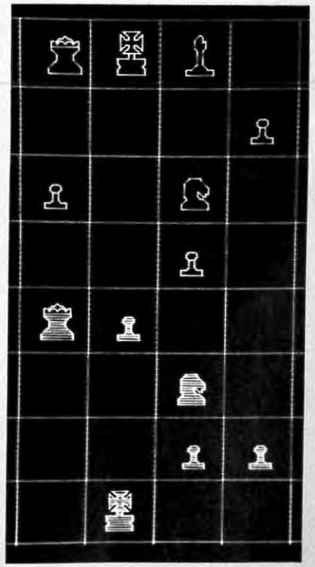
SID JOURNAL

The Official Journal of the Society For Information Display



A Low-Cost, High-Performance Constant-Velocity Vector Generator
By LEONARD F. HALIO

1974 SID International Symposium-Exhibition

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The 1974 SID Symposium in the Abstract

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SID Session at AFIPS Draws 400
By ARTHUR D. HUGHES

INTERNATIONAL SYMPOSIUM

vol. 11, Number 4 July / Aug.-1974

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PRESIDENT'S MESSAGE

In the September/October 1972 issue of SID JOURNAL, Dr. Carlo P. Crocetti, the then incoming President and my immediate predecessor in this office, summarized the objectives of the Society. The highest priority at that time was assigned to the establishment of our Proceedings as a truly professional and archival vehicle of display technology, and the consistent publication of the SID JOURNAL as a quality magazine.

The progress which has been made toward achievement of these goals reflects Dr. Crocetti's effective leadership. SID's position in terms of publications and symposia has been consolidated. Our institutional subscriptions are increasing. Competition has grown steadily to have papers accepted for presentation at our International Symposia, our technical meetings and for our publications. Concomitantly, so has the caliber of SID's contribution to the technological community which supports us. We have not "arrived", and we never will because there will always be room for improvement. But we certainly have come a very long way.

With this firm foundation to build upon, we can now afford to extend our horizons into areas which we have always espoused but have never been able to pursue with the necessary concentration. These are (1) interaction with the academic community, and (2) true "internationalization" of SID.

Professor Herbert Freeman of New York University, our new Academic Committee Chairman, has been authorized to establish an awards program to stimulate the generation of top quality technical papers in display technology and related disciplines among graduate students. Annual cash prizes will be awarded to the three best papers. Details will be published in a forthcoming issue of the JOURNAL.

With the assistance of Joe Markin, General Chairman of the 1975 SID International Symposium, a Far-Eastern Program Committee is being established in Japan to solicit papers and assist authors in preparing their presentations for SID's Symposia. England's IEE 1976 Conference on "Displays for Man/Machine Systems" will be actively supported by SID. Improved communications with our foreign colleagues is vital, particularly at a time when such substantial technological break-throughs are being achieved everywhere. Concurrently, we continue to participate, as appropriate, in nationally recognized programs.

These undertakings are making significant contributions to the quality of our publications and technical meetings, at chapter levels as well as nationally. As the Society's image is enhanced so is its impact on the community and the recognition afforded those who participate in its activities.

Robert C. Klein
President

a low cost, high performance constant-velocity vector GENERATOR

By LEONARD F. HALIO
Digital Equipment Corp.
Maynard, Massachusetts

The author describes an inexpensive, flexible device which fullfills basic requirements — and aids the "awesome task" of graphics programming.*

☐ The need for graphics in computation systems is becoming more widespread and necessary as the amount of data to be understood increases and the level of sophistication of the user decreases. To meet this challenge, engineers must implement both an inexpensive, yet functional and flexible device that fits into a system of almost any level of complexity.

Basic Goals

The technique chosen should meet some basic and universal goals. The vector method selected must draw fast, be stable with time and temperature, and be easily manufactured and tuned. And, most importantly, it

Graphic system utilizing the vectoring technique.

A patent has been granted on the system described by Mr. Halio, No. 3,800,183,* **Display Device with Means for Drawing Vectors, *with Mr. Halio and Herve Lavoie as co-inventors.*

By LEONARD F. HALIO

should aid the awesome task of graphics programming. An important example of aiding programming is when using relative vectors. For vectors to be specified by an absolute screen address, subroutined picture elements, (desired to save core memory) would be difficult as different screen addresses are required when using these subroutine pictures. If a picture element is to be moved dynamically each vector in the dynamic picture element must be recalculated. However, by allowing relative vectors (where the starting point is the end point of the previous vector) both of these problems disappear. Subroutines pick-up from where the last vector ended before entering the next subroutine. To move picture elements (or the entire picture) would require changing only the first vector, since all subsequent vectors will be drawn relative to it.

Vectoring Techniques

Vectoring techniques fall into two broad classifications:

(a) incremental
(b) stroke

The incremental technique draws vectors by a series of closely spaced points. This allows simple generator design and very accurate graphics but suffers from one important drawback: speed. Because of the wide bandwidth and fast settling times required of the CRT monitor, only relatively slow vectoring speeds are obtainable at a reasonable cost. Stroke vectoring inputs continuous linear voltages representing the vectors and therefore, requires much less bandwidth for faithful reproductions. The stroke technique can again be divided into two classes: Constant Time and Constant Velocity.

Constant time techniques use the same amount of time for both long and short vectors. (See figure lc). This produces a noticable intensity variation between vectors of different lengths, and intensity correction is a must. Further, constant time vector generators do not provide a natural match to the "constant velocity" characteristic of the CRT monitor it must drive.

The above shortcomings are not present in constant velocity generators. Since vectors are drawn with a constant velocity, intensity variation is unnoticeable and short vectors take proportionately less time than long vectors. As shown in Figure 1, the constant velocity generator is a more natural forcing function to the typical characteristics of the CRT monitor than that of the constant time generator.

Although a constant time generator is often a simpler system to augment in hardware, (i.e., two integrators driven from voltages representing the slope components,) excellent constant velocity vector generators of straight-forward design are also possible. Described herein is such a constant velocity generator, meeting the afore-mentioned goals, plus some additional features.

The Basic Generator

The display generator shown in figure 2 draws vectors at an approximately constant velocity (diagonals are $\sqrt{2}$ faster than normal vector components) and has as extra features: infinite position storage time, and no cumulative error buildup in relative vector drawing modes. The generator takes direction and magnitude data as shown in figure 3. Three bits decode into one of eight directions, while the latter part of the instruction gives the magnitude of the vector, 10 bits is typically a full screen movement. The vectors are taken to be in relative mode, so the starting position is the end of the previous vector. The Δ portion of the instruction therefore, gives the size of the vector to be drawn and the "DIR" bits tell the angle in which to draw. An intensity bit is also provided to draw the line visible (unblanked) or invisible (blanked).

The vector generator consists of a constant velocity ramp generator, a comparator, precision analog switches, analog summers, logic adders, registers, and three digital to analog converters (DACS). Two of

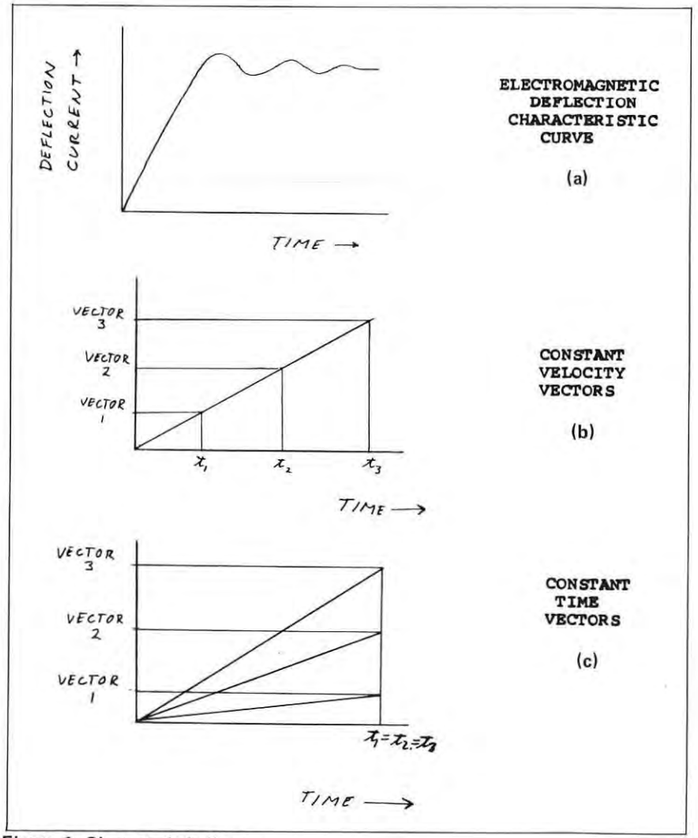

Figure 1. Characteristic Curves

the DACS hold the current beam position and the third DAC (Δ DAC) converts the magnitude (Δ) of the desired vector into a unique voltage for comparison. A constant velocity ramp is continuously compared to the Δ DAC. When the linear ramp equals the voltage, the comparator switches states, resetting the ramp generator. The DIR bits have previously been decoded to set the proper analog switch or switches coupling the generated ramp to the analog summers, thus deflecting the beam of the CRT in a constant and linear fashion in the desired direction. Position DAC's connected to the summer hold the starting point, which is the end point of the previous vector.

Meanwhile, logic adders have added the Δ portion of the new vector to the end position of the previous vector resulting in the new Digital end positions, $X_{old} + \Delta$ and $Y_{old} + \Delta$, to be stored in the X and Y registers. When the ramp equals the voltage representing the magnitude of the vector, a pulse is produced, zeroing the ramp generator and updating the X and Y position DAC's with the new end points stored in the X and Y position registers.

A unique combination of analog and digital logic provides many of the features of this system. Since the end point position is continuously updated and stored in a digital register, the vector generator is not subject to the drift and instabilities of an all analog system. In fact, there is no limit to the number of relative vectors since their positions are updated absolutely after each vector is drawn.

It would seem that a display, having only eight direction capability, would be severely limited. However, such is not the case. Exceedingly complex pictures may be display by this system (see figure 4). If an occasional vector of arbitrary angle is required, it may be generated by a software algorithm using the basic eight direction vectors to compose it. Nevertheless, extending the above

By LEONARD F. HALIO

system to one capable of generating vectors of any angle is not difficult.

Drawing Arbitrary Angles

The problem of drawing arbitrary angles is in finding a computation element and technique that will accept the ΔX and ΔY slope information as presented in the instruction format of figure 5 and still allow all the advantages of the basic generator, including substantially constant velocity vectoring. The element chosen was the multiplying digital to analog converter (MDAC). Choice of a DAC allows simple interfacing, tune-up, and excellent stability of the resultant generator.

The MDAC is little more than a variable gain amplifier, where the gain is set by the binary word appearing at its digital input terminals. The

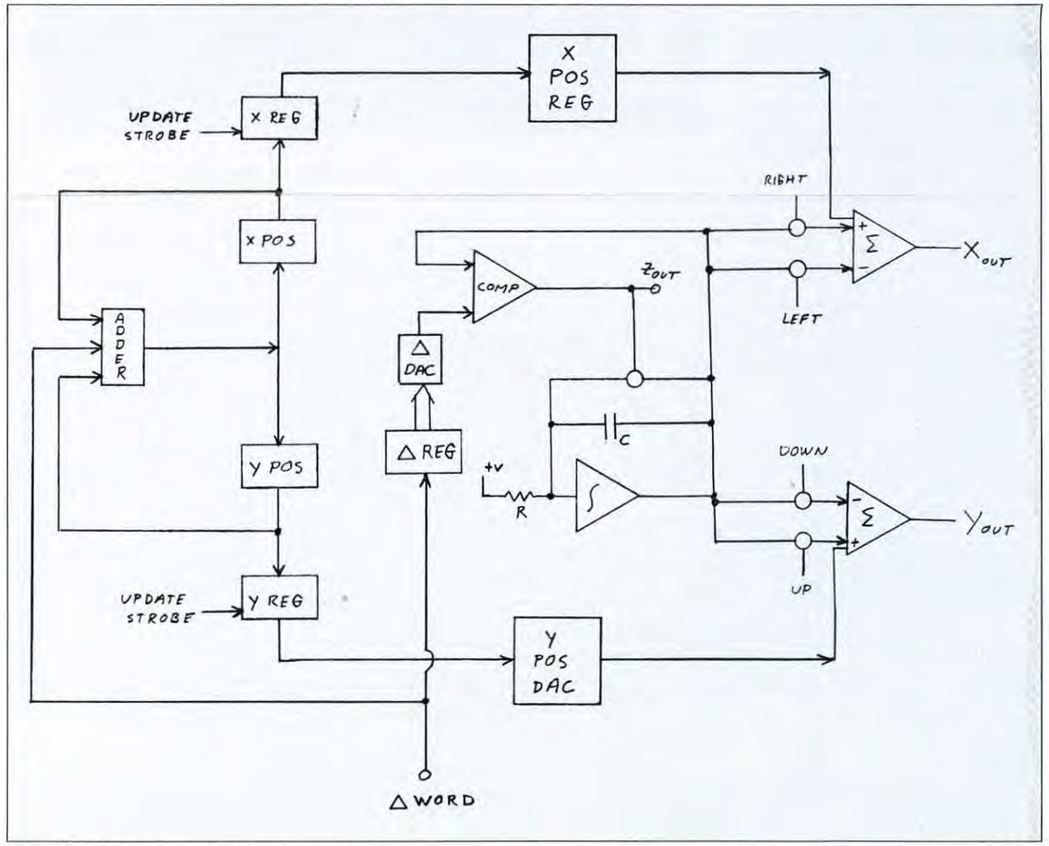

Figure 2. The Basic System

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reference input to the MDAC, instead of being a precision DC voltage, is usually some function waveform, in our case a ramp. The output of the MDAC is the binary fraction present at the digital input, times the reference input waveform. Slopes are modified by inserting the MDAC's (one for each axis) between the ramp generator and the analog switches as shown in simplified form in figure 6. The ΔX and ΔY slope information is presented to their respective MDAC digital input terminals and to a digital comparator, which indicates the larger slope component. An analog switch selects the larger slope for feedback to the analog comparator for comparison with the Δ DAC voltage. However, loading the raw ΔX and ΔY slope data into the MDAC registers will not yield a constant velocity vector. The reference input to the MDAC's will always go to its maximum value because the outputs will become attenuated by a factor equal to the ΔX and ΔY slope data. What we have here then is essentially a constant time system. To convert this system to a constant velocity system requires only a simple normalization algorithm. First the ΔX and ΔY data are shifted left together

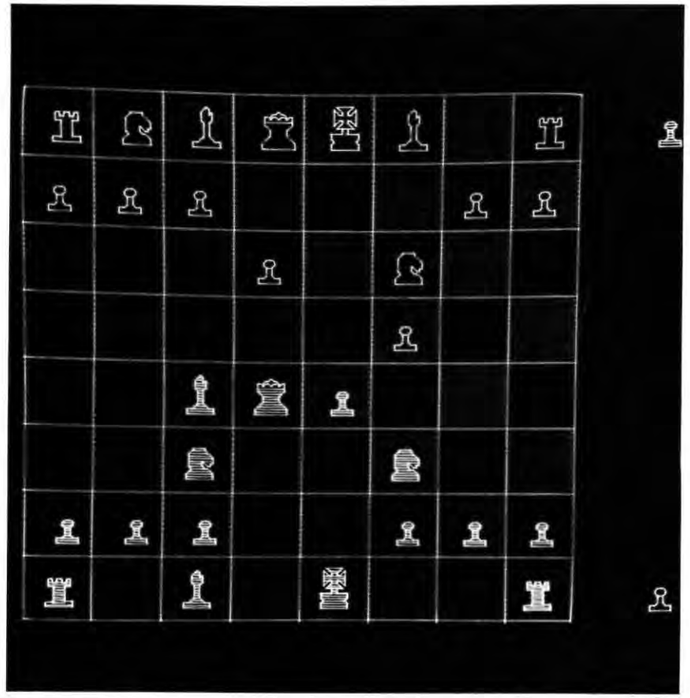

Figure 4. An example of basic vector operation capability. This picture is executed in less than 15ms.

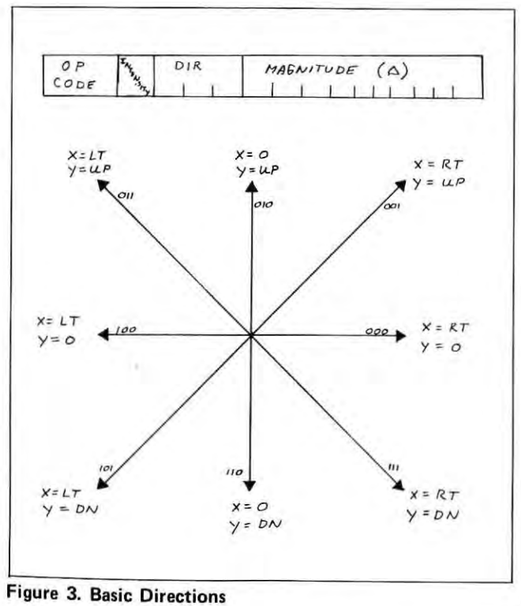

Figure 3. Basic Directions

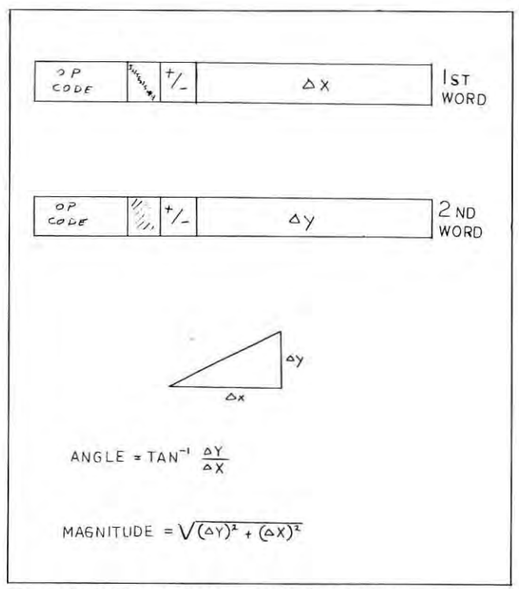

Figure 5. Arbitrary Vector Instruction Format.

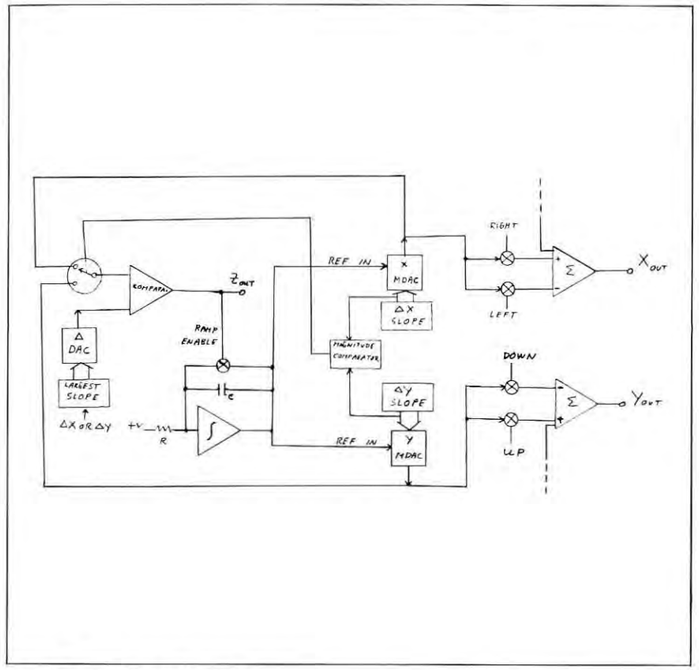

Figure 6. Arbitrary Vectors

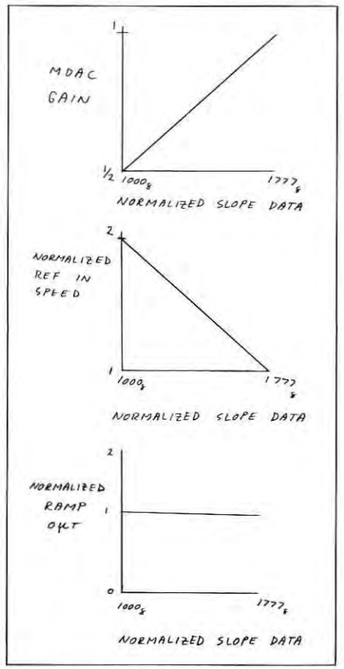

Figure 7. MDAC Gain Compensation

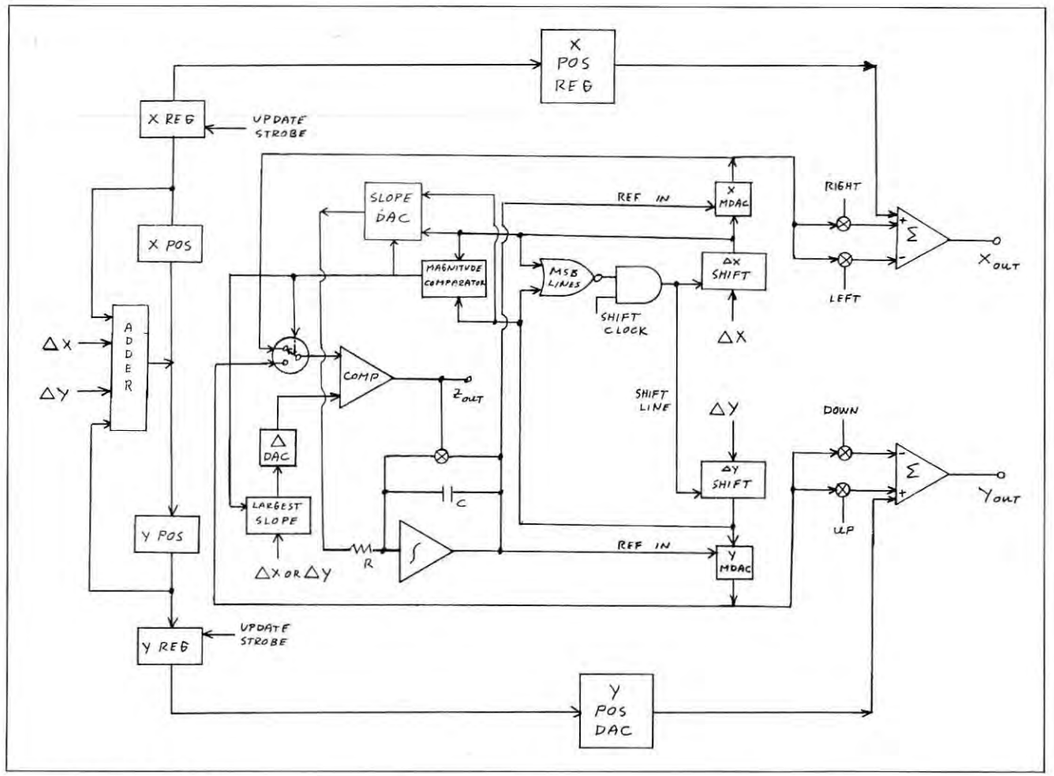

Figure 8. The Full System

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until a leading binary "one" is sensed in the most significant bit position of either slope register. This shifting operation reduces the deviation from the ideal constant velocity vector to a 2 to 1 ratio at the worst case. That is to say the speed differential between two worst case chosen vectors would have one going twice as fast as the slowest possible vector. To correct for the remaining error, the high order bits of the larger slope are fed into a "slope DAC" and this voltage modifies the velocity of the ramp generator. For example, the worst case attenuation occurs when the larger slope has a bit pattern equal to a one in the MSB position and zeros in all other bit positions. With this pattern the MDAC is running at one-half gain. All other patterns go from greater than one-half gain to full gain. The MDAC gain versus slope data is shown by the solid line of figure 7. When the 1000_8 slope pattern is detected, a sufficient voltage is returned to the ramp generator to double the speed of the ramp. Since the MDAC has a gain of one-half and the reference input has a speed of two times the normal, the resultant output is equal to the constant velocity speed. The ramp generator speed variation versus the slope data is shown by the dashed line of figure 7. The composite of the gain error and the speed correction yield a constant velocity output for all values of slope input. The completed generator is shown in figure 8.

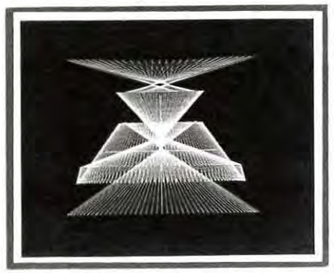


Fig. 9. A pattern of arbitrary vectors drawn with the generator of Figure 8.

Conclusion

High performance, constant velocity vector generators of simple and reliable design, are indeed possible. Extremely good results have been recorded by using these vector techniques. The generators have been incorporated into commercial display systems, many of which are in continuous use in the demanding areas of computer aided design and simulation. □

about the author

Leonard F. Halio graduated with honors from Lowell Technological Institute in 1967 with a BSEE, later obtained an MSEE from Northeastern University. Shortly after graduation he joined Digital Equipment Corporation in the area of Graphic Systems Development. His first project consisted of a high speed character generator for DEC's 338 display. Later he took project responsibility for a new 18 bit high speed stroke vector display system centered around the PDP-15 computer. During this project, he became a group supervisor, responsible for all PDP-15 graphics. Mr. Halio currently is an engineering manager within the Lab Data Products Group, responsible for Graphic Systems Development.

1974 SID International Symposium-Exhibition

Over 65 reports by more than 200 specialists from the U.S. and abroad, disclosing the spiralling worldwide developments in information display, were presented at the 1974 International Symposium and Exhibition of the Society for Information Display, held May 21-23 in San Diego, at the Town and Country Hotel.

A total of 934 persons registered for the 1974 meeting. They included both members of the Society for Information Display and nonmembers. Many of the latter, a total of 153 in all, signed as members of SID during the symposium. The registration compares favorably with that at other recent annual symposiums, SID spokesmen said.

The significant US/overseas strides made during the past year were underscored by speakers from industry, government and universities during 14 sessions. Europe and the Far East were represented by papers from Germany, England, France, Holland, Hungary and Japan.

Areas covered included laser-holographic-3D displays, computer interactive systems, and display quality and human perception.

The formal opening of the meeting was keynoted by an address on the fascinating history of the color picture tube, by E.W. Herold.

First appraisals of progress here and in France and the Netherlands in video disc technology were offered at the symposium. Topics included systems using photooptical video disc, transmission-mode optical video and optical readout / optical tracking techniques, advancements which will eventually be used to produce equipment for home, industry and education.

The major role played by information display in visual flight simulation was revealed for the first time at the meeting. Talks covered computer-generated TV imagery, pilot training and the future of simulators. Assessed were display and generation of visual images from TV camera/model setups and the potential of digitally-stored 3-D environment models, illustrated by installations at jet training schools.

Fiscal conservatism made headlines at the 1974 Symposium. Core of the often-outspoken differences of opinion voiced was the panel on "New Display Technologies: Assessments and R&D Investment Strategies," chaired by Dr. James Becker, principal scientist, Xerox Information Systems.

Attention was called during this panel session to the fact that a "rush" into newer display technologies in the recent past had resulted in considerable financial losses. Two spokesmen from Bell Labs, Drs. Eugene Gordon and Lawrence Anderson essentially favored using CRTs for large area displays. The two panelists had published a paper implying that display outlays ought to be made on existing, proven technologies rather than on still-undeveloped display media.

Dr. Becker thought that R&D cutbacks represented overreaction to some manufacturing "washouts." He did say that in the past some manufacturers had hurried into production with too wide a variety of display technologies. Becker gave his view:

"I personally would hate to see early exploratory work on new techniques cut back . . . It's important to the future of display development that funds for research and exploratory development be continued and probably increased."

Dr. Gordon, on the other hand, said "There are grosser misuses of R&D money in the display field than in many other areas."

The support accorded CRTs by Drs. Gordon and Anderson was joined in to some extent by Irv Reingold, of the Display Device R&D Technology & Devices Lab, Ft. Monmouth. He said he agreed with the Bell Labs people to the extent that he sees no strong competitor in sight for CRTs "but electroluminescent displays have come around."

Another panelist, Peter Brody of Westinghouse Research Labs, voiced faith in solid-state displays.

Egon Loebner, Hewlett-Packard research advisor, gave his opinion that LEDs would eventually replace CRTs for large-area purposes. The session appeared to represent a clear split

Robert C. Klein, named President of SID, addresses Symposium.

Robert C. Klein, of Kollsman Instrument Corp., Syosset, N.Y., was elected President of the Society for Information Display at the organization's Annual Symposium at San Diego in May. He succeeds Dr. Carlo P. Crocetti, of Rome Air Development Center, Griffiss AFB, N.Y.

Other new SID officers are: Vice President, Erwin A. Ulbrich, of McDonnell-Douglas Astro, Huntington Beach, California. Secretary, Thomas A. Curran, of Information Displays, Inc. Treasurer, Bernard J. Lechner, of RCA Laboratories, Princeton, N.J.

Carlo P. Crocetti, outgoing national President of SID, opens business session at 1974 Symposium.

H. Gene Slottow, General Chairman of 1974 Symposium, opens session of meeting.

Program Chairman Sam Stone welcomes registrants.

At luncheon together left to right, T.V. Curran, R.E. Thoman, H.G. Slottow, W.D. McElroy and new President of SID, R.C. Klein.

At luncheon are outgoing President of SID Carlo P. Crocetti, S. Stone, E.A. Ulbrich, B.J. Lechner, R.C. Knepper, E.B. Herron

1974 SID International Symposium-Exhibition

between the advocates of spending for established technologies and the spokesmen for thin-films, LEDs, electrophoretic, electroluminescent displays and other media, who advocated more expenditures for R&D in these areas.

Chairman Becker said he felt that panelists and audience would have concurred that "caution" is in order.

In a luncheon address by the Chancellor of the University of California-Davis, Professor W.D. McElroy, the unique possibilities of bioluminescence offering light without heat as a viable source of information display was presented.

The popular in-depth two-day seminars, introduced at SID 72, also were present at this year's meeting, held the day before and the day after the regular symposium sessions. Under the cosponsorship of the University of California-Berkeley and SID, eight lectures were offered on hardware for information display and display systems. Talks were given on matrix displays, optics, integrated circuits, interactive picture processing, and two-dimensional text display and processing in a workshop environment.

All registrants at the symposium will receive a copy of the annual symposium report, a "Digest of Technical Papers" – with more than 200 pages of illustrated 800-1000 word condensations of all SID papers – invited and contributed. Additional copies are available through SID offices in Los Angeles: $15.00 for society members and $20.00 for non-members.

The general chairman of SID 74 was H.G. Slottow, University of Illinois. Program chairman was S.M. Stone, GTE Laboratories, Waltham, Mass.

Evening session participants on visual flight simulation, left to right: W.E. Good/Chairman (GE), B.J. Shinn (GE), R.A. Waldrop (American Airlines), R. McLanaghan (Redifon).

Panelists at informal discussion session on image quality evaluation, left to right: E.W. Herold/moderator (Consultant), P. Roetling (Xerox), E. Gorog (RCA), H.L. Snyder (VPI), G. Kaelin (Motorola), H.C. Henderson (Philco-Ford).

Panelists at an informal display technology session, left to right: L.K. Anderson (Bell Labs), T.P. Brody (Westinghouse), J.H. Becker/Moderator (Xerox), E.I. Gordon (Bell Labs), E.E. Loebner (Hewlett-Packard), and I. Reingold (Army Electronics Command).

SID Confers Honors and Awards at San Diego

Frances Rice Darne Memorial Award was presented to Norman H. Lehrer (at left) by SID President Robert C. Klein.

Dr. Kenichi Owaki of Japan received recognition award.

Honors and awards conferred by the Society for Information Display at its 1974 annual Symposium are as follows:

The France Rice Darne Award – to Norman H. Lehrer "for pioneering advancement of the display storage tube, and for his continuing contribution to display technology."

Five SID Fellow awards were made to the following SID members:

Charles P. Halsted of the Delaware Valley Chapter, for his continuing work in advancement of the display field since 1951; contributing to color TV and inventing techniques for character generation and symbol size modulation. For his authorship and documentation planning in display technology, and for his executive leadership of the Delaware Valley Chapter of the SID and the 1971 International SID Symposium.

Albert Loshin of the Mid-Atlantic Chapter, for his pioneering work in subscription television, co-inventing several basic systems and leading in the acquisition of FCC approval for a Pay-TV system. For his mastery of new display technologies, including darktrace CRT digital storage, CRT character generation, gas discharge cell control and logic; interactive computer display, and other technological disciplines and their display applications. For his professional national committee leadership and expanding executive role in the SID Mid-Atlantic Chapter.

George Holz, of the Mid-Atlantic Chapter, for his basic and continuing advancement to gas discharge display, co-inventing an addressing technique which is applicable to flat panel TV, and inventing Time Domain Memory for plasma panel address. For his contribution to multi-plexed glow discharge indicators by simplifying adaptation to its control elements; applicable to the miniature calculator field.

Vernon J. Fowler, of the New England Chapter, for his professionalism and technical leadership in the electron beam, laser beam and plasma display fields, leaving behind a record of creative accomplishment and its publication. For his development of electron guns for high intensity electron beams and beam steerers for laser color TV displays and tracking systems, documented with prolific patents and literature contributions to display components and systems. For his dynamic and diligent continuing administrative contributions to the SID and to its Symposia.

Edwin H. Hilborn, of the New England Chapter, for his unpretentious contribution of a voluminous legacy to the display technology in the forms of 30 patents, 35 publications and presentations, in a variety of scientific disciplines, and many years of guidance of display research. For his leadership at NASA ERC since its inception in 1964 toward the development of display devices and fluidics, and for his dignified execution of the challenging task of abstracting patents for the SID publications.

Recognition awards were made to:

Dr. Kenichi Owaki, for initiating and advancing plasma display in Japan.

Dr. Andries vanDam, for the advancement of interactive graphic display.

Dr. Ivan Sutherland, for creative techniques and leadership in dynamic graphic display.

Dr. William E. Good, for the advancement and application of Light Valve Color Television.

Herbert C. Hendrickson, for the creation of advanced command and control systems.

The 1974 SID Symposium in the Abstract

Opening Session

The History and Development of the Color Picture Tube. *E.W. Herold, Consultant, Princeton, N.J.* The color picture tube, involving the shadow-mask principle, which has established itself as the basis for the only commercially successful color TV display for the home, represents a milestone in technological progress. An illustrated address covered its early developmental stages, and subsequent improvements, the latest of which is the present matrix color tube, as well as a novel system which eliminates dynamic convergence.

Display Devices and Techniques

A Digital 4 x 4 Matrix-Multiplier for Computer Graphics with Realtime Dynamics. *K.F. Kraiss, Research Institute for Human Engineering, Mechenheim, W. Germany.* A digital 4 x 4 matrix multiplier which can calculate transforms for graphic rotation, translation, scaling and projection in 4μs were described. The system is based on a highspeed (180 ns) 11-bit multiplier using a look-up table technique with TTL-ROMs.

Source Coding as an Aid to Optimal Display Terminal Design. *J.J. O'Reilly, University of Essex, Essex, England.* The transmission and storage of simple line drawings is of significant importance in the statistics and coding of line-drawing ensembles. Coding schemes used for interactive computer graphics were compared, quantitative results being based on sample statistics derived from computer-aided design applications.

A Dual Gun Scan Converter Tube with Organic Film Storage Target. *T. Nishino and H. Maeda, Matsushita Research Institute Tokyo, Inc., Ikuta Kawasaki, Japan.* A low-cost 1-inch scan converter tube with an organic film target and dual conventional vidicon guns was covered. Features include simple performance of write and read under low voltage tube operation.

A Stretched Segment LED Display. *G.T. Ikari, R.H. Haitz, P. Jeung and R. Solomon, Hewlett-Packard Co., Palo Alto, Cal.* A stretched-segment LED display development with improved segment surface brightness uniformity (2:1 from center to end), large viewing angle and high light output was described. Display optimization and performance using red, amber and green chips was discussed.

Gas Discharge Display System Techniques

Internal Random Access Address Decoding in an AC Plasma Display Panel. *J.D. Schermerhorn, Owens-Illinois, Inc., Perrysburg, O.* An ac plasma display panel, addressed using properties of the discharges for the decoding function, was discussed. Two electrodes per resolution element are interconnected to eliminate external pulse-source-per line usually required. A display drive system exploiting this technique uses an inverting waveform and ground level address pulses.

Light Pen Capability on a Plasma Display Panel. *P.D.T. Ngo, Bell Telephone Laboratories, Inc., Holmdel, N.J.* A potentially low-cost method of detecting the position of a light pen over on cells of a plasma panel has been devised. The technique is based on ability to address selectively one cell of the panel in such a way that if the cell is on, it flashes at a time different from all other cells without altering the on state; off cells are not turned on by this pulse.

Dynamic Light Pen Tracking on a Plasma Panel. *P.D.T. Ngo and W.H. Ninke, Bell Telephone Laboratories, Inc., Holmdel, N.J.* A two-model light pen tracking scheme was described. One mode finds the pen position initially and after each lifting of the pen position initially and after each lifting of the pen from the panel. The other tracks movements while the pen touches the panel.

AC Plasma Panel Television Display with 64 Discrete Intensity Levels. *B.C. Anderson and V. Fowler, GTE Laboratories, Waltham, Mass.* An ac plasma panel TV system which provides a full resolution, interlaced TV display with 64 discrete intensity levels was covered. Read-only memories for programmable control of the operational sequence and random access memories for data storage are used.

Video Disc Technology

A Review of Video Disc Principles. *A. Korpel, Zenith Radio Corp., Chicago, Ill.* Some of the pertinent parameters that apply to all video disc systems, such as playing time, signal-to-noise ratio, track width and highest spatial frequency. The three classes of systems – mechanical, capacitive and optical – were described, and the constraints placed by each system upon the pertinent parameters assessed.

Transmission Mode Optical Video Disc System. *R.L. Whitman, Zenith Radio Corp., Chicago, Ill.* The development of a transmission-mode optical video disc player was described, citing the initial problem of reading out the information impressed in the thin plastic disc to

the final correcting signal-timing errors. Other areas to be discussed include record groove tracking systems and electronic coding, measurement techniques and acquired data on record stability.

A Photooptical Video Disc System. *E.M. Kaczorowski and J.A. Jerome, I/O Metrics Corp., Sunnyvale, Cal.* A video disc system, in which a modulated beam records an analog video signal in a spiral track on a film disc, was described. Master discs are duplicated by contact printing. In the player a magnified image of the spinning disc is projected onto solid-state detectors, and the process signal is transmitted to the user's TV set.

A Video Disc Optical Design. *G. Broussaud, E. Spitz, C. Tinet, and Francois L. LeCarvennec, Thomson CSF, Orsay, France.* The fundamental requirements for a video disc player from the data rate on the disc and the physical constraints imposed upon the optical pickup, were presented. A proposed arrangement for a turntable based upon an air-cushioned flexible disc from which data readout results in a scattered pattern of coherent light produced by the disc, was described.

Video Disc System with Optical Readout and Optoelectronic Tracking. *K. Compaan and Piet Kramer, Philips Research Laboratories, Eindhoven, The Netherlands.* A technique involving impression of video and sound information on a disc surface in the form of shallow pits, with the information read optically with a reflected laser beam, will be discussed. Implications of this method for frequency characteristics of the signal and the necessary tracking system will be covered, citing features, such as stop-motion and random access.

Laser, Holographic, and 3-D Displays

Computer Holograms Revisited. *J.C. Newell, D.O. Dickman and M.A. Winkler, Univ. of Calif./Los Alamos Scientific Laboratory, Los Alamos, N.M.* The results of recent experimentation, affording an effective economical method of creating holograms from computer-generated three-dimensional graphic data, were presented.

The Intergram – The Integration of Motion Pictures into Holograms. *T.H. Jeong and H. Snyder, Lake Forest College, Lake Forest, Ill.* A technique – the integram – for the presentation of holograms from standard two-dimensional motion pictures, was described. The three-dimensional image, which can be seen without the use of special spectacles, can be displayed simultaneously within 360° of perspectives, in circular, linear or other formats.

Stereoscopic Television Display for Remote Vision. *J.R. Tewell and C.E. Polhemus, Martin Marietta Aerospace, Denver, Col.* The development of a technique which presents stereoscopic visual information with improved illumination efficiency to viewers in a manner directly analogous to vision through a window, was discussed. System requires no headgear, and movements fore-and-aft and in the vertical direction are not critical.

A Three-Dimensional Display for Radar Returns. *H.S. Cole, J.C. Reiche, D.W. Skelly and C.R. Stein, General Electric Co., Schenectady, N.Y.* Liquid crystal cells having light transmission characteristics, which can be modulated between clear and frosty, have been assembled in a stack for operation with a mini-computer to create a three-dimensional optical model of objects detected by radar.

Advanced Integrated Modular Instrumentation System (AIMIS). *W.G. Mulley, H. Green, D. Quiring, Naval Air Dev. Ctr., Warminster, Pa., and D.H. Close, Hughes Research Lab., Malibu, Cal.* AIMIS, designed to satisfy aircraft instrumentation requirements for the 1980 era, featuring the integration of tactical, flight, and engine information, was covered in a 4-paper report. Subjects to be discussed include acoustooptic laser deflection to eliminate the CRT in many applications, point-source holograms providing projection and combiner functions, and holographic storage and display techniques useful in full-color moving map displays.

Software and System Tradeoffs

Tradeoffs in the Design of an Intelligent Display Terminal. *D.I. Caplan, Raytheon Data Systems, Norwood, Mass.* The design of a programmable terminal system, whose central element is a minicomputer which refreshes displays for the system from the minicomputer memory, was presented.

Satellite-Host Tradeoffs in Computer-Aided Design. *J. Hatvany, Hungarian Academy of Sciences, Budapest, Hungary.* Survey and case-study results on sustained local interaction capability and intense bursts of remote computation required by industrial CAD to evaluate tradeoffs between low-cost graphic terminals of time-sharing host systems and small intelligent stand-alone systems.

Developing Man-to-Machine Software with Structured Programming Techniques. *A.D. Thompson, IBM Corporation, Morris Plains, N.J.* The development of man/machine software programs, within the PAR radar area of the Safeguard antiballistic missile project, through utilization of various structured programming techniques.

TUTOR Graphic Capabilities. *P. Tenczar, University of Illinois, Urbana, Ill.* Ten years of evolution in an active user environment has molded TUTOR into a powerful language for interactive graphics on the PLATO computer-based education system. Production of graphics software has been simplified by the use of automatic coding techniques.

Conic Curves for Graphics. *L. Villalobos, Hughes Aircraft Co., Oceanside, Cal.* A generator has been developed to produce subsets of conic curves with important mathematical and visual properties. These curves have been found to reduce data requirements up to an order of magnitude.

Menus as Devices. *R.A. Berman, Vector General, Inc., Canoga Park, Cal.* Selecting functions via a stylus on a set of software display menus has well recognized advantages of speed and ease of use, readability and hierarchical capability. A proposal citing the implementing of menus as if they were separate hardware devices was offered. In this form they should have a clean interface with any application software and should include functions for control, input and output.

Bioluminescence – Light Without Heat. *W.D. McElroy, Chancellor, University of California, San Diego, Cal.* Information Display technology progress, achieved over the years by intensive research in many exotic areas of chemical structures, may well find biochemistry a viable source, via bioluminescence. It is well known that a remarkable variety of organisms from bacteria to fishes shine by their own light. In some cases, the advantage of this biological luminescence for organisms can be identified, for example, as a sex attraction in fireflies. The light is produced biochemically from the oxidation of pigment yielding products in an excited state. A flash of light is released on return of the molecules to the ground state. The fascinating possibility of luminescent systems with definitive information available from the firefly represents an intriguing potential for displays offering light without heat.

Matrix – Addressed Panels

LED Color Display with Inherent Memory. *C. Suzuki, T. Uno and S. Mito, Sharp Corp. Central Res. Lab., Tenri City, Nara, Japan.* A display incorporating two visible (red and green) LEDs consisting of four PNPN layers with dynamic memory functions and optical sensitivity, enabling writing and erasing with a light pen.

The Thyroptor – A Gallium Phosphide LED with Integral Storage. *A.R. Peaker, V. Pastore, A. Mottram, B. Hamilton, Ferranti Ltd., Oldham, England.* A green LED with an integrated latching or memory function, operated by an optical feedback mechanism, which can be used in X-Y addressed storage displays and light pen systems.

Stable High-Brightness Thin-Film Electroluminescent Panels. *T. Inoguchi, M. Takeda, Y. Kakihara, Y. Nakata and M. Yoshida, Sharp Corp. Central Res. Lab., Tenri City, Nara, Japan.* Thin-film EL panels operable for more than 10^4 hours at 250 V, 5 kHz with 1.5×10^3 fL, without degradation, have been developed. Design and applications.

TV Imaging System using Electroluminescent Panels. *S. Mito, C. Suzuki, Y. Kanatani and M. Ise, Sharp Corp. Central Res. Lab., Tenri City, Nara, Japan.* A TV imaging system has been devised employing a vacuum-deposited thin-film EL panel. Output images have unusually high brightness and contrast compared to power-type EL displays.

Recent Progress in Electrophoretic Displays. *A.L. Dalisa and Roger Delano, Philips Laboratories, Briarcliff Manor, N.Y.* A device concept which offers the possibility of addressing electrophoretic displays with low voltage logic, was described. A materials analysis has led to an improved understanding of the colloidal suspension and its behavior during device operation.

A Low Power Single Chip Calculator using A Multiplexed Liquid Crystal Display. *E.T. Fitzgibbons and R.G. Carlson, Rockwell International Corp., Anaheim, Cal.* An eight-digit, ambient illuminated, multiplexed, dynamic scattering liquid crystal display, driven directly by a single LSI calculator chip, has been developed. The total calculator system, display, and multiplexing technique was described.

Transient Times of the Dielectric Deformation in a Nematic Liquid Crystal. *M.F. Schiekel, K. Fahrenschon and H. Gruler, AEG Telefunken Donau, W. Germany.* A new calculation, including inertial terms, which has been made of the time constants for all field effects in NLC, and found to yield good agreement with experiments.

Display Quality and Human Perception

Human Factors of Optical Displays. *R.S. Kicklighter and R.F. Witzel, Eastman Kodak Co., Rochester, N.Y.* What is a good image? What images do observers prefer to view? What characteristics account for this preference? Experiments which relate preferred image quality to screen size, screen height of image with respect to the eye level, space, image sharpness, screen scintillation, reproduced size of alphanumerics, and ambient conditions.

Measuring the Information Content of Visual Scenes. *J.C. McKechnie, Naval Training Equipment Center, Orlando, Fla.* A method developed to measure and compare the visual information within spatial scenes. The characteristics are quantified when this method is used; the measurement is objective.

Analysis of Perceived Image Quality. *R.W. Cohen and I. Gorog, RCA Laboratories, Princeton, N.J.* Display performance, when analyzed in terms of the visual capacity, defined as the number of displayed edges perceivable by a viewer. Given an MTF, a maximum visual capacity exists at a corresponding optimum viewing distance.

Peripheral-Visual Response Time and Visual-Display Layout Design. *R.F. Haines, Ames Research Center/NASA, Moffett Field, Cal.* Report on peripheral-visual response time to white and colored stimuli imaged in the full visual field under high and low luminance, acceleration, high temperatures, and other conditions which yielded valuable data applicable to instrument panel layout design.

Optical Characteristics of AC Plasma Panels. *R.W. Burke,*

H.J. Hoehn and M.E. Fein, Owens-Illinois, Inc., Perrysburg, O. Because a human observer is involved, it is always difficult to decide which measurable characteristics of a display device will characterize most effectively its performance. An analysis of this optical characterization problem for ac plasma panels, with meaningful comparisons with the performance of CRTs.

The Format and Color of Small Matrix Displays for use in High Ambient Illumination. *B. Ellis, G.J. Burrell, J. Wharf and T.D.F. Hawkins, Royal Aircraft Establishment, Farnborough, Hampshire, England.* Tests with a 4-mm display have shown that quasi-continuous characters are preferable to those with small bright dots and that red is easier to see than green in 10^5 lux. These studies and investigations of various human factors were discussed.

Visual Flight Simulation

Simulators/Past-Present-Future. *R. McLanaghan, Redifon Flight Simulation, Ltd., Sussex, England.* Described the component parts of a modern flight simulator. Problems associated with simulating the various cues that the flight crew experience during the normal, abnormal and emergency flight procedures. A high degree of realism is achieved in the visual simulation of the view from the aircraft cockpit, as well as the simulation of motion and sound in the cockpit itself. Emphasis was placed on the display and generation of the visual image from the TV camera/model system. Speculation about future simulators.

Computer-Generated TV Imagery. *B.J. Shinn, General Electric Co., Daytona Beach, Fla.* Basic concepts of dynamic scene generation using a digitally-stored 3-D model of the environment – terrain, buildings and moving vehicles. Advantages of digital TV systems, as well as present limitations. A CGI system, integrated with a flight simulator at a jet training school, was described.

Developments in Pilot Training. *R.A. Waldrop, American Airlines, Fort Worth, Tex.* Use and verstility of visual simulators for pilot training and upgrading, particularly for maneuvers and emergency situations that would normally be too dangerous for the pilot to attempt.

Gas Discharge Devices

Xenon-Based Gas Mixtures for AC Plasma Panels with Phosphor. *D.C. Hinson, Owens-Illinois, Inc., Perrysburg, O., and R.A. Bennett, Owens-Illinois, Inc., Toledo, O.* Electrical and optical properties, including vacuum ultraviolet-emission spectra, of xenon-based gas mixtures for color display/memory panels. A more efficient argon-xenon mixture and a suggested model for its properties described.

Color-TV Display Using a Flat Gas-Discharge Panel. *M. Fukushima, S. Murayama and T. Kaji, Hitachi Central Res. Lab., Tokyo, Japan.* A color TV display using a flat dc-pulsed gas-discharge panel with phosphor has been built and tested. The panel (120 x 170 dots, 1 mm pitch) was driven with line-at-a-time addresing.

32-Inch Graphic Plasma Display Module. *R.A. Strom, Control Data Corp., Minneapolis, Minn.* An 8 inch x 32 inch ac plasma display module with 33 lines/inch resolution, fully operated with a random write/erase capability, was described. The technology can be extended to very large graphic systems.

Single Substrate AC Plasma Display. *G.W. Dick, Bell Telephone Laboratories, Inc., Holmdel, N.J.* Construction and performance of experimental matrix-type gas plasma, ac displays in which all active electrodes and dielectric layers are applied on a single substrate. Optical efficiency is maximized, since cathode glows are fully exposed to the viewer on both ac half-cycles.

DC Gas Discharge Storage Displays. *F. Walters, Ferranti Ltd., Oldham, Lancs., England.* The theory of operation, method of construction and driving techniques for dc gas discharge storage displays. The thin matrix panel displays can be selectively addressed and erased in conjunction with inherent panel storage.

The Multilayer Gas-Discharge Display Panel. *C.D. Lustig, A.W. Baird, H. Veron, Sperry Research Ctr., Sudbury, Mass., and J.B. Armstrong and G. Watts, Beckman Instru., Inc., Scottsdale, Ariz.* A display panel with a gas discharge reservoir acting as a plasma source for an array of channels leading to a storage display section. Selective addressing is accomplished by layers of interposed segmented electrodes.

Large Area Displays

Optical Characteristics of Projection Display Screens. *J.J. DePalma, Eastman Kodak Co., Rochester, N.Y.* A general analysis of the optics of projection screens has yielded important information for improving screens, both front and rear projection. Data from theoretical and experimental investigation; recent developments in improved screen materials.

High Gain Specular Screens. *Y.G. Hurd, L.E. Carpenter & Co., Norwalk, Conn.* High-gain screens with specular surfaces and various amounts of diffusion were discussed. These screens can reject ambient light, can be used as containment screens, and can present several different images to different audiences simultaneously.

A Light-Reflecting Electromagnetic Display. *H.O. Peprnik, Ferranti-Packard Ltd., Toronto, Ont., Canada.* Alphanumeric, light-reflecting, electromagnetic displays, with characters ranging from 1 inch to 24 inches in height, that require power only to change data. Applications range from control and command centers to vehicular traffic control.

7000-Lumen Color-TV Projector Development. *D.B. Hakewessell, Conrac Corp., Duarte, Cal.* The development of a high brightness large-screen color TV projector, achieved by incorporating a 4.8-kW xenon lamp in place of the conventional 2.5-kW type was described. Details of the design problems, involving IR and ultraviolet energy absorption and a high temperature sequential color wheel for the field sequential projector.

Optimum Photoconductor Thickness and Dielectric Constant for the γ-RUTICON. *A.I. Lakatos, W.H. Cook and K.W. Pietrowski, Xerox Corp., Webster, N.Y.* The role of photoconductor thickness, as it manifests itself on the sensitivity and maximum imaging capability of the γRUTICON – the solid-state deformographic cyclicable imaging device.

Readout Considerations for a Class of Liquid Crystal Display. *G. Dir, J. Adams, W. Haas and J. Stephany, Xerox Corp., Webster, N.Y.* Readout methods for liquid crystal light valves. Techniques for improving contrast of photo-conductor-controlled liquid crystal memory panels by using anti-reflection electrodes and polarized light.

Display Applications

On-Board Vehicle Route Instructions Via Plasma Display Panel. *R.L. French, Avcon, Inc., Ft. Worth, Tex.* An on-board automatic route control system for motor vehicles, using a 256-character alphanumeric plasma display panel in a pseudo graphic mode to convey realtime route instructions and other information to the drive.

Pilot Warning/Collison Avoidance Display System. *W.E. Buchanan and E.F. Kiley, Johns Hopkins University, Silver Spring, Md.* Development of a low-cost system for display of digital pilot warning information and collision avoidance system messages, with emphasis on software, cockpit instrument design and applications to both ground and air-based systems.

Naval Environmental Display Station. *W.O. Kerman and E.R. Reins, U.S. Navy Environmental Prediction Res. Facility, NPS Monterey, Cal.* A review of the facilities of the naval environmental display station, which provides support to global naval operations through a unique combination of digital color display, electronic storage of computer graphics and display-oriented communications capabilities.

The Epic-II System for Experimental Electronic Painting. *V.J. Fowler, GTE Laboratories Inc., Waltham, Mass.* Electronic Painting in Color – EPIC – an electronic painting demonstration system has been recently developed to provide a high-quality all-electronic art medium. This paper covered its technical features, involving painting by moving a penlight in front of a TV camera, with the electronic painting recorded and displayed in selected colors on a color-TV screen.

Interactive Systems

Knowledge Workshop Terminal Systems. *R.W. Watson, Stanford Research Institute, Menlo Park, Cal.* The present state of development of computer systems to enhance office work (knowledge workshops) was summarized. Limitations of current display terminals, and the types of displays required to match future goals.

Systems Aspects of Displays. *D.E. Liddle, Xerox Research Center, Palo Alto, Cal.* This paper discussed various properties of displays and their human factors, but from a system point of view; that is, in terms of bandwidth and protocol between man and machine. Of particular interest is the area of office information systems – for document retrieval and editing, collaboration, and distribution – all in real time.

Document Storage and Retrieval. *L. Hausman, Infodetics Corp., Anaheim, Cal.* Low-cost automated document storage and retrieval systems employing magnetic tape and silicon storage tubes. The storage tube provides time base error correction of the tape recorder, scan conversion and display magnification.

Micrographics/Computer Information Display System. *R.L. Merwin, Dynamic Information Systems, Inc., Lakeville, Minn.* The combination of multiple CRT computer terminals with graphic buffers, central automatic microfilm selector and video generator modules, and a computer programmed to search, index, and update, providing users with a system with a new dimension of usefulness.

Switching Properties of Twisted Nematic Liquid Crystal Displays. *Cess J. Gerritsma, Philips Research Laboratories, Eindhoven, Netherlands.* A $\pi/2$ twisted layer of a liquid crystalline material with a positive dielectric anistropy Δe is frequently used in display applications. The known properties, unknown aspects and possibilities are discussed.

Earth Conference

First national conference to study worldwide earth environment and resource problems and remedial projects by governments and industries opens September 10 at the Philadelphia Marriott Motor Hotel. Some 80 papers by 155 specialists from the U.S. and other countries will be heard. Information from Lewis Winner, 152 W. 42nd St., New York, N.Y. 10036.

Optical Coating Tells of New Aquisition

Optical Coating Laboratory, Santa Rosa (Cal.) announces agreement in principle to acquire the photovoltaic product line of Centralab Division of Globe Union, Inc.

Optical Coating also announces opening of a Northeast sales office in Waltham, Mass. at 479 Winter St.

Two IEE Executive Appointments Told

Two top management appointments are announced by IEE (Industrial Electronic Engineers, Inc.) of Van Nuys, Cal. Keith Luskin has been named corporate Director/Sales & Marketing. Mr. Luskin joined IEE in 1973, prior to which year he had been in marketing posts with major display component makers. William E. Hartman, 14-year veteran with IEE, and former Director/Marketing, is now Director/Opto-Components Division, which makes subminiature lamps, LEDs, liquid crystal, neon tube, and incandescent, digital display products, and display mounting hardware.

Twin City SIDers have 'Visiting' Year

Minneapolis/St. Paul Chapter of SID issues recap of activities at end of its "first year of 'resurrection' ". Vern A. Born, chairman, says "The philosophy was to get out and see what was going on in display activity around town."

Born sums up what in retrospect is indeed a busy year. Chapter members visited CDC Roseville to see general purpose graphic terminals; Twin Cities Airport, where they viewed computer and radar information on a single display; Dicomed, for high-resolution, digitally processed graphics; Data 100, which showed "batch terminals for everybody."

Members also visited Dynamic Information Systems, for highspeed data retrieval; Futuristics ("Science, Fact for the Future"); and Arion Corp. for "an amazing demonstration of combining slides and sound in about ten dimensions."

Born says program format will continue in coming twelve months.

Exhibits Seen

BURROUGHS CORPORATION exhibited its new line of SELF-SCAN® bar graph displays and PANAPLEX® clock panel displays. One of the main attractions was the simulated automobile dashboard used to demonstrate how a bar graph can be used to monitor and control such parameters as engine speed, RPM, torque, fuel flow, brake power, and temperature. A circular concept of the bar graph panel was shown as part of this demonstrator. The "Self-Scan" bar graph is a flat indicator which displays two separate bar graphs. The neon orange displays are available with either 200-elements (0.5% resolution) or 100-elements (1% resolution) in a thin package 0.25" in depth (excluding tabulation). The displays need only six active drivers to operate the two independent information channels.

The "Panaplex" clock panels were shown in a demonstrator clock. The panels have a seven-segment format and are compatible with MOS clock chips. They exhibit high brightness at low power, with uniform brightness between segments and digits. The panels can display 12- and 24-hour time systems. The 0.7" characters emit pleasing, neon orange glow.

Circle 114 on Reader's Service Card

The **COMTAL CORPORATION** exhibit made the point that true image displays, unlike graphic or line drawing systems, have a third dimension, in addition to the two spatial dimensions. Color presentation of the image data is utilized as a means of maximizing the effective resolution of the third dimension. The COMTAL 8300 Series Digital Image Display with 3 independent images, each with a 512x512 format and 8 bit (256

level) amplitude resolution for each point, was exhibited. This display has gray-scale, true-color and pseudo-color presentation modes and includes 3 independent graphic overlays. Interactive processing was supported by a trackball and target, together with function processing, for real-time image processing without refresh memory modifications.

Circle 115 on Reader's Service Card

CPS, INC. showed new hardware from its "High Voltage" products group. Power supplies were exhibited that are used with CRT's which have high voltage focus elements that need to be dynamically focused. Also, a new 50kV 2mA precision supply for high resolution projection CRT's was exhibited. Mil-spec power supplies exemplified CPS's new thrust into this very demanding market area. These supplies are used on the S3A and Navy Airborne TT-581/AG display unit. A "quiet" photomultiplier tube power supply Model 5003N featured only 5mV ripple peak to peak at 2kV.

Circle 116 on Reader's Service Card

GAMMA SCIENTIFIC exhibited its new Model 3100 Scanning Spectro-radiometer, which scans from 400 to 700 nanometers and can be supplied with a variety of receptors. The cosine receptor configuration for spectral irradiance measurements shown in the photograph was exhibited at the Symposium. Microscopic and telescopic versions are also available for measuring spectral radiance.

The instrument features automatic dark current cancellation, and automatic scan and reset. It is calibrated to have a constant sensitivity versus wavelength characteristic, so that its output is displayed in absolute terms of spectral radiance (nonowatts/cm^2 nm sr), or spectral irradiance (nanowatts/cm^2 nm) at all wavelengths within its range.

Circle 117 on Reader's Service Card

This output data can be presented in graphical form on the included X-Y Recorder, or can be fed to the Model 3100-5C Digital Interface for digital output to couple to a digital computer.

Gamma Scientific also displayed its Model 3100-5C Digital Interface at the 1974 SID Symposium in San Diego.

This output accessory to the Model 3100 Scanning Spectro-radiometer includes 3½ digit display and bcd output of both power and wavelength channels. Sampling intervals every 5, 10, or 20 nm may be selected from the front panel for short term store and hand-off of data in both channels to a digital, data processing system.

Circle 118 on Reader's Service Card

GENERAL ELECTRIC CO. had a working model of its new PJ500 color TV projector. The compact unit yields picture sizes from 2 to over 20 feet in width, can be controlled remotely up to distances of 200 feet and can be used in either front or rear projection applications. The light valve uses a single electron gun and single optical axis to reproduce color TV pictures of high brightness and contrast. Color registration is inherent; thereby eliminating need for adjustment.

The projector consists of a projection head assembly with integral pan and tilt adjustments, and an electronics assembly which supports the head. The head contains a sealed beam Xenon lamp, the sealed light valve and the projection lens. The projector requires nominal 117V power and a video signal for operation. The projector is designed for a wide variety of front or rear screen applications. It has "the optical simplicity of a slide projector." Set-up controls are contained within the enclosed cabinet. Operating controls are conveniently mounted on a control panel.

Circle 119 on Reader's Service Card

HEWLETT-PACKARD COMPANY exhibited three of its new "Yokeless" X-Y CRT Displays. The units shown included the 1332A, a new high resolution, high brightness display with a 6¼ inch diagonal CRT and two new computer graphics quality large screen displays, with 17 inch and 21 inch diagonal CRT's, the 1317A and 1321A.

These displays all use electrostatic rather than electromagnetic deflection systems allowing very high speed operation at low power consumption. Use of a special dome mesh expansion lens ahead of the CRT's gun structure allows the tubes to be considerably shorter than would normally be expected for electrostatic deflection. Small spot sizes are also possible with both large screen units specified to have less than 0.020 inch spot size over their quality area and the smaller unit specified to have less than 0.012 inch spot size over its quality area.

Circle 120 on Reader's Service Card

OWENS-ILLINOIS presented at the show two AC plasma display/memory units, plus the hardcopy unit.

The hardcopy unit incorporates a 512-60 display and permits hardcopy to be taken electro photographically off the rear of the panel. Run at the show by a Nova 1220 mini computer, the hardcopy unit showed graphics and multifine alphanumerics with the resulting hardcopy being generated in less than 9 seconds.

The 512-60 AC plasma display/memory unit is a matrix of 512 x 512 lines at a resolution of 60 lines to the inch. Both alphanumerics of any size and limited graphics can be demonstrated over the 8½ inch square active surface area. The model 8-33 DIGIVUE® display/memory unit is a matrix 80 lines high by 256 lines across at a resolution of 33 lines to the inch. It is predominantly used in alphanumeric mode where using a 5 x 7 character, 8 rows of 42 characters each or 356 characters can be displayed. Both models offer inherent memory (no refresh memory required).

Circle 121 on Reader's Service Card

PHOTO RESEARCH, "The Light Measurement People", exhibited a line of instruments currently being used by most major manufacturers of CRT and display systems.

The Spectra Pritchard Photometer, Model 1980, which was exhibited, has an optional capability for pulse light measurements. Pulses as short as 100 nanoseconds can be displayed and measured and the total light energy in one or more pulses as short as 1 microsecond can be accurately measured with direct readout in foot-Lambert seconds. This feature was of interest to those who must measure total light output of pulses to expose film or other media for CRT writing.

The Spectra Spotmeter, Model UBD, with a spot size of ¼° (0.010" target size at 2½" working distance) was the model shown of this line of brightness measuring instruments.

The Spectra Photometer/Radiometer, Model 1000, which is widely used for LED measurements also was shown. This instrument makes precise measurements of LED outputs, including luminous intensity and total lumen output.

The Spectra Mini-Spot, a convenient hand-held brightness photometer with see-through optics and a one degree measuring field was popular at the show. It was borrowed to measure and confirm brightness of other various displays.

Circle 122 on Reader's Service Card

RAMTEK CORPORATION exhibited a working demonstration of its new low-cost graphic display system with capabilities from both the character-oriented and full graphic systems. It's designed for such applications as process control, power/utility control, fluid distribution and

management information usages.

The equipment can address a character to any location on a 256 x 256 grid. Images are stored in display lists which can be read back in whole or in part into the CUP via bi-directional interfaces designed for use with a broad range of minicomputers.

The FS-2000 combines full screen addressing and ease of producing cartesian graphics with "considerable savings" in the cost of memory along with the edit and blink capabilities of a character-oriented system.

Standard operations include dual intensity of each of seven colors, blink to half intensity, reverse background for characters, single byte relocation or modification of length, height, thickness and color, and four character sizes.

Circle 123 on Readers Service Card

RCA demonstrated in its exhibit its stacked-ceramic gun, ceramic evelope, fiber-optic faceplate and ruggedized cathode-ray tube (CRT) design for helmet mounted applications. The electrostatic focused and magnetic deflected cathode-ray tube design provides more than 10 footlamberts of brightness with a raster of at least 800 TV lines from its helmet mounted position to its visor reflector for the aircraft or tank pilot user. The design is equally well suited for other critical applications of severe enviromental conditions, limited space availability, or special visual considerations.

Circle 124 on Reader's Service Card

TEKTRONIX, INC. had as feature attractions in its booth the 4015 computer graphics terminal and the Tektronix 31/10, "the first interactive graphic calculator system."

The 4015 is the APL version of Tektronix's new 4014, the big screen (19-inch) terminal with graphic capability. This graphics terminal has 8512 alphanumeric characters with a choice of four different character sizes. It also has hard copy capability.

Booth attendants told visitors that the terminal had special applications in such areas as geophysical exploration, preview plotting, mapping, large-scale perspectives, computer-aided design and environmental planning.

Demonstrations of the Tektronix 31/10 interactive graphic calculator system were given. The system includes the Tektronix 31 programmable calculator and the 4010-1 graphic display terminal. The combination enables the operator to send a variety of commands to the terminal from the calculator's remote key.

Circle 125 on Reader's Service Card

WATKINS-JOHNSON COMPANY, a first-time exhibitor, achieved interest with their introduction of a new family of cathode-ray tubes designed to improve brightness, resolution and grid drive performance in special display applications.

Watkins-Johnson's CRT's at the show featured Laminarflo™ electron gun design as opposed to the traditional crossover gun technique. The concept of the Laminarflo gun design can be advantageously applied to all types of CRT's, including magnetic deflection-electrostatic focus, magnetic deflection-magnetic focus and electrostatic focus and deflection designs.

The W-J booth (No. 203) had a working display of a Laminarflo tube as employed in a special high-resolution closed-circuit TV monitor system provided by Systems Research Laboratory (SRL) of Dayton, Ohio.

Circle 126 on Reader's Service Card

SID Session at AFIPS draws 400

By Arthur D. Hughes, President
Hughes Associates, Inc.

The National Computer Conference was held at McCormick Place in Chicago on May 6-10, 1974. Attendance was 25,909. Over 100 sessions were held and 250 exhibitors occupied 800 booths in the spacious McCormick Place exhibit hall.

The high quality of the sessions and exhibits was a tribute to the American Federation of Informative Processing Societies (AFIPS). AFIPS members include not only SID, but also IEEE and other groups where interest in displays is high.

The success of the NCC in Chicago can be attributed, in part, to a growing trend in displays, computer graphics and related fields. A summary of the discussions covered by the SID-sponsored session entitled, "The Effect of Changing Technology on Computer Graphic Systems," follows:

SID Session Tape Recorded

The Society for Information Display was asked to sponsor a session at the National Computer Conference, on May 1, 1974. It was part of C.V. Ramamoorthy's Session Area on Computer Architecture and Hardware. Before the conference, the SID session was selected as one of twelve to be tape-recorded. (Session No. 26, available on Norelco cassettes for $7.50 from AFIPS, 210 Summit Avenue, Montvale, N.J. 07645, (201) 391-9810).

The responsibility for this session was under the able direction of Phillip P. Damon, Hughes Aircraft Company, Industrial Products Division, Carlsbad, California, a Director of SID. Phil selected the topic and developed a panel discussion of widespread interest.

Changing Technology

The topic of changing technology was obviously a key concern of NCC attendees, as over 400 assembled for the SID-sponsored panel discussion. Phil divided the topic into six parts and selected six education and industry representatives to appear on the panel discussion. Carl Machover, of Information Displays, Incorporated, contributed an overview of the subject. Robert H. Stotz, of the University of California, was concerned with the host computer interface and display processor. Luis Vallalobos, of Hughes Aircraft Co., spoke about graphic generators. Sol Sherr, of North Hills Associates, covered the actual display elements. Arthur D. Hughes, of Hughes Associates, Inc., was concerned with operator input/output devices. James D. Foley, of the University of North Carolina, provided a review of the software for computer graphics. A dialog between panel and attendees followed a short review by each panel member of his own area.

No startling breakthroughs were reported in any area. In spite of this, the interest in computer graphics was apparent, because panelists agreed that important progress has been made in all phases of computer graphics. Generally, this progress was reported along three fronts:

The first is the steadily-decreasing cost of electronic elements, coupled with the improvement in graphic generation characteristics of display systems. The storage tube CRT was given as a prime example of this trend. Graphics consoles using the storage tube CRT were said to approach the $2,000 to $3,000 price range. In other systems, lowered memory costs and that of digital logic elements have given new impetus to raster-scan displays using TV-displays, particularly for color.

Scan converters, combined with bandwidth compression techniques, were said to be additional methods of improving graphics capability while reducing system price. *Use of microprocessors,* particularly in interactive graphics terminals, was cited by several of the panelists as perhaps *the most important advancement in technology effecting computer graphics.*

Along the second front, it was agreed that a very significant factor was the general advancement in graphics software development combined with hardware improvements. The importance of this was emphasized as a key to the expansion of computer graphic markets through

development of specific applications. These were mentioned as including process and utility control; computer-aided design and manufacturing; text editing and graphic arts composition; image enhancement, such as for medicine; and computer-based education, including computer-aided instruction. Use of small, and perhaps eventually large area, displays was seen as coming to financial analysis and management information systems; but it was added that *no one yet knew how to take advantage of the promised high potential of management information applications.*

Finally, the third front was given as the shift in emphasis from development of specific graphic technologies to cost reduction, programming, applications and marketing. Because of this shift, panelists and attendees joined in a discussion of how best to use existing technology. In this regard, graphics standardization, or more exactly, the lack of it, was questioned. After years of effort, standards in certain areas of display characterization and graphic symbology were seen as emerging from display standards committees and the ACM Special Interest Group for Graphics (Siggraph). However, it was agreed that a "standard" graphic system, for example as a terminal on the ARPA or other networks, was certainly needed, but still a long way off.

Sessions of Interest

Two other NCC sessions of concern to SID members were Session 35, "Display Processing and Technology"; and Session 41, "Problems, Perils and Promises of Computer Graphics." The first was chaired by Bruce McCormick of the University of Illinois at Chicago Circle, the second by Lawrence Rosler, of the Bell Telephone Laboratories.

The session on Display Processing featured text editing and text processing systems. Charles H. Irby and Donald I. Andrews discussed, in detail, the highly-developed text manipulation system at SRI, using various types of alphanumeric and graphic display terminals for operator/system interaction. Thomas L. Boardman, Jr., of the University of Michigan, described a graphic data processing system where the communications capability for graphics data has been significantly developed. Arnold L. Griffith, of Information International, Inc., detailed his company's sophisticated graphics input processing system which includes multi-front character recognition.

'Problems, Perils & Promises'

The session on Problems, Perils and Promises gave attendees some first-hand observations and conclusions on the installation and operation of graphics systems. John B. Macdonald, of Western Electric Co., stressed that "computer graphics does not make possible anything that was previously impossible; it can only improve the throughput of an existing process." To be called a success, he estimates that improvement in throughput should take five years to pay for itself.

H.G. Marsh, of Raytheon Co., spoke of his outlay of over one million dollars for automatic drafting systems. He stated that operating savings range from 30%, for mechanical assembly drawing, to 45-50% for electronic schematics. James D. Foley (also in the SID session) suggested that the problems are not technological so much as those of integration of graphics into computer systems.

Robert Dunn, of the U.S. Army Electronics Command, reported on the *Workshop on Machine Independent Graphics* held on April 22-23, 1974, in Gaithersburg, Md. A major accomplishment was the formation of a standards planning committee under Siggraph to recommend graphics standards at the conference on Computer Graphics and Interactive Computing in Boulder, Colo., July 15-18, 1974.

Display & Computer Graphic Products

The NCC exhibits also included a fair share of display and computer graphic products. In display, Hughes Aircraft Co. showed the scan-converter based Conographic system. In hard-copy graphics, using electrostatic techniques, Gould Inc. Data Systems Division exhibited high-speed printer/plotters. In operator input devices, Talos Systems, Inc., of Scottsdale, Arizona, displayed the attractive Cybergraphic Tablet.

However, it appeared that Spatial Data Systems, Inc., of Goleta, California, received the most attention in computer graphics by displaying the *Computer Eye.* The Computer Eye is an input device using a TV camera (scanner), display (TV moniter), digitizer (converter to digital form), and computer controller (DEC PDP-11 minicomputer). A local Chicago newspaper featured the system with the headline: "Pictures by Computer Big Draw at Show Here." The exhibit demonstrated the Computer Eye System "taking" a picture of someone and printing out a "continuous-tone" picture, using the various characters to get shades of grey in a raster format on the printed sheet

IEEE Standards Now on Microfilm

Information Handling Services, the world's largest commercial micro-publisher of technical data announces agreement with IEEE (Institute of Electrical and Electronics Engineers) to place their Standards on microfilm.

Three microfilm formats (updated every three months) are now available and include: 8mm microfilm cassettes; 16mm microfilm cartridges; 98-page microfiche cards.

Information Handling Services, Denver Technological Center, P.O. Box 1154, Englewood, Colo. 80110.

NEW PRODUCTS

SID SID SID SID

IEE Readouts

Complementing its existing line of IEE-POLARIS Liquid Crystal dynamic scattering displays, Industrial Electronic Engineers, Inc., (IEE) introduces new and vastly improved series of *Field Effect* Liquid Crystal digital readouts.

The new field effect displays are being offered in both reflective, (model 1650-01) and transmissive (model 1550-01 P or N) configurations, and in a 3½ decade array with seven segment, .43" (llmm) high characters, ± sign, individual left-hand decimal points for each digit, and a colon for digital clock and counter applications. In addition, the transmissive models are available in either positive (dark characters/clear background) or negative (translucent characters against a dark field) versions.

These nematic distortion displays offer several significant advantages over those features which characterize other liquid crystal arrays: lower power (½ microwatt per segment @ 10-15 VAC, 30-1000 Hz); faster switching time (40-50 msec); higher contrast (25:1); longer life (20,000 hours @ 12 VAC); and broader operating ranges (-10°C to +65°C). Due to their slim profile (.125"/3.2mm) and extremely low power needs, the IEE-POLARIS Field Effect Liquid Crystal displays are ideally suited to such applications as portable or battery powered units where packaging density and power consumption are critical design considerations.

Circle 101 on Reader's Service Card

Newspaper Make-up

New electronic composition system for automated newspaper processing introduced by Ratheon Company. The new RAYCOMP™-100 system provides means for laying out and composing advertisements and other printed matter on a TV-like screen. Operator places advertisement content or text material into system by keyboard and punched paper tape or from optional magnetic tape unit. An overlay grid, indicating dimensions of the advertisement or text, is then called up and displayed on screen.

Advertisement content material is called up in sections and type faces and sizes selected through the keyboard. The material is manipulated, changed, edited, corrected, and finally positioned by the operator with the process repeated until the full advertisement is composed.

Circle 102 on Reader's Service Card

Car-Mel Electronics, Inc. "Informer" series of compact computer terminals may be used to enter information on a screen and transmit the data at high speed (up to 9600 baud) to a polling computer. Desk top unit weighs less than 10 pounds.

Circle 103 on Reader's Service Card

Line Printer

Advantages of 200-line-per-minute line printer said to be now available to users of Hewlett-Packard programmable desktop calculators. With new inteface card, calculators can be used in applications where multiple copies of printed records are needed, such as inventory, billing, payroll check printing and management reports.

Called the Hewlett-Packard Model 11287A Line Printer Interface, the card enables the Series 9800 calculators to control the HP Model 2607A Line Printer. The Model 2607A is a low-cost, 5 by 7 dot matrix, 132 character per line printer. Printing speed is 200 lines per minute, with up to six copies possible. Vertical formatting is possible under program control. A 64 ASCII character set is standard; an optional 128 character set can be used for printing both upper and lower case letters in a 5 by 9 dot matrix.

Exact information to apply new large-screen CRT displays is contained in Application Note 166, "Large Screen Display Applications and Interfacing," from Hewlett-Packard.

HP yokeless displays, of 17-inch (43.2 cm) and 21-inch (53.4 cm) diagonal size, can produce visible writing at a writing speed of 10 inches per microsecond (25.5 cm/ s); thus very large amounts of information can be presented, flicker-free, on the screen. To obtain maximum usefulness from the new displays, the Application Notes gives input requirements, attenuator calculations, data on Z-axis modulation, and details on options to satisfy special requirements.

HP Application Note 166 is available without cost.

Circle 104 on Reader's Service Card

HIGH-RESOLUTION PHOTOMETRIC MICROSCOPE ANALYZES ELECTRONIC DISPLAYS

The Gamma Scientific Model 700-10A Photometric Microscope is designed specifically to measure light from small areas — down to 1 to 2 microns, for instance. It has found wide use in the display industry as a basic tool for measuring the light output and resolution of display systems.

When fitted with a motor-driven scanning eyepiece, the combination shown here, the 700-10A can profile the luminance or spectral radiance of extremely small areas.

Inside the eyepiece, a slit or circular apertured probe is located so that its input end can be moved across the image plane. The virtue of this approach is that scanning is done after magnification, and the benefits are many.

To begin with, by changing the power of the objective, one can change resolution and scanning distance in the object plane, giving the system great flexibility.

Next, very high resolution can be obtained without ultra precise scanning mechanisms, but just by using a standard high-power microscope objective.

Also, the effects of vibration in the scanning system are minimized, both because the moving mass is extremely small and because the effects of any residual vibration in the system are reduced by the magnification of the objective.

This is only the beginning of our story of why Gamma Scientific has sold hundreds and hundreds of these microscopes and scanning eyepieces to the display industry. For the whole story, write or phone (collect) Gamma Scientific, 3777 Ruffin Rd., San Diego, Ca. 92123, phone 714/279-8034.

Circle 9 on Reader's Service Card

3D Digitizing

Summagraphics Corporation (formerly Scriptographics Corp.) offers 3D capability as a moderately-priced accessory for the Summagraph Data Tablets. Every point on any solid object that can be placed on a Summagraph Tablet/Digitizer (they range up to 36" x 48" in standard sizes), can be digitized with a resolution of 0.010" and an accuracy of ±½ LSB in all three dimensions.

One of the first applications is digitizing the patterns of a full line of men's shoes by a leading manufacturer. Other obvious uses include the preparation of NC tapes direct from models and recording the dimensions of the human form.

Circle 105 on Reader's Service Card

4K Ram Memory

With its adoption as the main memory in a series of new user-microprogrammable 16-bit minicomputers the 4K RAM has come to early maturity, says Hewlett-Packard. The new memory system makes it possible to achieve reductions in size, weight, power consumption and cost. Improvements are realized in memory speed and reliability. It is expected that MTBF will be from two to fifteen times better than commonly experienced with core-based minicomputers. Extensive tests are under way now, to confirm that expectation. Memory, processor, power system, and mainframe packaging of the units are all new.

Circle 106 on Reader's Service Card

Syntronic List

A six-page product index from Syntronic Instruments, Inc. lists a wide range of precision CRT deflection yokes, focus coils, accessory coils, rotating yokes and mechanical accessories for CRT displays. Important operating characteristics are charted and recommended applications are indicated for each component listed.

Circle 107 on Reader's Service Card

UK Optical Filters

Systems Components Div. of Baird-Atomic now distributes in U.S. optical filters by Parsons & Co. of England.

Circle 108 on Reader's Service Card

GE Color Video Projector

Focusing on "simplicity of design and reliability of performance," engineers at the GE Video Display Equipment Operation say they have developed a new color video projector that has a remote control capability and incorporates its unique light valve with a single optical path for projection. Called the PJ5000, the high brightness, color, video projector also features more efficient use of power inputs and a low weight of 135 pounds. Also, the compact unit can operate from a table top.

Applications for the PJ5000 include special entertainment events, sports features, instant information review for business, educational/teaching programs and industry training seminars.

GE says it sought to combine "the mobility found in smaller video projectors with the quality characteristics of larger, more powerful models." The PJ5000 system basically consists of a projector assembly which includes elevation tilt adjustments, an electronic systems assembly, a sealed beam Xenon lamp, a sealed light valve and projection lens, plus an enclosure molded from engineering structural foam resin.

The optical system utilizes the GE light valve or "Single Gun", single optical axis technique. This process provides inherent color registration, eliminating the need for convergence and adjustment.

The projection unit measures 17" x 22" x 30". When placed on its matching, accessory base, the overall height of the two-tone gray projector is approximately 48".

Circle 109 on Reader's Service Card

new products

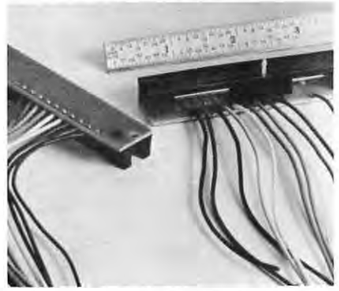
Translation Stages

Newport Research Corporation has two new translation stages which incorporate several unique functional features. Smaller of two, Model TSX-1, is 3"x3"x1" in size, employes lathe bed type movement with two ground and polished shafts which assure linear motion over entire 1" range. Coarse override adjustments can be carried out quickly by simply pushing on the top plate. Degree of force required to override screw adjustment is adjustable.

Second stage, Model 430, is 3"x4"x1" in size, utilizes precise micrometer-driven ball-bearing movement. In addition, it has useful feature — positionable micrometer and micrometer stop. This capability opens up convenient options. For coarse adjustments, micrometer and/or stop can be positioned at any point along dovetail tracks; micrometer can be exchanged for another with a different travel; micrometer assembly and stops can be removed and attached to other side, allowing either right or left handed adjustments.

Circle 110 on Reader's Service Card

Linear Selector Switch



New linear slide selector switch, Swift-Action, with 11 discrete positions is introduced by Sonitronic, Inc. Most outstanding feature is fast, snap-detent action, "with no stalling or lagging in between positions."

Said to have numerous important applications in industry including "pin-point-accurate selection" and association and fixed time parameters with specific machinery.

Switch provides "faster switching action from position to position than either the rotary or push button variety," visually digitizes specific functions.

Circle 111 on Reader's Service Card

Digital Stopwatch

"Slimline" Digital Stopwatch in compact panel-mounting instrument for measuring elapsed time intervals from hours down to microseconds, features bright light-emitting diode display, data outputs, remote control inputs. Manual controls are hidden under snap-in panel to prevent tampering, cast metal case is 9/16" thick, requires no space behind panel.

Stopwatch is ideally suited for many types of control, monitoring, and data acquisition systems, is designed as fully-compatible system component, can be easily interfaced with other equipment.

Circle 112 on Reader's Service Card

New Green SSL's

Four bright new green solid state lamps (LEDs) with guaranteed light output and "promise of immediate delivery" were introduced at recent IEEE exhibition in New York City by General Electric Company's Miniature Lamp Products Department

The two brightest, SSL44-2 and the slightly longer SSL44L-2, provide guaranteed minimum initial light output at 20 milliamperes of 1.8 millicandela with typical output of 2.4 mcd. Equivalent guaranteed light outputs for less expensive SSL44-1 and SSL44L-1 said to be 0.8 minimum and 1.4 mcd typical at 20 mA.

Under terms of guarantee, General Electric will refund purchase price to original purchaser or provide replacement lamps for returned lamps not meeting stated specifications.

Circle 113 on Reader's Service Card

If You Heard 'Em Lucky, If You Didn't, Too Bad

Capsule reports of SID Chapter meetings throughout the land:

MINNEAPOLIS / ST. PAUL – May 17, 1974. *Host:* 3M Company Research Center staff, directed by SID member Tom Werner, presented demonstration of the new 3M laser memory.

(SAN FRANCISCO) BAY AREA April 30, 1974. *Speaker:* Andrew Barnes, Tektronix, spoke on low-cost graphics through storage tube technology. Talk included demonstration of 4010 Computer Terminal with hardcopy unit.

MID-ATLANTIC CHAPTER – May 29, 1974. *Topic:* Brainstorming session was held, at NYC Statler-Hilton, with 9-member panel on general topic "Display Technologies for Various Applications." Panelists were: Mr. John Auman, General Motors Technical Center; Dr. Ifay F. Chang (Panel Coordinator), IBM Research Center; Mr. Robert Giglia, American Cyanamid Company; Dr. Zoltan Kiss, Optel Corporation; Mr. Thomas C. Maloney, Burroughs Corporation; Mr. Irving Reingold, U.S. Army Electronics Command; Mr. Sol Sherr, North Hills Electronics, Inc.; Dr. John A. VanRaalte, RCA David Sarnoff Research Center; Dr. James F. Womac, General Electric Research Center.

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New York, New York 10017

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Sunnyvale, California 94086

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4812 Kearny Mesa Road
San Diego, California 92111

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Plainview, New York

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Colorado Springs, Colorado 80907

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ELECTRONIC SYSTEMS DIVISION
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Sidcup, Kent, England

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Hauppauge, New York 11787

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Components Marketing
76 St. Martinstr.
Munich, West Germany

SINGER-LIBRASCOPE
Aerospace & Marine Systems Group
933 Sonora Avenue
Glendale, California 91201

SYNTRONIC INSTRUMENTS, INC.
100 Industrial Road
Addison, Illinois

TEKTRONIX, INC.
Information Display Products
P.O. Box 500
Beaverton, Oregon 97005

THOMAS ELECTRONICS, INC.
100 Riverview Drive
Wayne, New Jersey 07470

THOMSON-CSF
Paris, France

XEROX DATA SYSTEMS
El Segundo, California 90245

Optical Coating List

Optical Coating Laboratory announces availability of its 1974 Visual and Infrared Stock Filter Catalogs. Catalogs list wide variety of immediately available interference filters in both the visual and infrared portions of the specturm.

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