working groups of the ISCC, the CIE, and the ASTM. He was the author of many technical papers and reports, including NBS Monograph 104, *Colorimetry*, and was editor of NBS Special Publication 300-9, *Colorimetry*.

Nimeroff was an officer of the NBS Credit Union for 28 years and president for 17 years. He was also national director of the National Credit Union Association for 7 years.

Nimeroff is survived by his wife, Ann, a daughter, Phyllis, a son Travis, and a sister, Jeanette M'ilakofsky.

Charles A. Douglas

Lester C. Lewis – as I Knew Him.

One of Lester Lewis' continuing interests was in the scientific study of color and color specification. Through a mutual interest in this field, I have known him for many years.

While I believe that I first met Lester in 1936 at an M.I.T. Color Conference where he gave a paper on "Recent Progress on Color Problems in the Paper Industry," our acquaintance did not really begin until about 1939 when he came to Washington to work at the Textile Foundation of the National Bureau of Standards. The earliest reference I have to a paper by him on the subject of color is to one he gave in 1933, while still at the Meade Corporation, to a meeting of TAPPI (Technical Association of the Pulp and Paper Industry): "The Place of Pulp Color Measurement in Paper Making – Present and Future."

It was at N.B.S. that he and Deane B. Judd of the Colorimetry Section became friends and colleagues. Both were members, as I was, of the Inter-Society Color Council, in which for several years Lester was a voting delegate representing TAPPI. Among several of its activities, the ISCC sponsored color symposia on the technical programs of many of its member societies. I remember that in 1940 at the technical session of its annual meeting, TAPPI and the ISCC jointly sponsored a symposium on "Spectrophotometry in the Pulp and Paper Industry."

To present this technical subject to a group of paper makers, Lester Lewis and Deane Judd devised a unique format in which, as Mr. Papermaker and Mr. Meter, they carried on a dialogue, first to introduce the problem, then to introduce and discuss seven separate special topics related to the problem. I well remember the uniqueness of the presentation, and how well it was received. Mr. Papermaker consulted Mr. Meter, a physicist, "to make a study of color control to see whether suitable instruments were being used in the mill." Mr. Papermaker was a skeptic; he wanted "facts," not "theories." To supply the facts Mr. Meter first discussed the subject in general, then on specifics he consulted and introduced seven experts, each to present and discuss the "facts" in his own particular field.

The development of a new approach to the study and presentation of this particular problem is, I believe, typical of Lester's open-minded search for answers to many other problems. He was interested in collecting all the information that came his way on any subject that interested him. In color this interest lasted long after he left the professional field of color; it lasted throughout his lifetime. And

many of us, active in color in the 1930s and early 1940s, remember him for it.

Dorothy Nickerson

Note: Lester Lewis was still an individual member of ISCC at the time of his death.

NEWS OF MEMBER-BODIES

GRAPHIC ARTS TECHNICAL FOUNDATION (GATF)

Dr. Schaeffer Completes Term of Office

Dr. William D. Schaeffer, Research Department director at the Foundation, recently completed his six-year elected term as vice-chairman of the International Association of Research Institutes for the Graphic Arts Industry (IARIGAI).

Elected to succeed Dr. Schaeffer as vice-chairman was Harvey F. George, executive vice-president and research director of the Gravure Research Institute.

The election occurred at IARIGAI's 14th International Research Conference held in Spain.

Merger Discussions Discontinued

PITTSBURGH, Pa., October 21, 1977 – Merger discussions have been discontinued between officials of the Rochester Institute of Technology (RIT), Rochester, N.Y. and the Graphic Arts Technical Foundation (GATF), Pittsburgh, Pa.

Announcement of the termination of discussions was made today (October 21, 1977) by Dr. Paul A. Miller, RIT president, and William J. Mariner, GATF president.

A committee, directed by Frederick T. Marston, president of Kaumagraph Co., Wilmington, Del., had been working with RIT staff to develop principles under which the merger of the two organizations might be accomplished. The committee presented its report to the GATF Board of Directors at a September 29 meeting. The committee had agreed in advance that, before such principles could be approved, there be virtually unanimous agreement by the GATF Board of Directors.

According to the announcement, "It now appears that such unanimity is not possible to achieve at this time, and thusly, the discussions will be terminated for the present."

However, RIT and GATF officials have agreed to a continuing program of cooperation and collaboration designed to serve best the interests of the graphic communications industries. The announcement indicated that an area to be immediately investigated is quality control devices developed for the lithographic process by both RIT and GATF. A committee of staff personnel from GATF and RIT will be formed for that purpose.

DRY COLOR MANUFACTURERS' ASSOCIATION (DCMA)

Ceramic Colors and Metal Oxides Subcommittee Receives Board Funding

Up to $1,000 was authorized by the DCMA Board at its meeting October 5 for incidental expenses incurred by the ceramic Colors and Metal Oxides Subcommittee in establishing their organization and studies.

DCMA committees announced. President H. A. McKenzie has appointed committee chairmen and members for this year. Notices are now being sent to all 1977-78 committee appointees. This year's DCMA committee chairmen are: Ad Hoc Committee on Organizational Structure – M. Pisetzner (Sun), Finance – A. Weissglass (Magruder), Grants & Awards – P. Tudder (Glidden), International Commercial Relations – L. Andrews (du Pont), Inter-Society Color Council – A. M. Keay (Harmon), Membership/Credentials – S. Gorman (du Pont), Nominating – J. Counihan (Chemetron), Planning – P. Papillo (Ciba-Geigy), Program – R. Wickline (Chemetron), and Publicity – T. Kerr (American Cyanamid).

Ecology Committee Chairmen are: Organic Section – M. Dunn (Kohnstamm), Chairman, and P. Semadeni (Ciba-Geigy), Vice-Chairman. P. Hay (Sandoz) is Chairman of the Organic Pigments Subcommittee and P. Semadeni is Vice-Chairman. The Diarylide Yellow Subcommittee is chaired by H. Smith (Sun). The Inorganic Section is chaired by J. Dickenson (Harshaw) with G. Bruxelles (Hercules) serving as Vice-Chairman. Dickenson is also Chairman of the Cadmium Pigments Subcommittee, and Bruxelles is Chairman of the Lead Chromate Subcommittee. The new Metal Oxides and Ceramic Colors Subcommittee has K. Heiser (Glidden) as Chairman. D. McGarrity (American Cyanamid) is Chairman of the Iron Blue Subcommittee. M. Leduc (American Hoechst) is Chairman and D. Kaufman (Kohnstamm) is Vice Chairman of the Air & Water Polution & Solid Waste Section. G. Koehler (American Cyanimid) chairs the newly-formed Toxic Substances Section.

Color Seminar for Fabricators

A new activity of the CAD Division is sponsorship of a "nuts and bolts" color seminar for molders, extruders, and other fabricators who find the science (or "art") of coloring plastics a little on the fringe of their everyday working activity until something goes wrong. This session is designed to acquaint them with the basics of this technology.

A one day seminar was held on September 21 in Elgin, Illinois, at the Ramada Inn (Highways 90 and 31). Vic Mimeault of Ferro Corporation and Bob Swain of Chroma Corporation conducted the session, entitled "Color Management and Control for Plastic Fabricators." Topics covered were the color match; quality of a target; dry color, pellet concentrate and liquid forms of color; blending, mixing and those factors that occasionally cause fabricated part color variation.

Registration was $35.00 for SPE members and $45.00 for non-members.

We hope to sponsor the course in other areas of the country as well.

R. D. Swain

ANTEC "Coloring of Plastics" Seminar

We had 25 attendees at our second annual "Fundamentals of Coloring Plastics" seminar held in Montreal on April 26. This compared with 15 that attended last year's session in Atlantic City.

Ralph Stanziola of Applied Color Systems reviewed the basics of colorimetry and its application in measuring and dealing with problems of color control in Plastics. Tom Reeve of Du Pont then reviewed performance of various colorants and elements of dispersing them in plastics. Bob Swain of Chroma Corp. finished the day-long session with a discussion of the various predispersed colorant forms, and illustrations of problems that can arise from improper use of colorants.

This seminar will be presented again at Antec '78 in Washington, D.C. Consideration is being given to extending it to a two-day period to provide time for adequate discussion of the material. If this were the case, we would propose to concentrate on fundamentals and theory the first day, and practical applications the second day. We would appreciate getting comments, pro or con, on this rearrangement. Please address them to me.

Thomas B. Reeve
DuPont Co., Pigments Dept.
Chestnut Run Laboratory
Wilmington, DE 19898

RETEC '78 Plans Developing Rapidly

RETEC '78 is now fairly firmly set for early October, 1978, at the Sawmill Creek Inn in Huron, Ohio. It will be co-sponsored by CAD and the Firelands Section.

The program will be centered around colored automotive plastics. Program co-chairmen Bill Longley of Ford Motor and Barry Meyers of Custom Chemicals have already obtained firm paper commitments in the areas of:

Pigment suitability for automotive parts.

Color matching to replace chromates.

Shade sorting quality control.

Color variables in injection molding.

Color communication.

Color measurement comparisons between instruments.

Automotive color styling (panel discussion).

If you have any interest in participating, you can contact Bill at 313-323-3826 or Barry at 201-791-5100. They expressed particular interest in papers dealing with vehicle color identification, matching to automotive tolerances, solid and liquid color concentrate usage in the industry and color compounding of automotive vinyls.

Other Meeting Announcements

Additional color and safety related meetings that may interest our membership include:

Detroit Colour Council next meeting will be held at the Stephenson Club in Detroit on September 13. Emil Weddige, a noted artist, will speak on "How an Artist Uses Color." Contact Jim Grady, Du Pont, at 313-855-2353 if you wish to attend.

"Decorating of Plastics 1980" RETEC will be held at the Regency Hyatt O'Hare Hotel in Chicago on October 25 & 26, 1977. Co-sponsored by SPE's Decorating Division and the Tri-State Section, 13 papers and a panel discussion will cover such areas as chrome plating overlays, why decorate plastics, profits in automatic decorating, tool and machine design vs. foil costs, exterior automotive components, cosmetic packaging, plating on new plastics, process controls, color matching, hot stamping, and market projections. Registration chairman is Charles Conard, Windsor Plastics, 601 N. Congress, Evansville, Ind. 47715.

"Safety and Health with Plastics" NATEC will be held at the Regency Inn in Denver, Colorado, on November 8-10, 1977. Papers will deal with safety both within the industry and with consumers, product liability and general energy, environmental and ecological matters. More detailed information is forthcoming from SPE National.

ANTEC 1977 Montreal

The entire AM session on liquid colorants for plastics featuring a comprehensive panel of experts was extremely well attended. The estimated 200-250 in the audience was provided with an informative, interesting and often controversial panel. The panelists were chosen to represent different disciplines within the industry. Unavoidable last minute changes in the personnel on the panel apparently had no detrimental effect on the overall enthusiasm of the panel or audience.

Mr. Bill Laycock of Color Technology moderated and skillfully kept a lively question and answer period moving along nearly into the lunch hour.

Mr. William F. Heckrodt of Presto Products, Inc. came forward from our audience to fill a vacant spot on our panel and to represent "The Liquid Color Customer." Our grateful thanks to Mr. Heckrodt. The other panel members were: Vic Meneault (Ferro Corp.), Tony Adamo (Inmont Corp.), and John Freemott (Bee Chemical).

The panel was preceded by Inmont's Mr. Bill Arnheim with an introductory paper, "Liquid-Colorants, Application and Principle."

Our afternoon session was just slightly less well attended. Al Keay of Harmon Color moderated a more general session which comprised four excellent papers:

1. "Pigments in Hot Stamping Foils." Mr. Howard Conklin, Admiral Coated Products.

2. "The Use of Chromaticity Diagrams for Selecting Replacement Colorants." Mr. Dennis Osmer, Ciba-Geigy Corp.

3. "Using a Computer Color Matching System to Replace Lead Chromate Pigments in a Filled Vinyl Compound." Mr. Jeffrey E. Bowman, Armstrong Cork Co.

4. "Process Coloring of Thermosetting Resins." Mr. J. T. De Groff, Tenneco Chemicals.

Dennis Osmer and Jeff Bowman presented complementary papers. Mr. Osmer outlined a theoretical approach of selecting replacement colorants through the use of chromaticity diagrams. Mr. Bowman followed with details of the actual use of this system to replace lead chromate pigments in a filled vinyl compound.

T. V. Haney

The preceding items on the CAD of the SPE were reprinted from the *SPE Color and Appearance Division Newsletter*, 8,3, Fall 1977.

BOOK REVIEWS

Radiometric and Photometric Characteristics of Materials and Their Measurement. Publication CIE No. 38 (TC-2.3) 1977, Bureau Central de la CIE, 52, Boulevard Malesherbes 75008, Paris, France. 214 pages, $20.

This book is a committee report consisting of tutorial material as well as a collection of authoritative definitions and descriptive text. The report sets forth its scope and then discusses parameters affecting characteristics. It covers individual characteristics of refraction, diffusion, reflection, transmission, absorption and emission, as well as their interrelations. Characteristics of specific materials such as paper, plastic, and paint are also included. There are 123 literature references together with separate indexes of symbols and subject material.

The reader is reminded that the Greek letter ρ is usually used as the symbol for reflectance and, when necessary, luminous reflectance can be indicated by ρ_v and radiant reflectance by ρ_e.

Included are at least 43 definitions that are also found in the International Lighting Vocabulary (CIE Publication No. 17, 1970). However, the report indicates that the wording of 27 of these definitions is different from that in the vocabulary. This seems to indicate that the definitions in the vocabulary could be improved.

However, even in this publication (No. 38) the definition of gloss reads: "Property of a surface which, due to regular reflection or a pointed indicatrix of reflection, is responsible for the degree to which reflected highlights or the images of objects may be seen as behind the surface (this definition is under review)." The tentative status of this definition shows how hard it is to reach agreement on the definition of a material characteristic with which we are all familiar.

Table 1 lists 9 kinds of reflectance, states the measured quantity, gives the symbol to be used, and then lists the evaluation of the quantity on the scale of the perfect mirror as well as the perfect diffuser. Table 2 classifies reflecting and transmitting materials into groups according to their light-scattering properties, then into subgroups according to their surface structure, and finally cites a material example for each subgroup.

This definitive work has been in preparation for a number of years by the CIE International Technical Committee on "Materials." The Committee consisted of delegates from 26 countries as well as 18 other individuals who served as consultants. As is always the case in an undertaking of this magnitude, unanimous agreement on each item was seldom achieved, but the report contains the opinion of the majority of the committee members who represent most of the member countries of the CIE; so the document should not be treated lightly. On the other hand it is a committee report, and as such is not a CIE recommendation that has been officially approved by the National Committees.

The book is in 3 languages, English, French, and German; so only 1/3 of the 12-mm (1/2-inch) thick paper-back volume is in English. However, this 3-language format provides an opportunity for those whose native language is English to improve their reading fluency in French and German. CIE publications, like many others, are no longer inexpensive, despite efforts to hold down the costs. Nevertheless, acquisition of this publication is recommended for anyone working with radiometric or photometric characteristics of materials.

Copies can be obtained directly from CIE Central Bureau at the address indicated above. They are also available from Dr. Jack J. Tech, Secretary USNC-CIE, Room 308 Metrology Building, National Bureau of Standards, Washington, D.C. 20234. The price is $20 postpaid. Cash with order is desired but not required. Canadians may obtain copies by sending a check payable to "The Receiver General of Canada, Credit National Research Council" with their order to "Publications Distribution Office, National Research Council of Canada, Ottawa, Ontario K1A OR6."

Harry K. Hammond III
ASTM

Color — Universal Color Language and Dictionary of Color Names. U.S. Dept. of Commerce, National Bureau of Standards, NBS Special Publication 440, Washington, D.C. 1976. For sale by the Superintendent of Documents, U.S. Gov. Printing Office, Washington, D.C. 20402 as SD Catalog No. C13. 10-440, $3.25.

This paperback contains all the material of the original *The ISCC-NBS Method of Designating Colors and a Dictionary of Color Names* by Kenneth L. Kelly and the late Deane B. Judd, issued in 1956. It lists the equivalents of 7500 color names, which are defined in 31 Munsell name charts.

The present edition contains 19 added pages, in color, describing Kelly's Universal Color Language, originally discussed in Color Engineering, Vol. 3, p. 6 (1965). Also illustrated in color are the Munsell Color Solid, and pages from the color arrangements of the Standard Color Card of America, the Horticultural Color Chart, Maerz and Paul, The Color Harmony Manual, Plochere, and Ridgeway. Several pages of the ISCC-NBS Centroid Colors are also shown.

Standard Sample 2106 contains the Centroid Colors, illustrating the 267 major shades defined by ISCC-NBS. This, and the above publication, may be obtained in combination for $17.00.

Considering the years of highly talented effort which went into these publications, they are extremely valuable tools available at bargain prices. (Ever match colors over the telephone? Here's how.) Ken Kelly and his NBS colleagues are to be warmly congratulated.

T. G. Webber

Reprinted from the SPE Color and Appearance Division Newsletter, 8, 3, Fall 1977.

MEETINGS PAST BUT NOTED

Human Factors Society Architecture and Interior Design: A Human Factors Program, October 17, 1977

Human factors proponents are working hard to establish the significance of the human factors perspective for the professional practice of architecture, interior design, and planning. Our efforts have led many designers of the built environment to focus their attention on human behavior and human expectations and requirements and to adopt and adapt human factors methods to use them in their professional practice. For those of you not directly involved in this area of activity, you will be surprised at the number of human factors applications taking place within the State of California and across the nation. All of this activity was reviewed at the annual meeting tutorial workshop, entitled ARCHITECTURE AND INTERIOR DESIGN: A HUMAN FACTORS PROGRAM.

The workshop stressed how to go about collaborating with architects, interior designers, and planners, showing them how their offices can develop behavioral and human factors analytic capabilities, use this ability to strengthen specific components of design and planning programs and demonstrate to clients the value of this service.

The workshop helped in two ways to meet the challenge of user-oriented design and planning. In the first part of the workshop, a human factors information system was presented, a combination of information development and preliminary design and planning tasks that help give identity to user expectations and requirements and all their physical setting and planned environment correlates. In the second part the methods of investigation and analysis were introduced that will help make your human factors program a successful one. The third part of the workshop was an open discussion session.

John Harrigan
California Polytechnic University
San Luis Obispo, California 93467

Society for Information Display One-Day Technical Conference, October 28, 1977

Program:

Architecture of a Generalized, Multi-Function Plasma Display Terminal: Lester Turner, Interstate Electronics Corp.

A Comparison of Inter-Symbol Contrast Ratios for Segmented Digital Readouts: Jane M. Kline, ASD/ENECC Wright-Patterson

Video Document Reading: William T. Dyall, Sierra Scientific Corp.

Response Time & Operator Perception: B. B. Tiernan & R. E. Barber, AT&T Long Lines

Electrostatic Writing Systems for Info Displays: Alan J. Dawes, Versatec

Use of a High-Resolution Touch Surface in an Interactive Graphics System: Maureen Stone, Paul Van Arsdall, & Roger Johnson, University of Illinois

The Benefits of Color in an Airborne Integrated Tactical Display System: D. J. Oda, Ph.D., Lockheed-Calif. Corporation

A Unique Tactile Display for Attach/Fighter Aircraft: T. G. Drennen, McDonnell Douglas Astronautics Co.

Flat Panel Displays in Perspective: Larry E. Tannas, Jr., Rockwell International Marine Division

Mega Memories for Displays: Rose Mary Thompson, Aerospace Corp.

High Resolution Display of Weather Graphics: Joseph B. Fischer, Ford Aerospace & Communications

Color Display for Data Analysis and Processing Control: Robert O. Davis, Ford Aerospace & Comm.

Evaluation of Pseudocolor Transformation of LANDSAT and Skylab Images and Symbols on Test Charts: Donald L. Lamar and P. M. Merifield, CalESCO and Carl Gazley, Jr., J. V. Lamar & R. H. Stratton, The Rand Corporation

A Computer Graphics, Human Figure System Applicable to Kinesiology: William Fetter, Southern Illinois University.

LIBRARY OF CONGRESS

Papermaking: Art and Craft. 1968. Reprinted 1977. 96 p. $5. This richly illustrated book tells the history of papermaking and production from its earliest form in the Orient to the present.

Pictorial Resources in the Washington, D.C. Area. 1976. 297 p. $5.75. This helpful guide lists government, interna-

tional, and private organizations with pictorial collections in or around Washington. It outlines regulations regarding access, availability of reproductions, and hours of services. Liberally illustrated.

LETTERS TO THE EDITOR

Dear Sir

As you may know Mr. Kenneth S. Brooks, Joint Managing Director of Mack-Brooks Exhibitions Ltd, has appointed me Organiser of INTERCOLOR in Basle and I would like to take this opportunity of informing you of the new dates of this exhibition which will take place 20 - 24 March 1979.

I am enclosing a copy letter I have written to Mr. F. W. Billmeyer which I trust you will find of interest.

Yours sincerely,

Leslie Newman
Exhibition Organiser
Intercolor 79
Mack-Brooks Exhibitions Ltd.
62-64 Victoria Street
St. Albans, Herts, AL1 3XT
England

Dear Dr. Billmeyer

As you may know Mr. Kenneth S. Brooks, Joint Managing Director of Mack-Brooks Exhibitions Ltd., has appointed me Organiser of INTERCOLOR in Basle. From the files I see that you have been in correspondence and are aware of the new dates of INTERCOLOR 79.

At present I am negotiating with various Trade Associations particularly in Switzerland in connection with INTERCOLOR 79 sponsorship, support and co-operation. My reason for writing to you at this particular time is that I propose visiting the States around November 13 - 15, 1977 to coincide with the Washington meeting of the Color Marketing Group; I feel this would be a good opportunity to meet and discuss the ways in which we might co-operate in our mutual interest.

Perhaps you will kindly indicate if you will be available for a meeting round about this time; if you happen to have a committee meeting at which appropriate decisions may be taken near these dates, I would be happy to adjust the dates of my visit in order to have a prior meeting with you.

I look forward to meeting you in due course.

Yours sincerely,

Leslie Newman
Exhibition Organiser

PRODUCTS AND SERVICES

The Vincent Report

The Vincent report is a quarterly home furnishings market analysis, product development guide and forecast based upon a continuing study of cycles and futurism without any bias due to advertisers, public relations campaigns, or pressures from trade or professional organizations. Some of the material that will be covered on a continuing basis: How to use the author's original *color* and design matrix in developing a line for general textiles, floorcovering, domestics, furniture, decorative accessories and other home furnishings items, taking into account product life cycles. Examination of design and *color* origins and their development. Why there are limits to 'good taste.' When to trade UP and when to trade DOWN. Product development idea sketches covering innovative, 'second generation,' and traditional concepts, coordinated when feasible. Forecasts correlated with various economic scenarios. Suggested methods for sorting out the profusion of claims, and conflicting forecasts from various trade and professional home furnishings organizations. Commentary on major surveys, Commerce Department research. Comparison of European to American markets, how their respective product life cycles are interacting.

Aside from the printed content, a select group of *color* chips keyed to the Design and *Color* Matrix. A minimum of two Concept sketch pages. Also requests for information from suscribers will be handled on an individual basis, as long as the reply can be reasonably handled within the format of the Report. To order The Vincent Report, write to: H. D. Vincent, #45 Tudor City Place, New York, N.Y. 10017.

Food and Beverage Packaging Industry to Reach $22 Billion in 1985 as Plastic Containers Pace Growth

Forces of change generated by environmental and energy pressures, nutritional labeling requirements, increasing use of UPC and scanning devices, the broad use of microwave ovens, the portion pack trend, the continued search for non-pollutable throw-aways, and the emerging metric system are creating major innovations in food and beverage packaging. This, in turn, is causing equal concern over future brand strategies, according to a new, 365-page Frost & Sullivan, Inc. report.

The New York-based research firm concludes, "future consumer packages will be used increasingly as a market segmentation tool, becoming the means to create effective brand identification, and gain superior product positioning by product type and pricing."

A $14-billion market in 1975, food and beverage packaging dollar volume leaders continue to be the metal, glass, can and sanitary food receptacle manufacturers. More widespread use of plastic and converted flexible or composite packaging, however, is becoming more and more apparent as the trend moves toward less bulky containerization. The focus is on eliminating product spoilage, with the growth of convenience foods an added stimulant. "The industry's growth is imminent," says F&S, "and total dollar volume is destined to generate $22.8-billion by 1985."

In determining which categories of packaging can be expected to demonstrate the greatest growth performance during 1972-1985, the study concludes that the plastic

package market should grow over 300%, converted flexible packages, 231.6%, glass containers, 85.6%, metal containers, 153.8%, and shippers, 197.6%.

Motivating factors for the growth of plastic packaging processes and materials and the rapid demise of the others, are: the lower cost of plastic containers, less energy requirements, its expanded use in convenience food packaging, the availability of new, raw/film material combinations, its lighter weight, versatility and eye appeal, cleanliness, and overall superiority vis-a-vis glass and cans.

The output of new foods and beverages nevertheless creates new potential for manufacturers of glass, metal, and paper packaging to the extent they also embrace virtually all food types ranging from produce to fresh meats.

The "synthetic spectrum" includes restorable plastic bags; laminated cellophane packages; wrap-around or bag-in-box packages; cylindrical-coated paper cannisters; household-type containers; Corning's "back-around" containers; Borden's plastic refrigerator containers; plus a legion of allied developments attesting to the plastics packaging revolution.

The concepts are no less than ingenious. Now, plastic pouches (cushioned) easily maintain highly fragile taco shells, with the advent of other reclosable inner-bags in two-foil wrapping within a sleeve. In some instances, packaging has been so devised to provide substantial shelf life for what were heretofore perishables, i.e., yogurt dressings, cookie mixes, luncheon meats, fruits, and nuts. The elimination of corrugated outer containers for milk, the development of drawn alumninum cans for dips, and similar packaging for canned meats with usable containering for fresh frozen meats are developments noted in the report.

Design is a prime packaging requisite today, for example: The Schilling Division has accomplished an exceptional job of enshrouding their sourdough bread with a halo of quality through imaginative packaging and four color photography. Their brands are displayed sliced, in serving baskets, on the package, against the background of the Golden Gate Bridge, symbolically the birthplace of sour dough bread; Mrs. Smith's Pie Company, Johnson Pie, the Carving Board frozen red meats, Ore-Ida Foods, Green Giant, Larry's Foods, the Heinz Company, Swanson's, Campbell, even Good Humor along with myriad other enterprizing companies are heavily into the packaging trend. The limelight is on competing equitably, on generating volume and brand popularity. The formula comprises innovating, practical packaging; strong eye appeal; product preservation in many instances; a whole new packaging ballgame.

For further information, contact Customer Service, Frost & Sullivan, Inc., 106 Fulton Street, New York, New York 10038, (212) 233-1080. Reference Report #476.

NOTE TO EDITORS:

Please contact Jeffrey Swartz, Director, Media Relations, (212) 233-1080, for editorial information.

NATIONAL BUREAU OF STANDARDS

A New Technique for Translucency Evaluation

The translucent phenomenon that causes flux loss in spectrophotometric measurements involving a finite-size sample port is well recognized. A technique utilizing an integrated point spread function and laser and conventional light sources has been developed by J. J. Hsia of the spectrophotometry group in the Radiometric Physics Section. The details of the method, mathematical derivation, experimental set ups, and results are described in NBS Technical Note 594-12, "The Translucent Blurring Effect – Method of Evaluation and Estimation," which is now available. Inquiries concerning this technique and its possible use in error evaluation and estimation should be directed to:

Dr. Jack J. Hsia
Room A317, Metrology Building
National Bureau of Standards
Washington, D.C. 20234
Phone: (301) 921-2791.

Copies of Tech Note 594-12 are now being distributed to CORM members. Copies may also be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Order by SD Cat. No. C13.46:594-12, Price 75¢. Contact the editor of this *newsletter* if difficulty is encountered.

New Diffuse Reflectance Instrument Completed

A new reference spectrophotometer designed primarily for the analysis of diffuse transmittance and reflectance has been developed by the spectrophotometry group of the Radiometric Physics Section. This instrument contains a broadband monochromator, presently operated over the wavelength range from 400 to 750 nm, with optional fixed bandpasses of 2, 5, 10, or 20 nm. A special set of mirror optics just beyond the exit aperture of the monochromator provides a collimated beam that can be switched to either of two paths for optional use as a sample or reference beam. These collimated beams are directed into a dark room where a variety of measurement accessory systems can be installed. Measurements for which provisions have already been made include 6° hemispherical reflectance of solids, liquids, and powders; relative directional-hemispherical reflectance as a function of angle of incidence; and bidirectional reflectance factor in the plane of incidence. The wavelength range of this instrument is now being extended to 200 nm.

The details of the design, performance tests, and error analyses are described in a forthcoming NBS Technical Note 594-11, "Development of an NBS Reference Spectrophotometer for Diffuse Transmittance and Reflectance," by W. H. Venable, Jr., J. J. Hsia, and V. R. Weidner. This Technical Note will be available in approximately two months.

This new reference spectrophotometer is currently being used in experiments to establish a more accurate scale of directional-hemispherical reflectance. In addition to basic measurement research, the instrument will be used on a

regular basis to provide accurately measured standards to commercial laboratories that sell secondary standards or provide measurement services to the public. Inquiries concerning this instrument and its possible use for special measurement problems in diffuse reflectance should be directed to:

Dr. William H. Venable, Jr.
Room A317, Metrology Building
National Bureau of Standards
Washington, D. C. 20234
Phone: (301) 921-2453

Reprinted from *Optical Radiation News*, National Bureau of Standards, Number 16, July 1976.

CIE Technical Committee on Detectors

The first meeting of the new CIE Technical Committee on Detectors (TC-2.2) was held on May 20 and 21, 1976 in Braunschweig, West Germany. This committee was set up "to study the properties of detectors and measuring systems for optical radiation and develop standard procedures for specifying and measuring these properties." Within this purview the committee has taken over several activities which were previously under the auspices of TC-1.2 (Photometry and Radiometry) and has initiated some new ones.

As part of the committee's program to investigate the properties of detectors and techniques for measuring them, an intercomparison is being conducted to compare spectral response measurements. In this regard, the spectral responses of silicon detectors are now being measured in the 380 to 780 nm region by several laboratories. This intercomparison was originally initiated as part of the working program of TC-1.2, as was the preparation of a Technical Report on "Specifying the Performance of Photometers." Drafts of this report are now in circulation and comments are being accepted. In addition, it was decided at the May meeting to create two new programs: one to formulate specifications for detectors used in color measuring instruments and another to study problems encountered in measuring laser radiation. New subcommittees were set up to undertake these tasks.

Anyone interested either in participating in the CIE detector committee or in obtaining further details should contact the U.S. Chairman:

Dr. Edward F. Zalewski
B308, Metrology Building
National Bureau of Standards
Washington, D. C. 20234
(301) 921-2191

Reprinted from *Optical Radiation News*, National Bureau of Standards, Number 17, September 1976.

Modifications of an NBS Reference Spectrophotometer

The description of a new reference spectrophotometer capable of making transmittance measurements accurate to 0.0001 transmittance units has already been reported [1.2]. Modifications to this instrument and some further measurements performed with it are described by K. L. Eckerle in NBS Technical Note 913, issued July 1976. The extension of the range of the instrument down to 200 nm, providing a capability for making measurements over the spectral range 200 to 800 nm, is outlined, and extensive testing of the light averaging effectiveness of several types of devices and spheres is reported.

References:

[1] Mielenz, K. D., Eckerle, K. L. Madden, R. P., Reader, J., "New Reference Spectrophotometer," Appl. Opt. *12*, 1630 (1973).

[2] Mielenz, K. D., Eckerle, K. L., "Design, Construction, and Testing of a New High Accuracy Spectrophotometer," Nat. Bur. Stand. (U.S.) Tech. Note 729, 60 pages (1972).

Requests for further information should be sent to:

Mr. Kenneth L. Eckerle
Room A317, Metrology Building
National Bureau of Standards
Washington, D. C. 20234
Phone: (301) 921-2791

Participation in Bicycle Testing Workshop

Two members of the Radiometric Physics Section, W. H. Venable and V. R. Weidner, demonstrated procedures for testing the retroreflectors on bicycles in a bicycle testing workshop sponsored by the Consumer Product Safety Commission (CPSC). The purpose of this workshop was to acquaint interested parties in the procedures which will be used in testing bicycles for conformance to the new CPSC standards for bicycles as published in the Jaunary 28, 1976, Federal Register. A more detailed description of this workshop is given in the July issue of the NBS monthly news magazine, "NBS Dimensions."

The notes on the two preceding topics are reprinted from *Optical Radiation News*, National Bureau of Standards, Number 16, July 1976.

FASCAL

The Facility for Automated Spectroradiometric Calibrations (FASCAL), the most recent and ambitious product of the Optical Radiation Section's automation efforts, has reached a stage of development whereby routine spectral irradiance calibrations have been automatically performed on this equipment since June.

Since there have been no previously published descriptions of this facility, its main technical features will be described here in some detail along with a description of current usage.

The FASCAL facility incorporates all of the usual elements required for precision temperature-based radiometry. They are configured in a linear arrangement, dominated by

a heavy truss bridge structure 7.3 m long supporting a pair of ground 1¼-inch diameter stainless steel rails. These rails were carefully aligned by a laser beam to within ±.03 mm tolerance in straightness and parallelism. Riding the rails on linear ball bushings is an instrument carriage in the form of a rectangular box 240 cm long, 68 cm wide and 50 cm in height. All optical elements, dispersers and detectors are mounted within the carriage and can be positioned along the track to intercept the radiation from various radiation sources placed at stationary points alongside the rail structure. There are twenty-five available source mounting stations spaced along the length of the structure.

The instrument carriage is driven through roller chains by a digital servo-positioning system and may be automatically positioned with a resolution of 0.1 mm and a repeatability of 0.01 mm. Positioning speed is sufficiently rapid that an average move between two stations takes only about two seconds. The actual carriage position is tracked by an incremental rotary encoder which has a digital visual display. The digital position information is also entered into a minicomputer. There is a unique central position, designated the "home" position, to which the carriage may be driven at any desired time to verify the functioning of the incremental encoder and to reference it to an absolute scale.

The instrument carriage is divided into two compartments. One is light-tight and houses detectors, and the other contains optics and associated electronics. The latter compartment is almost entirely enclosed to minimize dust collection and scattered light. The optical arrangement of the instrument carriage is shown schematically in Figure 1. The dispersing element is a prism-grating double monochromator, mounted so that the exit slit is within the light-tight detector compartment. Monochromatic radiation from the exit slit can be directed to either of two detectors on a detector platform that can be positioned remotely. Radiation in the visible and ultraviolet is detected by a thermoelectrically cooled photomultiplier having an extended S-20 response. while infrared radiation is detected by a thermoelectrically cooled PbS detector placed at the focus of an elliptical mirror. The wavelength of the monochromator may be remotely set by a high-speed stepping motor with a resolution of .025 nm through a range of 200 nm to 2500 nm. An absolute encoder having .025 nm resolution permits the actual wavelength setting to be visually displayed and entered into the computer. A He-Ne laser, also mounted on the detector platform, can be automatically positioned so that its beam passes through the monochromator and optics in the reverse direction to facilitate alignment of optics and sources.

The fore-optics are arranged to enable measurements to be made on either radiance or irradiance sources. Radiance sources are focused on the entrance slit by a 6-inch diameter spherical mirror with the optical path being turned approximately 90° by a flat diagonal mirror. The spherical mirror is rotated a few degrees for irradiance measurements. This allows the exit aperture of a small integrating sphere to be imaged on the entrance slit of the monochromator. Irradiance sources are placed 50 cm from the entrance aperture of the integrating sphere, and extensive light baffling of the irradiance sources and sphere minimizes the effects of scattered light. A motor-driven chopper is positioned in the optical path when the PbS detector is used.

The monochromator entrance slit is almost completely inaccessible to direct viewing due to the enclosures, baffling and closely packed optical elements and associated equipment. To provide a view of this slit, a closed-circuit television (CCTV) camera is mounted within the carriage and focused on the monochromator entrance slit through a small flat mirror mounted near the 6-inch spherical mirror. This has been invaluable in the initial alignment of radiance sources and in monitoring the positioning of the source image on the slit (or slit mask used to limit the slit height) during the course of experiments. The image of the entrance slit is magnified some twenty-five times such that the notch on tungsten strip lamps imaged onto the slit is readily observable on the monitor screens.

The instrument carriage also houses ancillary equipment such as power supplies for the thermoelectric coolers, a remotely programmable high-voltage power supply for the photomultiplier, and an automatic photoelectric pyrometer. The latter is focused on the radiance sources, including a variable-termperature, graphite-tube blackbody source that occupies the "home" position.

Cables from all equipment housed in the instrument carriage are bundled and passed through the bottom of the carriage, where they ride in a smooth trough between the rails as the carriage passes back and forth. All control and measurement cables from the carriage and source supplies lead to the operator's console.

Measuring instruments and equipment to communicate with the operator and the computer are housed in the console. The operator interface consists of analog and digital displays, a CCTV monitor displaying the monochromator entrance slit and a CRT terminal and keyboard. Instrumentation includes a 5½ digit DVM, a lock-in amplifier, a picoammeter, and remote controls for eight source power supplies. A MIDAS system[1,2] provides the interface between instruments and computer. All measurement signals are multiplexed into the DVM through the MIDAS scanner, and all instruments may be remotely programmed and controlled through MIDAS modules. In addition, the current supplied to the lamp sources can be automatically monitored and controlled.

The MIDAS controller communicates serially at a rate of 1200 baud with a minicomputer having 32 K of core memory. The computer is equipped with a high speed disk system for program and data file storage. It is operated in a time-shared mode so that it can service other experiments, in addition to FASCAL, simultaneously. Programming is done exclusively in BASIC interactive language.

FASCAL is currently being used for routine spectral irradiance calibrations. These calibrations are carried out on groups of twelve 1000 W tungsten-halogen lamps preselected for stability, spectral composition, and directional uniformity. Three lamps from the group and one of our in-house standards (calibrated as described in the soon-to-be-published NBS Tech Note 594-13) are mounted in four of the outer row of lamp stations shown in Figure 1. Lamp alignment is accomplished with "reverse optics" using the laser in the detector compartment and a special alignment jig that is interchangeable with the integrating sphere. This

jig includes a diagonal mirror that directs the laser beam to the lamp station for positioning the lamp in the plan perpendicular to the optical axis, and a 50 cm arm terminating in a dial guage for setting the lamp-to-detector distance. Using the integrating sphere input to the monochromator, these four lamps are then intercompared automatically by FASCAL at our twenty-six customary wavelengths. Then another three lamps and a different in-house standard are measured in the same way. This process is performed sixteen times, with permutations of lamps and stations, until each of the twelve lamps has been compared against each in-house standard and each of the sixteen lamps has been measured in each of the four lamp stations. The redundancy of these measurements permits us to sense any systematic errors. For example, any dependence upon lamp station, or discrepancy among our four in-house standards would be thoroughly investigated.

We are now in the process of adding routine spectral radiance calibrations to FASCAL's repertoire. This is a more complicated problem requiring the rest of the features of FASCAL and we hope to report on these calibrations in the near future.

[1]Optical Radiation News, No. 8 (March 1975).

[2]C. H. Popenoe and M. S. Campbell, MIDAS, Modular Interactive Data Acquisition System — Description and Specification, NBS Tech Note 790 (August 1973).

Reprinted from *Optical Radiation News*, National Bureau of Standards, Number 18, November 1976.

Progress in Diffuse Reflectance Measurements

In the July 1976 issue of ORN, a preliminary report appeared giving the results of a reevaluation of the NBS scale of 6°-hemispherical reflectance factor. The reevaluation, which was done using a more sophisticated experimental procedure than had been used before, indicated that the reflectance factor scale maintained by NBS since 1967 should be revised downward by 0.1% to 0.2%. Current measurements at NBS of 6°-hemispherical reflectance factor are being made using the new scale. The uncertainty associated with the new scale is ±0.15%, compared with ±0.5% for the previous scale. A full report of the experiments and error analysis for the new determination will appear in the next issue of the NBS Journal of Research.

The new scale of measurement, which was determined by means of the Van den Akker "auxiliary sphere' method[1], was checked by redetermining it independently at several points using the method of Sharp and Little.[2] The results from the two determinations agree to within approximately 0.1%, well within the margin of error attributed to the determinations. A description of this experiment is being prepared for publication in a future issue of the NBS Journal of Research. Because of the close agreement between these two determinations and the satisfactory results from the recent international intercomparison of scales of directional-hemispherical reflectance factor measurements, plans for a third independent evaluation of the NBS scale using the Korte[3] method have been shelved.

Work is nearly completed on establishing a scale of 45°-0° reflectance factor. This measurement geometry is specified in a number of test methods such as in CIE No. 15 (E-1.3.1) 1971; ASTM E97-55 (1965); ASTM D985-50 (1969); Federal Test Method Standard No. 141a, Method 6121; and TAPPI methods T452 Os-58 and T217 Os-48. A large fraction of the color measuring instruments currently in use measure with this geometrical configuration. The first calibrations at NBS with this scale are scheduled to begin in September. Measurements for instrument manufacturers and commercial laboratories issuing secondary standards will be given highest priority initially.

[1]Van den Akker, J.A.; Dearth, L.R.; and Shillcox, W.M.; "Evaluation of Absolute Reflectance for Standardization Purposes," J. Opt. Soc. Am. *56*, 250 (1966).

[2]Sharp, C.H. and Little, W.F.; "Measurement of Reflection Factors," Transactions I.E.S. *15*, 802 (1920).

[3]Korte, Heinrich; and Schmidt, Martin; "Über Messungen des Leuchtdichtefaktors an be liebig reflektier enden Proben," Lichttechnik *19*, 135A (1967).

Reprinted from *Optical Radiation News*, National Bureau of Standards, July 1977.

Luminance-Brightness Comparisons of LED Alpha-Numeric Sources at Supra-Threshold Levels

R. L. Booker of the Radiometric Physics Section has recently completed an experiment in which observers adjusted the luminance of a 2856 K white comparison source so that it appeared to be of the same brightness as a red, yellow, or green LED alpha-numeric source. Although the present CIE photometric system predicts brightness/luminance ratios of 1.0, Booker found that the ratios, for the mean observer, ranged from 1.13 for the green to 2.54 for the red. This means that, on the average, 2.54 times as much white light was required for a brightness match with the red LED, or, in other words, the red LED appeared to be 2.54 times as bright as a white comparison source of equal luminance. These results demonstrate that there can be substantial differences between photometric luminance based on the V(λ) function and brightness as perceived visually.

This experiment is part of a cooperative effort between NBS and NRC-Canada to compare photometric luminance with perceived brightness (see ORN #15, May 1976). The NBS results were obtained using 1° sources of approximately 375 and 515 cd/m^2 luminance. Alman, at NRC, using 2° split bipartite field and a luminance of 10 cd/m^2, obtained mean brightness/luminance (B/L) ratios ranging from 2.70 to 2.85 for three different sources similar in chromaticity and saturation to the red LED and 1.26 for a yellow nearly identical in chromaticity to the yellow LED. This compares well with the B/L ratios of 2.54 and 1.28 obtained for the red and yellow sources in the NBS experiment.

Reprinted from *Optical Radiation News*, National Bureau of Standards, July 1977.

COMMITTEE ON PUBLICATIONS

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The deadlines for submitting items to be included in the *Newsletter* are: February 15, April 15, June 15, August 15, October 15, and December 15, in other words, the fifteenth of the even-numbered months.

Send *Newsletter* Items to Editor:
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1. Any person interested in color and desirous of participating in the activities of the Council for the furtherance of its aims and purposes . . . shall be eligible for individual membership (By-Laws, Article I, Section 2). Application forms for individual membership may be obtained from the Secretary (address given above).

2. The Council re-affirms its community of interest and cooperation with the Munsell Color Foundation, an independent private foundation devoted solely to the advancement of color knowledge in science, art, and industry. It serves as Foundation Associate of the Inter-Society Color Council. The Council recommends and encourages contributions for the advancement of these purposes to the Munsell Color Foundation. For information, write to S. L. Davidson, NL Industries, P.O. Box 700, Hightstown, N.J. 08520.

3. The Council promotes color education by its association with the Cooper-Hewitt Museum. It recommends that intended gifts of historical significance, past or present, related to the artistic or scientific usage of color be brought to the attention of Christian Rohlfing, Cooper-Hewitt Museum, 9 East 90th Street, New York, New York 10028.