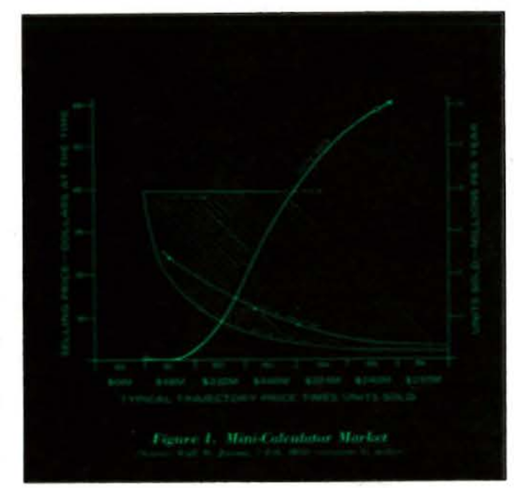
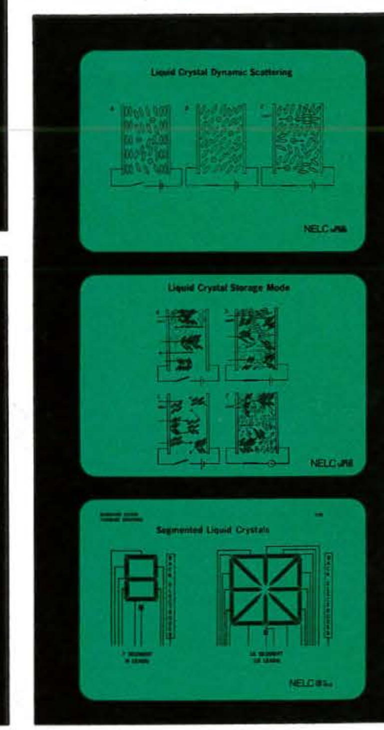
SID JOURNAL

The Official Journal of the Society For Information Display
Formerly INFORMATION DISPLAY JOURNAL

1973 *international* SYMPOSIUM and EXHIBITION

Statler-Hilton Hotel
New York City, New York
May 15-16-17, 1973





Flat Panel Displays . . . Who Needs One?

By Frank C. Martin, Jr.

SID 1973 International Symposium & Exhibition Program

The New, New Math

By E. A. Ulbrich

"skinny" display

vol. 10, number 2
march/april 1973

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The Official Journal of the Society For Information Display

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PRESIDENT'S MESSAGE

As you will notice from our cover, this issue marks a return of the name, "Information Display" to the masthead of the Society's Journal. After almost a two year period during which time "Information Display" was published independently, the Society has come to a satisfactory settlement of our differences with our former publisher. The overall effect of this settlement is to make the Society's Journal the exclusive publication in our technological field. With this issue, our Journal once again will serve as the "common meeting ground" of display scientists, display users and the display industry in order that each may serve to bring to the attention of the others new technologies, new requirements and new products in the display field.

I think it is also fitting that this issue contains a preview of our annual Symposium, SID '73, to be held in New York City in May. It is clear that the Committee, and, in particular, the Program Committee, is to be commended for having compiled an excellent set of papers which will have appeal to virtually every engineering and scientific discipline within the display community. There is every indication that SID '73 will be one of our best symposia to date.

Since publications and technical meetings represent our most visible activities to our general membership and the Display profession as a whole, I am naturally quite proud that we have made such significant studies in these two areas of our Society's endeavors. I am sure that the future holds promise for even greater achievements yielding further benefits to our membership.

Dr. Carlo P. Crocetti
President

INFORMATION SYSTEMS
TECHNOLOGY DEPARTMENT 3100

FLAT PANEL DISPLAYS
Who needs one?

by Frank C. Martin, Jr.
NELC
Naval Electronics Laboratory Center
San Diego

NELC 209-6 SAN DIEGO

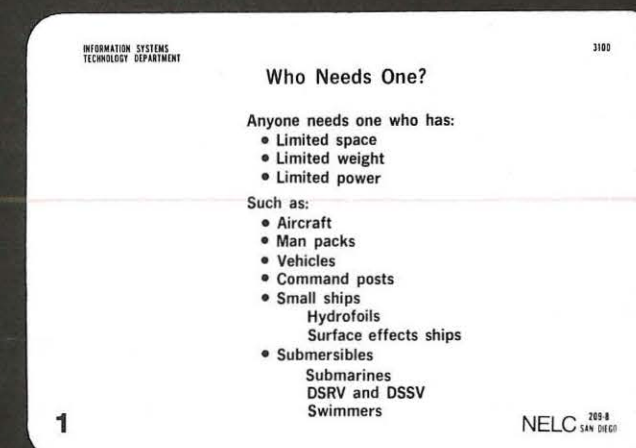
An update on "skinny" display technology.

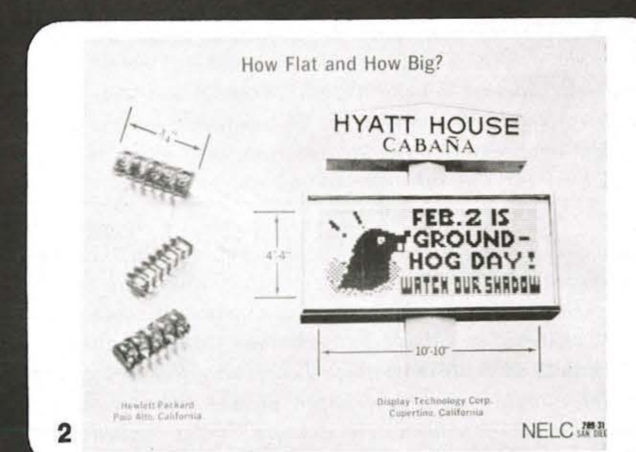
In any presentation of flat panel displays, one usually raises as many questions as answers. With flat panels, the questions are: Who needs one? How flat and how big? How much can you afford to pay for them? How long can you wait before you need it? Must it meet Mil Specs?

1 *In answer to the question of who needs one, anyone needs one who has limited space, limited weight, or limited power. The list you see contains vehicles with priority payloads which may pay the higher cost of flat panel displays. These include man packs, vehicles, and the new technology surface ships: hydrofoils, surface effect ships, and cramped submersibles such as submarines, Deep Submergence Rescue Vehicles, Deep Submergence Salvage Vehicles, lock-out divers and swimmers. In some cases there exists a requirement where cost is almost no object.*

2 *How flat and how big are flat panels? On the left are five digits packaged in three quarters of an inch length. These small seven-segment numerical indicators are used in the HP-35 calculators. On the right is an outdoor electrostatic Distec display by Display Technology in which each vane is 1.3 inches square. Each 5 by 7 character must be at least 9 inches high and can be back-lighted at night or reflect sunlight during the day. This approach to large screen flat panels will not be discussed in detail here, but indicates the range of sizes available.*

3 *What are liquid crystals? Liquid crystals are materials which have a different index of refraction along one optic axis than along another. Without external disturbance they exist in a liquid state pretty much in an ordered anisotropic crystalline form. Shown in this view are three types of liquid crystals: nematic, smectic, and cholesteric. The nematic type is best used for those display applica-*





tions which only require short persistence. The smectic materials have not found widespread usage for display applications to date. The cholesteric materials, on the right, are also ordered molecules. About 20% cholesteric materials mixed with the nematic materials provide a long-term display memory.

4 How are liquid crystals used? This diagram shows the use of liquid crystals in the dynamic scattering mode. The crystals in the undisturbed state are aligned in a fairly uniform order. As a potential is applied across them, they begin to change their molecular alignment. As this voltage is retained across them for any period of time, ions begin to migrate across the cells, disturbing the order of the materials. When this order is disturbed, boundaries of different index of refraction are formed throughout the crystal and light is caused to scatter. When looking at the display, one sees a milky or cloudy appearance in an otherwise very transparent medium. The distance across this pair of panels is approximately 0.0005″.

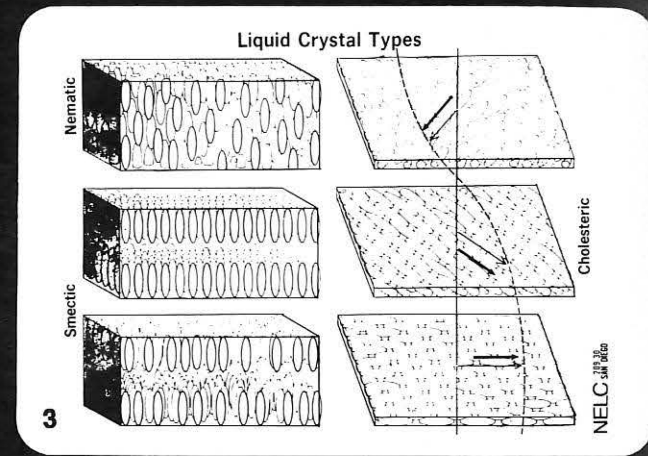
5 Another phenomenon is the storage phenomenon. The material is in a rather ordered state until selectively disturbed by the application of an electric field. If cholesteric material is added to the nematic material, a permanent "set" can be caused on the order of the liquid crystal material which, as shown in the lower left corner, remains after the electric field is removed. Liquid crystal cells have been shipped completely across country and back without disturbing images formed. High vibrations and exceeding the liquid crystalline temperature of the material would destroy the stored image. Another method of deliberately erasing the storage mode panels is the use of an A.C. voltage which reorients the crystals to the clear state.

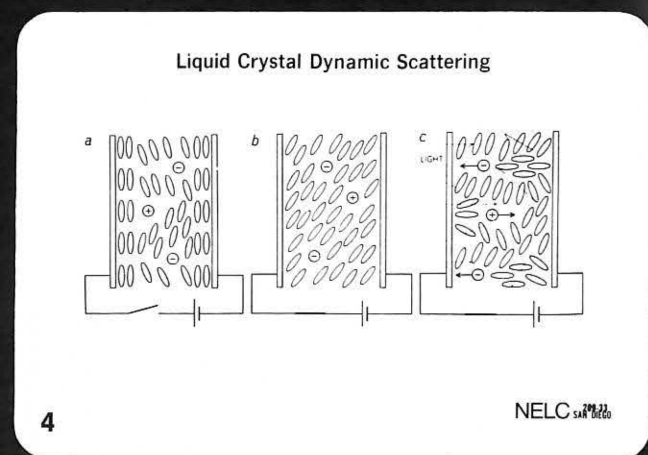
6 The biggest use of liquid crystals to date is in the form of a 7-segment array. By selectively energizing any combination of the 7 segments, the ten numerals and a few alphabetical characters can be generated. This requires the use of one lead for each segment, one for decimal, and another lead on the back for substrate. These devices lend themselves to be used with polarizing materials and can present data as you can see it here, black on a clear background or clear on a black background. For military applications, we cannot be satisfied with only 7-segment devices which will produce numbers and a few characters. We must be able to present the complete alphanumeric set.

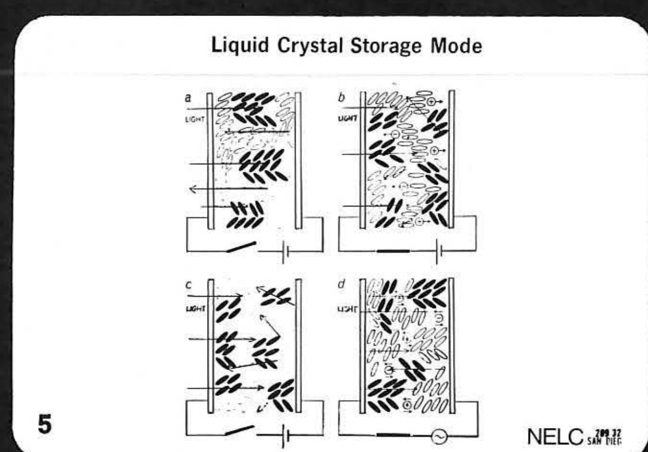
One format adaptable for liquid crystals which will provide a total alphabet plus the numeral set is the 16-segment format shown on the right hand side of the figure. Notice that this takes 16 segments for the presentation of alphanumeric information, plus a decimal, plus one lead for the substrate for a total of 18 leads.

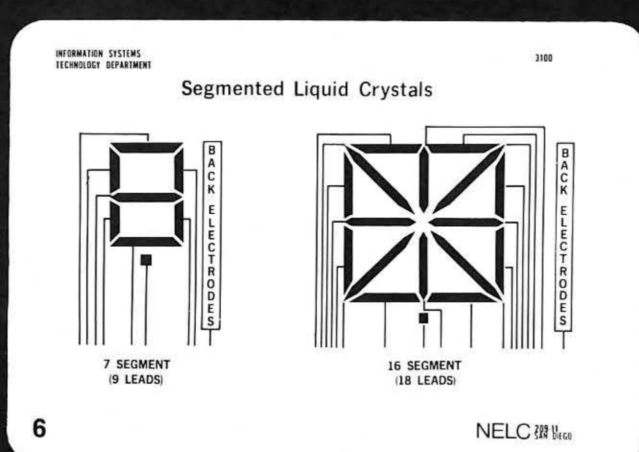
7 Another form of liquid crystals which appears very promising for future flat panel displays is the photo-activated crystal. In this figure you see the same cell used for scattering-type liquid crystals, with an added photo conductive zinc sulfide or cadmium sulfide coating over the conductive glass coating. To operate this device, ultra violet imaging light is focused on the photo conductive surface, which causes a reduction of the impedance of the zinc sulfide or cadmium sulfide layer. As voltage is applied, only those portions of the liquid crystal where the UV imaging light was focused will scatter light.

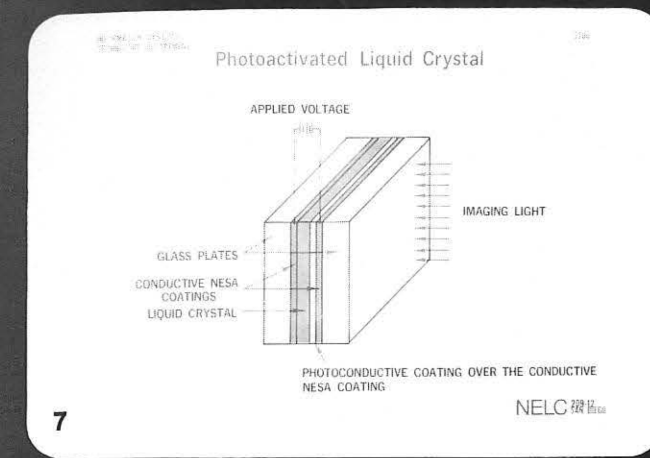
Now if a second light source containing no light wave-

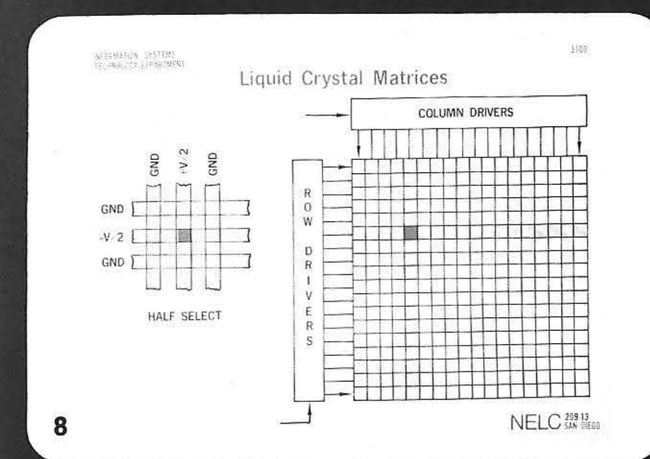


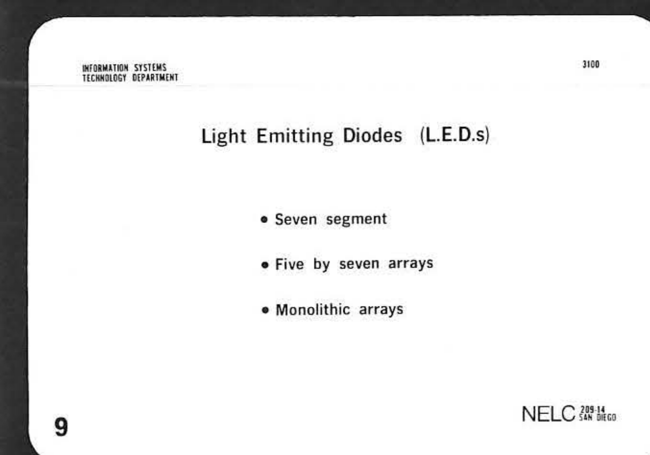


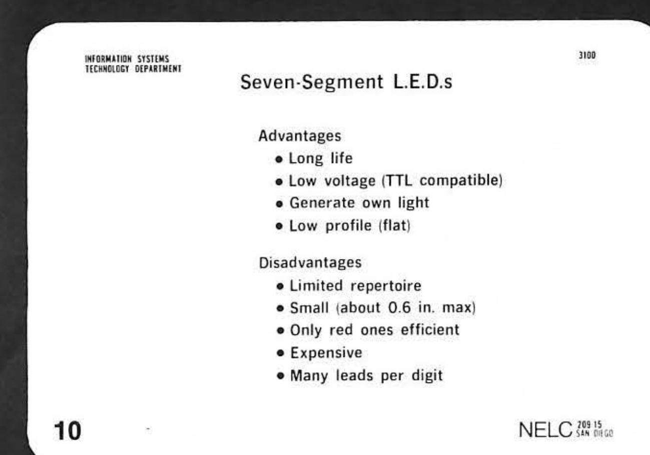












length which can be detected by the photo conductive layer is passed through the cell, only those areas which have been distorted by the imaging light will show scattering. In this manner, large screen displays can be generated by passing a high power light through the liquid crystal where only a small modulating UV light source was used to form an image. This technique can be used either in the reflective or the transmissive modes of liquid crystals, and should be of high usefulness in the not-too-distant future.

Another form of liquid crystals is the matrix. A number of military agencies are funding work on this. If a sandwich containing orthogonal sets of rows and columns of transparent conductors is placed on the two substrates of a liquid crystal cell and the conductors are selectively energized, images may be generated at the intersections of the energized row and column. One of the present drawbacks with this type of display is the "half-select" problem which has plagued a number of display technologies in the past. This problem is best shown on the left side of the screen, where it can be seen that the center pair of vertical and horizontal conductors have $\frac{+V}{2}$ on a column and $\frac{-V}{2}$ on a row or a full voltage, V, applied across the center of the array; but $\frac{+V}{2}$ to ground is present on the top and bottom intersections above and below, and $\frac{-V}{2}$ is present to ground at the left and right intersections. If there is not a very steep slope in the brightness or scattering curve, faint images will appear on all of the rows and columns of the selected pair as shown on the intersections on the right. 8

Another emerging technology is the light emitting diode (LED). The 7-segment devices and 5 by 7 arrays are available from a number of manufacturers. We are beginning to see a few monolithic arrays. 9

I have defined a 7-segment array in liquid crystal technology. This is accomplished in the LED technology by cementing a number of small diodes in rows forming the seven segments and drawing current through selected cathodes with all anodes tied to a common bus. The 5 by 7 arrays consist of seven rows of five diodes plus a decimal. These are usually interconnected with common anodes by row and common cathodes by column. By selectively energizing a row and drawing current through selected column leads, up to five digits per row can be selected simultaneously. By sequencing through rows, a large choice of symbols and characters may be presented.

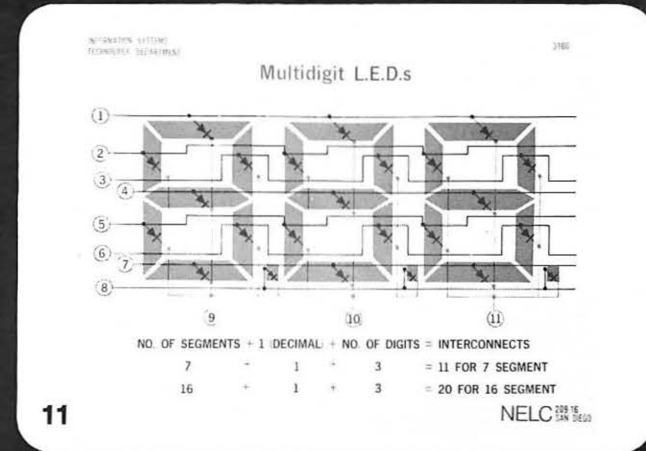
Monolithic arrays in GaAsP and GaP have been fabricated which contain over 500 diodes in a 3/4″ square array. High yields of these arrays will lead to lower costs and the possibility of "tiling" the monoliths into larger arrays.

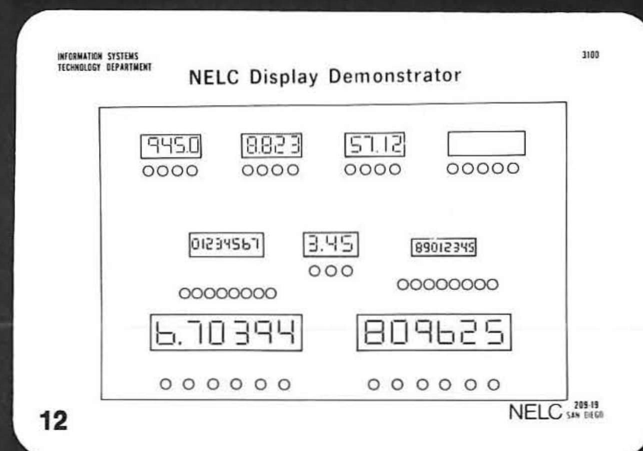
There are several advantages to LED's in the 7-segment form over liquid crystals. First, they have an extremely long life, in the order of 100 years. This is far in excess of the 4,000 to 10,000 hours of life predicted for liquid crystals. Secondly, they are activated by a low voltage. They are TTL-compatible and are operable over a wider temperature range. The diode drive is similar to any conventional diode. Usually less than 2 volts is sufficient to 10 *drive them to an acceptable output. The current required is compatible with 54/74 TTL gates unless large arrays are driven. Another advantage is that they generate their own light. The color of a liquid crystal display can be chosen by the source of controlled illumination, but this source requires space either behind or in front of the display. By providing their own light, LED's offer a very thin profile. The disadvantage of 7-segment devices is the limited character repertoire, as with liquid crystals. Another disadvantage is size. LED's are expensive, and about 6/10 inches high is the largest available. Only the red ones are efficient. We also have the problem of nine leads per digit. They are expensive, but the cost may be justified if they will last a lifetime when driven properly.*

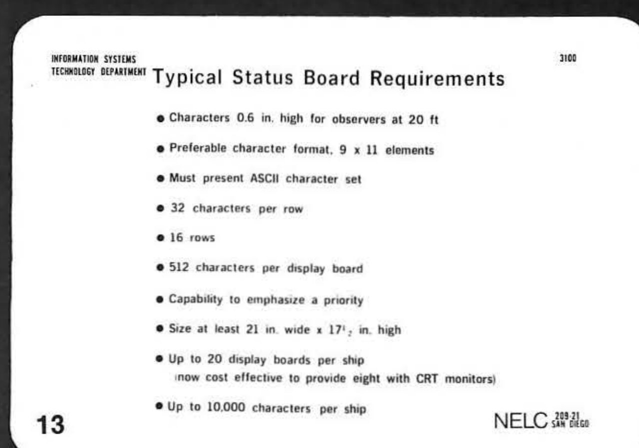
11 *There are cost effective ways of driving a number of numerals together. The little 5-digit midget from the HP-35 calculator has 7 segments per digit. All anodes for identical segments are bussed together and are sequentially energized, one through eight. All cathodes per digit are commonly connected. Current drawn on selected numeral spaces while a row is energized causes segments to illuminate. Iterative cycling through the eight rows at above 100 cycles per second eliminates flicker and stroboscopic interference in a vibrating equipment.*

12 *The next figure shows the front of a portion of the NELC display demonstrator with which we are investigating and characterizing various samples of light emitting diodes and liquid crystals. The upper right-hand window which was to contain five 5 by 7 arrays of characters has not been filled because we are trying to condense the circuitry into something that can be standardized to work not only with 5 by 7 arrays, but 7 by 9 and even 9 by 11 arrays. The purpose of showing this is to point out one of our bigger problems. We have 43 seven-segment digits displayed here with decimal capability at each numeral space. Beneath each integer is a small LED lamp which indicates to the operator in which space he will write if he depresses the typewriter key.*

13 *Let's project that to a typical status board requirement. These are numbers that are typical for a modern surface ship display. We need characters 6/10 inches high for observers at 20 feet. We would like to have a format something like 9 by 11 elements per character. We certainly want to be able to present the ASCII character set. We need 32 characters per row and 16 rows, which is a total of 512 characters per display board. We need a method of emphasizing a priority at any designated location on that board. If an aircraft is in distress on the combat status board, we would like to have our attention drawn to an immediate action requirement. Liquid crystals may offer us a method of accomplishing this if we can project white or amber for general status light and red backlighting where there is emphasis required. This same "luxury" is very difficult to achieve with plasma or with light emitting diodes, and is certainly a far cry from the presently available electroluminescent materials. In an aircraft carrier CIC there may be as many as 20 display boards. Some of these change very rapidly, while others such as weather, ship's course, speed, and call signs of aircraft do not change very rapidly. But eight of these are desirable in the very near future. If we provided all 20 of them, the total would be 10,000 digits. A typical status board size is 21 inches wide by 17½ inches high (at least) to hold these 512 characters.*







The main objective of the discussion to this point is to emphasize the high complexity and resulting costs of attempting to utilize small available off-the-shelf flat panel devices for typical military applications.

Now let us look at another display technology which is
14 *now available for commercial applications. Plasma panels can be obtained in moderately large sizes up to 8½ inches square. Plasma panels are particularly suitable for X-Y presentations or the display of large amounts of alphanumeric data. Sixty-four 7 by 9 characters may be presented on each of 32 rows (2048 characters total) on these panels. When larger sizes are available, they may satisfy the status board requirement just presented. They may also offer some relief in the complexities of the interface.*

Some panels have inherent memories, others have gray scale. Some are transparent. They are certainly high resolution: up to 60 cells per inch. They are thin and dimensionally stable. Accurately projected map information may be precisely correlated to X-Y generated panel information because the plasma coordinates are ruled on the glass substrates. They have many disadvantages also. A 512 x 512 Owens-Illinois Digivue, although a fine display, has 1,024 leads coming away from the front panel. It requires reasonably high voltages. These are not readily accessible in integrated circuit packages to date. There's a complex address decode logic required in order to convert 9 binary bits to 512 individual leads for each axis. This is a great bulk of hardware, especially if high voltage drive is required. These panels may be susceptible to environmental problems. Two thin glass panels spaced a mil or ½ mil apart at an internal pressure of ⅓ of an atmosphere may cause concern for aircraft applications. Plasma panels are also slower to enter and delete data. The maximum interface frequency with the Digivue is 50 KHz or 20 microseconds per element.

Variations in plasma panel construction for two ven-
15 *dors is shown in the graph. One uses dielectrically-coated transparent orthogonal electrodes on the front and rear transparent substrates with a one-mil spacer and seal around the periphery. Sustainer voltages are applied to the electrodes which will not initiate ionization but will sustain it if it has been started by a momentary higher voltage.*

To write on the panel, reinforcing X-select and Y-select voltages are applied to the vertical and horizontal electrodes and ionization is caused to commence. If attenuating phases are added, ionization is caused to cease. NELC has a panel of this type. The characters offer a very good high-resolution display. This panel is transparent so that map overlays may be projected from the rear.

On the right is shown the Control Data-type plasma display which contains a set of rectangular tubes which can be placed 33 to the inch and can extend as long as 32 inches. Control Data is working on mounting these on highly flexible plastic substrates and has incorporated these in a data terminal.

This figure shows a combination of technologies which
16 *we in the display group thought might be a good one. It consists of an electroluminescent panel which is sandwiched together with a louvred display film that is available from 3M Corporation. The light, directed downward from the Energy Conversion Devices electroluminescent panel, is allowed to pass through the liquid crystal. If*

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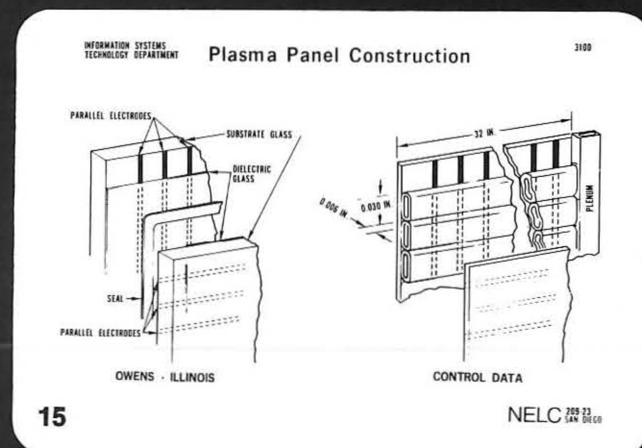
INFORMATION SYSTEMS TECHNOLOGY DEPARTMENT — 3100

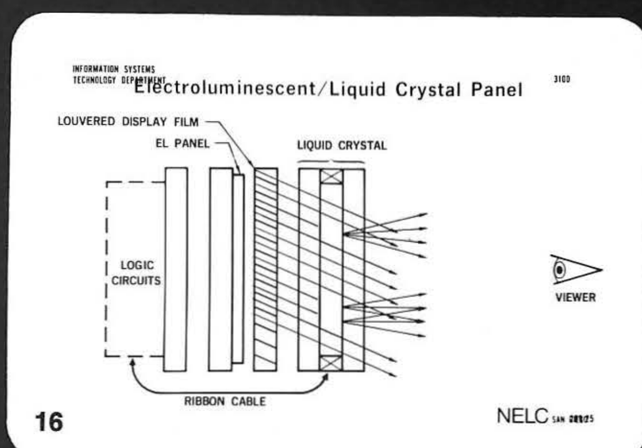
Plasma Panels

Advantages
- Available in moderately large sizes
- Particularly suitable for x-y
- Memory
- High resolution
- Transparent
- Thin
- Dimensionally stable

Disadvantages
- Many leads to large panels
- High voltages required
- Complex address decode logic
- Susceptible to environmental problems
- Slower than L.E.D.s

14 — NELC SAN DIEGO





SEEN AT 'DISPLAY UPDATE '73' IN SAN DIEGO

More than 125 people attended a highly successful one-day conference sponsored by the San Diego Chapter of the Society for Information Display on December 8 at Sheraton Inn-Airport, San Diego. The one-day meeting was held under the title "Display Update '73." Registrants came not only from Southern California, but from as far away as Sweden.

Twelve papers were presented (some will appear in future issues —ED.). The morning session was titled "Updating Display Techniques," the afternoon "Updating Display Applications." The following papers were given:

Morning Session

Visual Perception & Illusion in Image Transmission Systems, Harold Allsberg, Jet Propulsion Laboratory.

Imagery Storage Techniques, Robert D. Vernot, Joseph J. Frangipane, Philco-Ford Corp., C&TS Division.

The Halftone Response of Electrical Recording Storage Tubes, R. A. Davidson, Litton Data Systems Division.

Flat Panel Displays, Who Needs One? Frank C. Martin, Jr., NELC.

Nematic Liquid Crystal Displays; Properties & Limitations, Ulrich Bonne/J. P. Cummings, Honeywell Corporate Research Center.

Generation of 3-D Halftone Images on a Raster Display Using a Call Format, B. W. Jordan, Jr., Northwestern University; R. J. Langley, TRW Systems.

Luncheon Address

Automation in the U.S. Navy, Capt. N. D. Harding, USN, Commanding Officer, Naval Electronics Laboratory Center, San Diego, Ca.

Afternoon Session

Which Flat Panel Display Technology? — A Specific Example, George Robert Kaelin, Ph.D., Litton Industries, Inc., Data Systems Division.

Improved Memory Tube for Alpha-Numeric and Graphics Applications, K. R. Hesse, Hughes Aircraft Company, Industrial Products Division. *turn to page 34*

1


2


3


4


5


1. L.M. Seeberger, Hughes Aircraft; Pat Dupuis, Northrop (only gal at meeting); Roger Denig, McDonnell-Douglas.
2. Ken Hesse, Hughes Aircraft, delivers paper at P.M. session.
3. Capt. N.D. Harding, USN, addressed group on "Automation in the U.S. Navy."
4. Dick Thoman (2nd from left) with three delegates from Sweden, Hasse O. Lafsson, Lennart Alfredsson, Stellar Moren at all-day meeting.
5. 6; and 7. Display people on display, during the luncheon hour.
8. Display Update '73 speakers.

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8


60 Papers To Be Heard At SID Intl. Convention

Reflecting its growing global stature in the expanding fields of information display, the forthcoming International Symposium of the Society for Information Display, to be held in New York City, Statler Hilton Hotel, May 15-17, will offer more than 60 papers authored by over 120 authors from here and abroad, including representation from England, Italy, Japan and Norway.

During 14 daytime sessions a highly-diversified array of subjects will be covered: display input/output techniques, solid-state display technology, liquid crystal displays, raster and vector graphic display systems, displays and computers in education, plasma displays, special-purpose display techniques, CRT devices, display information perception, aerospace display applications, displays and systems, and processing and applications.

Such topical developments as 36-character dc electroluminescent alphanumeric displays, multicolor field-effect display devices and plasma displays with gray scale will be described. Other advancements to be disclosed include megabit plasma display boards, pocket calculator display systems, 1125 scanning-line laser color TV display, storage CRT with liquid crystal display; also integrated drive circuits for LED-LCC displays, LEDs in high ambient illumination, as well as helmet-mounted cameras and displays for pilot training and solid-state vertical-scale instrumentation.

The ever-popular informal panel discussions will be held on Tuesday and Wednesday evenings: May 15 and 16. In four timely sessions, such topics as the impact of new technology on display system architecture, expanding TV services, active-passive displays and new directions for raster imaging will be assessed. Over 30 from industry, government and universities will participate in impromptu current and future status reviews.

A formal-opening keynote address by Robert Adler, director of research, Zenith Radio, will offer long-range forecast on TV, citing upcoming innovations that may set new standards for design. The first day will also be highlighted by awarding of citations for the best papers delivered in San Francisco during SID 72.

On Wednesday, May 16, a dynamic luncheon talk on integrated character animation display techniques will be given, supported by a large screen color-TV demonstration. An exhibition of the latest display developments will also be held, with operational systems, equipments and accessories, valued at over $5-million, on view.

The in-depth two-day seminars, introduced at SID 72, have also been programmed for this year's meeting and will be held on the day before and after the SID sessions: Monday, May 14 and Friday, May 18. Under the cosponsorship of the Polytechnic Institute of Brooklyn, eight lectures will be offered on human factors in informa-

Tenth Retrieval Colloquium Slated

Changing Patterns in Information Retrieval will be the theme of the 10th annual National Information Retrieval Colloquium, to be held May 3 and 4, 1973, at the Independence Mall Holiday Inn, 4th and Arch Streets, Philadelphia, Pa. 19106.

The National Information Retrieval Colloquium (NIRC) is an annual two-day conference sponsored by 10 regional societies and organizations in the information storage and retrieval sciences. It serves as a forum for practitioners and academicians to propose novel ideas, discuss trends, and learn of new applications and techniques.

This year's keynote speaker is Robert S. Taylor, Dean, School of Library Science, Syracuse University.

The technical program will be comprised of four sessions, each containing a state of the art paper followed by interactive panel and audience discussion.

SID 1973 INTERNATIONAL SYMPOSIUM and EXHIBITION

NEW YORK CITY, STATLER-HILTON HOTEL

MAY 15-16-17, 1973

SID 73 — reflecting its growing worldwide technological stature — will feature the most comprehensive global development reports on diversified information display subjects ever presented, with over 60 papers by more than 120 from here and abroad, including speakers from England, Japan, Norway, Italy and the Netherlands, in 14 daytime sessions, and 21 panelists participating in evening discussion forums . . . The program will also be highlighted by invited talks on a long-range forecast on TVs future and upcoming innovations, on-line dialogues with graphic terminals and perception of displayed information, as well as a luncheon address — Wednesday, May 16 — on integrated character animation display supported by a large-screen color-TV demonstration . . . Illustrated 800-1000 word condensations of all papers — invited and contributed — plus introductory comments on day-evening sessions will appear in a DIGEST of TECHNICAL PAPERS, distributed to all registrants . . . The author interviews with face-to-face discussions will be continued, with scheduled announcements by session chairmen . . . Also scheduled is a cocktail hour on Tuesday, May 15 . . . The annual 3-day exhibition, which will be held in the first-level hotel exposition center, contiguous to the Grand and Gold Ballrooms, site of the day sessions, will include dynamic operational systems, equipments and accessories, valued at over $5-million.

THE TIMELY TWO-DAY SEMINARS, **introduced in '72 at SID, have also been programmed for Monday, May 14 and Friday, May 18 . . . Under the cosponsorship of the Polytechnic Institute of Brooklyn, eight lectures will be offered on human factors in information display and computer graphics. Complete session and registration details appear in the center-fold.**

A MESSAGE DESK, **in operation daily during SID '73, will accept all incoming calls for posting on a bulletin board. Specially-assigned SID telephone number is 212-947-2578.**

FOR PROMPT REGISTRATION/RESERVATION SERVICE, **the registration forms should be completed as early as possible and returned to the hotel and SID 73 treasurer, but surely before the deadlines noted . . . Additional programs are available from SID, 654 N. Sepulveda Blvd., Suite 15, Los Angeles, Cal. 90049, or Lewis Winner, 152 W. 42d Street, New York, N.Y. 10036.**

THE CAMERA-RECORDER REGULATION POLICY, **forbidding cameras or recorders in the evening panel rooms, will again be in force during SID 73 to insure spontaneity and freedom of impromptu expression among panelists and audience. But, recorders and cameras will be allowed in the day session rooms.**

A HOSPITALITY DESK **in the first-level registration area, will contain an assortment of pamphlets, brochures, maps, restaurant and shopping guides, plus daily listings of special events in the Greater New York area.**

THE STATLER-HILTON HOTEL **in New York City, where all of the day-evening sessions and seminars and exhibits will be held, is located on 7th Avenue, between 33d and 32d Streets, opposite the Penn-Central and Long Island Railroad stations and the new Madison Square Garden Center, convenient to the internationally-famous Broadway theatre district and all terminals, subway stations and buses. . . . . . .**

THE SID 73 INTERNATIONAL SYMPOSIUM/EXHIBITION, **the 14th annual event, is sponsored by the Society for Information Display, with headquarters in Los Angeles, Cal. SID membership forms, publications and complete information on supplementary society activities, including regional programs, will be available in a SID booth on the exhibition floor.**

SES. I/TUES., MAY 15/9:00 — 10:15 A.M.

FORMAL OPENING/KEYNOTE
(Grand Ballroom)

Welcoming Remarks —

J. H. Becker
General Chairman, SID 73

H. G. Slottow
Program Chairman, SID 73

Annual SID Business Meeting

Presiding —

C. P. Crocetti
President, SID

SID Honors and Awards Presentations —

W. Bethke
Chairman, SID Honors and Awards Committee

1972 Symposium Best-Paper Awards —

J. H. Becker

KEYNOTE ADDRESS

The Future of Television

Robert Adler
Vice President/Director of Research
Zenith Radio Corporation

SES. II/TUES., MAY 15/10:30 A.M. — 12:00 NOON

Display Input/Output Techniques
(Grand Ballroom)

Chairman: R. S. Kicklighter
Eastman Kodak Co.
Rochester, N.Y.

2.1: A Tracking and Pointing Light Pen Systems for Plasma Display/Memory Devices
W.J. Coates, R.L. Johnson and P.T. Tucker
University of Illinois
Urbana, Ill.

2.2: The Analog Touch Panel — A Finger-Operated Computer Graphic Input Device
J.A. Turner and G.J. Ritchie
University of Essex
Essex, England

2.3: Hard Copy from Plasma-Panel Displays using Simultaneous Charge-Transfer Electrophotography
G.F. Day, Varian Associates, Palo Alto, Cal.
F.H. Brown, Owens-Illinois, Inc., Okemos, Mich.

2.4: Graphic System Application of Plasma Display-Memory Devices with Direct Electrical Readout
R.L. Johnson and L.F. Weber
University of Illinois
Urbana, Ill.

SES. III/TUES., MAY 15/10:30 A.M.—12:00 NOON

Solid-State Display Technology
(Gold Ballroom)

Chairman: W.F. Goede
Northrop Corp.
Palos Verdes, Cal.

3.1: Convolution Scattering Model for Ferroelectric Ceramics and Other Display Media
A.L. Dalisa and R.J. Seymour
Philips Laboratories
Briarcliff Manor, N.Y.

3.2: Ferroelectric Ceramic Surface-Deformation Devices for Image Storage and Display
C.E. Land and W.D. Smith
Sandia Laboratories
Albuquerque, N.M.

3.3: Electric Field and Light Intensity Dependence of Image Formation in the -Ruticon
A.I. Lakatos
Xerox Corp.
Rochester, N.Y.

3.4: An Operating 36-Character DC Electroluminescent Alphanumeric Display
A.L. Mears, J. Parker and R.W. Sarginson, Royal Radar Establishment, Worcestershire, England
R. Ellis, Thames Polytechnic, London, England

Register Now — Dynamic Second Annual Seminar
Mon., May 14 / Fri., May 18

SES. IV/TUES., MAY 15/1:45 — 5:00 P.M.

Liquid Crystal Displays
(Grand Ballroom)

Chairman: L. Goodman
RCA Laboratories, Princeton, N.J.

4.1: Interdigital Field-Effect Liquid-Crystal Displays
R.A. Soref
Sperry Rand Research Center, Sudbury, Mass.

4.2: Singular Electrooptical Characteristics of Liquid Crystal Display with Interdigital Electrodes
T. Shimojo, K. Matsuda and K. Kasano
Ise Electronics Central Laboratory, Inc.
Tsumura-cho, Ise-shi, Japan

4.3: A Remote Access Data Entry Terminal with Liquid Crystal Display
C.R. Stein
General Electric Co., Schenectady, N.Y.

4.4: Multicolor Field-Effect Display Devices with Twisted Nematic Liquid Crystals
S. Kobayashi, Inst. of Phys.-Chem. Res., Saitama, Japan
F. Takeuchi, Nippon Cal. Mach. Co., Osaka, Japan

4.5: AC-Driven Photoactivated Liquid Crystal Light Valve
W.P. Bleha, J. Grinberg and A.D. Jacobson
Hughes Research Laboratories, Malibu, Cal.

4.6: Image Storage Panel Based on Cholesteric Liquid Crystals
W. Haas, J. Adams and G. Dir
Xerox Corp., Webster, N.Y.

4.7: Matrix Addressed Liquid Crystal Panel Display
L.T. Lipton and N.J. Koda
Hughes Aircraft Co., Oceanside, Cal.

SES. V/TUES., MAY 15/1:45 — 5:00 P.M.

Raster and Vector Graphic Display Systems
(Gold Ballroom)

Chairman: R.L. Johnson
University of Illinois, Urbana, Ill.

5.1: The Architecture of a High-Performance Graphics Display Terminal
B. Rosen
Carnegie-Mellon University, Pittsburgh, Pa.

5.2: Hardware for High-Speed Digital Vector Drawing
S. Kriz
Carnegie-Mellon University, Pittsburgh, Pa.

5.3: An Image Analysis Interactive Display
W.D. McFarland and S.J. Dwyer, III
University of Missouri-Columbia, Columbia, Mo.

5.4: A Graphic Display System using Raster-Scan Monitors and Realtime Scan Conversion
T.B. Cheek
Adage, Inc., Boston, Mass.

5.5: Some Quantization Problems in Digitally-Generated Pictures
R.G. Shoup
Xerox Research Center, Palo Alto, Cal.

5.6: A Color CRT Image Display System

F.J. Bruns, V.T. Rhyne and J.A. Schell
Texas A&M University, College Station, Tex.

5.7: Display Enhancement by Video Signal Processing

M. Rosen and R. Wright
Conrac Corp., Duarte, Cal.

TUES., MAY 15/8:00 P.M.

INFORMAL DISCUSSION SESSIONS/E-1..E-2

E-1: The Impact of New Technology on Display System Architecture (Ivy Suite)

Moderator: T.B. Cheek
Adage, Inc.
Boston, Mass.

E-2: Whither Television (Georgian Suite)

Moderator: J. Markin
Zenith Radio Corp.
Chicago, Ill.

SES. VI/WED., MAY 16/9:00 — 9:55 A.M.

INVITED: Displays and Computers in Education
(Grand Ballroom)

Chairman: H.G. Slottow
Owens-Illinois, Inc.
Perrysburg, O.

6.1: On-Line Dialogues with Graphic Terminals in the PLATO Computer-Based Education System

D.L. Bitzer
University of Illinois
Urbana, Ill.

SES. VII/WED., MAY 16/10:00 — 11:45 A.M.

Plasma Displays
(Grand Ballroom)

Chairman: G. Chodil
Zenith Radio Corp.
Chicago, Ill.

7.1: Picture Display with Gray Scale in the Plasma Panel

S. Umeda, K. Murase, H. Ishizaki and K. Kurahashi
Fujitsu Laboratories Ltd.
Akashi/Hyogo, Japan

7.2: Plasma Display with Gray Scales

K. Kurahashi, H. Tottori, F. Isoga and N. Tsuruta
Mitsubishi Electric Central Research Laboratory
Amagasaki/Hyogo, Japan

7.3: A Megabit Plasma Display Panel

R.E. Ernsthausen and R.A. Martel
Owens-Illinois, Inc.
Perrysburg, O.

7.4: Surface Discharge Type Plasma Display Panel

K. Takashima, N. Nakayama, Y. Shirouchi,
T. Iemori, H. Yamamato and S. Sato
Fujitsu Laboratories Ltd.
Akashi/Hyogo, Japan

SES. VIII/WED., MAY 16/10:00 — 11:45 A.M.

Special-Purpose Display Techniques
(Gold Ballroom)

Chairman: I. Reingold
U.S. Army Electronics Command
Fort Monmouth, N.J.

8.1: Pocket Calculator Display System

D.S. Cochran
Hewlett-Packard Co.
Palo Alto, Cal.

8.2: MIDAS — A Teleprinter Concept using Dual Mode Paper

G.S. Minto
Cambridge Consultants, Ltd.
Cambridge, England

8.3: A 1125-Scanning-Line Laser Color TV Display

T. Taneda, S. Tatuoka,	M. Yamamoto,
H. Masuko and M. Aiko	A. Hashimoto, H. Horiuchi
NHK/Japan Bdcstg. Corp.	Hitachi Central Res. Lab.
Tokyo, Japan	Tokyo, Japan

8.4: Rear Projection Screens

R.E. Thoman
General Dynamics Electronics
San Diego, Cal.

WED./MAY 16/12:00 NOON — 1:50 P.M.

LUNCH
(Georgian Suite)

INVITED ADDRESS/DEMONSTRATION

Integrated Character Animation Display System

L. Harrison III
Computer Image Corporation
Denver, Col.

The interface between a digital data input source and a fully-integrated character animation display system, will be described. The output is a full-color video display of recognizable, animated images, in realtime. The concepts of this technique will be discussed, citing its practical application as a means of coming to grips with the information explosion.

SES. IX/WED., MAY 16/2:00 — 5:30 P.M.

Cathode-Ray-Tube Devices
(Grand Ballroom)

Chairman: B. Kazan
IBM T.J. Watson Research Center
Yorktown Heights, N.Y.

9.1: A Multibeam CRT for Realtime Display of Slow-Scan Information

M.E. Carpenter and D. L. Say
GTE Sylvania, Inc., Seneca Falls, N.Y.

9.2: Digitally-Addressed High Brightness Flat Panel Display

L.A. Jeffries
Northrop Corp., Palos Verdes Peninsula, Cal.

9.3: A Large Screen Display for Bistable Storage of up to 17,000 Characters

C. Curtin, J. Hutcheon, B. Mason and J. McTeague
Tektronix, Inc., Beaverton, Ore.

9.4: A Storage CRT with Liquid-Crystal Display

C.H. Gooch, R.C. Bottomley, J.H. Firkins,
J.J. Low and H.A. Tarry
M/D/Services Elec. Res. Lab., Herts, England

9.5: Bistable Storage Tube with AC Controlled-Display Element

I.F. Chang and W.B. Pennebaker
IBM T.J. Watson Res. Ctr., Yorktown Heights, N.Y.

9.6: The Signal-Generation Mechanism in Bistable Storage Scan Converters

E. Sang
Tektronix, Inc., Beaverton, Ore.

SES. X/WED., MAY 16/2:00 — 5:30 P.M.

INVITED: Perception of Displayed Information
(Gold Ballroom)

Chairman: L.M. Biberman
Institute of Defense Analyses
Arlington, Va.

10.1: The Mythology of Target Acquisition System Design and Performance

L.M. Biberman
Institute for Defense Analyses
Arlington, Va.

10.2: A Unitary Measure of Video System Image Quality

H.L. Snyder
Virginia Polytechnic Inst. and State Univ.
Blacksburg, Va.

10.3: S/N Ratio Thresholds for Image Detection, Recognition and Identification

R.H. Willson and F.A. Rosell
Westinghouse Electric Corp.
Baltimore, Md.

10.4: The Aliasing Problem in One- and Two-Dimensional Sampled Displays

R.R. Legault
Environmental Research Inst. of Michigan
Ann Arbor, Mich.

10.5: Analysis of Image-Detection and Display Systems

A.D. Schnitzler
Institute for Defense Analyses
Arlington, Va.

WED., MAY 16/8:00 P.M.

INFORMAL DISCUSSION SESSIONS/E-3..E-4

E-3: Active or Passive Displays (Ivy Suite)

Moderator: T.P. Brody
Westinghouse Research
Pittsburgh, Pa.

E-4: New Directions for Raster Imaging (Georgian Suite)

Moderator: I. Sutherland
Evans and Sutherland Computer Corp.
Salt Lake City, Utah

SES. XI/THURS., MAY 17/9:00 — 11:45 A.M.

Light Emitting Diode Displays
(Grand Ballroom)

Chairman: J.E. Bigelow
General Electric Co.
Schenectady, N.Y.

11.1: Green LED Displays — A Planar Approach

A.R. Peaker
Ferranti Ltd.
Oldham, England

V. Pastore
Ferranti Electric, Inc.
Plainview, N.Y.

11.2: Monolithic GaP LED Displays

L.C. Kravitz, J.F. Womac, F.K. Heumann,
H.H. Woodbury
General Electric Corp. Res./Dev., Schenectady, N.Y.

11.3: Packaging of Multicharacter LED Modules with Self-Contained Driving Circuitry

H.T. Groves
Litton Systems, Inc., Van Nuys, Cal.

11.4: Integrated Drive Circuits for LED and LCC Displays

P.B. Page
ITT Components Group/Europe
Essex, England

11.5: The Use of LEDs in High Ambient Illumination

B. Ellis and G.J. Burrell
Farnborough, England

11.6: Packaging Solid-State Displays

J. Norrie
AMP, Inc., Harrisburg, Pa.

SES. XII/THURS., MAY 17/9:00 — 11:45 A.M.

Aerospace Display Applications
(Gold Ballroom)

Chairman: P.W. Siglin
U.S. Army Electronics Command
Fort Monmouth, N.J.

12.1: A High-Resolution, Multi-Purpose, Color-TV Display System for Airborne Applications

R.N. Winner
Hughes Aircraft Co.
Culver City, Cal.

W.G. Mulley
Naval Air Dev. Ctr.
Warminster, Pa.

12.2: A Helmet-Mounted Camera and Display System for Pilot Training

P.D. Pratt
Honeywell, Inc.
Minneapolis, Minn.

12.3: Data Storage and Retrieval Device for Aircraft

P.L. Nelson and R.H. Norwalt
RCA Advanced Technology Laboratories—West
Van Nuys, Cal.

12.4: Video Image Display Subsystem

W. Sidas and V. Zadikow
Hazeltine Corp.
Greenlawn, N.Y.

12.5: A Microprogrammed Display System

T. Bolstad
Norwegian Defense Research Establishment
Kjeller, Norway

SES. XIII/THURS., MAY 17/1:00 — 3:00 P.M.

Displays and Systems

(Grand Ballroom)

Chairman: G. Hrbek
Zenith Radio Corp., Chicago, Ill.

13.1: An Electrochromic Display with Memory
C.J. Schoot, P.T. Bolwijn, H.T. vanDam, E.A. vanDoorn, J.J. Ponjee and S. vanHouten
Philips Research Labs., Eindhoven, Netherlands

13.2: Systems Approach to Color-TV Display Devices using Index CRTs
D.E. Sunstein
Sunstein Engineering, West Conshohocken, Pa.

13.3: A Slow-Scan TV Camera for the Analysis of Fluctuating Illumination Patterns
A. Arrigucci, P. Pandolfini, L. Stefanutti, R. Vanni
Instituto di Ricerca Sulle Onde Elettromagnetiche of CNR, Florence, Italy

SES. XIV/THURS., MAY 17/1:00 — 3:00 P.M.

Processing and Applications

(Gold Ballroom)

Chairman: J.B. Flannery
Xerox Corp., Rochester, N.Y.

14.1: Screen Printing Techniques for Economical Fabrication of Digital Displays
S.J. Stein and C. Huang
Electro-Science Labs., Inc., Pennsauken, N.J.

14.2: LED Analog Meter and Speedometer
C.H. Roberts
Aeroquip Corp./AMB Div., Barrington, Ill.

14.3: Solid-State Vertical Scale Instruments
R.L. Skovholt
General Electric Co., Wilmington, Mass.

For SID 74 - San Diego — May 21 - 23

Polytechnic Institute of Brooklyn Office of Special Programs May 14 & May 18

Statler-Hilton

COSTS
The fee for each session will be $60.00, which will include coffee during session breaks. For those attending both sessions, a combined fee of $100.00 will apply.

WHO CAN ATTEND
Engineers and scientists who need or want to refresh or update their own knowledge will find the seminars valuable for present and future use in their particular field or fields in which their companies, departments or agencies are involved. Whether one attends one or both of the seminars, a background knowledge will be gained to enhance their abilities and the possible applications of the information offered.

WHERE AND WHEN
Two seminars will be presented in the Play Penn Room on the lobby floor of the Statler-Hilton Hotel in New York City. On Monday, May 14, 1973, preceding SID 73, four lectures will be devoted to human factors in information display. On Friday, May 18, at the conclusion of the SID international program, a companion series of four lectures will be presented on computer graphics. All sessions will begin at 9:00 A.M. and continue until 5:00 P.M. to afford informal discussion time, coffee breaks are planned for each morning and afternoon of both the Monday and Friday sessions.

Sponsors of this special event are the Polytechnic Institute of Brooklyn and the Society for Information Display. The seminars are part of the continuing professional studies made available by the Office of Special Programs of the Polytechnic Institute of Brooklyn.

PROGRAM Monday, May 14, 1973

HUMAN FACTORS IN INFORMATION DISPLAY

8:15 A.M. **Registration . . . Statler-Hilton Hotel/Play Penn Room**
9:00 A.M. **Welcoming Remarks**
9:05 A.M. **Basic Consideration**
General theory . . . data, information, role of observer.
Methodology . . . classification, evaluation, investigations.
A. Debons
Professor and Vice Chairman, Interdisciplinary Control Program in Information Science, University of Pittsburgh, Pittsburgh, Pa.
10:30 A.M. **Session Break**
11:00 A.M. **Physiological and Psychological Aspects of Visual Perception**
Physiology . . . eye, optic nerve, brain.
Psychological . . . response, anomalies, illusions.
S. Deutsch
Professor of Bioengineering, Surgical Department, Rutgers Medical School, Rutgers University, New Brunswick, N.J.
12:20 P.M. **Lunch**
1:30 P.M. **Legibility Research**
Fonts . . . dot matrix, stroke, standard.
Testing . . . criteria, techniques, results.
D. A. Shurtleff
Digital Systems Engineering Department, MITRE Corp., Bedford, Mass.
3:00 P.M. **Session Break**
3:30 P.M. **Data**
Parameters . . . definitions, measurements.
Sources . . . literature, tests.
Conclusions . . . discussion.
Capt. K. Burnett
Air Force Flight Dynamics Laboratory, Wright Patterson Air Force Base, Dayton, O.
5:00 P.M. **Adjournment**

PROGRAM Friday, May 18, 1973

COMPUTER GRAPHICS

8:15 A.M. **Registration . . . Statler-Hilton Hotel/Play Penn Room**
9:00 A.M. **Introductory Remarks**
9:05 A.M. **Historical Review . . . The Past**
The beginnings . . . applications, capabilities, expectations.

POLYTECHNIC INSTITUTE BROOKLYN SEMINAR

Initial developments . . . limitations, successes, failures.
Recent trends . . . applications, capabilities, expectations.
C. Machover
Vice President/Marketing, Information Displays, Inc., Mt. Kisco, N.Y.
10:30 A.M. **Session Break**
11:00 A.M. **The Present**
Applications . . . industrial, nonmilitary government, military.
Systems capabilities . . . information, interaction, pictorial.
Needs . . . present limitations, performance improvements, special applications.
R. M. Dunn
Graphics Systems and Technology, Branch, R&D Technology Support Activity, U.S. Army Electronics Command, Fort Monmouth, N.J.
12:20 A.M. **Lunch**
1:30 P.M. **The Future**
Trends . . . applications, capabilities.
Developments . . . systems, usage.
Acceptance . . . industrial, government, consumer.
B. Herzog
Director/Merit Computer Network, University of Michigan, Ann Arbor, Mich.
3:00 P.M. **Session Break**
3:30 P.M. **Technology and Equipment**
Categories . . . vector, raster, storage.
Capabilities and limitations . . . information density, legibility and quality response.
Developments . . . matrix panels, input devices, intelligent terminals.
S. Sherr
Executive Vice President, North Hills Associates, Glen Cove, N.Y.
5:00 P.M. **Adjournment**

Electro Optical Sales Up

U.S. sales of special-purpose electro-optical tubes for the first half of 1972 have shown a startling 89.4% gain, according to figures compiled by the Electronic Industries Association. Both light-sensing and light-emitting tubes showed a tremendous jump in both units and dollars, with light-emitting tubes climbing from one million to 2.1 million units, and the dollar value of light-emitters up from $16.2 million to $21.6 million.

New DPM Maker

Tekelec Inc., Westlake Village, California, is a new manufacturer of digital panel meters for the American market. Backed by Tekelec Airtronic, a French test equipment manufacturer, the new company is headed by President Philip Wasserman. The company will have 0.5" high liquid crystal displays in 2½, 3½, and 4½ digit versions.

SID PROGRAM P. 16

the new, new math

A father who happens to be a member of SID makes his two school age children part of an experiment assessing in advance the probable impact of mini-computers.

By E. A. ULBRICH
Social Implications Chairman
Society for Information Display

● One of the fast growth areas of information displays appears to be portable mini-calculators. These are devices which currently are selling for about $89 to $395, which utilize large-scale integrated circuit chips and various kinds of numeric displays, mostly LED's, to solve a wide variety of arithmetic, algebraic, and trigonometric problems input by the user. Currently the market for such calculators is in the rapid growth stage as shown in Figure 1, and is characterized by increasing competition, falling prices, and peaking sales. Once an information business starts to gross $300 million, impacts start to be felt in many areas of society outside of the normal realm of SID. It is the purpose of this short article to describe such an impact.

Some years ago, with appropriate fanfare and hoorah, mathematics teachers announced that a "new" mathematics would now be taught. Fueled up with new text-books showing graphically all the new concepts, I clearly remember the rationalization that this "new" math would help children understand how computers work. This seemed to make sense because computers at the time were large, complex and expensive; and often required interfacing with a whole hierarchy of computer linguists who could understand these computers. One of the tenets of the "new" math seemed to be that to assist in understanding, several algorithms would be taught for each arithmetic operation. In my limited experience with my own family, what really happened was that all the algorithms were partially learned resulting in a lack of student confidence in any single algorithm and errors, errors, and more errors. Meanwhile, our progressing technology arrived on the scene with a computer that was small and simple and cheap, and which spoke plain English. As seen in Figure 2, the total price of an average mini-calculator is roughly equivalent to the fraction of annual educational cost per student currently allotted for mathematics instruction. Further, the price of the calculator is trending down while the price of instruction is trending up.

Fearing nothing, I proposed to make an *unscientific* experiment to obtain a first order indication of the effect of mini-calculators on children who had had a full set of instruction on the "new" math and who seemed to be making a lot of errors in arithmetic based on my Depression-era standards that every penny counts.

The constraints of time, money, and authority limited this test to my own two children, but I hope that the results yield at least a little insight into the impact on the educational system of these portable calculators and perhaps on additional computer-assisted instruction machines forthcoming. I composed a test of 12 problems involving common everyday types of calculations. These were:

1. Balancing a check book (two additions, one subtraction)
2. Buying gasoline (one multiplication)
3. Figuring automobile mileage (one division)
4. Calculating installment pay ment (one division, one multiplication)
5. Calculating tax and tip (two multiplications)
6. Ordering concrete (two multiplications)
7. Buying groceries (one addition)

Problems were presented operationally so that there could be no semantic confusion. The children previously had been taught how the computer worked (about four months ago). It operates in float-

CHILD		WITHOUT COMPUTER			WITH COMPUTER		
	Grade	No. Attempted	No. Right	Time Used-Min.	No. Attempted	No. Right	Time Used-Min.
BOY — 12 Years	7	12	5*	16	12	11**	8
GIRL — 9 Years	4	4***	4	16	12	12	16

*Mainly careless errors
**Error of omission
***Stated that complex multiplication and division weren't learned yet

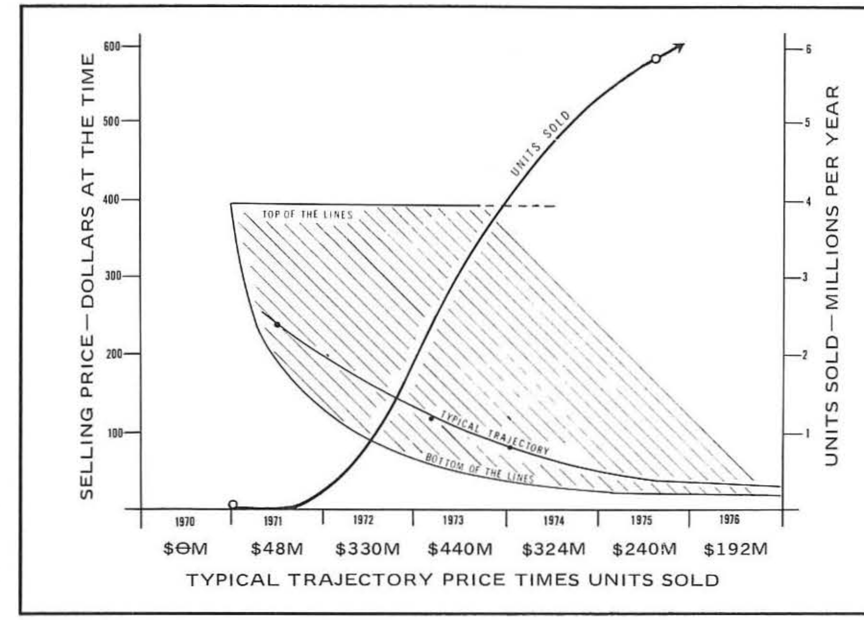


Figure 1. Mini-Calculator Market
(Source: Wall St. Journal, 7 Feb. 1973) extensions by author.

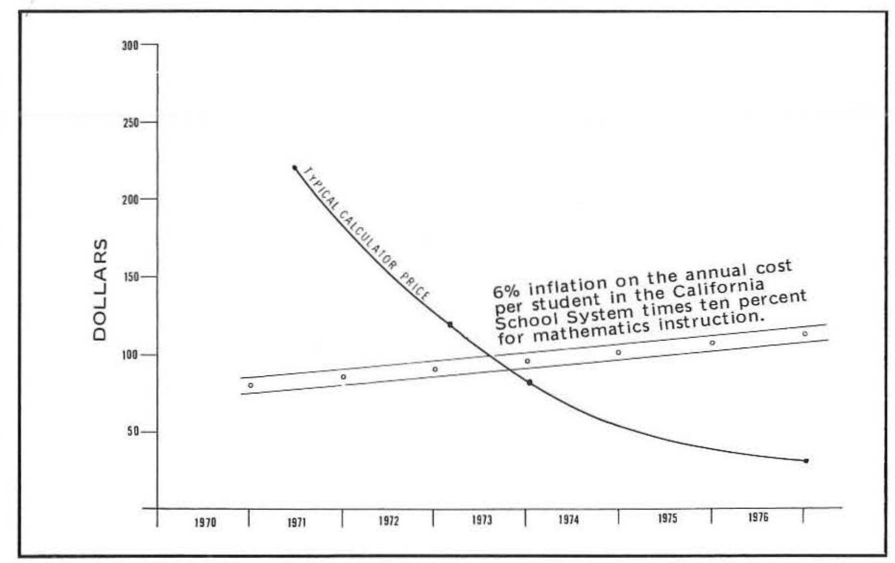
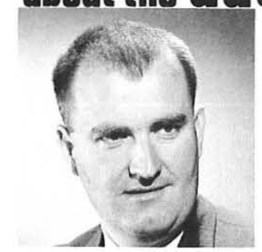


Figure 2. Mini-Calculators and Mathematics Instruction
(Source: Statistical Abstract of the U.S.) extensions by author.

about the author



Mr. Ulbrich, at the McDonnell Douglas Astronautics Co. in Orange County, California since 1967, is Manager, Information Systems Development, Advance Systems and Technology Division. In 1967 he helped set up the Information System Subdivision. Previously, he had worked for the General Electric Company, North American Aviation, and Genisco Technology. Service in the Navy involved engineering instruction on nuclear weapons. A Registered Professional Engineer (Ohio), he is a member of SID, IEEE, AIAA, Air Pollution Display, and other groups. In SID, he is Society Secretary; and has been Western Region Director and past President, Los Angeles Chapter. He has a BS degree in electrical engineering from Rose Polytechnic Institute (1954) and his MS from University of New Mexico (1961). He is married and has two children.

ing point. Table 1 shows the results. As might have been expected, the computer saved the older child time (8 minutes versus 16 minutes) and it also eliminated careless errors although an error of omission was substituted. Of more interest, the younger child, who could only handle additions and subtractions without the computer, was capable of performing multiplications and divisions perfectly, using the computer. She had, however, been taught the basic concepts of multiplying and dividing up through single integers. The mini-calculator really proved to be a help in saving time, improving accuracy, and assisting in instruction.

Independent of these very limited, admittedly unscientific test results, what insight has been gained and what impact might we see in this information display area? The insight seems to me to be that we must consider these mini-calculators *now* in our mathematics education. This is going to be terribly difficult not only because of teacher resistance caused by productivity increases but more importantly because much of our mathematics educational system is based on mental algorithmic competition. In our affluent age, are the values of conservation and competition taught by the Depression still valid or can we spend a little money to get correct answers for all arithmetic and trigonometry problems by fourth grade students and spend the savings on more pleasant things?

The impacts seem huge. Students freed from grinding out mathematical algorithms may be propelled into conceptual mathematics and, as a minimum, will be better trained as computer users. That miniscule fraction that must learn how the computers work inside may well develop a hierarchy as described earlier under linguistics, but we must face the fact that the great majority of users want answers, not methodology. Lastly, I would like to say that another impact, untested above, is in the storage of mathematical tables etc.

As a matter of reference, I recently consulted my high school trigonometry text. It included 120 pages of tables of functions, mainly trigonometric and logarithmic. These tables were mostly 4 place tables. The mini-calculator used in the tests above contained all of these tables, at least algorithmically, out to 10 places. That means that the calculator is the equivalent of a set of tables a million times larger than that in the trigonometry book. This capability may not be commonly required right now but the impact is striking when further application of the mini-calculators is made to more specific areas of endeavor. A mini-calculator is already available specializing in financial calculations. Perhaps others could be easily generated for such diverse things as satellite orbital calculations, rotating mass calculations, fluid mechanics calculations, alternating current calculations, bridge truss calculations, etc. An immediate benefit could result if mini-calculators are introduced into our current educational process. ●

SID 1973 International Symposium and Exposition

EXHIBITS PREVIEW

Following are highlights of some of the exhibits which will accompany the 1973 Symposium:

Celco
Illustration Number 1.

Introducing . . . cof/fic, the Celco DSC-I, II, III. High-resolution, low distortion CRT camera display systems. Ultra low distortion to 0.05%, high stability, 100 Lines/mm resolution — low cost and compact: mounts directly on CRT. Optional PMT for film scanning and image digitization with optional computer interfaces and thru-the-lens light sensing.

Conrac
Illustration Number 2.

Conrac will feature a design aid, a slide rule oriented to modulation transfer and contrast calculations for displays.

The rule has two functions: first a Sine Wave MTF Calculator, and second a Contrast Ratio Calculator for CRT type displays.

The first side relates spot size (half power width), information density (TV lines per display height or cycles per inch) and modulation transfer function.

The second side relates phosphor brightness (at the phosphor in foot lamberts), ambient light (in foot candles), implosion plate transmission (neutral color density) and contrast ratio, for five different faceplate configurations.

General Electric Company
Illustration Number 3.

The General Electric PJ500 color television video projector is a compact unit utilizing a unique state-of-the-art light valve. The light valve uses a single electron gun and single optical axis to faithfully reproduce color TV pictures of high brightness and contrast. Color registration is inherent; thereby eliminating need for adjustment.

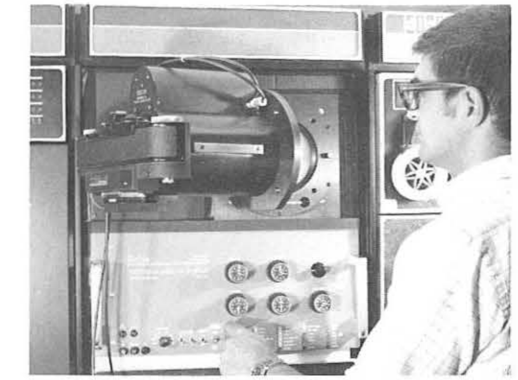
The Projector consists of a projection head assembly with integral pan and tilt adjustments, and an electronics assembly which supports the head.

Thomas Electronics, Inc.
Illustration Number 4.

Thomas Electronics, Inc. will exhibit ruggedized high brightness, high resolution avionic tubes. Some of these tubes will incorporate narrow band pass filters for high contrast displays for environments in extremely high ambient normally experienced in cockpit environment. Also to be shown, one or two tubes, as completed assemblies incorporating tube yoke and shield.

Thomson-CSF
Illustration Number 5.

THOMSON-CSF will feature their improved performance recording storage tubes with fast erase and long storage capability. The newest member of their storage tube family is the model TH 8803 that provides a limiting resolution performance of 4300 TV lines per diameter. It can store 16 million bits of digital information or the equivalent in the full gray scale TV image format for more than 20 minutes, under continuous readout scanning operation.

1


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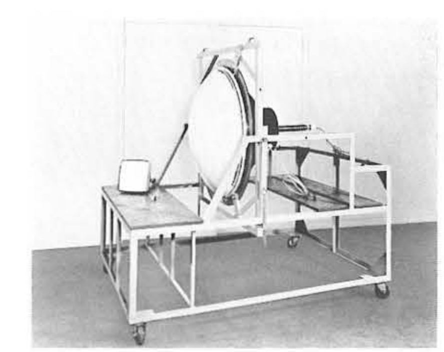


5


NEW PRODUCTS

SID SID SID SID

New Displays Interfaced With MOS/LSI

Sperry Information Displays today announced the addition of eight new seven-segment planar gas discharge displays to their expanding digital display line.

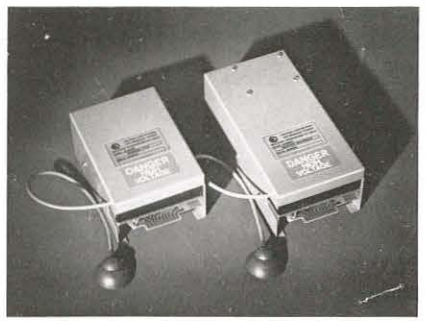
The new 1/3″ and 1/2″ units were specifically designed for interfacing with MOS/LSI. These new displays are recommended for use in all dc or multiplexed applications, with or without suppressed (blanked) zeros.

The SP-330 Series (1/3″) and SP-350 Series (1/2″) offer the user advantages of improved electrical characteristics not previously available in displays of this type. These improvements include reduction of (1) the anode voltage, (2) the cathode current required, and (3) the blanking requirements.

In addition, a keep alive cathode provides an internal ion source that reduces re-ionization time to less than 30 micro-seconds, allows zero suppression, and improves the operation of the displays in dark environments and at low temperatures. The character sizes of the new displays are identical to Sperry displays previously introduced.

Circle #101 on Readers Service Card

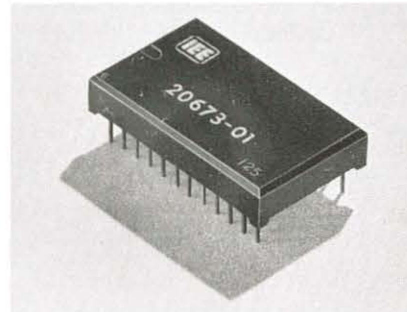
Low Cost HV CRT Power Supplies



Optimum performance at low cost in small, totally silent modules. Outputs (fixed): 10, 12, 15, 18 or 20 KV at 10W max; inputs 24 ± 3 VDC, 115 or 230 VAC; regulation 0.1%; ripple: 0.05% pk-pk; full load transient response: 0.3% pk, less than 2 ms recovery. Short-circuit and arc-proof, factory reparable, guaranteed. Model 710, 10 KV, $125 (10). Stock to 3 weeks. Custom modifications available include non-standard output voltage, additional low-voltage outputs.

Circle #102 on Readers Service Card

New Hybrid Circuit Chip



IEE, well known for their broad line of Rear-Protection Readouts now unveils a companion device, the Series 20673 Hybrid Circuit Driver/Decoder.

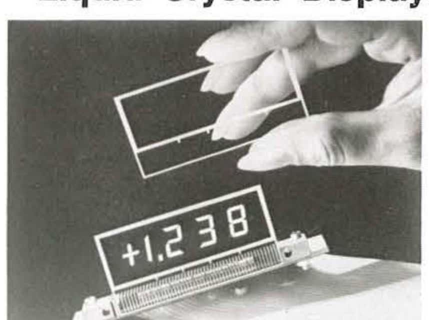
The unit is an "all in one" 24 pin dual in-line package, optimizing miniaturization with overall dimensions of only .762″ x 1.277″. Versatility plus is inherent, starting with a high drive capability of 300 ma lamps at 30 volts.

Operating on a standard 5.0 V logic supply, the chip is designed to decode standard 8421 BCD data to 12 outputs, or, if only 10 decoded outputs are required, the two remaining may be connected as lamp buffers. The 20673 is DTL/TTL compatible, coming with or without, memory and features lamp blanking as standard.

The hybrid chip (capable of driving any of the vast line of IEE Readouts) is an addition to IEE's line of high current Driver/Decoders suitable for mounting on the user's PC board.

Circle #104 on Readers Service Card

Liquid Crystal Displays From IEE



Industrial Electronic Engineers Inc., is presently taking orders for their New Series 1500 "Transmissive" Liquid Crystal Display.

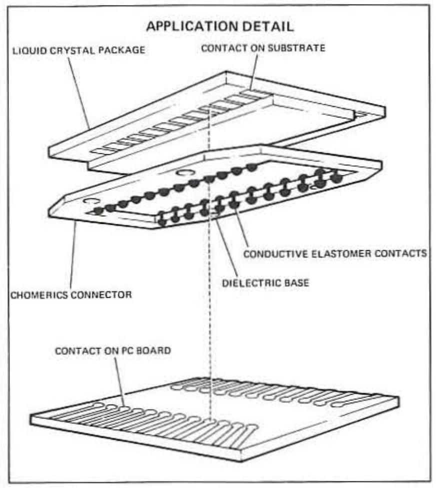
The IEE Series 1500-02 is a 3½ decade Liquid Crystal Display with four floating decimals and an overflow (± .1) (.0-9) (:0-9) (.0-.9). A colon is incorporated in the display for additional application advantages such as clocks, etc.

Outstanding features of the Series 1500-01 are:

- Optimum Readability
- Single Plane Viewing
- MOS Compatibility
- Thin Profile
- Microwatt Power Consumption
- Low Cost

Circle #103 on Readers Service Card

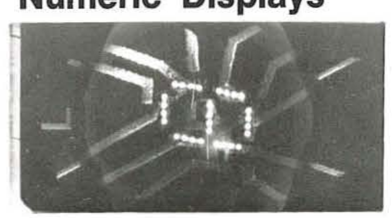
New Leadless Interconnector

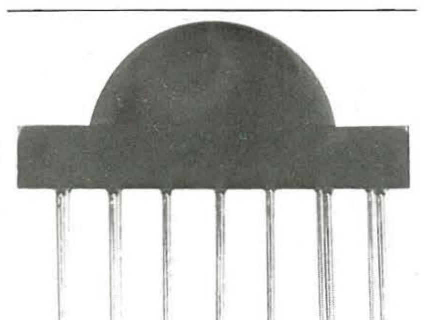


A leadless interconnector is now being manufactured for use in connecting liquid crystal and other types of displays directly to a P/C board. The connector consists of conformable conductive elastomer pads through-molded in a dielectric frame. With light pressure on the top of the display provided by a clamp, leads on the bottom of the display are connected to contact pads on the P/C board directly below. This type of interconnector provides a gas-tight joint to both the display and to the P/C board and eliminates the need for solder connections. This means that the display may be easily disconnected for replacement. The technology also extends to leadless packaging of MOS devices.

Circle #105 on Readers Service Card

Numeric Displays



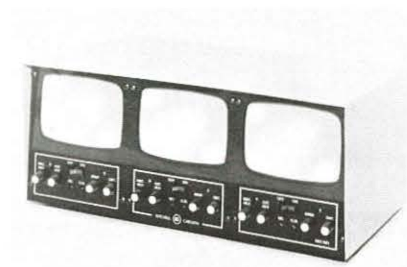


A family of four new, low cost LED numeric displays designed for portable-type instruments and desk top calculators have been introduced by Litronix. These new devices utilize a "bubble top" integrated lens construction similar to that developed for smaller hand-held calculator displays. This allows minimum use of gallium arsenide phosphide material, which is then magnified to the specified digit height. The lens is molded as part of the device package, eliminating the costly machining and assembly operations required by other light dispersing techniques.

The new devices fall into two basic categories: The Data-Lit 4 and 402 are both 0.19" high, common cathode digits offering 300 ft-L brightness at only 5 mA per segment.

Circle #107 on Readers Service Card

SC Electronics New Single & Triple-6 Monochrome Monitors



SC Electronics, a wholly owned subsidiary of Audiotronics Corporation and manufacturer of Setchell Carlson TV monitors and monitor/receivers recently introduced its new Triple-6 & Single-6 monochrome monitors.

The Single and Triple-6 are professional quality, American-made monochrome monitors with single 6-inch (Model 6M917) and three-in-a-row, side-by-side 6-inch picture tubes (Model 6M917T), a horizontal resolution of 600 lines, 100% solid-state circuitry, and the most advanced SINGLE MODULE CIRCUIT BOARD currently available.

This unique SINGLE MODULE is a complete one-piece, easily removable chassis which permits rapid, on-the-spot maintenance—for reduced maintenance costs and the elimination of valuable downtime.

Circle #106 on Readers Service Card

INFORMATION SYSTEMS TECHNOLOGY DEPARTMENT — 3100

Some Flat Panel Development Supported By DOD Activities

- Air Force
  - Wright Patterson: Plasma, Monolithic GaP L.E.D.s
  - RADC: Plasma, flat CRT
- Army
  - ECOM: Large array L.E.D.s
  - Evans Lab: Plasma
  - Night Vision Labs: Plasma
- NASA
  - Goddard: Plasma, Liquid crystals
- Navy
  - ONR: Electroluminescence
  - NAVELEX: Electroluminescence, Ferroelectrics
  - NAVSHIPS: Liquid crystals

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INFORMATION SYSTEMS TECHNOLOGY DEPARTMENT — 3100

Potential Applications

Display Medium \ Application	Alarms and Indicators	Direct View Tactical Displays	Large Screen Displays	Small Status Indicators	Large Status Boards
CRTs		E		G	G
L.E.D.s	E	G	G	E	G
Liquid Crystals		G		G	E
Photoactivated Liquid Crystals		G	E		G
Plasma Panels		G	G	E	G
Electroluminescent Panels					

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INFORMATION SYSTEMS TECHNOLOGY DEPARTMENT — 3100

How Can Industry Contribute ?

- Maintain an internal IR&D display program
- Improve flat panel problem areas
  - Media
  - Drive
  - Memory
  - Transformation
- Combine improvements to reduce display interface
- Provide economical displays which meet military requirements and specifications

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Flat Panel Display

Continued from page 12

scattering has taken place as caused by the energizing of some of the liquid crystal's transparent electrodes, only the scattered light is deflected upward into the viewer's range of vision. It turns out that the EL panel is not bright enough, having only approximately 50 foot-lamberts of luminance. This might come close to being an ideal sandwich. A ribbon connector, shown between the liquid crystal and the logic circuit, would be very short and would cut down the space problem with the devices.

All DOD activities support flat panels. Here is a list **17**
of a few of them. Although we try to stay abreast, we're sure that there are many more that we do not know about. What's NELC's role? NELC has an in-house funded program to evaluate flat panel technologies. Right now, we are investigating liquid crystals, light emitting diodes, and plasma. In addition we are searching for electroluminescent materials which have enough competitive advantages to make them worthwhile.

We are also studying the competitive advantages and **18**
disadvantages of these media to the various naval applications. Display engineers must present data to various sizes of audiences, from monocular images to large screen displays. Console indicators and tactical displays are usually for one or a few persons. Auxiliary height-size displays and small console status readouts of course, speed, fuel, altitude, bearing, weapon status, etc., are in the same class. Large status boards and strategic displays are usually viewed by large audiences. The matrix of applications versus display media on this graph represent my own personal informal predictions for best choices within the next five years. The letters "E" and "G" represent excellent and good potential applicability. Blanks indicate marginal applicability in my own judgment.

Almost every military operational officer would like to have a color selection on his displays; a few would also like to have three-dimensional displays. Without some new technology breakthrough, we believe it will be more than five years before these latter capabilities are in widespread fleet use.

How can industry contribute? It may sound pre- **19**
sumptious to ask industry to use its own money. It is safe to say, however, that the leading companies now supported by DOD in display contracts have won their leadership positions through vigorous Independent Research and Development programs over the preceding years. In a recent meeting, Dr. George Heilmeier, of ODDR&E, summarized the four categories of flat panel problems: the media, the drive, the memory, and the transformation or decode. Perhaps these four areas cannot best be improved by the same contractor. Perhaps team contributions will offer the best combined improvements to reduce flat panel display complexities and interfaces.

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

To communicate to SID members the variety and types of programs being made available to members of SID chapters, here is a selection from recent chapter meetings:

NEW ENGLAND

November, 1972

Speaker: John E. Ward, Deputy Director, M.I.T. Electronic Systems Lab. *Topic:* "Interactive CATV."

January, 1973

Speaker: A. Johnson, GTE Sylvania. *Topic:* "Digisplay—Digital Cathode Ray Tube."

MID-ATLANTIC

November, 1972

Speaker: Irving Reingold, Ft. Monmouth, N.J. *Topic:* "Flat Panel Display Technology."

December, 1972

Speaker: Y. S. Chen, Bell Telephone Labs. *Topic:* "Field Interfaced S-Discharge, flat panel, gray scale."

SOUTHWEST CHAPTER

October, 1972

Speaker: Carl Machover, V-P/Marketing, Information Display, Inc. *Topic:* Interactive Graphic Displays."

January, 1973

Speaker: Sumner Williams, Texas Instruments. *Topic:* "ISCC-NBS System of Color."

SAN FRANCISCO BAY AREA CHAPTER

November, 1972

Speaker: Joseph Roizen, Telegen. *Topic:* "Why SEACM/60?"

December, 1972

Speaker: Matt Lehman, Stanford Research Institute. *Topic:* "Holography—How It Works and Why."

LOS ANGELES CHAPTER

October, 1972

Speaker: T. W. Halloran, Aerojet Electrosystems Co. *Topic:* "Spectrovision."

November, 1972

Speaker: from Vector General Corp. *Topic:* "Demonstration—Vector General."

December, 1972

Speaker: Dr. Dan Forsyth, V-P, Information International Inc. *Topic:* "Image Processing and Graphic Arts Com"

January, 1973

Speakers: Fred Weems, Glen Coleman, both of Federal Aviation Administration. *Topic:* "En-Route Air Traffic Control."

DELAWARE VALLEY CHAPTER

November, 1972

Speaker: Lee Harrison III, Computer Image Corp. *Topic:* "Computer Used to Generate Animations for TV Programs and Commercials."

SAN DIEGO CHAPTER

October, 1972

Speaker: Duane Gomez, NELC, Display Technology Div. *Topic:* "Road Racing Visual Signaling and Accident Avoidance Criteria."

November, 1972

Speaker: R. E. Thoman, General Dynamics/Electro Dynamics. *Topic:* "Large Screen Projection Displays."

January, 1973

Speaker: J. J. Stapleton, Hughes Aircraft. *Topic:* "Advanced Image Devices."

SID Welcomes The Following New Members

Bruce C. Abernethy, Dallas, Tx.; Ralph E. Aldrich, Lexington, Ma.; Harold M. Austefjord, San Jose, Ca.; Yale Barkan, Fullerton, Ca.; Michael N. Barry, Lexington, Ma.; James Bement, Webster, N.Y.; Robert A. Berman, Manhattan Beach, Ca.; F. Andrew Best, Wash. D.C.; Lucien M. Biberman, Bethesda, Md.; L. F. Blachowicz, Melbourne, Fl.; A. K. Brandon, Burnsville, Mn.; Dennis L. Bryant, Hacienda Hgts., Ca.; Henry W. Burke, Fullerton, Ca.; James A. Carpenter, Fountain Valley, Ca.; Matthew F. Carroll, San Francisco, Ca.; John Cawley, Neptune, N.J.; Ken T. Chow, Palo Alto, Ca.; Robert K. Clark, Argonne, Il.; Ernest F. Close, Ft. Wayne, In.; Lionel E. Davis, Scotland; Alfred C. Denson, Rockville, Cn.; Philip J. Dunleavey, Waterbury, Cn.; Roger E. Ernsthausen, Perrysburg, Oh.

Roger A. Evans, Cold Spring Harbor, N.Y.; Dorothy L. Finley, Los Angeles, Ca.; Cameron B. Forrest, Calabasas, Ca.; Richard C. Gerdes, Tucson, Az.; David W. Giedt, Huntington Beach, Ca.; Richard B. Glickman, Sherman Oaks, Ca.; Wm. D. Greason, London, Canada; George Gregory, Los Angeles, Ca.; Henry Gregozek, Mt. View, Ca.; M. M. Halberstam, Brooklyn, N.Y.; George D. Harris, Fairlawn, N.J.; Donald L. Hasting, Newport, R.I.; Walter B. Hatfield, Murray Hill, N.J.; Jerry Heilwel, Great Neck, N.Y.; Ulrich Hess, Sunnyvale, Ca.; Dorothy L. Holmes, Oroville, Ca.; David H. Huebner, Fort Worth, Tx.

Harold H. Jacobs, Medford, Ma.; Harry K. James, Santa Clara, Ca.; Rune Johansson, Sweden; Akira Kan, Moonachie, N.J.; David R. Karn, Baldwinsville, N.Y.; C. G. Kepner, San Antonio, Tx.; Peter Kyropoulos, Warren, Mi.; Bruce C. Lane, Hollywood, Ca.; Ray H. Lee, Calabasas Park, Ca.; Wendell J. Lehr, Palo Alto, Ca.; Eugene B. Leiderman, Arlington, Va.; J. Darryl Lieux, Mountain View, Ca.; Stuart A. McIntosh, Ft. Wayne, In.; Andrew Madsen, Alamo, Ca.; Henry L. Matter, Vandenberg AFB, Ca.; Robert A. Mesard, Farmingdale, N.Y.; Calvin T. Morton, Lansdale, Pa.; Ronald R. Mourant, Farmington, Mi.

J. A. Murphy, Framingham, Ma.; John O. Mysing, New Carlisle, Oh.; John Noel, Quebec, Canada; Kaichiro Odagawa, New York, N.Y.; Robert Parker, Marina Del Rey, Ca.; Sam Peresztegy, Orlando, Fl.; Kipp O. Pritzlaff, Encino, Ca.; John C. Reiche, Liverpool, N.Y.; David Sapper, Plainview, N.Y.; Hrant H. Sarkissian, Costa Mesa, Ca.; Kaname Satou, Hawthorne, Ca.; Richard J. Schick, Arlington Hgts., Il.; Armand J. Schmitt, Waltham, Ma.; Verne E. Searer, Elkhart, In.; Newland F. Smith, New Canaan, Ct.

Sidney J. Stein, Pensauken, N.J.; J. D. Thompson, Redwood City, Ca.; Herbert J. Vernon, Ft. Wayne, In.; Ronald J. Walrath, St. Paul, Mn.; D. A. Williams, Centerville, Oh.; Ulrich P. Wissman, Schenectady, N.Y.; Ash M. Wood, Arcadia, Ca.; Wm. Wuersch, Northridge, Ca.; James R. Yankaskas, Stratford, Ct.; Yoshio Yuasa, Hawthorne, Ca.; Arthur R. Zingher, Berkeley, Ca.