THE ACCELERATING PACE OF COMPUTER-TO-PLATE

by Richard E. Amtower

INTRODUCTION

Since the beginning of laser platemaking over ten years ago, both suppliers and prospective users have been alternately predicting and awaiting the arrival of computer-to-plate--the imaging of printing plates or film negatives directly from electronically composed digital databases. Back in 1976 at the ANPA Show in St. Louis, EOCOM was the first to show live computer-generated platemaking, with a rather primitive and slow software-based data system. Two years later, EOCOM again demonstrated computer-to-plate imaging at the IFRA Show in Copenhagen. The system shown in 1978 was somewhat faster with more features, capable of composing and imaging a variety of text, lineart, and halftone images, but was still only for demonstration. In spite of significant progress on several fronts of the computer-to-plate field, even in 1980 EOCOM was able to say only that at best, computer-to-plate was "possible" in this decade.

Why all the interest in computer-to-plate, and what took so long to bring it about? The advantage can best be summarized as a combination of less and more: less labor, less consumables, more speed, more quality, and more control. Reduction of labor force costs and improvements in deadline go hand in hand; decreasing the number of manual steps required to make the plate which finally goes on the press is an all-important factor both in prepress production costs and prepress production deadlines. Improvements in editorial control are brought to the ultimate when the editor actually sits at the terminal which composes the page and directs the imaging of the page he sees on his display screen. Improvement in image quality comes about through reduction of intermediate steps, which never fail to degrade quality.

The savings potential of computer-to-plate is widely recognized to be enormous. Looking at data from standard industry sources (NPES, ANPA) it is possible to quickly measure the major areas of savings potential for computer-to-plate. The newspaper industry in the U.S. spends over $100 million per year for phototypesetter

EOCOM Electronic Systems, American Hoechst Corporation


EOCOM

paper, over $100 million per year for lith film, and over $50 million per year for chemistry and supplies associated with preparation of pasteup, including processing chemistry, wax, tape, pasteup boards, etc.--a total of over $250 million per year in pasteup and camera negative related supplies.

This large number is dwarfed, however, by the magnitude of labor costs in composing, camera room, platemaking and other prepress labor--over 120,000 man years each and every year. With a conservative $20,000 per year for salary and fringe, this is a yearly cost of over $2.4 billion. Joe Ungaro, Vice President and Executive Editor of Westchester Rockland Newspapers, estimates that direct computer-to-plate has the potential to save $2 billion per year for the newspaper industry. Other sources have estimated annual savings of between $50,000 and $500,000 per year for typical U.S. newspapers, while The Los Angeles Times has estimated potential savings of $3 million per year for computer-to-film systems.

Savings--return on investment--improvements in deadlines and quality--and control: No wonder the continuing fascination with computer-to-plate or image. But with an incentive of this magnitude for the industry, one must ask why has computer-to-plate taken so long? The answer is simple--up to now, the complete elements of the computer-to-plate system: electronic page composition, the digital interface, and the digital imager, were not all available. In fact, only one element has been on hand: the digital platemaker or imagemaker.

EOCOM, among others, has supplied a variety of digital imaging systems: the LASERITE[R] 100, capable of automatically exposing film, plates, paper and proofs, the LASERITE V designed for smaller newspapers, capable of imaging double wide offset plates, and the LASERITE 200 (Figure 1), EOCOM's latest line of separate sending and receiving units specifically for high quality facsimile applications. All these systems are capable of accepting the digitized page image in a binary rasterized facsimile format.

In a sense, then, we have actually backed into computer-to-plate, with the first digital imagers appearing in 1976, the first practical or production digital interface in 1981, and true full electronic page composition with text and graphics appearing at the end of the line in early 1982. Because of the tremendous progress made in these last two areas over the last two years, EOCOM and Hastech Corporation of Manchester, New Hampshire are now ready to announce and to demonstrate at both the ANPA and DRUPA Shows this June the reality of computer-to-plate as a practical production tool for newspapers--and in the future, for all printing applications.

EPIC--The Raster Image Processor

There was no question at EOCOM that electronic page composition systems for newspapers would eventually arrive. There was equally no question that the digital imager had already arrived. The problem, then, was how best to position the Company to complete this digital imaging system which would ultimately arrive. It was our decision at EOCOM to develop a digital interface which would allow LASERITE systems to accept input codes from a variety of frontend electronic composition devices, since no single company had emerged as a leader in this area, and since even more certainly no standard format had been decided for the output of such frontend systems.

This input device, at first known as the Raster Image Processor (RIP), had several requirements. First was the ability to convert symbolic typesetter-like data into binary raster codes, specifically the LASERITE facsimile format. High processing speed was required, as well as multiple font capabilities, including sizing, obliquing, and storage of a large number of master fonts. Finally the ability to handle graphics, including halftones, lineart, logos, rules and borders was a key requirement.

The solution to this set of requirements was the development of a dedicated high speed single purpose computer based on bit slice microprocessor technology, with the latest in large dynamic RAM memory. Specifications for the RIP, or as it now became known, EPIC--the EOCOM Page Image Composer, were determined to include the following:

EPIC
EOCOM Page Image Composer

INPUT:

On-line or Mag Tape
Phototypesetter code (any standard 100 pica system)
or
RIP Native Code (Modified ASCII)

FUNCTIONS:

Font Generation
- Sizing (4-120 pt, 1/10 pt increments)
- Obliquing
- Font storage: 160M bytes on-line

Halftone Generation
- From contone input
- Up to 100 line screen

Logos
- Stored as font characters

Automatic Rule Generation

Spatial Control
- Automatic sort, position of page elements
- Up to 100 picas
- Tabs, spaces, leading in 1/10 pt increments
- Automatic base alignment

OUTPUT:

Registration	-	± .001"
Output Resolution	-	1000 lpi standard
Output Rate	-	Up to 6.3 Mbits/sec (< 1 min/page)
Image Control	-	Positive/negative Right/wrong reading Reverse
Merge Capability	-	Merge paginated data with camera-ready copy Multiple burns

These specifications would essentially turn the LASERITE system into an extremely powerful phototypesetter, capable of outputting 50 full page images as plates, negatives, paper positives or proofs per hour. The modular nature of EPIC makes the interfacing of LASERITE to the page composition system a triviality: Input from the page composition system goes to EPIC, which then feeds LASERITE with a standard facsimile signal.

The EPIC Raster Image Processor (Figure 2) consists of a microprogrammed processor used to perform decompression and scaling operations on information describing font characters. The EPIC/RIP is compatible with the PDP-11/44 family of minicomputers, and appears as a peripheral device to the computer interfaced via the Unibus. As a peripheral device EPIC can also be used to perform various preprocessing functions. Its operation in any application is a function of both hardware features of the processor and the resident program tailored to the specific typesetting application. Because the processors are microprogrammed, they can easily be configured to handle a variety of data formats without hardware changes. The total system consists of a PDP-11/44 CPU, central memory, 160 Megabyte Winchester disk, the EPIC Raster Image Processor, and a mag tape drive which is used as backup.

The Raster Image Processor unit of the EPIC (Figure 3) is based on LSI bipolar bit slice microprocessors. The functions performed by the ALU are controlled by the microinstructions stored in a Writeable Control Store, which is composed of bipolar RAMS. The microprogrammed sequence and control unit controls the sequence in which the microinstructions are executed. The instructions output from the Writeable Control Store are stored in a pipeline register so that one instruction can be executing while the next one is being fetched, which allows a fast instruction time of 166 nanoseconds.

The function of the EPIC is to generate binary raster scan data from input in the form of symbolic typesetting commands. The symbolic commands are used to define the XY position of the character and to point to the location in character memory where the description for that character can be found. Logotypes and lineart are processed by the RIP using the same algorithms used to generate characters. All characters to be imaged, including font masters, halftone fonts, logotypes, etc., are stored on the disk in highly compressed bit map form. Complete image integrity is maintained by this technique.

EPIC SYSTEM CONFIGURATION SHOWING RIP UNIT IN DETAIL

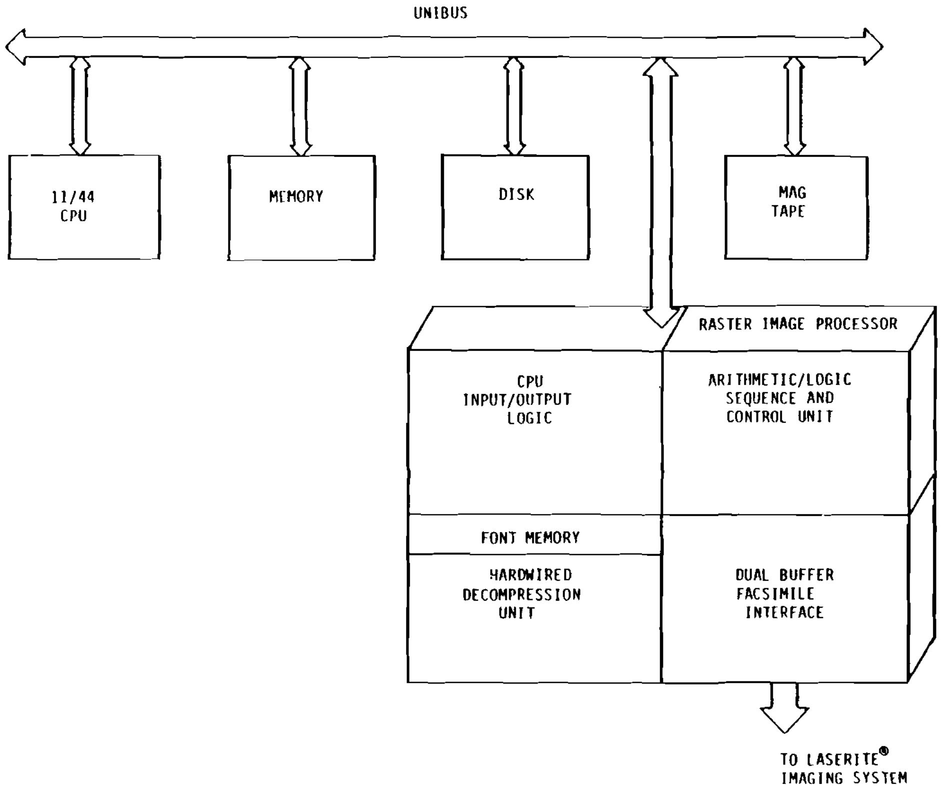


FIGURE 2.

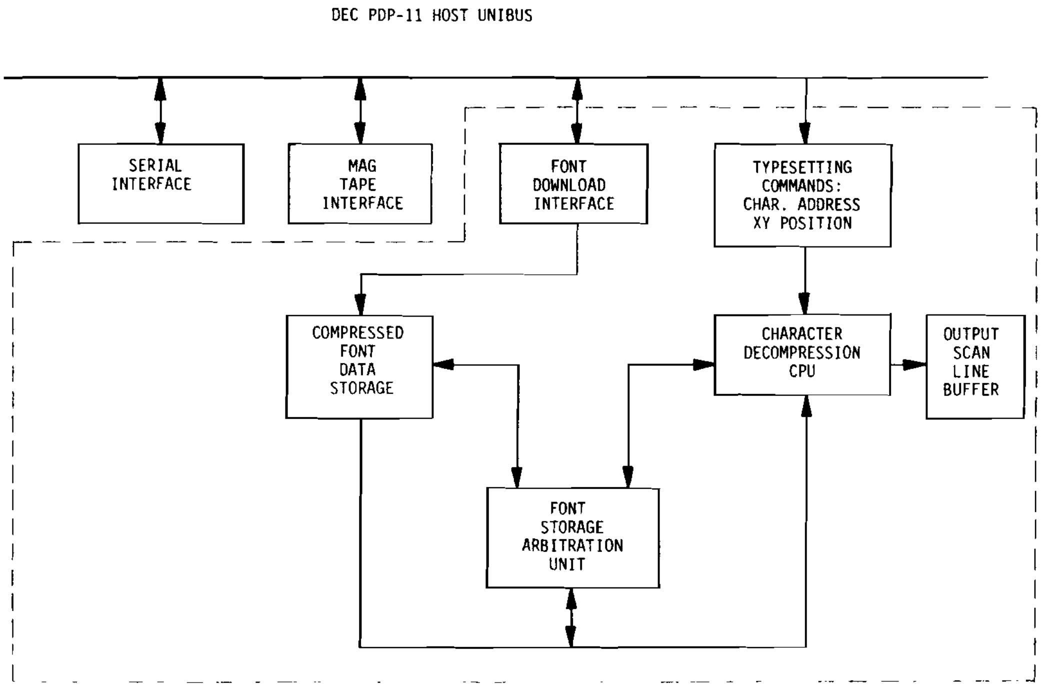


FIGURE 3.

EOCOM PAGE IMAGE COMPOSER

EPIC PROCESSING FLOW

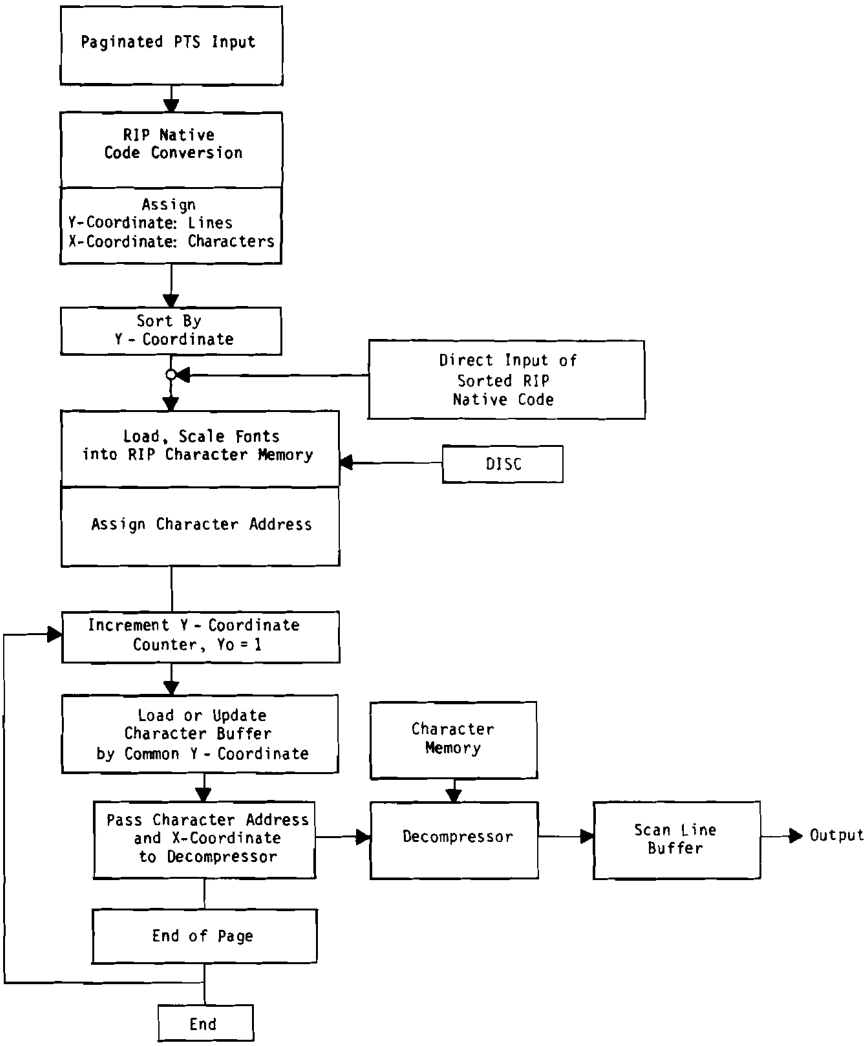


FIGURE 4.

The EPIC imaging cycle is as follows (Figure 4): Paginated phototypesetter input (APS 5, Videocomp, 606, etc.) is first converted into RIP native code by the 11/44, which generates a file of RIP compatible data from the input composed page information, including font requirements (character sizes, styles, etc.) and character position information (X and Y location by character number). All information is then sorted by Y coordinate. Alternatively, at this point systems such as the Hastech PagePro system can directly input sorted RIP native code into the EPIC. Next, font information is read from the disk and scaled by the RIP and stored in dynamic character memory in the RIP; character addresses are assigned to characters as they are stored in dynamic character memory. All character information has been carried out so far in the highly compressed EPIC bit map code.

The next step is for the RIP to pull out characters in Y-coordinate sequence and transfer them to the character buffer, with the character's assigned memory address. The character decompressor then decompresses the data pointed to by the address in the character buffer and sends it to the scan line buffer located in output control. Scan line buffer addresses correspond to the X position address of each character being decompressed. The complete scan line is then sent to the LASERITE for imaging, under clock control from the LASERITE. As the scan line is being output to the LASERITE, the 11/44 CPU is loading the next line of character codes into the character store buffer. After all Y addresses for the page have been processed, the page is complete, and the EPIC is ready for the next set of paginated input data.

Through this sequence of steps, the EOCOM Page Image Composer will take any completely paginated image with any arbitrary set of symbols sorted by X and Y location and convert them to rasterized facsimile format input to the LASERITE. When data is input in RIP native code, as in the EOCOM/Hastech computer-to-plate to system, a complete page may be readied for imaging in less than the reset time of the LASERITE--which means that a page can be prepared during the normal time required for scan carriage retract and loading of the next plate or negative.

Input data is obviously not limited to newspaper pages--books, technical publications, business forms--in fact any type of graphic material may be imaged.

Printed Circuit Board Applications

At the time the first EPIC unit was completed in 1981, newspaper pagination systems to provide input data were still not available. EOCOM turned its attention to a non-publishing application where completely composed image data was available--that of printed circuit board design.

Today's highly complex multilayer printed circuit boards are too complicated to be prepared by anything other than Computer Aided Design systems--known as CAD. The CAD systems allow the designer to prepare from a schematic complete printed circuit board images, interactively selecting components and automatically routing connections components and between layers.

Output from CAD systems has typically been to mechanical XY photoplotters. The input format for these photoplotters is symbolic vector format data: combinations of photographic apertures and position commands, which allow the plotter to trace out a variety of lines, pads, other symbols. The drawbacks of these photoplotters are their extreme slowness and limitation to highly sensitive silver-halide film. A single layer of a typical computer or communications system PCB may take up to 12 hours to plot, time which must be added to the normal production cycle for printed circuit boards before even a prototype can be obtained. In addition, imaging on film inevitably introduces degradation in the final accuracy of patterns on the printed circuit board due to the intermediate steps and mechanical handling required.

The answer, as in the printing industry, is laser direct imaging. EOCOM's new LDI series of laser imaging systems for the electronics industry image a variety of photosensitive materials directly from CAD system output, as translated by the EPIC Raster Image Processor. The typical process flow for laser direct imaging in several applications is shown in Figure 5. Proof plots, artwork (film negatives) and direct printed circuit boards can all be imaged with an EPIC/LDI system (Figure 6).

The principles involved are exactly the same as those required for newspaper direct to image systems. EOCOM's LDI-1500 (Figure 7), a direct imaging system for printed circuit boards incorporating the EPIC Raster Image Processor, was introduced at Productronica in Germany in October of last year. The EOCOM LDI systems are practical production systems for printed circuit boards artmaster generation and are available today.

LDI-1500

LASER DIRECT IMAGING TYPICAL PROCESS FLOW

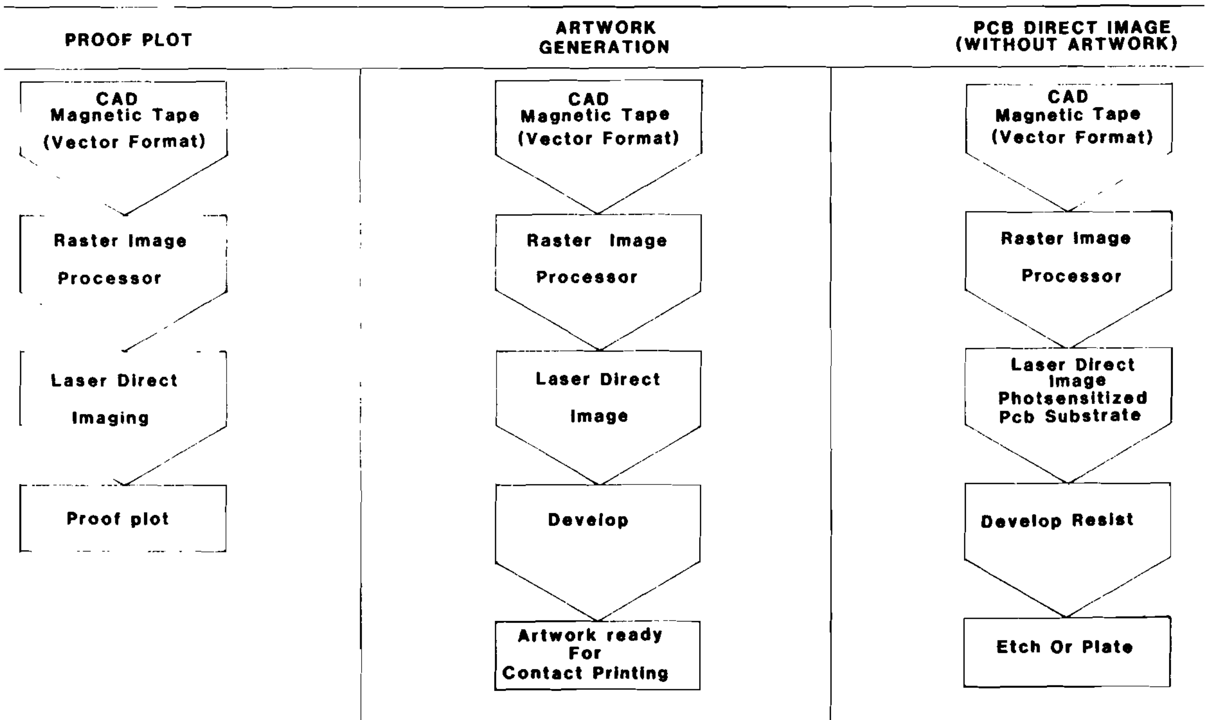


FIGURE 5.

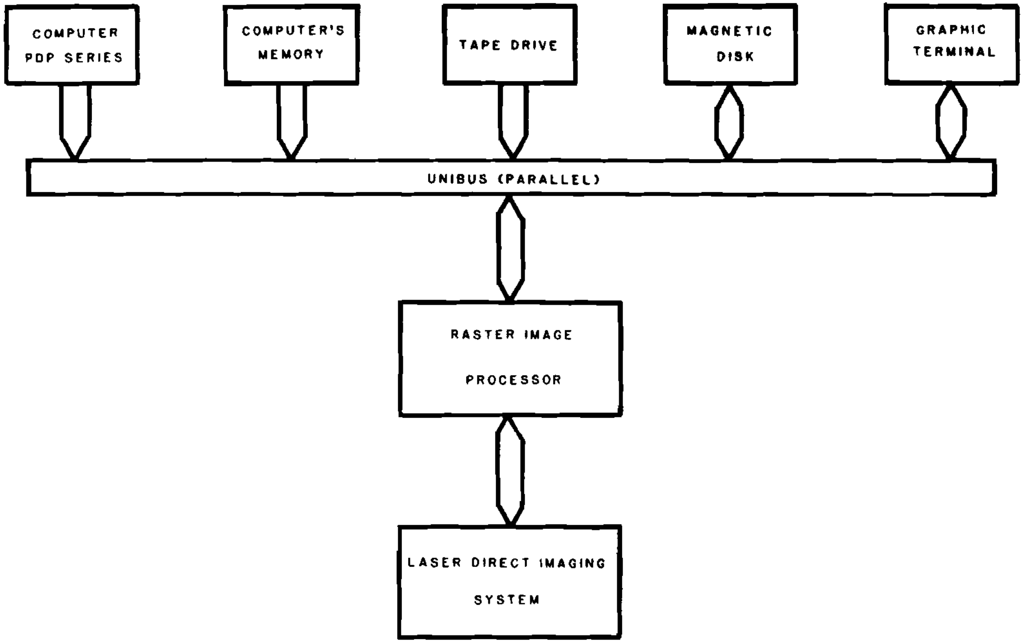


FIGURE 6. **BLOCK DIAGRAM OF LDI-1500 SYSTEM**

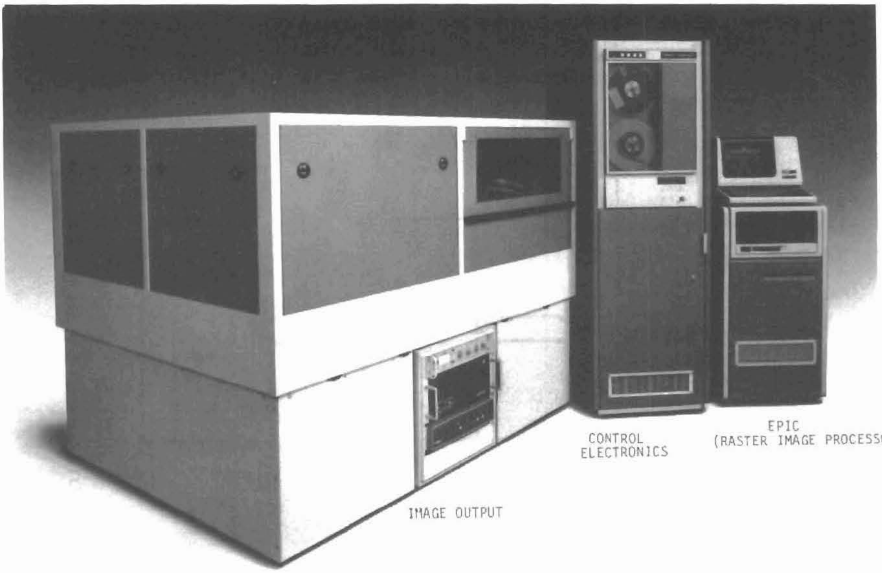


FIGURE 7. LDI™-1500
Direct Printed Circuit Board Imaging System

EOCOM/HASTECH
COMPUTER-TO-PLATE CONFIGURATION

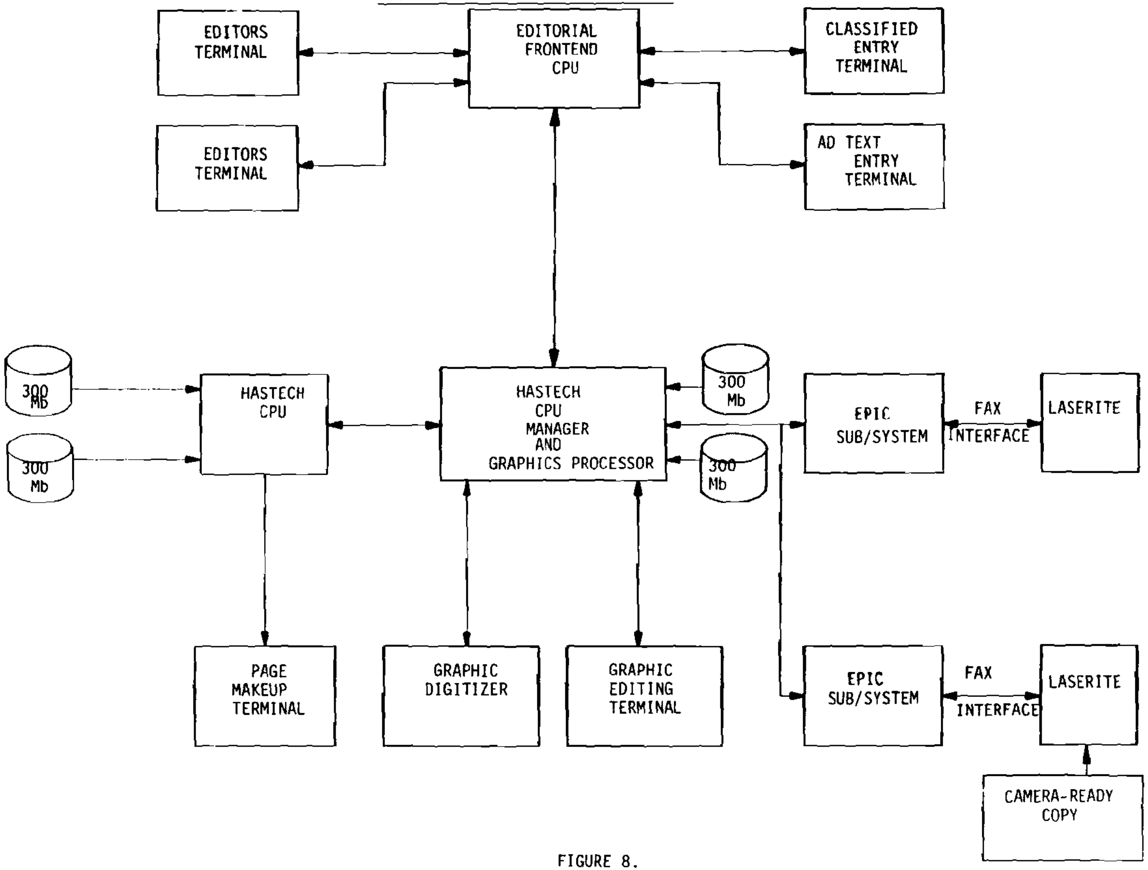
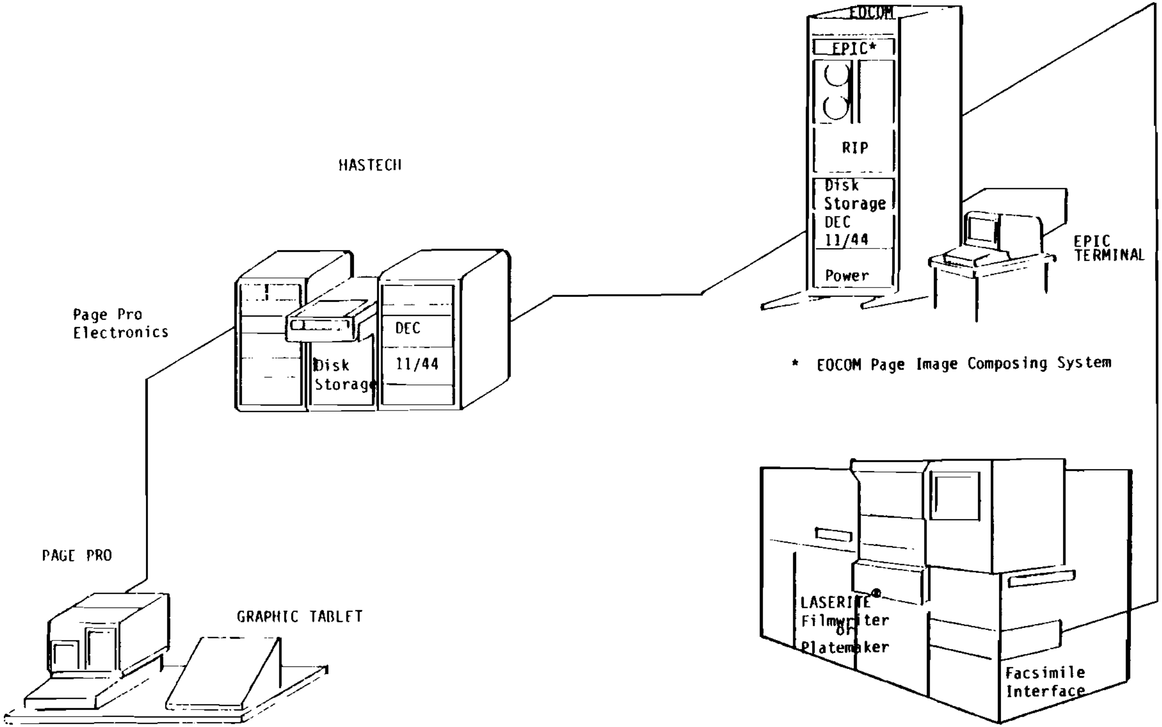


FIGURE 8.



HASTECH PAGEPRO PAGE MAKEUP SYSTEM AND EOCOM IMAGE GENERATION AND OUTPUT SYSTEM
TO BE SHOWN AT DRUPA AND ANPA EXHIBITIONS IN JUNE 1982

FIGURE 9.

Pagination

The last missing element for newspaper computer-to-image systems was really the frontend of the digital chain--the Electronic Pagemakeup System. This last element has been provided by Hastech Corporation in the form of their PagePro System. PagePro is a modular pagemakeup system composed of hardware and software elements, including page layout terminals, controllers, disk memory, and the NewsPro, AdPro, and GraphPro software modules.

This total system, as it will be demonstrated at DRUPA and ANPA, provide the user with the ability to organize quantity, shape and proportion of news text on full broadsheet or tabloid newspaper pages, to compose retail ads and automate classifieds, and to incorporate logotypes, lineart and halftones into newspaper pages, with full "electronic darkroom" capability (cropping, enhancement, sizing, rotation and correction).

In the same way that EOCOM's LASERITE with EPIC Raster Image Processor can accept a variety of frontend inputs, Hastech's PagePro Pagination System has the ability to drive a variety of output devices. Particularly valuable in the system to be demonstrated at the ANPA and DRUPA is Hastech's ability to output page images directly to EPIC in EOCOM's RIP native code, thus simplifying and reducing the number of steps preparatory to imaging.

Direct To Image: The Computer-To-Plate System

The combination of EOCOM's EPIC + LASERITE as the complete digital output device with Hastech's PagePro Electronic Page Composition System makes possible the first practical production computer-to-plate system (Figure 8). The configuration which will be demonstrated at ANPA and DRUPA this June consists of a Hastech PagePro System with NewsPro, AdPro, and GraphPro software modules, driving an EOCOM LASERITE with EPIC Raster Image Processor (Figure 9).

Digital typefaces used by the EOCOM EPIC imagesetting system are from the Compugraphic 8600 font library. Over 1,000 styles are available for the EPIC System through a licensing arrangement with Compugraphic; in addition, the entire International Typeface Corporation library is also available. Many foreign language typefaces are also available. About twenty styles are being used in the EOCOM demonstration in four ranges covering sizes from 4 point to 120 point.

Features of the system will include full electronic pagination of text and graphics, including lineart, logos and halftones, with the ability to directly image plate, film, paper, or proofing material. The total output rate of the system will be up to 50 page images per hour in the form of press ready printing plates. An advantage in cases where customers choose to phase computer-to-plate into production is the ability to use existing phototypesetters at a customer facility as backup for the LASERITE platemaker. An additional and very important feature is the systems' ability to handle camera ready copy, such as national advertisements, through the merge capability inherent in the LASERITE read platen. Since up to 60% of newspaper display advertising lineage comes in the form of camera-ready copy, this is an important time and labor saving necessity.

EPIC/LASERITE with Hastech offers newspapers the features, power, and savings which have been awaited for many years. One of our customers, after discussing this system with EOCOM and Hastech, said "I should be hearing trumpets--it's finally here." He's right--and maybe this paper should have been called "The Exhilarating Pace of Computer-to-Plate."