A COST AND QUALITY ANALYSIS OF THE THREE ELECTRONIC COMMUNICATION SYSTEMS CURRENTLY IN USE IN THE PRINTING AND PUBLISHING INDUSTRY

Susan L. Richards

Abstract: This article briefly describes, analyzes and compares existing the electronic graphic communication systems currently in use by the printing and publishing industry.

This article, prepared for the 1987 TAGA proceedings, represents a selected portion of a larger study published by the author in 1986, as the thesis requirement for a Master's Degree in Printing Technology at Rochester Institute of Technology. (1)

Each of the three electronic communication systems is given a generic system name based on its major design distinction from the other two systems. The system names assigned are:

System 1: Page Facsimile

System 2: Character-Encoding

System 3: Pixel Density-Map

Page Facsimile systems are primarily used by newspaper publishers. The **Character-Encoding** and **Pixel Density-Map** systems are alternate methods used by newsweekly magazine publishers.

All three electronic communication systems offer the user a means of transmitting editorial, and in some cases advertising pages, to remote printing facilities for manufacturing and distribution.

The decision considerations for the potential user is how to best match the communication system, i.e. how the system operates, the cost and

quality levels of that system, with the user's requirement for transmitting graphic information.

The author describes the development and increasing use of each electronic communication system. Also included is a brief history of each communication system and its basic operation.

Through the use of a cost and quality analysis the author establishes the relative cost of operation, and the possible quality levels attained, using each communication system.

Based on all the data analyzed the author concludes the article with an evaluation of each communication system from a potential user's standpoint.

Introduction to Electronic Communication Systems

The need for timely dissemination of information, and the high distribution costs of printed matter, has given rise to the development and increasing use of electronic graphic communication systems in the printing and publishing industry.

At the present time there are three electronic graphic communication systems in use: (2)

System 1: Page Facsimile

System 2: Character-Encoding

System 3: Pixel Density-Map

Currently several publishing companies, who publish daily national newspapers and weekly newsmagazines, are the primary users of these communication systems.

The national market approach of these publications has brought about the further development of electronic graphic communication systems, which offer the many advantages of timeliness and reduced national distribution costs.

A typical electronic communication system used in printing and publishing consists of a single transmission site, usually at place at the publisher's editorial offices, and a remote, or a number of remote, receiving locations.

At the transmission site the graphic information is assembled in the desired publication format, prepared for transmission and transmitted. The remote site(s), located at printing facilities throughout the country, and in some cases around the globe, receives the transmitted graphic information.

At the remote location, the receiving imaging equipment converts the received graphic information into a suitable prepress form. The printing facility manufactures and distributes the publication in a particular geographical location.

For the average publication, whether a daily, weekly or a monthly, the costs of these electronic graphic communication systems and the network design necessary to implement them, are at present economically prohibitive.

However, as these systems improve in availability and cost effectiveness, it will be feasible for other publishers to utilize existent electronic communication system designs and in some cases to develop their own electronic communication systems.

The major impetus for the publisher to adopt the new electronic communication technology is the advantage of more timely closing schedules for editorial and advertising pages, and sizable savings in distribution costs.

Another significant advantage of electronic communication systems is the potential for the publisher to develop a full communication system.

A full communication system is comprised of the transmission of the entire publication, including all advertising and editorial pages. At present a limited number of full electronic communication systems are in use. (3)

Most publishers using these systems ship the films for advertising pages to the remote printing locations conventionally, either by mail or overnight courier services.

Communication System Analysis

For analysis purposes the author has developed basic system descriptions, costs and quality parameters for each of the three electronic communication systems.

All analysis information contained herein was supplied to the author by communication system vendors and current users of each of the three major communication systems.

In all cases, for the purposes of comparison, any specific descriptions and data supplied have been developed into representative generic descriptions of design, components and costs.

To assist the reader, a brief history of the development and basic functional descriptions of each communication system are included.

The cost analysis segment includes the cost of the system components, storage capacity requirements and transmission media necessary for implementation. This cost analysis data is used to determine the relative cost of each system for comparison purposes. An analysis is also conducted using this data to determine the costs of multiple receiving sites for each communication system.

The quality analysis consists of the use of representative 4/color and text subjects from each system. This data is used to assess the effect, if any, on the quality of the received film and the printed copy caused by the transmission system used by each electronic communication system.

Finally, the system descriptions, cost and quality analysis data is used for the overall evaluation of each communication system.

System Decision Considerations

From a communication standpoint, the decision for the user is based on how best to match the electronic communication systems available, to the user's need for communicating graphic information.

To achieve an efficient match, each potential user must be in a position to assess the company's present transmission requirements and future communications needs.

At present, electronic communications technology is rapidly changing, and there is very little specific and comparitive information available on any of the communication systems in use today.

As a result, very little has been published by the electronic communication industry to aid the potential user in making communication system decisions.

The lack of specific system information can impose severe limitations on those potential users who are presently in a position to investigate possible electronic communication systems options.

In order to best match the system with the user's requirements for communicating graphic information, it is critical for the potential user to know specific information about any communication system under consideration. This specific information is categorized as follows:

First: How is each communication system designed and how does it transmit the graphic information from the transmission site to each remote receiving site.

Second: What are the approximate costs to operate each communication system. Specifically, the costs of components, storage, error checking, maintenance, transmission media and the cost of adding remote sites.

Third: Is there a means to assess, and compare, the quality of the transmitted 4/color and text film received at a remote location by each communication system.

Fourth: Is there also a means to assess, and compare, the final reproduction quality of the printed copy from the film received at those remote sites, for each electronic communication system.

When the above information is analyzed and compared for each graphic communication system, the potential user is then in a better position to choose one electronic graphic communication system approach over another.

Communication System Descriptions

The brief system descriptions which follow are intended to provide the reader with basic system information, including communication system design and operation.

System 1: Page Facsimile (4)

The System Introduction

In an article entitled "Page Facsimile in the Eighties" published in the 1981 TAGA proceedings, Richard E. Amtower describes Page Facsimile as follows: "In its simplest form, page facsimile is the transmission of complete newspaper pages in electronic form to a remote site for platemaking and printing." (5)

Page Facsimile systems have been been developed for, and primarily used as, newspaper graphic communication systems. The systems in use today have evolved from the original systems pioneered in the 1920's for the news services for transmitting wirephotos. (6)

Over the past two decades the use of Page Facsimile systems has increased significantly.

These systems offer the newspaper publisher the many advantages of the electronic media including, savings in distribution costs and a reduction in the time between closing pages and press starts.

Also for many newspaper publishers there has developed a strong competition with the broadcast media, for the timely dissemination of information. Page Facsimile systems also provide a means for those publishers who need to expand from outmoded or overloaded facilities in central metropolitan areas, to remote regional locations. (7)

Basic System Description

Prior to transmission, in the Page Facsimile system the text is typeset and prepared as reproduction copy. All the graphics and photographs, black and white or 4/color, are reproduced as halftone films. Contact prints are made from the output films.

The page is then pasted-up conventionally as a mechanical with the photographs, graphics and text in position. The page mechanical, one for each process color, is photographed and reproduced as a page negative film. A contact print is made from each process color page negative.

During transmission the facsimile scanner, at the transmission site, scans the page print and converts the entire page, photographs, graphics and text, into data elements. The transmission system transmits the data elements via a suitable telecommunication link to the remote location(s).

Upon receipt of the data, the facsimile recorder at place at the receiving location images an exact copy, a facsimile, of that page onto film from the data elements received. The page film, per color, is used to make plates for printing.

System 2: Character-Encoding (8)

The System Introduction

Character-Encoding communication systems were initially developed for use by text oriented news-

weekly publications. The original system was pioneered by "U.S. NEWS & WORLD REPORT" in the mid 1970's.

The primary quality development requirement of this communication system was based on a means of reproducing the highest quality text possible, at each remote printing location. The technology which was developed to meet this text quality requirement was a method of creating another "original text", also referred to as "local font generation", by having the typesetting equipment located at each remote site.

The equipment designed for this purpose consisted of an intelligent photo imager at place at each remote site served by the transmitter, to provide this "local font generation."

The users of this system also needed a means to transmit black and white photographs to each remote printing location. A black and white scanner was designed to scan the original photographs prior to transmission. The intelligent photo imagers at the remote sites, were adapted to process the halftones by out-putting a local font of halftone dots to reconstruct the original halftone scanned at the transmission site.

At its inception there was no need for the Character-Encoding system to transmit 4/color pages. To accommodate the eventual use of extensive 4/color pages in these publications, all 4/color films were shipped conventionally to each remote site.

However, for editorial purposes the need arose to transmit late closing 4/color pages. The communication system was adapted to transmit a limited number of 4/color pages per issue. To meet this requirement the users of these systems designed an interface between the transmission electronic color scanner and the receiving photo imagers. The device introduced was called a Color Conversion Unit.

It should be noted that at present this communication system design has far exceeded its

original capabilites, which was the transmission of only text material. The system has 4/color graphic quality limitations but remains in wide use today due to its economy of data transmission.

The Basic System Description

Prior to transmission all graphics, including black and white photographs and 4/color, are scanned and stored on magnetic tape as halftones. The text is typeset in a front-end typesetter and stored in a data storage queue. A device called a Communication Controller is used to character-encode the text characters by assigning ASCII symbolic character codes to each letter.

In some communication systems, the 4/color graphics portion of the page is assembled using a color preview system with a video display terminal (VDT). If these 4/color pages are to be transmitted to a remote site, a Color Conversion Unit (CCU) device is used to assign 8 bit, byte codes to the 4/color halftone dots.

The 4/color page is assembled on a typesetting preview system using the VDT. A File Manager is used to merge the text and graphics, per process color, in the appropriate publication format.

The codes generated at the transmission site to encode the original page are then transmitted over a suitable telecommunication link to the remote receiving location(s).

Upon receipt of the transmitted character codes the intelligent photo imager, at each receiving location, converts the symbolic character codes into locally stored fonts. These stored fonts include a halftone font, creating a new "original" at each remote location. The photo imager outputs page film, per color, for film assembly and platemaking.

It should be noted that at this writing only a limited number of 4/color pages are transmitted using this communication system. The majority of 4/color text pages, and all advertising pages are shipped conventionally to the printing sites.

System 3: Pixel Density-Map (9)

The System Introduction

The Pixel Density-Map system incorporates the most current communication system technology in use today. This system has been primarily developed over the past few years by "TIME" magazine. The major design requirement of this new communication system is based on the latest 4/color quality and transmission requirements of news-weekly publications. These publications are now predominantly 4/color oriented.

The primary quality requirement of this communication system is based on a means of transmitting and reproducing the best 4/color quality possible at each remote location.

The technology developed to meet this 4/color quality requirement is a method of creating another "4/color original", just as a color scanner does at a pre-press location. Essentially the equipment designed is the placement of the input part of the color scanner at the transmission site, with the output part of the color scanner, including the color computer, at each remote receiving location.

However, the users of these systems also needed a way of transmitting text material to each remote location. Initially a character-encoding system, similar to the one used for System 2, was used for transmitting the text.

However there was a limitation using this method. Two different output devices were required at each remote location. One for the text and another for the 4/color. Another means had to be devised to use only one device to output the entire 4/color page, with the text in position.

To meet the need to transmit text with this system, a typesetting device was introduced into with a raster image processor to convert all the text to raster format. In this manner the entire page, including text and graphics, could be imaged by the output part of the scanner, at each remote printing location.

Perhaps the greatest potential that the Pixel Density-Map system offers is a full communication system approach. The high level of 4/color quality makes it possible to eventually transmit all advertising and editorial pages using this system.

The Basic System Description

Prior to transmission, all graphics are scanned and stored as continuous tone data elements, called pixels, by an electronic color scanning device. All pixels reside in the memory of the system as density values, also called gray levels. Usually 256 gray levels are used.

The text is typeset in a front-end typesetter and converted to raster form, for transmission and imaging, by a Raster Image Processor (RIP) built into the typesetter.

A preview system with a VDT is used for color and graphics page assembly and storage. The text portion of the page is assembled with a typesetting preview system. Text and graphics, including photographs are kept separate during the transmission. A File Manager equipped with an extensive disk storage system stores all the page data, per color, including text, for as long as necessary.

During transmission the continuous tone density values, encoded from the original page, are transmitted via a suitable telecommunication link to the remote receiving location.

Upon receipt of the data at the remote site, the receiving imager, essentially the output part of an electronic scanner, receives the density values of the images on the page and the color computer assigns a line screen, creating halftones at each receiving location.

The text is merged with the graphics in the receiving photo imager. The imager output is page film for film assembly and platemaking.

COMMUNICATION SYSTEM COST ANALYSIS

The System Cost Analysis is intended to provide approximate costs for the operation of each communication system. This information is intended for comparison purposes only.

The analysis is comprised of the following approximate costs: components, data storage, error checking, system maintenance, transmission media and the costs of additional remote receiving sites for each communication system.

The approximate costs are based on 1986 pricing levels and have been obtained by contacting current users of each communication system. Also contacted were technical representatives from equipment manufacturers and companies supplying transmission services for each communication system.

In some instances cost data has not been made available to the author. In these cases, the author has approximated costs based on the available data from the other communication systems. All author approximations are noted as they occur, in each section of the cost analysis.

Items Analyzed:

System Components: An analysis of system component requirements, i.e. all operating equipment, including error checking, for the transmission site and a receiving site. Included are the costs of these components for each communication system.

System Data Storage: An analysis of system data storage requirements at the transmission site and a receiving site. Included are the costs of this storage for each communication system.

Error Checking: An analysis of the costs of error checking service for a transmission site and a receiving site, computed on a monthly basis, for each communication system.

System Maintenance: An analysis of the cost of system maintenance for a transmission site and

receiving site, computed on a monthly basis, for each communication system.

System Transmission Media: An analysis of the transmission media currently used by each communication system, and the costs of the transmission media, computed on a monthly basis for each communication system.

Overall System Cost Comparison and Evaluation: A comparison and evaluation of the overall costs, based on the use of one receiving location for each communication system.

Multiple Receiving Sites: An analysis and evaluation of the costs of additional receiving locations for each communication system.

System Costs Comparisons

	System 1	System 2	System 3
SYSTEM COMPONENTS			
Trans. Site -	$ 734,600	$1,345,000	$1,305,000
1 Rec. Site -	221,250	295,000	545,000+
TRANSMISSION COMPONENTS			
Trans. Site -	$ 435,000	$ 90,000	$ 15,000+
1 Rec. Site -	175,000	90,000	415,000+
ERROR CHECKING COMPONENTS			
Trans. Site -	$ 36,000	$ 5,000+	$ 18,000+
1 Rec. Site -	5,000	5,000+	5,000+
TOTAL COMP.-	**$1,606,850**	**$1,830,000+**	**$2,303,000+**
SYSTEM STORAGE			
Trans. Site -	*	$ 52,000	$ 128,200+
1 Rec. Site -	*	26,000	63,200
TOTAL STORAGE	----	**$ 78,000**	**$ 191,400+**
TRANSMISSION MEDIA/for 1 receiving site			
Trans./mo. --	$ 13,000	$ 960	$ 14,318

ERROR CHECKING/for 1 receiving site

Service/mo. -	$ 1,000	$ **	$ 500+

SYSTEM COMPONENT MAINTENANCE/per month

Trans. Site -	$ 700	$ 10,150	$ 10,000+
1 Rec. Site -	400	2,850	5,000+

TRANSMISSION SYSTEM MAINTENANCE/per month

Trans. Site -	$ 1,450	$ **	$ **
1 Rec. Site -	365	**	**
TOTAL SYSTEM MAINTENANCE -	**$ 2,915**	**$ 13,000**	**$ 15,000+**

\+ approximation based on available data.
* a limited amount of storage is built into the components of System 1.
** included in transmission media costs.

Evaluation of Total System Costs

All total costs are based on the use of a central transmission site and 1 remote receiving site.

Total Components:
Evaluation: System 3 requires the use of the most expensive system components.

Total System Storage:
Evaluation: System 3 requires the most system data storage capacity.

Error Checking Service:
Evaluation: Based on the available data, System 1 requires the most error checking expense per month for this service.

Total System Maintenance:
Evaluation: Based on available data, System 3 requires the most expense/month for this service.

Transmission Media:
Evaluation: The present system design for System 3 uses the most expensive transmission lines. System 1 is close to the same cost per month. System 2 is much less expensive for transmission costs.

Multiple Receiving Sites

System 1: Page Facsimile

Number of Sites	All Components	Storage	Trans Media per month	Error Checking & Maint /mo.
1 ---	$ 401,250	$ *	$ 13,000	$ 1,765
5 ---	$ 2,006,250	$ *	$ 13,000	$ 8,825
10 ---	$ 4,012,500	$ *	$ 13,000	$ 17,650
15 ---	$ 6,018,750	$ *	$ 13,000	$ 26,475
20 ---	$ 8,025,000	$ *	$ 13,000	$ 35,300
25 ---	$10,031,250	$ *	$ 13,000	$ 44,125
30 ---	$12,037,500	$ *	$ 13,000	$ 52,950

System 2: Character-Encoding

Number of Sites	All Components	Storage	Trans Media per month	Error Checking & Maint /mo.
1 --	$ 390,000	$ 26,000	$ 960	$ 2,850
5 --	$ 1,950,000	$ 130,000	$ 4,800	$ 14,250
10 --	$ 3,900,000	$ 260,000	$ 9,600	$ 28,500
15 --	$ 5,850,000	$ 390,000	$ 14,400	$ 42,750
20 --	$ 7,800,000	$ 520,000	$ 19,200	$ 57,000
25 --	$ 9,750,000	$ 650,000	$ 24,000	$ 71,250
30 --	$11,700,000	$ 780,000	$ 28,800	$ 85,500

System 3: Pixel Density-Map

Number of Sites	All Components	Storage	Trans Media per month	Error Checking & Maint /mo.
1 --	$ 965,000	$ 63,200	$ 14,318	$ 5,500
5 --	$ 4,825,000	$ 316,000	$ 14,318	$ 27,500
10 --	$ 9,650,000	$ 632,000	$ 14,318	$ 55,000
15 --	$14,475,000	$ 948,000	$ 14,318	$ 82,500
20 --	$19,300,000	$1,264,000	$ 14,318	$110,000
25 --	$24,125,000	$1,580,000	$ 14,318	$137,500
30 --	$28,950,000	$1,896,000	$ 14,318	$165,000

Multiple Site Costs Evaluations

Components:

Evaluation: System 2 costs the least for additional remote sites, in terms of the components costs required at each receiving site. System 3 is much more expensive than the other systems for the costs of components required at each receiving site.

Data Storage:

Evaluation: System 3 requires the most expense for data storage required at each receiving site.

Error Checking and Maintenance/per month:

Evaluation: System 3 requires the most expense per month for error checking and maintenance service for each receiving site.

Transmission Media/per month:

Evaluation: At present System 2 is designed as a point-to-point transmission system. Each site is transmitted to individually. As a result, System 2 is significantly more expensive than the other systems in terms of transmission media costs per month, for additional receiving locations.

COMMUNICATION SYSTEM 4/COLOR ANALYSIS

The 4/color analysis consists of the use of a series of photographs of a sample highlight area for each communication system.

Materials Analyzed:

The 4/color subject analyzed for each system was taken from a lead story page supplied by current users of each communication system. Each 4/color page supplied was part of an actual issue transmitted, received and printed by that communication system user.

A sample highlight area in the process color magenta was chosen. Magenta was chosen for 4/color analysis for the following reasons: First; magenta dots are easily identified. Second; magenta dots are among the smallest dots produced by electronic color scanners to maintain gray balance requirements in the color separation process.

It is inferred that the effect, if any, the transmission system has on the magenta transmission will be consistent with the effect on the other three colors transmitted.

Photographic Enlargement:

A method of photographic enlargement using a microscope, was used to photograph each highlight dot area. A #58 green wratten filter was used to visually separate the magenta dots from the other three process colors. The enlargement size was 53.4 times the original size, of each area.

Photographic Series:

A series of photographs of the identical highlight dot areas were made of the following:

The Original: The magenta dots in the 4/color subject prior to transmission.
The Received Film: The magenta dots in the film received at the remote site.
The Press Sheet: The magenta dots in the press sheet printed from the transmitted film received at the manufacturing facility.

System 1: Page Facsimile:

Page Facsimile is the only communication system that directly transmits the original data read by the facsimile scanner at the transmission site.

The data received is immediately imaged by a facsimile recorder at place at the remote receiving site.

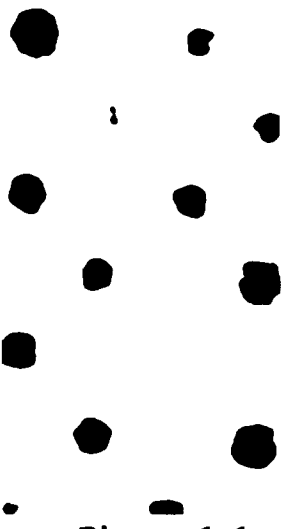

Figure 1-1

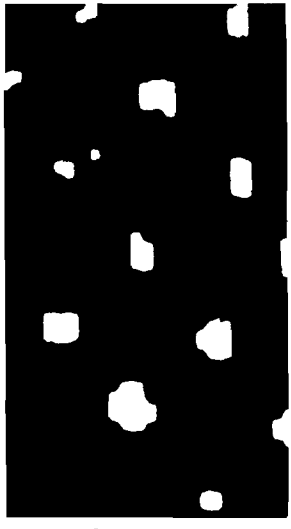

Figure 1-2

Figure 1-3

Analysis of Sample Highlight Area:

Figure 1-1: The Original consists of a dot area with many different highlight dot sizes.

Figure 1-2: The Received Film is a negative which shows the distortion of the original dots, in size and shape, caused by the transmission system on the highlight dots received. The scan frequency has caused a noticeable stair-stepping effect on the dots received.

Figure 1-3: The Press Sheet shows a limited amount of dot gain on press, as expected.

System 2: Character-Encoding:

The Character-Encoding system is the only communication system that converts the original halftone data into ASCII codes and transmits these codes via a transmission link. The character codes received are locally generated into the appropriate halftone fonts by the receiving photo imager.

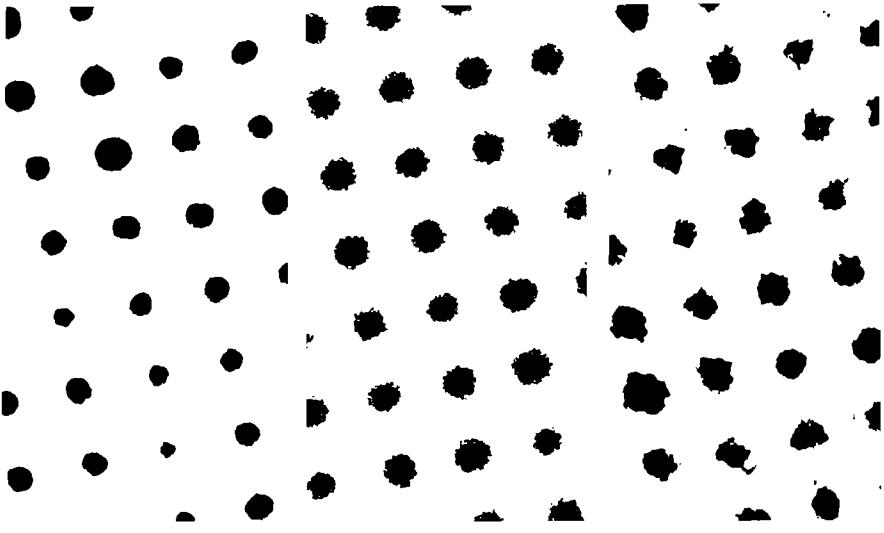

Figure 2-1 **Figure 2-2** **Figure 2-3**

Analysis of Sample Highlight Area:

Figure 2-1: The Original consists of many different highlight dot sizes.

Figure 2-2: The Received Film is positive film which shows soft dots, created by the receiving photo imager. There is a limited amount of dot sizes when compared to the original dots. None of the dots in the received film are as small as in the original.

Figure 2-3: The Press Sheet shows minimal dot gain on press. A better grade of paper was used for this sample. It is possible that when the Received Film was contacted for plates, the dots were sharpened to produce a hard dot.

System 3: Pixel Density-Map:

The Pixel Density-Map system is the only communication system that converts the original data into density values and transmits these densities via a transmission link to the remote receiving site.

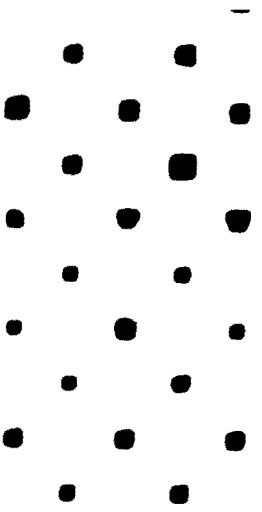

Figure 3-1

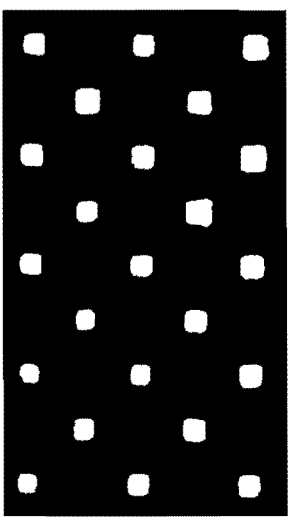

Figure 3-2

Figure 3-3

Analysis of Sample Highlight Area:

Figure 3-1: The Original consists of many different size dots in the highlight area.

Figure 3-2: The Received Film is negative film and does not have as many different dot sizes as the original. It is possible that this limitation could be caused by the screening requirement specified for this remote printing location.

Figure 3-3: The Press Sheet shows the square dots in the film now have a rounded shape, probably caused by the smoothing effect of the printing process. There is a minimal amount of dot gain due to the better grade of paper used.

4/Color Quality Evaluations:

System 1: Page Facsimile: Generally the highlight dot areas were found to be more distorted by the transmission system and less effected by the printing process.

Conclusions: The 4/color capability of the Page Facsimile System is found to be poor, particularly in the reproduction of highlight areas on the newsprint stock used. However, with the limited quality expectations of the newspaper industry, this system meets the 4/color quality requirements for editorial and advertising pages.

System 2: Character-Encoding: The highlight area in the received film exhibits the limitations of the photo imager at the receiving location. There are only a limited amount of halftone dot sizes in this system, usually 256 different sizes. Only full size dots are stored in the halftone font in the photo imager.

Conclusions: From the 4/color highlight area analyzed for this communication system it has been found that the CRT in the photo imager produces soft dots in the received film. There is also a limitation in the number of sizes of the dots created from the ASCII codes received. Creating only full dots limits the 4/color capability in this communication system.

There is less of an effect from dot gain in the printing process used with this system. The soft dots can be compensated for in contacting the film to hard dots for platemaking. Also a better grade of paper is used for this type of magazine.

The overall 4/color capability of this system is adequate for 4/color editorial pages. However due to the nature of creating the halftone dots at the receiving location ,the quality is not considered to be adequate for 4/color advertising applications.

System 3: Pixel Density-Map: As seen in the original, hard dots are output in the received film. The highlight area in the received film exhibits the dot size limitations imposed by the screening requirement specified at the receiving location.

Conclusions: This system has the greatest potential from a 4/color quality standpoint. From the highlight area analyzed, hard dots are created in the receiving photo imager. As for the limitations in highlight dot sizes seen, the screening requirement can be specified to a higher line screen. A higher line screen creates smaller dot sizes in the highlight areas. Line screens of up to 175 lpi are possible with this communication system.

There is less of an effect from dot gain in the printing process used with this system. A better grade of paper is used for this type of magazine.

The overall 4/color capability of this communication system is excellent for both 4/color editorial and advertising pages.

COMMUNICATION TEXT QUALITY ANALYSIS

The Text analysis consists of visually choosing sample serif letters, one from each communication system, photographing them and conducting an analysis of each letter from the enlarged photographs.

Text subjects were from live pages supplied by a users of each communication system. Each letter was enlarged photographically as was done in the 4/color analysis for each system.

Photographic enlargement:

A method of photographic enlargement using a microscope was used. Each photograph contains as much of each letter as possible again with the magnification of 53.4 times the original.

The Text Quality Analysis

System 1: Page Facsimile

Page Facsimile is the only communication system in the study that directly transmits the original textual data read by the facsimile scanner at the transmission site. The data received is immediately imaged by a facsimile recorder at place at the receiving site.

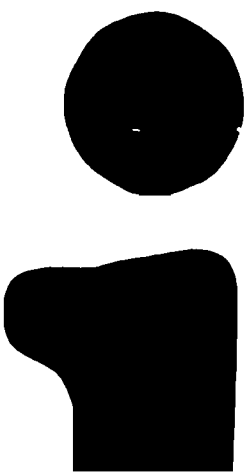

Figure 4-1

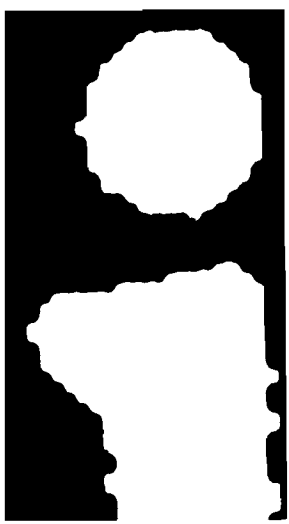

Figure 4-2

Figure 4-3

Analysis of Sample Serif "i":

Figure 4-1: The Original letter prior to transmission exhibits a sharp edge and good definition of the serif. Type density in the original is good.

Figure 4-2: The Received Film is a negative. This letter exhibits the jaggies caused by the scanning frequency used. There is some distortion on the straight part of the letter. This effect indicates a possible synchronization problem in the scanning device used. Type density is good in the film.

Figure 4-3: The Press Sheet shows some dot gain in the printed letter on the newsprint stock used. Even with the smoothing of the printing process, the distortion caused by the synchronization problem is evident.

System 2: Character-Encoding:

The Character-Encoding system is the only communication system that converts the original type into ASCII character codes and transmits these codes via a transmission link to the remote receiving site. The codes received are locally generated into the appropriate text fonts and sizes, by an intelligent photo imager at place at the receiving site.

Figure 5-1 **Figure 5-2** **Figure 5-3**

Analysis of Sample Italic Serif "i":

Figure 5-1: The Original letter has sharp edge and very good definition of the serif, in the prepress proof used for analysis. Type density is good.

Figure 5-2: The Received Film is positive film and exhibits the soft edges that were seen in the halftone dots created by the receiving photo imager. The type density is fair.

Figure 5-3: The Press Sheet letters show a minimal amount of dot gain, as was also evident in the press sheet analysis for the halftone dots in the 4/color analysis.

The Text Quality Analysis

System 3: Pixel Density-Map:

The text in this communication system is raster image processed and it is the raster data that is transmitted for each letter. The receiving imager draws the letters from the raster image data received.

Figure 6-1

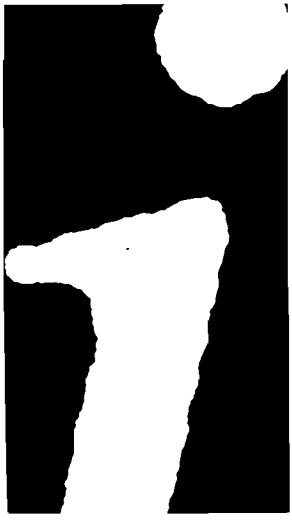

Figure 6-2

Figure 6-3

Analysis of sample Italic Serif "i":

Figure 6-1: The Original letter has a jagged edge caused by the raster processing, but there is good definition in the serif. The type density is good.

Figure 6-2: The Received Film is negative film and also exhibits a jagged edge, however there appears to be more definition in the letter. The type density is good.

Figure 6-3: The Press Sheet for this letter shows a minimal amount of dot gain and there is a definite smoothing effect from the printing process. The jagged edges still appear in the printed copy.

The Text Quality Evaluations

System 1: Page Facsimile: It is important to note that the original type in this system is photographed, as is the entire page, and contacted to a velox print prior to transmission. As a result, the type shape and density can be manipulated in the velox by exposure and development. The type prior to transmission is made sharp in the velox with none of the jaggies normally seen in original type created by the CRTs used in the front-end typesetting system.

The transmission system does have a great deal of effect on the edge quality and density of the type. Jaggies are easily seen in all the type in the received film. This stair-step effect is caused by the scanning frequency used at the transmission site and to some extent by the amount of data compression used for transmission. This is seen clearly in the received film.

What is seen in the press sheet is a significant amount of dot gain from the printing process used. The newsprint paper used contributes greatly to the dot gain seen on the press sheet.

Conclusions: The smoothing effect caused by the printing process makes the type quality for this system acceptable based on the limited quality expectations of the newspaper industry.

System 2: Character-Encoding: The original supplied is a pre-press proof which has sharp edges and fair type density. The received film shows the soft edge that was seen in the halftone dots. There is some noticeable dot gain in the press sheet, filling in the serif areas.

Conclusions: The type in this system is locally generated by the receiving photo imager. Based on the analysis of the type, this communication system is the best from an overall quality standpoint. The soft edges on the type seem to have a minimal effect on the type in the final repro-

duction. The type produced in this communication system is extremely good and meets the quality requirements of a weekly magazine.

System 3: Pixel Density-Map: The original supplied was positive film from the transmission site. The effect of the raster image processor is evident in the ragged edges of the serif type. There is minimal dot gain evident in the press sheet for this letter. The printing process has smoothed out the ragged edges to a certain extent.

Conclusions: The type in this system is raster image processed prior to transmission. This accounts for the jaggies in the original type. Based on the analysis of the type, this communication system is adequate from an overall quality standpoint. The ragged edges on the type do have a significant effect on the type quality in the final reproduction. Generally the type produced in this communication system is good and meets the quality requirements of a weekly magazine.

OVERALL SYSTEM EVALUATIONS

System 1: Page Facsimile: At present, Page Facsimile systems are the only systems that can operate using a full communication system design. As a result, this system can offer the user the advantage of transmitting the entire publication, including all 4/color editorial pages and 4/color advertising.

This communication system is relatively simple for the user to install and operate. From an overall cost standpoint the Page Facsimile system is the least expensive of the three communication systems.

The quality levels attained for the transmission of both 4/color and text using this system as presently designed, are considered adequate and best suited for newspaper applications.

System 2: Character-Encoding: At present, this communication is limited in the number of 4/color editorial pages that can be transmitted. Also all advertising films are shipped conventionally.

Due to the nature of encoding the graphic information this communication system is more complex to install and operate, particularly if 4/color editorial pages are transmitted. From an overall cost standpoint the Character-Encoding system is the second most expensive of the three communication systems.

There exist inherent limitations in the quality of the 4/color transmission attained using this system. However, the text quality levels achieved are superior and as such are best suited for use by publications that are text oriented.

System 3: Pixel Density-Map: It is evident at present that this communication system is still in a development stage. Because of the level of system sophistication necessary for encoding and transmission this system is also complex to install and operate. From an overall cost standpoint the Pixel Density-Map system is the most expensive of the three systems.

The Pixel Density system is the best transmission system for 4/color. It is far superior to the other two communication systems in this regard. The great potential with this system is the eventual development into a full communication system design. However, an improvement in the method of encoding and transmitting the text is necessary for this communication system to reach its full quality potential.

FOOTNOTES

(1) Master's Thesis, 1986 Rochester Institute of Technology, Rochester, NY. Thesis title: "A Cost and Performance Analysis of the Three Electronic Communication Systems Currently in Use in the Printing and Publishing Industry."

(2) The author has chosen generic names to describe the three electronic graphic communication systems in use today.

(3) "USA TODAY" uses a full Page Facsimile system, which includes the transmission of full page 4/color ads. "THE WALL STREET JOURNAL" uses a facsimile system to transmit advertising pages which are generally line art.

(4) Present users of Page Facsimile systems include, "USA TODAY", "THE WALL STREET JOURNAL" and "THE NEW YORK TIMES."

(5) "Page Facsimile in the Eighties", by Richard E. Amtower, 1981 TAGA Proceedings. Page 264.

(6) Ibid. This article contains a detailed historical account of the development of facsimile systems.

(7) Ibid. Page 264.

(8) Present users of Character-Encoding systems include: "NEWSWEEK", "U.S. NEWS & WORLD REPORT" and "BUSINESS WEEK."

(9) At this writing "TIME" magazine is the only publication using this electronic communication system.

ACKNOWLEDGEMENTS

The author would like to gratefully acknowledge the contribution of the following companies for their help and cooperation in the development of this article: **American Satellite Company, A T & T Communications, Crosfield Electronics Inc., Publisher's Phototype Inc., Time Inc., USA Today and U.S. News & World Report.**