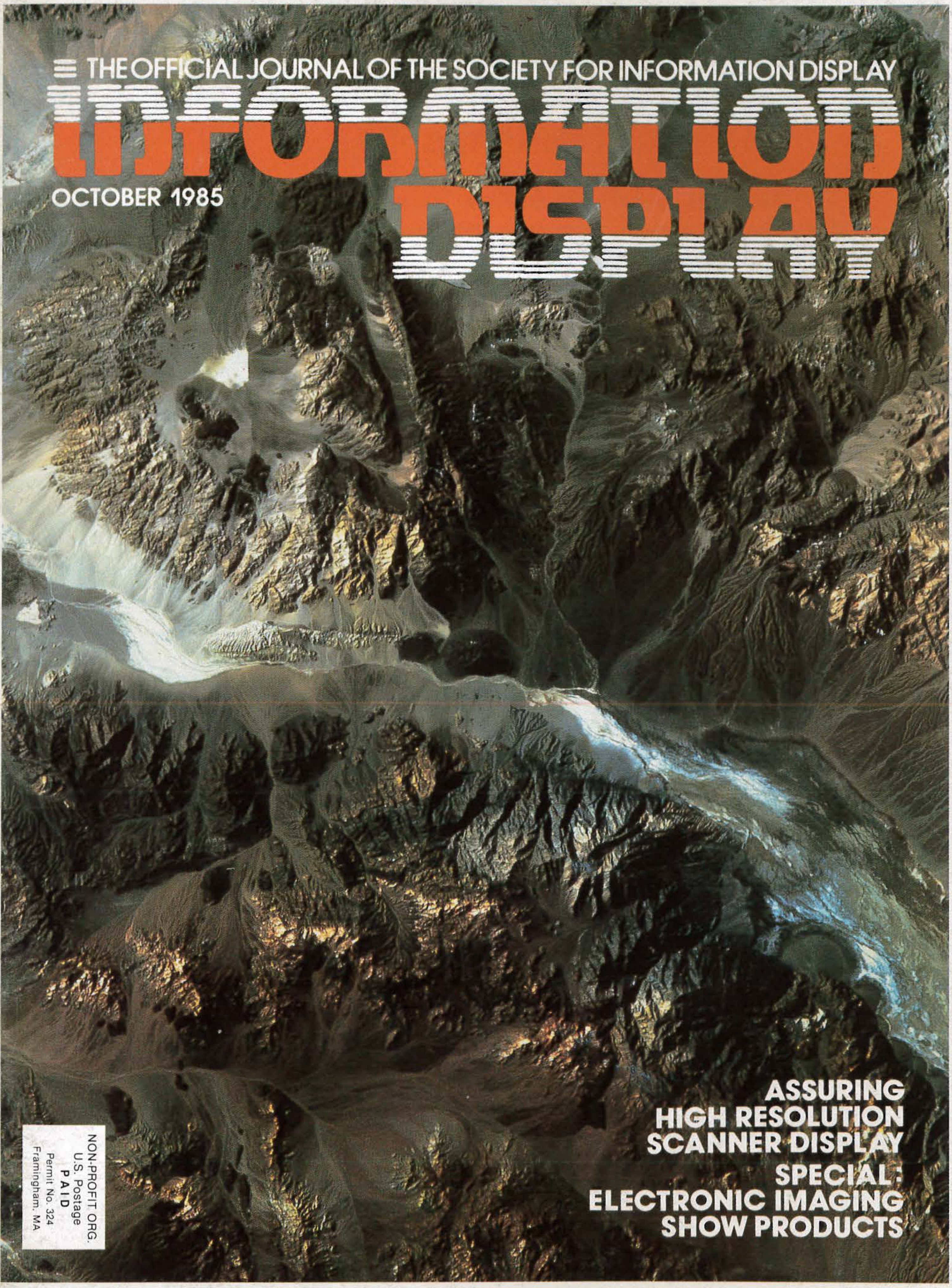
THE OFFICIAL JOURNAL OF THE SOCIETY FOR INFORMATION DISPLAY

INFORMATION DISPLAY

OCTOBER 1985



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Events

NATIONAL

OCTOBER 13-16: Topical Meeting on Multilayer Ceramic Devices, American Ceramic Society, Electonics Div., Marriott Inn, Orlando, FL. Contact: John B. Blum, Dept. of Ceramics, Rutgers University, Box 909, Piscataway, NJ 08854 (201/932-4367)

OCTOBER 14-17: Info '85, NY Coliseum, New York, NY. Contact: Cahners Exposition Group, Jennifer Patchell (203/964-0000)

OCTOBER 14-16: 1985 ACM Annual Conference—The Range of Computing/Mid 80s Perspective, Denver Hilton Hotel, Denver, CO. Contact: Dr. Schlesinger, Association for Computing Machinery, 11 West 42nd Street, New York, NY 10036. (212/869-7440)

OCTOBER 15-17: 1985 International Display Research Conference, San Diego, CA. Co-sponsors: IEEE Electron Devices Society, the Society for Information Display, the Advisory Group on Electron Devices. Contact: Palisades Institute for Research Services, IDRC, 201 Varick St., New York, NY 10014 (212/620-3388)

OCTOBER 17-18: Electromagnetic Pulse (EMP) Design & Test—Short Course, Boston, MA. Contact: See above, October 7-8.

OCTOBER 18-20: Computers in Education, Sheraton Centre Hotel, New York, NY. Contact: Carole Dornblasser, Conference Management Corp. 17 Washington Street, PO Box 4990, Norwalk, CT 06856-4990 (203/852-0500)

OCTOBER 20-24: Computer Graphics Atlanta (CGA '85), Georgia World Congress Center, Atlanta, GA. Contact: CGA '85, 2033 M Street NW, Suite 333, Washington, DC 20036 (202/775-9556)

OCTOBER 21-23: Computers in Aerospace V Conference, Hyatt Regency, Long Beach, CA. Sponsor: AIAA Computer Systems TC in cooperation with ACM. Contact: Melvyn J. Brauns, Ford Aerospace MS V03, 3939 Fabian Way, Palo Alto, CA 94303 (415/852-4188)

OCTOBER 22-23: Eighth Annual Newport Conference on Fiberoptic Markets, Sheraton-Islander Inn, Newport, RI. Contact: Janet Roche, Kessler Marketing Intelligence, America's Cup Ave. at 31 Bridge St., Newport, RI 02840 (401/849-6771)

OCTOBER 23: Electrostatic Discharge (ESD) Control—Short Course, Boston, MA. Contact: See above, October 10.

OCTOBER 23-25: Symposium on Expert Systems in Government, McLean, VA. Sponsor: IEEE-CS. Contact: Marshall Abrams, Mitre Corp., 1820 Dolley Madison Blvd., McLean, VA 22102 (703/883-6938)

OCTOBER 26-27: ISECON '85—The Information Systems Education Conference. The Sheraton Houston Hotel, Houston, TX. Contact: Data Processing Management Association, 505 Busse Highway, Park Ridge, IL 60068-3191 (312/825-8124)

OCTOBER 28-30: Second Annual ACM Northeast Regional Conference, Boston, MA. Sponsor: ACM Northeast Region. Contact: Bryan Kocher, 250 Edge Hill Rd., Sharon, MA 02067 (617/863-5100)

OCTOBER 29-30: Second Annual Conference on Flat Information Displays, Red Lion Inn, San Jose, CA. Contact: Murray Disman, Pres, International Planning Information, 1259 El Camino Real, Suite 324, Menlo Park, CA 94025 (415/364-9040)

OCTOBER 29-31: Laboratory Instrument & Equipment Conference & Exhibition (LAB-CON/New England) Northeast Trade Center, Woburn, MA. Sponsor: Research & Development Magazine. Contact: Margaret Young (312/668-8100)

NOVEMBER 4-7: Seventh IEEE Symposium on Mass Storage Systems, Tucson, AZ. Contact: Bernard T. O'Lear, NCAR, PO Box 3000, Boulder, CO 80307 (303/497-1268)

NOVEMBER 4-7: SENSORS '85—Conference on Sensors for Untended Manufacturing, Society of Manufacturing Engineers, Detroit, MI. Contact: Society of Manufacturing Engineers, One SME Drive, PO Box 930, Dearborn, MI 48121 (313/271-1500)

NOVEMBER 6-8: American Ceramic Society, Glass Div. Meeting, Corning Hilton, Corning, NY. Contact: James E. Shelby, Alfred University, Alfred, NY 14802 (607/871-2470)

NOVEMBER 11-14: 1st International Conference and Exhibit on Computer Workstations, San Jose Convention Center, San Jose, CA. Contact: IEEE Computer Society, 1109 Spring Street, Suite 300, Silver Spring, MD 20910 (301/589-8142)

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OCTOBER 1985 VOL. 1 NO. 10

Cover photo: Image over Death Valley, from 600 miles above earth, was produced on the CELCO 8000A Ultra-High Speed and Resolution Color Film Recording System. (Page 16)

FEATURES

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DEPARTMENTS

INFORMATION DISPLAY (The Official Journal of the Society for Information Display) is edited for corporate research and development management; and engineers, designers, scientists, and ergonomists responsible for design and development of input and output display systems used in various applications such as: computers and peripherals, instruments and controls, communications, transportation, navigation and guidance, commercial signage, and consumer electronics.

Editorial covers emerging technologies and state-of-the-art developments in electronic, electromechanical, and hardcopy display devices and equipment; memory; storage media and systems; materials and accessories.

Events

NOVEMBER 13-15: 1st Videotext Engineering and Technology Forum, Meridian Hotel, San Francisco, CA. Contact: Cynthia Parsons, OnLine Intl., 989 Avenue of the Americas, New York, NY 10018 (212/279-8890)

NOVEMBER 17-22: Imaging Science & Technology Show and Exhibit, Society of Photographic Scientists, Fall Symposia, Marriott Crystal Gateway, Arlington, VA. Contact: David A. Fatora, M.F. Graphics, 12700 SE Crain Hwy., Brandywine, MD 20613 (301/372-1245)

NOVEMBER 18-19: Electromagnetic Pulse (EMP) Design & Test—Short Course, Washington, DC. Contact: See above, October 17-18.

NOVEMBER 18-22: Tutorial Week Washington '85, IEEE Computer Society, Hyatt Crystal City, Arlington, VA. Contact: Martez A. Camilleri, IEEE Computer Society, PO Box 639, Silver Spring, MD 20901 (301/589-8142)

NOVEMBER 18-22: Tutorial Week San Francisco '85, IEEE Computer Society, Cathedral Hill Hotel, San Francisco, CA. Contact: See above, November 18-22.

NOVEMBER 21-22: Ninth Annual Western Educational Computing Conference, California Educational Computing Consortium, Oakland, CA. Contact: Alexia Devlin, CECC, San Francisco State University, Accounting Data NADM-358, 1800 Holloway Ave., San Francisco, CA 94132.

December 2-6: DCG'85—Defense Computers and Graphics Conference, DC Convention Center, Washington, DC. Contact: Caby Smith, World Computer Graphics Assn., 2033 M Street NW - Ste. 399, Washington, DC 20036 (202/775-9556)

DECEMBER 2-6: Tutorials for Professional Development—Advanced Computer Topics, Boston, MA. Contact: Gerry Segal, Education Manager, Association for Computing Machinery, 11 West 42nd St., New York, NY 10036 (212/869-7440)

DECEMBER 9-13: Second International Conference on Artificial Intelligence Applications, IEEE Computer Society, Miami Beach, FL. Contact: Artificial Intelligence, % IEEE-CS, PO Box 639, Silver Spring, MD 20901 (301/598-8142)

INTERNATIONAL

OCTOBER 14-17: COMDEX Europe, RAI Congress & Exhibition Center, Amsterdam, The Netherlands. Contact: Aileen Vogt, The Interface Group (617/449-6600)

OCTOBER 28 - NOVEMBER 1: Computer Graphics Korea, World Computer Graphics Assn. & Korean Trade Promo Corp. (KOTRA)., Seoul, Korea. Contact: World Computer Graphics Assn. (202/775-9556)

OCTOBER 28 - NOVEMBER 1: SYSTEMS '85, Munich Fair Center, Munich, W. Germany. Contact: Jerry Kallman (201/652-7070)

NOVEMBER 4-8: Composants Electroniques '85, Parc des Expositions - Paris Nord, Paris, France, US Dept. of Commerce. Contact: Joseph Burke (202/377-5014)

NOVEMBER 11-14: Sixth Chilean Electrical Engineering Conference, IEEE Chile Section and Chilean Computer Science Society, Santiago, Chile. Contact: Marcelo Guarini, VI Electrical Engineering Conference, Universidad Catolica de Chile, Casilla 6177, Santiago, Chile.

NOVEMBER 18-21: Canadian Computer Show & Conference, Canadian Information Processing Society, Toronto International Center, Toronto, Canada. Contact: Robert Grainger (418/252-7791)

NOVEMBER 18-21: CommuniTech & Computer '85 Malaysia, Putra World Trade Center, Kuala Lumpur, South East Asia. Contact: CommuniTech & Computer '85 (01/486-1951)

NOVEMBER 25 - DECEMBER 6: 2nd International Technical Symposium on Optical and Electro-Optical Applied Science and Engineering, Palais des Festivals et des Congres, Cannes, France. Contact: Society of Photographic & Instrumentation Engineers, PO Box 10, Bellingham, WA 98227.

DECEMBER 2-6: Fourth International Conference on Bio-stereometrics, Cannes, France. Contact: See above, November 25-December 6.

DECEMBER 5-7: SEMICON/Japan, Tokyo International Trade Center, Tokyo, Japan. Contact: Bill Galarneau (415/964-5111)

Recently Patented

Analog color freeze-frame transmission process: US 4514753—June 1985.

Describes a process of transmitting analog encoded color television signals over telephone lines on other communications channels. By reencoding color video signals to eliminate the high-frequency color subcarrier components, images can be transmitted with less susceptibility to degradation by "noisy" circuits, with resultant more accurately received color pictures.
Bruce Johnson and Glen Southworth—Colorado Video Inc. Boulder CO.

Liquid crystal matrix display device: US 4513282—April 23, 1985.

Describes a liquid crystal display device that possesses many of the advantages of a dot-matrix type display, with respect to flexibility of changing character or symbol position and size; together with the advantages of a limited number of external connecting leads provided by a segment type of display that can indicate only numerals or symbols of predetermined size at predetermined locations. The display device is based upon a matrix of groups of display segments, with each group, or the segments within a group, being individually selectable to form numerals and characters using either individual display segments or combinations of groups of display segments.
Tadahiko Nakagiri—Citizen's Watch Co. Ltd., Tokorozawa, Japan.

Scanning liquid crystal display cells: US 4511926—April 16, 1985.

Describes a curtailed drive scheme for a matrix-array liquid crystal display cell in which the field developed across each picture element is maintained for only a fraction of the time interval between consecutive addressings. This reduces the effects of differences in time constants across the display for addressing schemes in which the average time constant is short compared with this time interval between consecutive addressings.
William A. Crossland, Peter W. Ross and Peter J. Ayliffe—International Standard Electric Corp., Harlow, England, UK.

Full word coding for information processing: US 4500955—February 19, 1985.

Describes an information processing system comprising means for inputting alphanumeric words into the system. It is comprised of serial aggregations of coded representations with a coded representation for each character in the alphanumeric words; and an encoding means for matching each inputted word with a unique predetermined unitary representation independent of any reordering of the serial aggregations of the coded representations comprising a word.
Ifay F. Chang, Chappaqua, NY, assignor to International Business Machines Corp., Armonk, NY.

Flat storage CRT and projection display: US 4491762—January 1, 1985.

Describes a flat storage cathode-ray tube with enhanced brightness. A mesh collector and a dielectric storage site array form an integral part of a silicon wafer that includes thereon an addressable array of field effect transistors. The transistors are associated with a dielectric storage site in the array for controlling a writing of the storage site. The addressable array of transistors works in cooperation with a flooding electron gun to effect selective writing of the storage site array. The enhanced brightness cathode-ray tube may be adapted for use in a projection display.
Ifay F. Chang, Chappaqua, NY; assignor to International Business Machines Corp. Armonk, NY.

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"The greater part of progress is the desire to progress."
—Seneca (The Younger)

In an effort to improve our working knowledge of the display field—technology and applications—we've assembled a rather extensive collection of papers on various subjects related to display systems. Despite this, our editorial staff library really only begins to scratch the surface of information available.

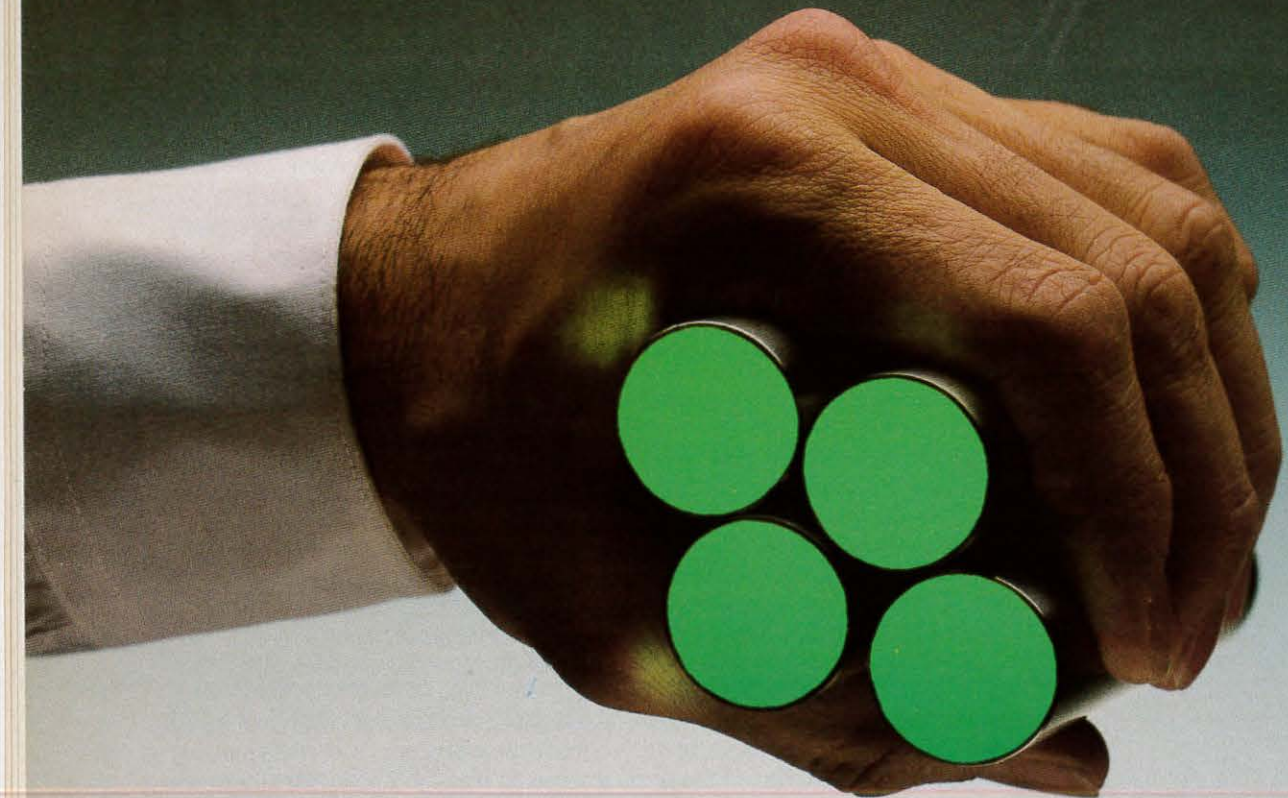
While the Society's Proceedings, Symposium Digests, and Seminar Notes most assuredly comprise the core technical literature for such a collection, a considerable amount of information concerning display applications—both problems and solutions—lies dormant, awaiting our uncovering. This is where YOU the reader of ID could prove to be of enormous assistance to us.

Many of you are more deeply involved in professional societies other than SID—and rightly so, if you design automative or medical instrumentation, for example. Papers prepared for and delivered to such professional disciplines rarely find their way into the hands of SID's general membership. True, while much of this material would be of little or no interest to many in the Society, there are perhaps twice as many more who would be sincerely interested—in more than a chance reading.

As your President, Dr. Chang has said on more than one occasion, in more than one column in this Journal, sharing our individual knowledge and ideas can often provide insight to difficult design or production problems one might encounter in isolation. And so, papers on display applications from various disciplines, other than purely display professionals (automotive, medical, industrial controls, photography, astronomy, robotics, electronic sensing and imaging, and on and on) could be of extreme interest to many allied professionals beyond those originally intended. But, only if YOU let us know about the availability of such literature; only if YOU take the time to photocopy such material and send it to us for review—and possible publication.

Joseph A. MacDonald
Editorial Director

Our new CRTs are quite a handful.



Introducing Litton's 1" tube.

Now let's see. What could you use a miniature CRT for?

How about a helmet-mounted display.

A compact film recorder.

A hybrid typesetter.

Or a compact display inside a crowded tank.

Litton's L-4272 cathode ray tube is the newest sub-miniature on the market.

And one of the best.

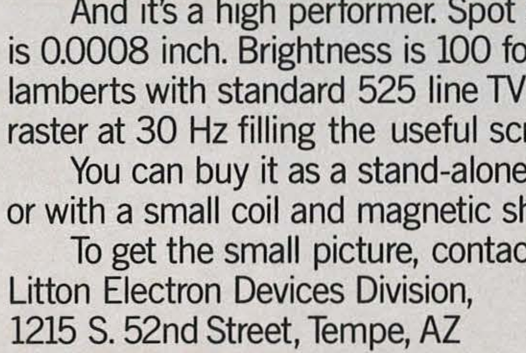
It's made by the leader of high resolution, high precision CRT's. Litton's reliable CRT products have been used in everything from advanced reconnaissance systems to sophisticated photocomposition machines.

The L-4272 is ruggedized, so it'll survive inside a tank, an aircraft or any vehicle using forward-looking infrared systems.

And it's a high performer. Spot size is 0.0008 inch. Brightness is 100 footlamberts with standard 525 line TV raster at 30 Hz filling the useful screen.

You can buy it as a stand-alone item or with a small coil and magnetic shield.

To get the small picture, contact Litton Electron Devices Division, 1215 S. 52nd Street, Tempe, AZ 85283. Phone (602) 968-4471. TWX: 910-950-0149.



Litton Electron Devices

PEOPLE

Metapath Inc., Foster City, CA, announced the appointment of Robert S. Koontz as president. Formerly president of Cambrian Systems (Westlake Village, CA), Koontz has held various executive positions with Grenex, DML, and Burroughs. Metapath designs, manufactures, and markets data-switch products used to interconnect a wide variety of dissimilar computer devices.

RIT Research Corp., Rochester, NY, named as its president Dr. Harvey E. Rhody, professor of electrical engineering, and former head of the Department of Electrical Engineering at Rochester Institute of Technology (RIT). The Research Corp., a subsidiary of RIT, provides assistance to business, industry, and government in a wide variety of disciplines such as computer science, electronics, energy, engineering, photography, and other disciplines.

Sawyer Research Products Inc., Eastlake, OH, elected David P. Larsen president and a director. Larsen co-founded Crystal Systems Inc. in 1972 to manufacture blanks and equipment for the quartz crystal industry. In 1979, Sawyer Research purchased Crystal Systems appointing Larsen as General Manager of the group.

Optical Fiber Technologies Inc., Billerica, MA, announced the appointment of Thomas W. Tamulevich president of the company, which he founded in 1981 as a subsidiary of Epoxy Technology Inc. Under his direction as Executive Vice President of the company, OFTI introduced the world's first field-installable SMA singlemode fiber-optic connector, the SC Series featuring ultra-precision lapped ceramic ferrules for improved thermal stability and mechanical durability, a re-useable test connector for single-mode optical fiber, and a series of Bi-Conical FO connectors.

National Computer Graphics Assn. (NCGA) announced Thomas C. Cain, vice president of federal systems and government relations for Computervision will take office as president of the society for the coming year. Before joining Computervision, Cain was vice president of marketing for CALMA, of California, and Information Displays Inc., of New York.

ORGANIZATIONS

Systron Donner, Microwave Div., Van Nuys, CA, has delivered to the US Navy ahead of schedule a state-of-the-art, microprocessor-based velocity deception module for use in electronic countermeasure systems at the Navy's Pacific Missile Test Center (PMTC). From design stage to first production unit took just six months. The VDM units are installed in a pod on a drone aircraft and are used to capture and deceive the velocity gates of incoming "hostile" threat radards. Systron Donner is the major US subsidiary of THORN EMI Electronics, UK.

Non-impact printing theme of Congress

The Third International Congress on Advances in Non-Impact Printing Technologies will be held August 24-28 at the Fairmont Hotel in San Francisco, CA. Sponsored by the Society of Photographic Scientists and Engineers (SPSE), the Congress will cover all topics pertinent to non-impact printing and will provide an opportunity for professionals in this field to exchange tutorial and state-of-the-art information. The first two in this series of Congresses were held in Venice, Italy (1981) and Arlington, VA (1984).

Primary intent of the Congress is to convey recent technical advances; tutorial reviews, experimental methods, and instrumentation—as well as evaluations of equipment, materials and processes also will be included. Topics to be covered are: electrography, ionography, electrophotography, image processing, lithography and plate making, magnetography, optical image bars, consumable materials, non-impact paper requirements, and thermography. An exhibition of the latest developments in non-impact printers and related products is scheduled concurrently with the Congress.

Contact: Thomas W. Gribb, Eastman Kodak Co., Dept. 197, 901 Elmgrove Rd., Rochester, NY 14650 (715/725-1643)

Human factors standards backed for VDT workstations

The National Computer Graphics Association has endorsed the current efforts to complete and ensure adoption of the American National Standard for Human Factors Engineering of Visual Display Terminal Workstations.

Under the formal processes of the American National Standards Institute (ANSI), the Human Factors Society has developed this standard in an effort to ensure that acceptable human factors engineering principles and practices are taken into account in the design and use of visual display terminals and workstations, and the environment in which these devices are used. Particular efforts were made to base the standard on established principles and practices and to substantiate the elements in the standard with accepted empirical data wherever possible.

At present, the standard deals with perceptual and physical characteristics. There is no immediate effort to develop a specific human factors standard for computer graphics workstations, as the concepts addressed in the standard developed relate to workstations in a general sense and are not task specific.

Materials researchers call for papers

The Material Research Society is inviting authors to submit abstracts for contributed papers to be presented at the society's Spring Meeting, April 15-18, 1986, at the Hyatt Rickeys and Palo Alto Hyatt, Palo Alto, CA.

The technical program will consist of

a series of nine symposia on topics at the forefront of materials research. Of particular interest to the readers of ID is the following symposium: Amorphous Silicon Materials and Applications, Chairman - A. Madan, SERI, 1617 Cole Boulevard, Golden CO 80401.

Contact: John B. Ballance, Exec. Dir., Materials Research Society, 9800 McKnight Road, Suite 327, Pittsburgh, PA 15237, (412/367-3003).

Deadline for submittal of material is December 1, 1985.

Study on transborder data flow criticized

The International Information Industry Congress (IIIC), which met in Tokyo in June, protested plans by the Organization for Economic Cooperation and Development (OECD) to study data flow in multinational companies, which it said could lead to taxing certain kinds of information exchange between subsidiaries.

IIIC members agreed to discourage this direction through their countries' representatives attending the meeting and by adopting a generalized statement against governmental restrictions on transborder data flow. They advocated that "national security" restrictions should apply only to data actually having national security implications, rather than having general restrictions on commercial, financial, and non-military technical information.

The OECD met again at the end of June to resolve these differences and propose three new studies: a study updating of a four-year old study on intercorporation flows; a study of international trade flows; and a study on marketing computer services abroad. Even though the private sector objected to the first proposal, the latter two were accepted on the basis of the US becoming involved in the Brussels harmonized code system and the desire of the US to market abroad. *(AFIPS Washington Report)*

Computer simulation papers solicited

The Society for Computer Simulation invites authors to submit abstracts of technical papers for the Summer Computer Simulation Conference to be held at the MGM Grand Hotel, Reno, NV, July 28-30, 1986.

A comprehensive and innovative coverage of the field of simulation is planned consisting of over 60 sessions covering 18 topical groups, among them: artificial intelligence, biomedical simulation, computer systems, data communications systems, government simulation/computation activities, missile simulation, physical and engineering sciences, simulation credibility and validation, and simulation methods.

Detailed 300-word abstracts should be submitted to: Barbara Novak, SCS, PO Box 17900, San Diego, CA 92117. (619/277-3888)

Deadline for submittal is December 15, 1985.

Inverter matrix simplifies matching power sources: EL lamps

One of the primary problems confronting project engineers in the design of tomorrow's EL displays is trying to match power sources and EL lamps.

Compounding the situation is the fact that most design engineers still use the same empirical problem-solving techniques in making the proper match that Destriau applied when he first recorded the phenomenon of EL in 1936.

Despite half-a-century evolution of EL technology—from simple thick-film, AC-powder EL lamps to today's active-matrix, thin-film EL displays—designers still determine the proper light output required by applying varying voltages or frequencies, or both, to excite the lamp's phosphors. And, until recently, there were but two choices for determining this output; a designer either worked with line voltage and frequency, or used an inverter to generate a different (more optimal) voltage and frequency.

When using line voltage and frequency, one must settle for the limited performance of the lamp under those conditions. Except in aircraft and military applications, where a 400 Hz source is readily available, this usually means that the lamp is not very bright—thus limiting applications where an EL light source could be used.

Alternatively, one could set up in the laboratory a variable voltage and frequency source, operating a lamp under various sets of parameters until the combination becomes useable for the application desired. Once parameters for the power source are developed, a designer could either design and build an inverter in-house, or find a vendor able to do so.

But, because design of an inverter demands a working knowledge of various disciplines that cross over—chemistry, physics, and electrical engineering—relaying technical information of such highly sophisticated and dissimilar nature can be difficult, time-consuming, and often confusing for all involved.

Inverter selection

In an effort to simplify the process of selecting an inverter, Endicott Research Group Inc. (Endicott, NY) has studied the most frequently used EL lamps from the largest group of manufacturers, and developed unit loads that closely simulate five areas of EL lamps of the "foil" type—4,6,12,16, and 20 square inches. Once unit loads were defined, a hypothetical matrix of 105 different Type II inverters (see box) was developed that has overlapping output characteristics.

by Robert S. Rakowski, President
Endicott Research Group Inc.
Endicott, NY

Types of Inverters

Inverters basically can be:

Type 1—constant output voltage/ fixed frequency;
Type II—load sensitive/variable output voltage and frequency.

Type I—These units usually consist of a two-transmitter oscillator switching the primary of a step-up transformer, whose square output wave shape sometimes is altered to produce a quasi-sinusoidal waveform. In its simplest form, this inverter consists of at least five components: two transistors, an R-C network, and a transformer. More components may be added depending upon whether input polarity protection, output wave shaping, input current limiting, or other parameters are elected as options.

Type II—These units usually consist of a single transistor oscillator switching the primary of a fairly complex step-up, three-winding transformer whose output waveform is quasi-sinusoidal. This type of inverter, in its simplest form, consists of a least four components; up to six components, if input polarity protection and the ability to work into an infinite impedance (a compromise) are elected as options, and more if further features are desired.

Type II inverters have some not so obvious advantages over Type I inverters. Simpler in construction, they usually cost less to build, and a lower internal component count contributes to increased reliability. More importantly, though, Type II inverters use the connected lamp load as part of their circuitry, so the aging characteristics of the EL lamp—manifesting itself as a change downward in capacity—is used to lower the time constant of the inverter's oscillator. This produces a corresponding increase in the output frequency of the inverter, thus helping to lessen the decay rate of an EL lamp's light output. This "compensation" effect can extend time to the end of an EL lamp's useful life, the extent of which depends upon how closely the EL lamp and Type II inverter are matched to each other's electrical characteristics (see chart).

This included seven different input voltages—5,9,12,15,18,24, and 28 volts DC—and three different output voltage levels—80 VAC, 100 VAC, and 120 VAC—all at 400 Hz.

The matrix already has enabled production of a series of inverters (LPS-1) that produce an output voltage of 80 VAC at 400 Hz, designed to power foil-type EL lamps used primarily to backlight liquid crystal displays, membrane switches, or dead front panel legends. This series typically will produce from 6 to 8 foot-lamberts luminosity at the EL lamp surface.

A second series of inverters (LPS-3), in pilot production, will produce an output of 120 VAC at 400 Hz. These are designed for higher brightness applications that require from 18 to 20 foot-lamberts.

For medium brightness applications, requiring 12 to 14 foot-lamberts, a series of inverters (LPS-2) can be produced having an output of 120 VAC at 400 Hz. At present, however, there are few applications requiring medium brightness levels.

As newer, or different, types of lamps come into common use, other series of Type II inverters can be developed to meet specific drive characteristics. Since all EL lamps can be regarded as lossy, light-emitting capacitors, once characteristics of such new, or evolving, "capacitor-types" are studied to find mean values per unit area, similar matrices of Type II inverters can be developed.

(Article developed from A Standard Power Source for Thick-Film AC Powder EL Lamps, by Robert S. Rakowski, President, Endicott Research Group Inc. Endicott, NY—SAE/A20-A, May 1985.)

PAPERS ON DISPLAY

Information Display is soliciting original articles that cover all aspects of display technology and applications—display systems, sensing and imaging instrumentation, printing technologies, input/output devices, interactive graphics, storage media, and human factors engineering.

Articles may also be developed from technical papers originally prepared for: symposia, seminars, and workshops; professional and technical society meetings or journals; corporate in-house publications. NO ARTICLE previously published in a commercial magazine will be considered for publication in ID.

Notes for contributing authors and specifications for submitting manuscripts can be obtained from the Editor of ID. Address all inquiries and submit contributed articles to: The Editor, Information Display, 310 East 44th Street, #1124, New York, NY 10017.

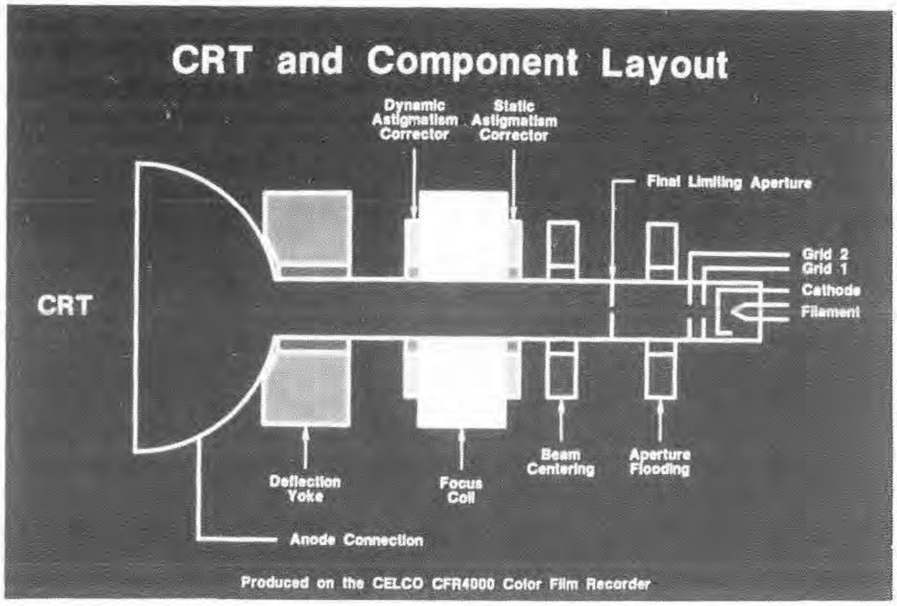
Component positioning, alignment, key to high-resolution displays

High-resolution cathode-ray tube scanning systems have been used for many years and for many diverse applications:

- Under precise computer control, the CRT spot has been used to track high-energy particles in nuclear research.
- CRT-based Computer-Output-Microfilm machines have made it possible to store huge amounts of data in document form directly from the computer database.
- Digitizing master fonts using CRT scanners, and the development of high-speed CRT electronic photo-typesetting devices, have made other methods of preparing printing plates obsolete.
- High-speed fingerprint scanning for storage and subsequent identification of criminals is now accomplished using high-resolution CRT systems.
- Satellites and deep-space probes send to earth electrical signals that are converted into their informative pictorial counterpart through use of high-resolution CRT display.
- Advanced CRT color film-recording systems are providing theater-quality computer graphics image generation, such as required for animation, oil exploration analysis, and other geological interpretations.

The purpose of this article is to describe the electro-optical components required, and the techniques for their precise positioning and alignment to assure state-of-the-art performance in CRT-based, ultra-high resolution color film recording systems.

by John M. Constantine Jr.
Vice President
CELCO, Mahwah, NJ



CRT selection

Basic to overall performance of the CRT display is the cathode-ray tube itself; its proper selection is essential. Here are some points to consider.

A magnetically-deflected and -focused CRT will achieve the highest performance in terms of resolution and brightness. This type of CRT has the ability to operate more practically at higher anode and G2 potentials than its electrostatic counterpart.

Anode voltages of 25 to 30 kV and a G2 voltage of 2 kV are typical. With magnetic focus, one is able to precisely align the focus lens; and thus, because of a larger lens diameter, produce a better quality lens than compared to the electrostatic type. Additionally, the relative ease in applying fast dynamic focus current changes in a magnetic lens, compared to making rapid variations of a high voltage (electrostatic), strengthens the case for magnetic focus of the CRT.

High voltage operation enables the use of electron gun design techniques producing a small crossover region and small beam bundle with good light output.

CRTs used in film-recording applications must be free from stray emissions—the result of electrons being emitted by a source other than the cathode (such as a sharp metal point in

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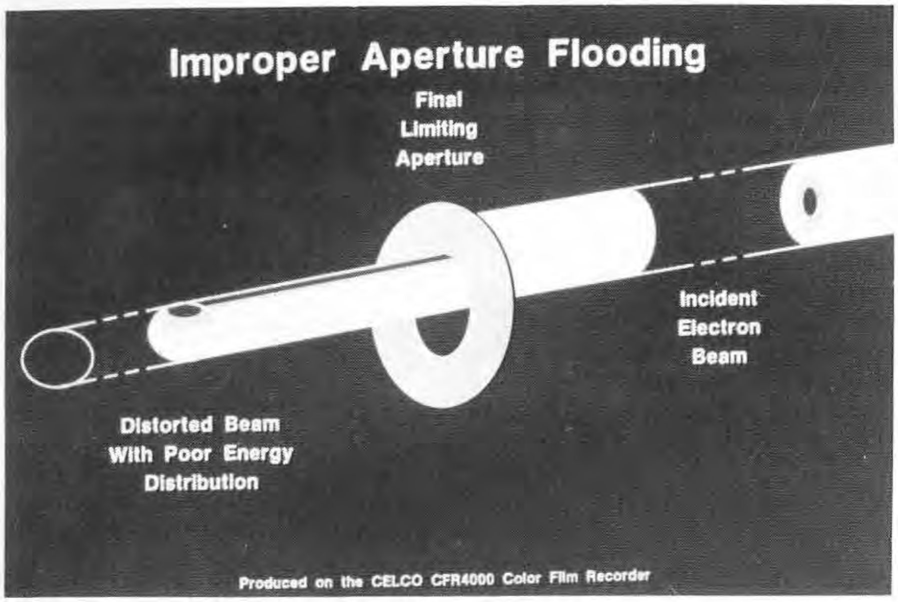
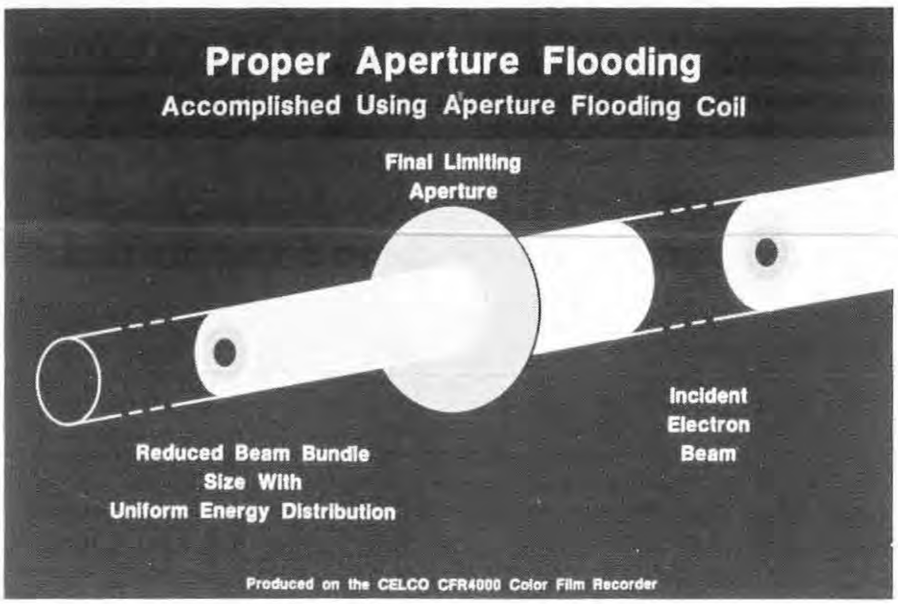




the electron gun structure). Since these stray electrons are not controlled by the G1-cathode bias, even when the CRT beam is cut off, such electrons will continue to reach the phosphor screen and expose the film when no exposure is called for.

For color film recording, a white phosphor—with the required RGB component spectral characteristics—must be applied to the faceplate, using fine grain deposition techniques to assure low-noise operation. And, the phosphor must be resistant to aging to allow for consistent operation of the system over long periods of time. Finally, the faceplate must be arranged so as to be optically flat to maintain precision optical alignment.

Beam alignment

With the proper cathode ray tube, possessing all the characteristics necessary for the intended film-recording application, attention should be turned towards insuring its proper use.

In the beam forming region of the CRT between the cathode surface and the G1 control grid, the electrons are focused by an electrostatic field so that they form a crossover near the plane of the G1 aperture. As the beam emerges from this crossover region it begins its divergent path, passing through the first accelerator, or G2 aperture, located less than 50/1000 in. from G1. Because the beam diameter through both the G1 and G2 apertures is many times smaller than the apertures themselves, no beam trimming occurs in this region.

Continuing to diverge at an angle of a few degrees, the beam is accelerated to the final anode potential and toward the final limiting aperture where the outer portion of the beam is extruded through an aperture smaller than the beam diameter—thereby removing the most divergent electrons from the beam.

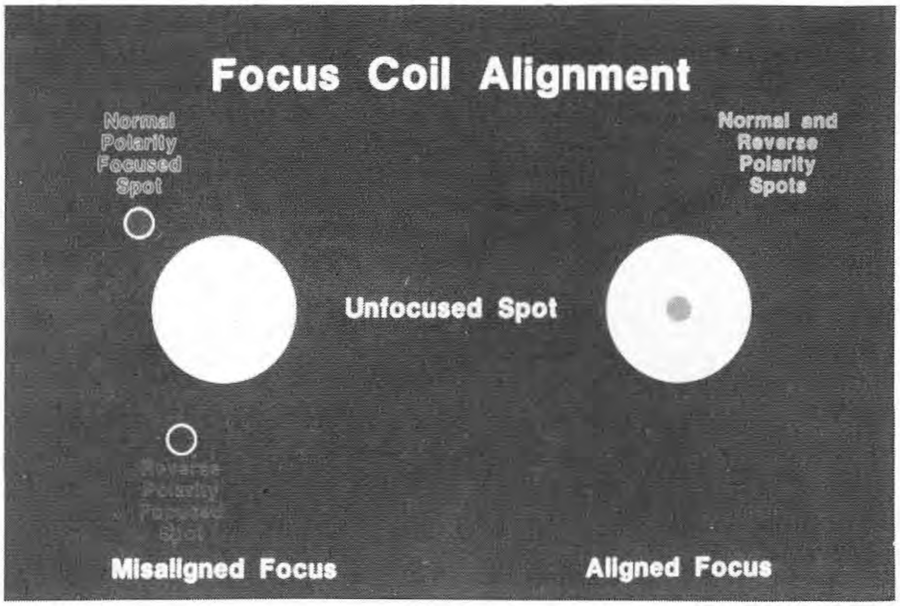
If the beam is not aligned to the center of the aperture, less than optimum beam energy transfer to the screen will result and a non-uniform energy distribution in the resulting spot will tend to distort the information in that spot. To correct for this error, a thin electromagnetic deflection coil (aperture flooding coil) is placed ahead of the G1, G2 region, that allows for the positioning of the beam to the center of limiting aperture.

Proper alignment is accomplished by adjusting the coil currents while observing a low intensity, unfocused, undeflected spot at the center of the CRT. The optimum setting is achieved when the unfocused spot appears most evenly illuminated and the lighted area appears centered within the sharp outline of the aperture. (Fig. 1 and 2).

Following the beam trimming region, a correction to the beam path is made to direct it to the precise mechanical center of the CRT face, thereby correcting any small errors in electron gun alignment within the CRT neck, or CRT neck misalignment. A centering coil, placed approximately 1 in. ahead of the final aperture, makes small X and Y positional corrections to bring the unfocused spot to center.

Beam focusing

The electron optical focusing lens, or focus coil, produces an axial magnetic field that changes the direction of the electrons in a rather complex helical



trajectory—causing them to converge towards the phosphor screen. A single-gap, thin lens with both static and dynamic windings produces the focusing fields.

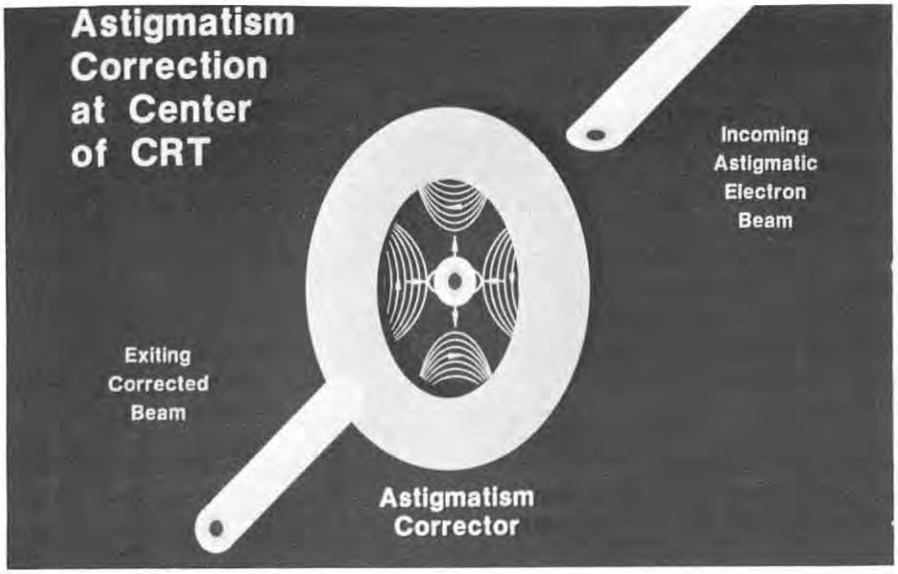
Positioned at a point along the CRT neck, approximately one inch behind the deflection yoke, the focus coil must exhibit low residual magnetism and be of homogeneous metallurgical structure—so as to eliminate spot shift and the need to refocus the display during use and from day-to-day operation. It should have fast dynamic response and good flux settling characteristics.

Alignment is accomplished by mounting the focus coil in a micropositioning device permitting accurate and independent adjustment of horizontal and vertical translation, pitch, and yaw. Object of the alignment procedure is to obtain a focused spot in both the positive and negative focus polarity that is precisely at the center of the unfocused, undeflected spot.

Static astigmatism

The magnetic lens should be free from astigmatism and have low spherical aberration for smallest spot size. Astigmatism at CRT center is an aberration caused by asymmetries in the magnetic focus lens or in the CRT itself, or both.

Focus lens asymmetries may result from errors in mechanical construction, lack of homogeneity in the material that



provides the flux path, or non-uniformity of the winding that produces the field.

Astigmatism in the CRT is due in part to lack of circular symmetry in the electrostatic lens elements, errors in alignment of the elements in the gun structure, or uneven static charging of a gun support structure.

Astigmatism is observed with the aid of a 100X microscope, by slightly reducing the static focus field strength. As the spot begins to defocus it will no longer maintain its round shape if astigmatism is present. Instead, it will become elliptical with orientation of the elliptical axis dependent on the net effect of the causative errors.

Correction is achieved by introducing currents into the two separate phases of the correction coil in the amount and proportion necessary to reshape the elliptical spot into a round one. (Fig. 3)

Beam deflection

To maintain a focused spot as it is deflected from the CRT center towards its edge, it is necessary to reduce the strength of the focus field. This is due to the increase in path length from the focus coil to the flat plane of the CRT face, and the added focusing action of the deflection yoke fields on the beam. (Fig. 4)

But, to maintain proper focus on the screen, an approximate 5% reduction in the main field strength is required for a 20-deg deflection. A parabolic waveshape is introduced into the dynamic winding as a function of deflection, bucking the main focus field, reducing its strength so that the spot remains focused at all points on the display. (Fig. 5)

Because display symmetry, off-axis spot size, and registration of pixel data are all affected by deflection yoke characteristics, it is essential to incorporate a high-quality yoke to assure ultimate display performance.

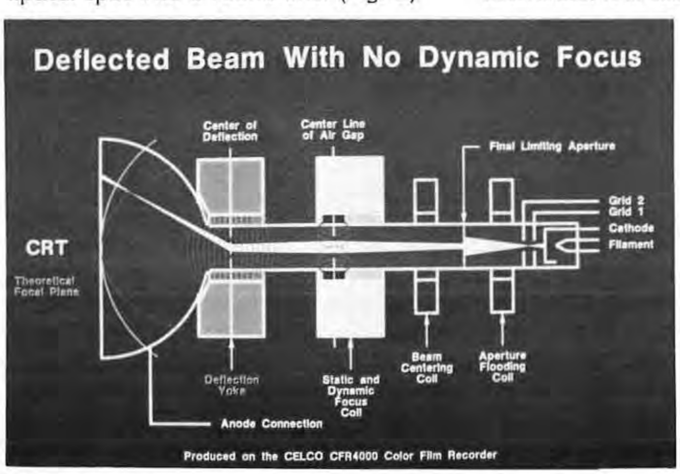
Before these parameters may be properly measured, the deflection yoke must be accurately aligned. A micropositioning assembly similar to that used for focus coil alignment is required. It should have the additional capability for accurate rotational adjustment of the deflection yoke about the axis of the electron beam.

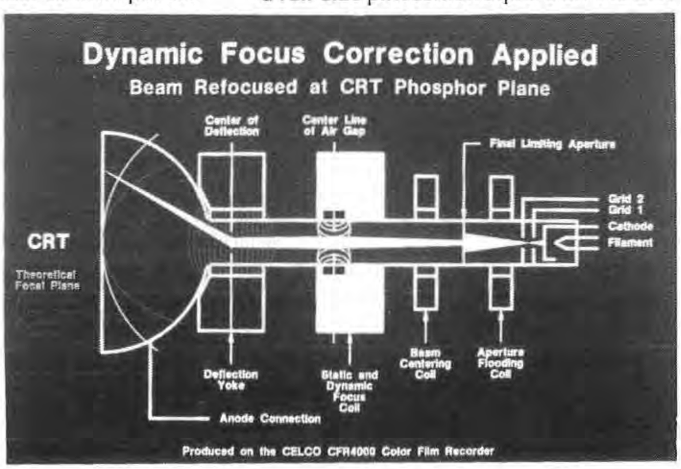
Yoke rotation is adjusted so that, visually, a scanned line is parallel to the horizontal reference plane. Next, the line is viewed through a 50X microscope mounted on a precision X-Y traverse and traversing across the diameter—it will most likely appear bowed either up or down. The bow is balanced using the rotation adjustment. The object is to align the horizontal scanning beam with the horizontal yoke axis. By translating the yoke vertically, and making a few small adjustments, the line can be made to coincide with the horizontal reference plane within 0.001 in.

Deflection is next switched to the vertical yoke axis and the adjustment procedure is repeated to remove any bow in the vertical line.

Yaw adjustment is made by intentionally introducing 5 to 10 mils of bow into the horizontal scan with the vertical translation. If any imbalance in the bow is observed, it can be removed by using the yaw adjustment. The same procedure is applied to the vertical scan using the pitch adjustment to equalize the bow.

Additional fine-tuning of pitch and yaw may be accomplished by displaying a full-size pincushion square on the CRT





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- Ability to measure light source color and color difference between sources.
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For more information, write Minolta Corporation, Industrial Meter Division, 101 Williams Drive, Ramsey, N.J. 07446. Or, call (201) 825-4000.

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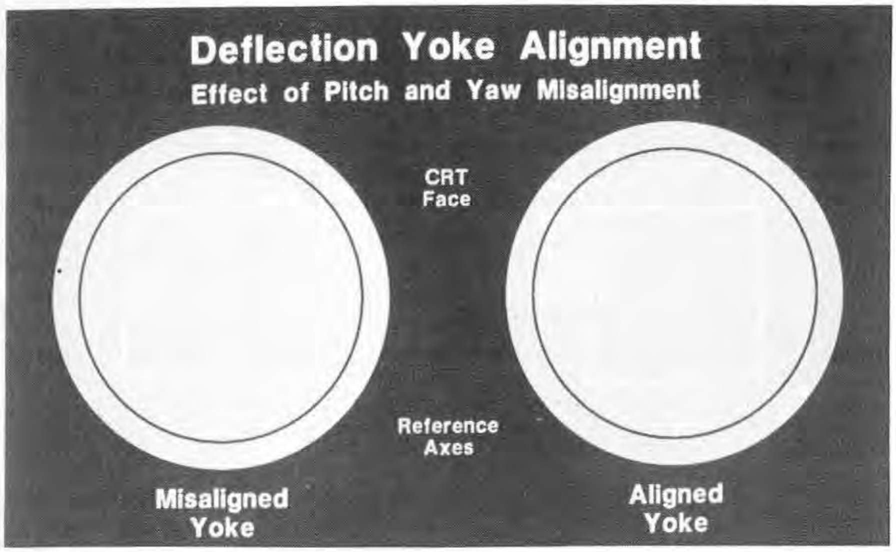

with an accurate grid pattern projected on the CRT face, and adjustment made to achieve the best balance of symmetries around the edges.

When the alignment of one component is changed, however, interaction among all the components occurs, making it necessary to repeat the alignment procedure—starting from the aperture flooding coil, proceeding forward to the yoke. (Fig. 6)

Pincushion distortion

The non-linearity between yoke current and the displacement beam on a flat-face CRT gives rise to the characteristic "Pincushion" distortion. The symmetry of this distortion is one of the criteria examined in evaluating deflection yoke performance. Other factors will also affect this symmetry, and must be accounted for, such as improper alignment of the yoke, electron beam not perpendicular to the CRT faceplate at center, or uneven charge distribution inside the CRT. Failure to take these factors into consideration may result in drawing erroneous conclusions about yoke performance.

In cases where the deflection angle or the size of the electron beam bundle, or both, is too large, the ability for even the finest deflection yoke to limit deflection astigmatism may be exceeded. In such instances, an additional correction coil must be added. Similar to the static corrector, but of low inductance design, this coil is used to reshape the astigmatic electron beam into a round one at all locations on the CRT face. The required corrective wave-forms are determined by a complete mapping of the CRT face and are applied dynamically as a function of deflection.

Magnetic shielding

A final consideration is the effect of the earth's magnetic field on the electron beam inside the CRT. This can cause various unwanted problems, such as disruption of the beam leading to larger than desired alignment corrections and causing degraded linearity and pattern distortion problems.

Once alignment has been accomplished, however, any movement of the system or movement of magnetic structures near the system will require its complete realignment. The effects of spot jitter and noise produced by electro-magnetic interference could render the display useless. Proper shielding practices utilizing high-permeability nickel alloys will attenuate these unwanted effects.

The need for precise positioning and alignment of the various electron-optical components cannot be overemphasized. Concern for, and recognition of, the importance of limiting errors—both long- and short-term—in the magnetics and the deflection system waveforms, to values as small as one part in 50,000, are necessary requirements for ultra-high resolution color film recording applications.

(Article adapted from *Electron Optical Techniques for an Ultra-High Resolution Color Film Recorder*, by John M. Constantine Jr., Yoke Designer and Vice President, CELCO, Mahwah, NJ. Copyright 1984-Society of Photo-Optical Instrumentation Engineers.)

Electronic Imaging: An Overview

Advances in computers and semiconductors, in the past decade, have led to commercially viable digital image displays—electronic imaging systems—with which visual scenes are recorded directly (or captured from film), digitized, and processed electronically for display on TV-type monitors, or stored for future use.

A wide range of information—taken from the natural world, as well as that generated by humans—is today digitized so that it may be rapidly and accurately processed electronically to enhance its value and usefulness. And, while the more traditional examples of information processing (electronic spreadsheets, project management, word processing and number crunching, to cite a few) are common place in most businesses today, many people don't stop to realize that visual images too are forms of information that also can be processed by computers.

Because the natural world around us is largely analog, visual image information must first be digitized for use in the computer. And converting this information to a computer-useable form involves placing in memory and processing considerably more data than required with alpha-numeric information processing.

This is because image information consists of continous variations on the basic parameters of light, such as color, intensity, and saturation; comprises a seemingly endless variety of textures, patterns, sizes and orientations; and is densely packed. For example: A standard 35-mm color slide might be represented by as much as 100 million bits of information, while a typical industrial-use photograph converted to digital form could require 4 million bytes or more. If the image is in color, it could be as much as 12 million bytes or 96 million bits.

Electronic images include not only visible scenes, but also those inaccessible to the human eye (those recorded by infra-red and X-ray, for instance).

Once a visual image has been captured and stored digitally in computer memory, that information can then be manipulated (processed) to enable the end user to extract features, recognize patterns, analyze and enhance the image as necessary.

Image processing

Electronic image processing is the technical "umbrella" for a very broad horizontal industry, and numerous vertical markets. Major areas of application include:

- **Manufacturing**—machine vision systems for robot guidance and inspection. For most effective use, robots require real-time electronic image processing to analyze the task and send appropriate information to the robot's processing brain (controller) to allow the proper positioning of the arm.
- **Medical**—noninvasive diagnostics, permits a physician to view the body's interior without the costs, delays or risks involved through surgery, and includes radiography, telegraphy, nuclear magnetic resonance (NMR), computerized tomography (CT), and positron emission tomography (PET).

  NMR permits the scanning of images of the soft tissues, showing them in sharp relief, as magnetic fields and radio waves create an internal image of a selected portion of the body. CT uses X-rays to achieve images of low-contrast soft tissues. With PET, the body is injected with a small amount of natural substance tagged with a radio active tracer that emits positrons; these react with electrons found in all body cells and allow the tracking of the body's metabolism.
- **Geophysical**—seismic analysis for oil and gas exploration.
- **Graphic arts**—flexible and fast page make-up and plate preparation, automatically combining both text and graphics.
- **Cartography**—up-to-date mapping and revisions.
- **Remote sensing**—analysis of satellite-generated pictures for numerous uses, including weather forecasting, satellite tracking and guidance, ground data systems for spacecraft testing and telemetry.
- **Communications**—news gathering for TV broadcasts and electronic-based systems for generating special effects in movies.
- **R&D**—basic to any effort in electronics.
- **Forensic services**—fingerprint and handwriting analysis.
- **Military**—heart of an electronic warfare system.

The following pages describe some of the component technologies and devices that are requisite for electronic image processing.

Electronic Imaging Technology, Products and Services

This special listing of products and services includes responses to *Information Display*'s request for information on exhibitor participation in this year's Electronic Imaging Conference and Exposition in Boston, October 8-10.

Andus Corp. 1819
Products: Thin-film coatings on polymer subtrates for high technology applications; custom coatings for both prototype and production runs.
Canoga Park, CA (818/882-5744)
For information, circle Reader Service #50

Artek Systems Corp. 1720
Products: Image analysis system that automatically counts and measures objects to provide dimensional information.
Farmingdale, NY (516/293-4420)
For information, circle Reader Service #51

Chorus Data Systems 1618
Products: High-resolution image capture systems for the IBM; 1024 x 1024, 8-bit PC-EYE video capture board and Compressit Board a co-processor unit that increases speed of compression using on-board firmware; and image processing software, true color capture software, IMiGIT series of graphics editing software, and PhotoMail an interactive display, voice and image communications package for image transmission via modem.
Merrimack, NH (603/424-2900)
For information, circle Reader Service #52

Cohu Inc. 1826
Products: High-performance camera models 5200, 5300, 5400, and 1600B; solid-state MOS color TV camera, model 4600; solid-state CCD TV camera; high-resolution digitizable model 8900 TV camera system.
San Diego, CA (619/277-6700)
For information, circle Reader Service #53

Colorado Video Inc. 1311
Products: Model 491 Video Frame Store and Model 493 Video Peak Store. Demonstrations include filtering, grayscale modification, histograms, and pseudo 3-D display. General-purpose frame store, 491, contains four memories and when combined with a Direct Memory Access Digital I/O Module 793, can be used with any computer, ranging in size from an Apple to a VAX. Video memory, 493, is used for electro-optical scan conversion, transient recording, tracking and stroboscopic image recording.
Boulder, CO (303/444-3972)
For information, circle Reader Service #54

Dage-MIT Inc. 1312-14
Products: Series 81 camera featuring 1600 TVL resolution, 40 MHz bandwidths, 0.25% linearity; and HR-2000, 14-in. monitor featuring 2000 RVL resolution, 50 MHz bandwidth, 2 video input channel, 1 data input channel.
Michigan City, IN (219/872-5514)
For information, circle Reader Service #55

Datacube Inc. 1633
Products: MaxVideo line of real-time image acquisition, signal processing, storage, and display modules for the VMEbus. Modular architecture allows vision system manufacturers to select only the functionality needed for their particular application or plug in additional MaxVideo modules to expand functionality. Framestore and signal processing modules can be cascaded for added pixel depth and processing power.
Peabody, MA (617/535-6644)
For information, circle Reader Service #56

Data Translation Inc. 1813-1815
Products: Image processors for the IBM PC (DT 2803) and the MicroVAX II (DT2603); new products for VME bus and IBM PC/AT; and DT2750 graphics board for the Q-bus.
Marlboro, MA (617/481-3700)
For information, circle Reader Service #57

ECRM 1708
Products: Autokon 1000, laser graphics system and PelBox raster image recorder. The Autokon drives the PelBox recorder offering high-resolution output of graphics and text onto film or paper.
Bedford, MA (617/275-1760)
For information, circle Reader Service #58

EEV Inc. 1924
Products: P4320 "freeze frame" variable high-speed exposure CCD cameras designed for applications that include analysis of moving objects; P4313 miniature intensified CCD camera with remote heas; Image intensifiers for night vision, low-light level, surveillance and baggage inspection; LCDs featuring alpha-numeric display models, multi-dot matrix modules, custom and standard displays in twisted nematic and dichroic technologies; CRTs for avionic and medical applications, featuring LD947 and LD957 for Head-Up and Head-Down applications.
Elmsford, NY (914/592-6050)
For information, circle Reader Service #59

PHOTONICS TECHNOLOGY, INC.

PIONEERS AND LEADERS IN THE Design, Development, and Production of AC Gas Discharge Displays

PHOTONICS TECHNOLOGY PRESENTS

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This is the world's first large area, high resolution, non-projected, flat display terminal. Utilizing AC gas discharge plasma display technology, the terminal has an active display matrix of 1600 by 1200 pixels measuring over 39 inches (one meter) diagonally with 5.3 square feet of viewing area and a resolution of 2500 pixels per square inch. All drive electronics are mounted in a 4 inch thick picture frame package around the perimeter of the transparent, thin (0.5 inch) display screen allowing for rear-projected and see-through applications.

Jointly developed by Photonics Technology, Inc., Luckey, Ohio and Magnavox Electronic Systems Co., Ft. Wayne, Indiana.

Photonics and Magnavox are presently completing the development of AC gas discharge flat panel displays ranging in size up to 3 meters with active display matrices up to 4096 by 4096 pixels. Multicolor displays are also being developed.

Photonics is the world's leading developer and manufacturer of sophisticated, high technology AC gas discharge displays. We are able to design and manufacture flat display panels, monitors, and/or terminals in a variety of sizes at relatively low costs. Our flat displays range in size from a few centimeters up to one meter. Some of our standard and custom displays include the following:

Panel Size, Pixels	Resolution, Pixels Per Linear Inch
128 x 256	40, 60
128 x 512	60
256 x 256	60
256 x 512	64
512 x 512	60, 64, 73, 83
512 x 1024	60
1024 x 1024	60, 73, 83
1200 x 1600	50.8, 101

Our standard display resolution ranges from 30 to 100 pixels per linear inch (900 to 10,000 pixels per square inch). Display resolutions up to 200 pixels per linear inch are available.

For Further Information, Contact:

Donald K. Wedding Sr., VP Marketing Photonics Technology, Inc., P.O. Box 432, Luckey, Ohio 43443, 419-666-0033.
Research, Development, and Manufacturing facilities located at 6967 Wales Road, Northwood, Ohio 43619.

For information circle Reader Service #29

Products

EG&G Gamma Scientific 1912/1914
Products: Optical radiation measurement systems (from UV200 nm to far IR 14.5 um) for spectral and spatial analysis of CRTs and other electronic displays, including color graphics computer controlled C-9 spectral/spatial scanning system for measurement of line width/spot size, chromaticity, color temperature, linearity, luminance, and MTF; 880 automatic spectroradiometer system (280-1100 nm) with silicon detector sensitivity equalling that of some PMTs; GS-6020 X-Y precision positioner (20 in motion in X-Y); and GS-1400 ACR (anvis compatibility radiometer).
San Diego, CA (619/279-8034)
For information, circle Reader Service #60

EG&G Reticon 1916
Products: Solid state image sensors K-series available in 128, 256, 512, and 1024 element configurations with 25 micron center-to-center spacing and a 250 micron wide aperture; operating at a clock rate up to 1 MHz.
Sunnyvale, CA (408/738-4266)
For information, circle Reader Service #61

Floating Point Systems Inc. 1305
Products: FPS-5000 family of Array Processors, used in image processing, are upgradeable with peak speeds from 8 million floating point operations per second (MFLOP) to 62 MFLOP, depending on the model; MP32 Multiple Instruction Multiple Date (MIMD) array processor, with up to 7 MW that uses a Motorola 68000 control processor and up to three computational processors, can process a 1K x 1K 2-D complex FFT in less than 2 seconds; and an extensive software library that includes the Advanced Math Library (AMLIB) and the Image Processing Library (IPRLIB).
Portland, OR (503/641-3151)
For information, circle Reader Service #62

Galileo Electro-Optics Corp. 1307
Products: Fiberoptic and electro-optic components spanning the spectrum from 190 nm to 12 um, used in a variety of applications including medical laser delivery systems, robotis, welding and controls; Line Image Digitizer-Glasscan—and bar code reader and detector assembly with CCD camera.
Sturbridge, MA (617/347-9191)
For information, circle Reader Service #63

Gould Inc. Imaging Graphics Div. 1428
Products: High-peformance image processing hardware and software ranging from high-end IP8000 series, suitable for multi-user R&D work and algorithm development, to low-end FD5000 series, providing image processing suitable for production applications, as well as R&D. Applications for either system include remote sensing, medical imaging, non-destructive testing, robotic vision, industrial inspection and simulation.
Fremont, CA (617/465-1130)
For information, circle Reader Service #64

Image Peripherals Inc. 1318
Products: COPYSCAN series of image scanners featuring rapid scanning and high-quality digitization of any standard-sized document containing text, drawings, or photographs, offering resolutions ranging from 120 to 400 dots per inch and handling either A- or B-sized documents; DISPLAYSCAN series of image display terminals offering high resolution, full page viewing of alphanumeric, graphic, and image documents, consists of a 15-in terminal, keyboard, and controller unit and features high resolution—from 120 to 200 DPI, 512 or 1024 Kbytes memory, and standard RS422 interface.
Acton, MA (617/263-4005)
For information, circle Reader Service #65

International Imaging Systems 1411
Products: Image Viewing and Analysis Station (IVAS) provides full 1024 x 1024 display resolution; incorporates 24-bit configurable image memory, four graphic overlay planes, and a 512 x 1024 annotation plane for simultaneous display of image, graphics, and alphanumeric data; offers monochrome and pseudo-color display when processing 12-bit image data, plus true color for 8-bit image data.
Milpitas, CA (408/252-4444)
For information, circle Reader Service #66

International Robomation/Intelligence 1520
Products: Image processing systems feature IRI PCB256 INSPECTOR; printed circuit boards inspector as well as the IRI P256 Vision System that is used for industrial imaging applications.
Carlsbad, CA (619/438-4424)
For information, circle Reader Service #67

Javelin Electronics Inc. 1303
Products: Mini-head color camera, JE-3210M, two-piece, solid state, designed for applications where minimum camera size and weight are important (1½ x 1⅝ x 2¾); Low-Light solid state camera JE-2062IR, black-and-white camera requires a minimum illumination of less than 2 lux (0.2 fc) using a f/1.4 lens; Two-piece Machine Vision Camera JE-2262M, solid state monochrome camera designed to meet requirements of machine vision; External Sync Color solid state camera, JE-3012A, has external sync capability in two modes-separate horizontal, vertical and chroma, or composite "black burst."
Torrance, CA (213/327-7440)
For information, circle Reader Service #68

Kontron Electronics 1923/1925
Products: Family of image processing systems based on a fast-frame buffer with between 1 Mbytes and 128 Mbytes of image memory and a high speed image processor; includes a stand-alone system using a 68000-based host computer and UNIX operating system and a subsystem for existing DEC-hose computers.
Mountain View, CA (415/965-7020)
For information, circle Reader Service #69

Litton Systems Inc. 1631
Products: Precision high-resolution cathode-ray tube for color and black-and-white photo recording; miniature and multi-beam CRTs. (See advertisement on page 8.)
Tempe, AZ (602/968-4471)
For information, circle Reader Service #70

Marinco Computer Products 1917/1919
Products: Line of array processors for the IBM PC, IBM AT, AT&T 6300, and Multibus computers. Array processors allow the micro-computer-based imaging system to perform more intensive image processing applications (such as 2-D FFTs) that were previously done only with the larger computer-based systems. Processors include both interger math and floating point math.
San Diego, CA (619/587-0461)
For information, circle Reader Service #71

MII 1808
Products: Line of TV camera tubes, HR series, that mechanically and electrically fits all standard 1" TV cameras. Gun structure yields 1400+ TV lines resolution with no sacrifice in beam reserve or quality, and is available with several different photoconductive layers, thus allowing a choice of performance characteristics for any application.
Birdsboro, PA (215/582-5361)
For information, circle Reader Service #72

Minolta Corp. 1931
Products: TV color Analyzer II, used to objectively set the white balance in a color monitor; luminance meters, illuminance

1986 SID INTERNATIONAL SYMPOSIUM

CALL FOR PAPERS

The Society for Information Display International Symposium, the only annual global forum devoted to all aspects of information display, will be held at the Town & Country Hotel, San Diego, California, May 6–8, 1986.

AREAS TO BE COVERED

Original papers, **not previously published or presented,** covering all aspects of information display will be presented. The areas of interest include, but are not restricted to:

EMISSIVE FLAT PANELS: Plasma, electroluminescent, vacuum fluorescent and other flat cathodoluminescent displays and materials, light-emitting diodes, backlights.

NONEMISSIVE FLAT PANELS: Liquid crystal, including active-matrix-addressed liquid crystal, electrochromic, electrophoretic, magneto-optic, electromechanical and ceramic displays and materials.

CRT DISPLAYS: CRTs and monitors for entertainment, computer display and specialized applications; flat and miniature CRTs; electron optics including gun and yoke design; CRT materials; high resolution, storage, beam index, high brightness, and multibeam CRTs.

HARD COPY/DISPLAY STORAGE: Printers including ink jet, thermal, electro-graphic, electrostatic and impact systems; plotters; optical disk/video disk; videotape; electronic photography; facsimile.

DISPLAY SYSTEMS AND APPLICATIONS: Computer graphics, high-definition TV, digital TV, teleconferencing, games displays, military/avionics/C^3 display systems, image processing and analysis, automated crew stations/workstations, displays in expert systems, imbedded training.

DISPLAY ADDRESSING/PACKAGING: "Active" matrices including thin-film transistors and two-terminal devices; multiplexing techniques; ICs for display drivers and controllers; interconnection techniques; glass and plastic processing; ruggedized display fabrication.

INTERACTIVE I/O TECHNOLOGY: Interactive displays; input/output devices including touch panel, keyboard and voice-I/O software.

HUMAN FACTORS: Display standards and legislation; display ergonomics, measurement and characterization; visual perception; choice of color, font.

LARGE-AREA DISPLAYS: Projection systems including projection CRTs, light valves, lasers, optics and screens; message boards and mosaic displays; simulator displays.

ABSTRACT DEADLINE

The deadline for receipt of abstract and technical summary is December 9, 1985. Please follow the guidelines on reverse side precisely.

LATE-NEWS PAPERS

A limited number of 20-minute late-news papers, reflecting important new developments, will be considered if a 500-word summary, with pertinent illustrations, suitable for publication, is received by February 24, 1986. Call Hildegarde Hammond for further information (telephone: (212) 620-3388).

FURTHER INFORMATION

All questions or inquiries for further information regarding this meeting should be directed to one of the following:

Mark Goldfarb
Symposium Coordinator
Palisades Institute for Research Services, Inc.
201 Varick Street
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Thomas L. Credelle
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RCA Laboratories
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(609) 734-3128

Allan R. Kmetz
Symposium Program Chairman
AT&T Bell Laboratories
600 Mountain Avenue
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Murray Hill, NJ 07974
(201) 582-6179

Jay Morreale
Exhibit Manager
Palisades Institute for Research Services, Inc.
201 Varick Street
New York, NY 10014
(212) 620-3371

meters, and chroma meters to determine color temperature of a CRT.
Ramsey, NJ (201/825-4000)
For information, circle Reader Service #73

New Media Graphics Corp. 1731
Products: A line of interactive graphics display generators including PC-Video Graph, a single-board that installs in the IBM PC, XT, or AT offering high resolution graphics; PC-GraphOver, 2-4 board set for IBM PC, XT, or AT offering, up to 4,096 simultaneous colors at a 640 x 400 resolution, plus the ability to merge graphics overlays with video background coming from videotape, videodisc or TV camera; GraphOver 9500, on a rack-mountable chassis, works with any computer and offers high-speed graphics at a 768 x 484 resolution, plus the ability to merge graphics and video backgrounds.
Burlington, MA (617/272-8844)
For information, circle Reader Service #74

Number Nine Computer Corp. 1405-1407-1409
Products: REVOLUTION 512 x 32 graphics board, a 24-bit image buffer available for the PC; REVOLUTION 1024 x 8 graphics card with four times the resolution of the original 512 x 8 board; and image processing software for R&D environments.
Cambridge, MA (617/492-0999)
For information, circle Reader Service #75

Numerix Corp. 1718
Products: High-speed array processors; MARS-432, a 32-bit floating-point array processor for such applications as medical, seismic, scientific, and signal processing applications, provides direct addressability of up to 16 million words (64 Mbytes) of data memory and direct access to high-speed internal data base. Computational power is 30 Megaflops; computation of a 1024 point complex FFT in 1.7 ms, DMA transfers at I/O bus rates of 20 Mbytes/sec, two data memory reads or one write every 100 ns, and paged memories for uninterrupted processing during I/O transactions.
Newton, MA (617/964-2500)
For information, circle Reader Service #76

Photometrics Ltd. 1434
Products: Line of products includes cryogenically- and Peltier-cooled CCD cameras with resolution up to 2000 x 2000 pixels, having digitized output range from 12 to 16 bits; data acquisition and image processing 68000 computer for use with any of the family of slow scan camera heads.
Tucson, AZ (602/623-8961)
For information, circle Reader Service #77

Photonics Development Corp. 1817
Products: PIAS, stand-alone photon-counting image acquisition system that detects and displays individual photons (fundamental particles of light) in real time as well as carry out follow-up image processing or analysis. PIAS image is a 3-stage microchannel plate detector with a silicon position sensitive anode. Various types of imagers are available to detect X-ray, XUV, VUV, and visible photons, as well as charged particles. Applications include stelight measurements, micro and macro biological fluorescence, and laser spectroscopy.
Middlesex, NJ (201/469-1171)
For information, circle Reader Service #78

Photo Research 1424-1426
Products: PR-719/M Spot SpectraScan Fast Scanning SPATIAL Scanning System designed specially for CRT Line Width Measurements using the fast scanning capability of the PR-703A/M Fast Scanning System.
Burbank, CA (818/843-6100)
For information, circle Reader Service #79

Pulnix American Inc. 1427-29
Products: Line of video cameras for industrial imaging systems feature high resolution (384 x 491 h,v pixels), can interface to any image processor or automatic inspection device; cameras can be synced to a computer, mounted on microscopes, in covert conditions, on mobile units, and replace current tube-type cameras.
Sunnyvale, CA (408/733-1560)
For information, circle Reader Service #80

Roy Ball Assoc. 1431
Products: IBM PC-based image analysis system performs functions such as filtering, geometric classification, transforms, pattern recognition, restoration; upwards compatible with proved mini-computer software; full range of supported peripherals and hardware options; standalone or intelligent work station option.
Ottawa, Ontario, CN (613/226-7890)
For information, circle Reader Service #81

Sierra Scientific 1807-1809
Products: HD-1200 series of video display monitors for critical monochrome, grayscale imaging systems, featuring 40 MHz bandwidth, automatic horizontal line rate lock, adjustable glare hood on all cabinet models, and 1% specifications on geometry and video and size stability. Models available in 12-in., 15 in., and 20 in. screens for benchtop, rackmount, or open frame for incorporation into other equipment. Videomega high-performance television camera optimized for digital imaging in industry, medicine, and the laboratory, featuring switchable scan rates of up to four per camera, selectable bandwidth of 3 MHz to 30 MHz. High signal-to-noise ratio of up to 60-db and comprehensive digital remote controls.
Sunnyvale, CA (408/745-1500)
For information, circle Reader Service #82

Star Technologies Inc. 1634
Products: Strategic Defence Initiative Radar Imaging System, Medical Imaging System and other systems including ST-100 and ST- PSP array processors.
Lexington, MA (617/862-2111)
For information, circle Reader Service #83

3M Imaging Systems Div. 1536
Products: Dry Silver papers and films for high-quality recording, are exposed with conventional electro-optical sources and processed entirely by heat without the solutions, ink, or toners that characterize traditional imaging/processing technologies. Designed for spectral sensitivities with resolution greater than 150 line pairs/mm for paper and 250 line pairs/mm for film.
St. Paul, MN (612/733-1056)
For information, circle Reader Service #84

Toko America Inc. 1811
Products: Video frame storage devices, with inputs usually NTSC or PAL with parallel computer interfaces available for sophisticated processing requirements, includes DR 72 single-or-dual frame Microfreezer, SK1600X B/W strobed high-speed analysis system, and VFM-101 B/W frame memory.
Mt. Prospect, IL (312/297-0070)
For information, circle Reader Service #85

Trek Inc. 1814
Products: Complete line of instruments for electrostatic measurements, largely for characterization of photoreceptors used in electrophotographic copying machines and computer printers.
Medina, NY (716/798-3140)
For information, circle Reader Service #86

Vickers Instruments Inc. 1416-1418
Products: Joyce Loebl Color Scandig, a high-resolution drum scanner densitometer, providing full color simultaneous scanning in both reflection and transmission modes and digitizes analog data from films, photographs; Laser Color Writer, provides fast, accurate and high-resolution image reproduction.
Malden, MA (617/324-0350)
For information, circle Reader Service #87

Expert systems help strategists win in inimical domains

Planning in *friendly* domains is relatively straightforward, and has been done with such systems as PERT, on conventional computers, for more than 30 years. Hitches frequently occur, such as schedules slip, shipments are lost, the weather changes, but thorough planning can provide for these "routine emergencies" and corrective actions can be applied.

Inimical domains, on the other hand, involve opponents intent on upsetting your carefully laid plans. They are far more complex, especially in the great variety of possible opponent responses, and the radical shifts in possible outcomes that each response causes.

It appears now that expert systems technologies are ideally suited to tackle the kind of fast-changing planning required for success in an unfriendly contest (such as military strategizing). Expert systems form a branch of Artificial Intelligence science. AI seeks to endow computers with human-like abilities, from the ability to speak and understand human language, to the ability to learn from experience. Specifically, expert systems are aimed at simulating the endowments of a human expert, including wide-ranging knowledge, well-analyzed experience, and the ability to apply that experience to situations and thereby predict their probable outcomes.

In the Artifical Intelligence Research branch at Texas Instruments, Rajendra S. Wall and a team are developing an expert system that will help teach humans to plan successful strategies in many inimical domains. The first system they've constructed is called the "Command, Control, Communications and Intelligence (C^3I) Testbed." The name has a military sound, but the general principles and computer programming being developed can be applied just as well to competition in research, business, sports, games, and medicine.

The system at TI presently runs on multiple LISP machines. LISP, the language favored by researchers working with expert systems, is structured primarily to handle the symbolic reasoning necessary to work with words and ideas, in contrast to conventional computer languages that are structured to manipulate numbers.

Conflict situation

One application that's typical of a large category of problems that can be solved with the help of an expert system is a military conflict. Each player in the conflict sits at a LISP machine and commands a squad of soldiers fighting in a small city.

There are two common ways to approach such a conflict. An inexperienced sergeant can search through his imagination for every possible response to the enemy's latest action, guess ignorantly about the possible outcomes, and finally choose the tactic that seems best. This approach was taken all too often during the War Between the States, at all levels of command on both sides, and tragically prolonged the war.

In contrast, an experienced sergeant, or one who has been thoroughly trained to profit from the cumulative well-analyzed experience of others, can quickly appraise the situation, consider the few most-likely moves, and choose the one most likely to succeed. This is the approach that C^3I will be able to teach. Just as great military teachers have done, C^3I analyzes the historical conflicts in its experience bank. Such experiences are input to the system's knowledge base by human domain experts, who abstract the experiences and classify them for retrieval by the system as it needs to apply them to new situations.

A look at some of the classes of experience, and familiar examples, will help explain how C^3I coaches:

- **Start-up**—experiences are short, sharp, and simple. The attack on Pearl Harbor, for example, might teach the advantage of surprise. It could also teach the benefit of elementary preparedness, and show from other experiences how easily picket ships cruising offshore could have given early warning to blunt the attack.
- **Reference experiences**—are much more complex. As in all classes, failures are analyzed as well as successes. Napoleon's plan for Waterloo—dividing the Allied and Prussian forces, then defeating them separately—might be used as an experience to illustrate problems of confronting two opposing forces.
- **Model experiences**—are sets of events that have happened so often in such similar ways, that the lessons learned are classic. The problems of a frontal attack against a well-fortified defense, for example, can be abstracted from experiences of the French knights at Agincourt, the charge of the Light Brigade at Balaklava, and the French warfare of World War I.
- **Counter-example experiences**—are taught only after "Mocel" principles are well-learned. Counter-examples teach why "Model" experiences sometimes fail, or why violations sometimes succeed. Lee's division of his forces at Chancellorsville was a violation that worked. So was MacArthur's unorthodox choice of Inchon for an amphibious landing.
- **Anomalous experiences**—is a classification that holds new tactics awaiting analysis. Although most of the tactics employed in Vietnam were centuries old, complex combinations of modern weapons occasionally give rise to new tactical opportunities.

C^3I also has many capabilities for relating these experiences to the situation under discussion, and for explaining the relationships using text, maps, and graphs.

For information, circle Reader Service # 15

(Article developed from Artificial Intelligence Letter, Texas Instruments Data Systems Group, Austin, TX)

For information circle Reader Service #47

President's Message

SOCIETY FOR INFORMATION DISPLAY
8055 West Manchester Avenue-Suite 615
Playa Del Rey, CA 90293 - 213/305-1502

Your Journal has been notified by ASAE (American Society of Association Executives) that ". . . the judges (of ASAE's Gold Circle Awards for Association Magazines) have selected (ID) for display at the ASAE Management Conference, November 3-6, 1985, Boston Marriott Copley Place, Boston, MA." Although ID did not win a trophy, the judges cited the publication for its excellence.

This recognition among Association publications, reflects your Board of Directors committment to provide the SID membership with a professionally designed and edited Journal that is both technically informative and literally interesting.

Our editorial staff's efforts are to be commended and most certainly merit your continuing support—both readers and advertisers alike. Only with a sound advertising base will they be able to continue to meet the editorial needs of the reader. And, only with a strong reader involvement will they be able to continue to provide the editorial content demanded by the membership and anticipated by the advertiser.

I urge every Chapter Chairman to conscientiously send to ID's Editor, Joe MacDonald, timely reports of Chapter meetings and activities that the SID membership should be aware of. And, I exhort every member of SID to submit at least one technical paper or article on your particular activity in the display industry so it might be considered for future publication.

The success of ID can only continue through a team effort. Together, we can further improve our Journal, increase the recognition our Society deserves and, maybe next year, win that trophy.

Ifay Chang

Chapter Notes

Japan: July 11, 1985
Topic: Report on SID 1985 International Symposium.
This meeting was held jointly with the Image Display Group of the Institute of Television Engineers of Japan, and with the BCCE Group of IEEE, Tokyo Chapter.
At the Chapter's Annual Meeting the following members were approved as the 1985 FY SID Chapter executive committee members:

Chairman: Shunsuke Kobayashi
Tokyo Univ. Agri. Tech.
Vice Chairman: Chuji Suzuki
Sharp Corp.
Secretary: Shigeo Mikoshiba
Hitachi Ltd.
Secretary-Elect: Minori Yokozawa
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Sony Corp.
Program Chairman: Hejjyu Uchiike
Hiroshima Univ.
Newsletter Editor: Shigeo Mikoshiba
Hitachi Ltd.

UK & Ireland: September 4, 1985
Chapter Committee reported out, among other business, the following meetings:

- November 26—Applications meeting to be hosted by Plessey, will cover plasma panels in a rugged environment (Plessey); consumer displays for the future (Philips); vehicle displays, how to pack more data on a small display (Electronic Facilities Designs); human factors and IDRC, San Diego feedback.
- Late February 1986—Large-area displays meeting.

Books

The Design of Interactive Computer Displays: A Guide to the Select Literature

Edited by Kate McGee, Catherine Matthews, The Report Store (1985) 618 pp., $125 ($95, prepaid)

A reference tool for practicing display designers—both those concerned with hardward and those working in software development—this book provides a comprehensive guide and quick reference to a diverse collection of pertinent literature brought together from many disciplines.

The guide is intended for personal use by all engineering and design professionals involved in, or interested in, any aspect of the design of displays for interactive computer systems. It will also prove useful for those in management positions in organizations concerned with the quality of computer displays: such as human factors researchers, perceptual psychologists, and graphics professionals.

The focus of this collection is information applicable to the design of interactive computer displays—more specifically, to one or more of three aspects of display-interface design: the equipment and its limits and potentials, the information itself, and the user's constraints and capabilities. Primary sources of the collection are the literatures of engineering technology, computer graphics, graphic arts, cartography, mathematics, statistical graphics, human factors, human engineering, and perceptual and cognitive psychology, each of which brings a particular perspective to bear on design issues.

Engineering technology and computer graphics—work included here is primarily basic technical information on the operating characteristics of display devices. For computer graphics there are, as well, several widely used texts, reports from workshops, and a number of dissertations that are regularly cited in the literature.

Graphic Arts, Cartography, Mathematics and Statistical Graphics—these selections address the issue of information presentation. A number of works from the graphic arts deal with the presentation of complex information in a combined picture-text or picture format. The titles from cartography approach the problem of presenting large amounts of abstract data in a concise and readily comprehensible form. The texts on statistical graphics deal specifically with the analysis of data and its presentation in tabular, chart or graph form. The works on mathematics are of two kinds: some, such as the titles on fractals and hypergraphics, describe material that forms the basis of many graphics algorithms; others have been included because they stimulate visual thinking or because they can be used to generate graphics algorithms.

Human Factors, Human Engineering, Perceptual and Cognitive Psychology—works treat user capabilities and constraints as these relate to the design of the interface. Since displays are visual interfaces, the titles selected emphasize visual perception and processing and task performance in response to visual stimulation. In addition to standard works on vision a number of technical reports in the collection describe research projects on displays and visual performance.

THE REPORT STORE, 910 Massachusetts St., Suite 503, Lawrence, KS 66044 (913/842-7348)

Application Programming in IBM Basic

by Bruce Powell Douglass, Chilton Book Co. (1985) $29.95.

Written for IBM PC programmers, this book shows beginners and experienced programmers alike how to combine BASIC statements and functions into well-designed applications programs. It describes not only what BASIC statements do, but how to make them work in developing a program, providing a thorough grounding in correct programming techniques. The book also contains numerous utility programs for such tasks as stacking, linking lists, shell sorting, binary searching, hash functions, random access file compression, polynomial evaluation, debugging, and program cross-referencing.

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Azusa, CA 91702
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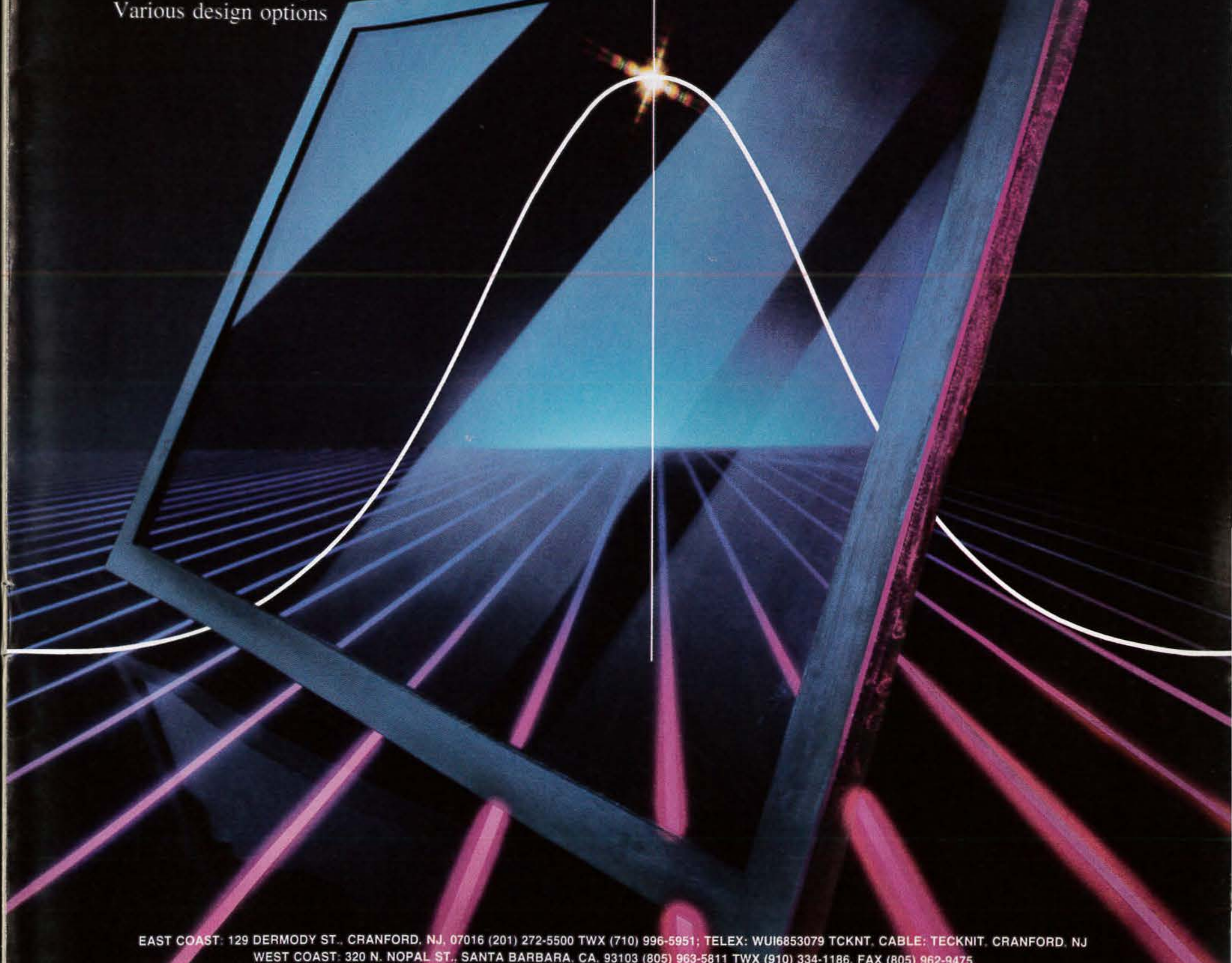

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