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TITLE

LARGE-AREA PLASMA DISPLAY IMPROVEMENTS IN UPDATE SPEED INTERFACE ELECTRONICS,
PARALLAX REDUCTION, DIRECT INTERACTIVE OPERATION AND DEVELOPMENT OF HIGH LEVEL G

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Response to Call for Papers: SID '93

TITLE & ABSTRACT

Paper Title:

Large-area Plasma Display Improvements in Update Speed, Interface Electronics, Parallax Reduction, Direct Interactive Operation and, Development of a High Level Graphical Language Interface.

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Abstract:

This paper reports on the solutions found to four major problems that are currently inherent in large-area plasma displays: slow display update speed, large parallax error, inadequate direct operator interaction and, the ability to run only a low level graphical language. The solutions found, particularly the digital interface, have, not only military, but also commercial, including HD-TV, and industrial implications.

Intended for presentation at Product Engineering / Applications sessions.





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OBJECTIVE and BACKGROUND

A. Bagnulo et al: Large-area Plasma Display Improvements in Update Speed, Interface Electronics, Parallax Reduction, Direct Interactive Operation and, Development of a High Level Graphical Language Interface.

Objective and Background:

The objective of this paper is to report on solutions to four major problems that are currently inherent in large-area plasma display manufacture. The four problems addressed are:

- (1) large-area plasma displays suffered from a slow total redraw time, averaging in the five second range;
- (2) an unacceptably large parallax error which defeats the potential to use large-area plasma displays as an electronic overlay device which is suggested by the ability to manufacture this product in the "see through" form;
- (3) an inadequate mechanism for direct operator interaction which inhibits the operator from working with such a large "drafting board like" device in natural and traditional ways;
- (4) the ability to run the displays with only a low level graphical language interface, this problem seriously impedes the integration of this device into local area networks such as an X-Windows UNIX group of workstations and prohibits the running of regular DOS application programs.

Display screens are the most important part of the human-computer interface since they take advantage of man's most powerful sensory organs -- the eyes. Displays are used not only to present information to the operator but also to guide the operator in entering information into the computer.

The Plasma display is the only device that can be made in large-area, one meter and larger, and, which can be made in a "see-through" version so it can be used as an "electronic map overlay" to replace the currently used, non-electronic, clear plastic mylar sheets which are placed over maps in tactical command and control applications.

The application of automatic data processing to land forces command and control has been hampered by the lack of a suitable display device as confirmed by experiments at the Canadian Defence Research Establishment at Valcartier, Quebec (DREV) in Automated Tactical Command and Control research. The purpose of this project was to provide a large-area, interactive, see-through, plasma, "electronic map overlay" worksurface using a 1-m diagonal plasma display





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RESULTS

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Large-area Plasma Display improvements in Update Speed, Interface Electronics, Parallax Reduction, Direct Interactive Operation and, Development of a High Level Graphical Language Interface.

Results:

First, a new integrated circuit board plasma driver was developed for displays up to 4096 by 4096 pixels (or any size smaller) to reduce the total-screen erase and redraw to approximately one second and has made the updating of application induced image changes to be virtually in real time. It has been found that this improvement can be further improved to 1/20th of a second (0.02 sec) by modifying the drive electronics so that the data is shifted to the display a line at a time with a 32 bit bus interface, currently the data is shifted in 2 byte increments due to driver board restrictions.

The new interface realizes data transmission and packing benefits through the use of two modules, one resides in the bus of the 80486 server and the other in the display head, communication between them is via a parallel data link. The module in the display head essentially loads the new incoming "bit map" data into a FIFO buffer and compares this to the old data in a second buffer (these buffers store the data as useable bit map records of what is displayed on the screen) and any differences are noted. The second FIFO buffer and the display are then updated simultaneously with only the differences since the last update - this enables most screen updates to be virtually in real time. An interesting feature of the second buffer is that it is made to be a system accessible RAM buffer of the actual bit map displayed on the screen.

Second, the parallax error problem was solved by designing the framework to hold the 1 meter glass panel so that it would allow a paper map (which can be larger than the display area) to be in contact with the underside of the plasma display glass. The layout of the electronics boards in the display head were reconfigured to be on the operator side of the plasma display glass in such a way as to offer the operator unrestricted access to pic, write and draw directly on the plasma display glass as a worksurface.

Third, a thin clear digitizing overlay was developed to enable the operator to have direct contact interaction with the images on the large-area display. With the use of a digitizer pen the operator works (pics menu items, draws, controls the information, etc.) on the surface of the display as if with pencil on paper without the use of remote devices. Since electromagnetic radiation induced from the 120MHz 700 Volt switching of the plasma display line drivers interferes with the digitizer wave forms, special measures for noise reduction were employed.




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RESULTS

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RESULTS / IMPACT / PUBS

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Fourth, software drivers were designed and developed to enable the X-Window graphical software on the Interactive Unix operating system to function through the new plasma driver interface boards using the 80486 microcomputer as a plasma display server. This provided network access to the plasma display by any X-Window based tactical application. The plasma display performs as an X-Terminal providing almost application transparent access to the display.

Impact:

This display system will be experimented with and evaluated by the User Functions Group in the Command and Control Division at DREV to determine its suitability to meet Canadian Army command and control requirements.

The new plasma interface developed for this project has profound implications for the entire large-area display community as it demonstrates the viability of a direct digital interface which eliminates the twin problems of redundant signal conversion and restricted image generation inherent in the currently used "video" approach. As audio, television and post production methods increasingly incorporate digital processing it is reasonable that these digitally mastered programs be directly "digitally" displayed. This type of interface is not display size dependent as are the various "video" interfaces. Hence the implications for High Definition Television are that the digital interface approach will free both the television producers and the consumers from having to conform to and accept a specific HD Standard.

Prior Publications:

This is the first publication of this research work. Some of the technical details have been reported in Patent applications but this is presently restricted and is not for public distribution.

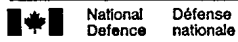
These technical details have been reported in an "in-house" Contractor's Report by PCP Plasma Computer Products to DREV. Funding for this research was jointly provided by PCP Plasma Computer Products Corporation and the Government of Canada, Department of National Defense, administered through the Defense Research Establishment Valcartier.



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