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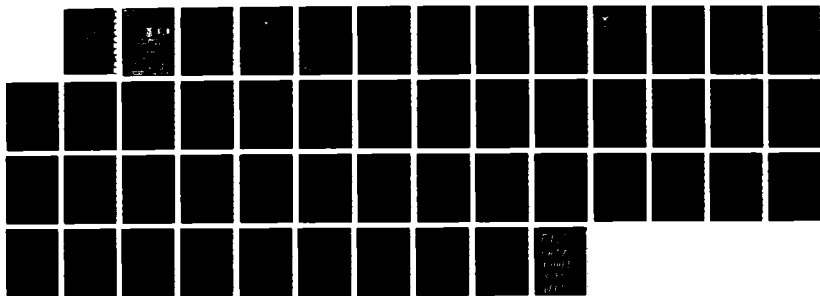
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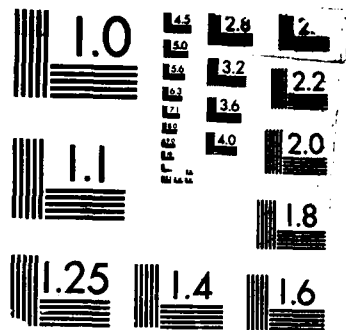
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AIR COMMAND AND STAFF COLLEGE

STUDENT REPORT

DESKTOP PUBLISHING
FOR THE
AIR COMMAND AND STAFF COLLEGE
MAJOR DANNY J. MOORE 88-1880

"insights into tomorrow"

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REPORT NUMBER 88-1880
TITLE DESKTOP PUBLISHING FOR THE
AIR COMMAND AND STAFF COLLEGE

AUTHOR(S) MAJOR DANNY J. MOORE, USAF

FACULTY ADVISOR MAJOR JAMES D. GATEWOOD, ACSC/EDT

SPONSOR MAJOR JAMES D. GATEWOOD, ACSC/EDT

Submitted to the faculty in partial fulfillment of
requirements for graduation.

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PREFACE

Currently, the Air Command and Staff College does not have the capability to produce curriculum materials with standardized formats and typefonts. The school recognized the acquisition of a desktop publishing system could remedy this problem. But before the school can begin purchasing the major components of a system, two major questions needed to be answered. First, what were the school's present and projected requirements for desktop publishing? And second, which products could best satisfy those requirements? This research study was performed to help the school answer these questions.

Although the author does not have a degree in computer science or extensive experience with computer programming, he has worked with a variety of computer applications in office, education, and home environments. In his previous Air Force assignment, he demonstrated his expertise in this field by automating the planning, programming, and budgeting system used by Air University. He has continued to broaden, as well as deepen, his knowledge of computer capabilities in various settings by conducting this research study about desktop publishing.

The reader should have a general familiarity of computer terminology to understand some of the terms used in this report. Unique and possibly unfamiliar terms and concepts were explained in the study. Thus, a brief review of computer terminology may be needed to fully comprehend the study.

The author wishes to thank his project advisor, Major James D. Gatewood, for his assistance in developing this research study. Also, the author wishes to express his appreciation to the members of his family for their patience and support.



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ABOUT THE AUTHOR

Major Moore was born December 5, 1949 in Sherman, Texas, and graduated from Greensburg High School, Louisiana in 1968. He earned a bachelor of science degree in health, physical education and recreation and received his commission through the Air Force Reserve Officer Training Corps program at Louisiana State University in 1973. Major Moore earned a master of science degree in safety from Central Missouri State University in 1975. He has completed one-third of the coursework in pursuit of a doctorate degree in adult education from Texas A&M University. Major Moore was initially assigned to a strategic missile squadron at Whiteman Air Force Base, Missouri, where he served on missile combat crews as a deputy commander, commander, alternate squadron commander, and alternate wing commander from 1973 to 1976. Following missile duty, Major Moore was assigned to the Ground Safety Division, Headquarters Aerospace Defense Command, Peterson Air Force Base, Colorado. He served there as chief of the Traffic Safety and Safety Education Branch from 1976 to 1978. Major Moore was next assigned to the Air Force Officer Training School, Lackland Air Force Base, Texas. While there, he served as a flight commander, a squadron operations officer, a communicative skills instructor, and as the chief of the Academic Research Section. In 1980, Major Moore was assigned to the Safety Education Division, Headquarters Air Force Inspection and Safety Center, Norton Air Force Base, California. He served there until 1982 as a safety education and training staff officer, responsible for all safety education and training courses in the Air Force. In his next assignment, the major was a deputy squadron commander in a basic military training squadron, Lackland Air Force Base, Texas. He was reassigned in 1983 to Headquarters Basic Military Training School, where he served as chief of the Curriculum Branch. In 1984, he became the commander of a co-educational basic military training squadron. In 1985, Major Moore was assigned to the Plans and Programs Division, Headquarters Air University, Maxwell Air Force Base, Alabama. He served there as chief of the Professional Continuing Education Programs Branch until December 1986, when he became chief of the Programs Analysis Division. In August 1987, he was assigned to the Air Command and Staff College as a student.

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EXECUTIVE SUMMARY



Part of our College mission is distribution of the students' problem solving products to DOD sponsors and other interested agencies to enhance insight into contemporary, defense related issues. While the College has accepted this product as meeting academic requirements for graduation, the views and opinions expressed or implied are solely those of the author and should not be construed as carrying official sanction.

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REPORT NUMBER 88-1880

AUTHOR(S) MAJOR DANNY J. MOORE, USAF

TITLE DESKTOP PUBLISHING IN THE
AIR COMMAND AND STAFF COLLEGE

I. Purpose: Determine the best, most cost-effective desktop publishing products currently available which will satisfy the requirements of curriculum materials in the Air Command and Staff College (ACSC).

II. Background Data: ACSC has recognized the need for a desktop publishing system to standardize the formats and typographic characteristics of the curriculum materials. "A desktop publishing system consists of a personal computer using a program that allows you to import or enter text and graphics elements on the screen, edit and move the different elements around, and print them out on a dot matrix or laser printer" (9:64). The requirements and potential uses for a desktop publishing system had to first be identified. Then, pertinent articles and product reviews were compiled and used to recommend the most appropriate image scanner, large-screen monitor, laser printer, and software for ACSC to acquire.

III. Findings: An informal survey of ACSC's curriculum personnel yielded estimates of the number and composition of the pages of curriculum materials generated annually. These

CONTINUED

estimates were correlated with the author's assumptions of the expected output from the evaluated components of a desktop publishing system in order to derive specific requirements for the school. He found that ACSC needed one scanner and two laser printers connected to two desktop publishing workstations.

IV. Product Evaluations: The author studied numerous articles and product reviews from current periodicals in order to evaluate the major components of a desktop publishing system, i.e., scanners, monitors, laser printers, and software programs. For each component category, the author selected eight factors which could be used as criteria to objectively judge the effectiveness of the products in that category. Each factor was assigned a weight ranging from one to eight, depending on the author's examination of the literature and his own personal convictions of the relative importance of the factor to the overall analysis. The author then awarded one to five points to each product for every factor being evaluated. The better the product could perform in a certain factor when compared to other similar products, the more points that were assessed. Next, the author multiplied the number of points a product received for a specific factor by the factor's assigned weight. The resulting numbers for each factor were then added to determine a product's total number of points. Finally, the product evaluations concluded with the products being ranked in descending order based on their total points. These evaluations were used to make product recommendations.

V. Recommendations: The products recommended in this research study should satisfy ACSC's present and projected requirements for desktop publishing. The school may decide to purchase products other than those recommended by the author. To cover this possibility, the author provided additional product information to consider in making alternate component selections. Nevertheless, these were the products and quantities recommended for acquisition:

<u>Component</u>	<u>Product Name</u>	<u>Unit Cost</u>	<u>#</u>	<u>Tot Cost</u>
Scanner	Kurzweil Discover 7320	\$ 9,950	1	\$ 9,950
Monitor	Taxan Crystal View	2,195	2	4,390
Laser Printer	Okidata Laserline 6	1,995	2	3,990
Software	Xerox Ventura Publisher	895	2	<u>1,790</u>

Total Cost \$20,120

(Note: This total cost excludes the costs of microcomputers and other components which were outside of the scope of this research study, e.g., hard disk drives, expanded memory boards, mouse devices, etc.)

Chapter 1

INTRODUCTION

"Desktop publishing is a phrase coined by Paul Brainerd of Aldus Corporation" (9:64). The term ". . . typically refers to the use of a microcomputer and laser printer to generate finished pages that combine text and graphics and that typically use multiple fonts" (11:90). The term as used in this research project is as follows:

. . . [T]he process of integrating text and graphics on a desktop computer, and manipulating that information with software to compose and lay out pages. The pages then produce hard copy according to the quality needs of the user. Desktop publishing's key difference from word processing is the relatively sophisticated software that will set different type fonts, edit graphics, format pages in various styles and interface with sophisticated printers and phototypesetters to produce font scaling and graphics integration (17:40).

Some people have suggested perhaps a more accurate term would be desktop composition (22:50; 11:90). There is some validity to using this term because there are usually two major steps in the publication process. The first step is all of the prepress activities such as writing copy, creating graphics, typesetting, layout and pasteup--everything required to prepare a printing project for press. The second step is the actual printing or duplication of the document (14:79). Regardless of the misnomer, desktop publishing is the term most widely used.

In this study, the term "desktop publishing system" is a combination of both software and hardware. The software is the ". . . heart and soul . . . [of the system, consisting of] . . . those elements that let you design a page format, control typographic specification, and perform pagination prior to output" (13:159). The hardware used in a desktop publishing system includes a personal computer with a large capacity hard disk, a high-resolution monitor, a mouse, a laser printer, and a digital scanner (13:159; 6:93).

The school can expect to receive significant benefits from purchasing and using a desktop publishing system. "Desktop publishing systems can decrease the cost of producing documents and increase the flexibility for producing timely results" (24:147). Additionally, these systems will allow more current articles to be published since the time needed for internal coordination and prepress activities can be dramatically reduced (11:90). The number of typewritten pages can be condensed by about 40 percent. This could save considerable amounts in printing, storing, and shipping costs (14:82).

Documents that have been produced with a desktop publishing system ". . . are easier to read and better remembered than typewritten documents" (14:82). Neurologic research has documented how each side of the brain is uniquely designed to carry out processing activities differently as things are perceived by the brain (23:10).

The desktop publishing system employs a computer, that due to the software and laser printer, can print alphanumeric symbols, but it can just as easily draw pictures, diagrams, or any . . . symbol systems . . . simultaneously appealing to both [the] left and right brain hemispheres--the whole brain. . . . [T]extual meaning is believed to be processed primarily in the left hemisphere and images and pictures on the right side of the brain. Now, because of the text/graphics duality of the microcomputer, a . . . document can easily include right brain images to clarify both content and context. . . . To employ desktop publishing to produce documents that use only the trusted textual conventions is to waste part of the technology and its communication power, not to mention half of the brain. . . . It is time to develop and understand the efficiencies of the right brain document and its role in the management . . . and training functions that each of us performs daily. . . . [Desktop publishing] does not have to be another "half-brained" idea (23:13).

THE PROBLEM

The Air Command and Staff College (ACSC) has decided to acquire desktop publishing capabilities to produce better looking curriculum materials while saving time and money. The problem is determining the most cost effective combination of hardware and software products which will best meet the school's requirements and potential needs. This

research study will help to resolve this problem by pursuing certain objectives and using a combination of research methodologies.

RESEARCH OBJECTIVES

This research study will examine the acquisition of a desktop publishing system for the resident course of instruction at ACSC by accomplishing the following five research objectives:

1. Ascertain the existing hardware and software resources available within the school.
2. Identify the school's requirements and potential uses for a desktop publishing system.
3. Review current periodicals to evaluate hardware and software products for ACSC use.
4. Recommend specific products for the school to purchase.
5. Ensure the recommended products are compatible with those planned for acquisition by the Extension Course Institute (ECI) for their print plant.

RESEARCH METHODOLOGY

A combination of methods was used to gather information for this study. One method was the informal interview. The school's curriculum writers, editorial assistants, and those responsible for computer product acquisitions were interviewed by the author. The data gathered was used to quantify and standardize the school's requirements and potential uses for desktop publishing. Interviews were also conducted with the project officer for ECI's planned acquisition of a desktop publishing system for their print plant. These interviews provided information about the products and capabilities of their proposed system.

Another method was also used for this study, a review of the literature. In most instances, the author was unable to observe demonstrations of the various products or to personally evaluate the products to discover which would best satisfy the school's requirements. Consequently, every effort was made to review the most current periodicals.

In addition to this introductory chapter, this research study is composed of four more chapters. Chapter 2 provides background information about the school's capabilities, certain assumptions made by the author, and specific limitations on this research project. Chapter 3 is a description of ACSC's requirements and potential uses for desktop publishing. Chapter 4 contains an explanation of the criteria that were used to evaluate the various products and the results of those evaluations. Finally, Chapter 5 recommends the products which the author believes ACSC should purchase.

Chapter 2

BACKGROUND DATA

CURRENT COMPUTER RESOURCES

Before evaluating various desktop publishing products, it was necessary to ascertain the existing hardware and software resources available within the school. This was important to reduce the possibility of purchasing products which duplicated the capabilities of current computer resources, and thereby waste limited financial resources. It was also important to be able to use as much of the existing resources as possible in order to obtain optimum compatibility, decrease purchase costs, and reduce training time once a desktop publishing system was purchased.

Hardware Capabilities

Curriculum materials in ACSC are prepared using various computer hardware products. The school's word processing center uses the Lanier minicomputer system with four terminals. The Lanier system relies on daisywheel printers for its output. Curriculum personnel, both administrative and faculty, use either a Z-100 with a Gemini Board or a Z-158 microcomputer. Altogether the school has 64 Z-100s and 65 Z-158s. These computers operate with the Microsoft Disk Operating System (MS-DOS) and use primarily dot matrix printers; however, some daisywheel printers are also used.

Software Capabilities

There are two major categories of computer software used to prepare ACSC's curriculum materials. The one used most often is word processing software. The Lanier computer uses its own proprietary word processing software and the MS-DOS computers use the SMART word processing software. As an aside, the files produced on one system cannot be used on the other. The second major type of software used is a drawing program. Curriculum personnel sometimes use PC Paintbrush to draw graphic images to accompany text they have typed.

ASSUMPTIONS

The author made several assumptions in conducting this research study. The first assumption was the result of a limitation imposed by Captain Ronald Ford, Chief of Computer Capabilities and Plans. He said the products recommended in this report must be compatible with the school's existing hardware and software as much as possible. Thus, the author assumed that any desktop publishing software reviewed in this project should be capable of reading and writing files that can be used with PC Paintbrush and SMART. The alternative would be for the school to purchase sufficient copies of new software which would be compatible with the recommended desktop publishing software--a costly proposition. The second assumption was that the data collected from curriculum personnel during the requirements survey accurately reflects the school's requirements. The last assumption was that ACSC would purchase the number of personal computers deemed necessary in the requirements survey to establish a desktop publishing system. The number of computers eventually purchased directly effects the number of monitors, printers, and scanners recommended in the requirements survey.

LIMITATIONS

This research study had several limitations. First, this report was limited to the curriculum materials used only in the resident course of instruction of ACSC. Thus, the use of desktop publishing in the school's nonresident course was beyond the scope of this project. Second, evaluations of the products reviewed in this report were made by studying articles in recent periodicals. Additionally, people who were in the local area that were knowledgeable of the reviewed products were informally interviewed. Third, the retail prices of the reviewed products have to be used because the actual prices the school would have to pay are unknown, but probably less than the retail price. Finally, the products recommended in this report must produce text and graphic images which are compatible with the hardware and software that ECI plans to purchase for their print plant. This was important because ECI's print plant is responsible for printing most of ACSC's curriculum materials.

Chapter 3

FINDINGS

REQUIREMENTS SURVEY

A survey instrument was developed to standardize and quantify the information obtained from curriculum personnel about their course materials. The survey data were compiled from each division's current needs and operations. The survey results in Table 1 include assessments from curriculum personnel of how many pages of curriculum materials are produced each year. The author then estimated the amount of time each desktop publishing component would normally be operated each day and the average production of pages per hour. Based on the staff's input and the author's estimates, ACSC's requirements were determined to be two laser printers, one scanner, and two desktop publishing workstations. (For the purposes of this study, a workstation consists of a large screen monitor and microcomputer with desktop publishing software.)

The author's estimates of product usage were based on the presumption that the computer in a desktop publishing workstation could not be used with both a laser printer and a scanner simultaneously. Additionally, the author presumed if the computer were being used in a desktop publishing application, e.g., importing and rearranging text, it could not be used with a printer or scanner. Thus, the usage of the products was considered to be mutually exclusive for the purpose of determining requirements. The author further presumed that the computer operators would have other job responsibilities, obligations, and interruptions which would prevent the products from being used more often than his estimates. Finally, the author calculated the products would be used an average of 21 days per month (250 days per year).

(NOTE: If other assumptions were made of product usages and capabilities, or if other estimates of operating time were considered to be more accurate, then the requirements may be different.)

Laser Printer Requirements

Based on the requirements survey results in Table 1, ACSC has a requirement to publish 26,815 pages of curriculum materials each year. With 250 workdays in a year, this equates to an average of 108 pages per day. During a typical 8-hour workday, the author estimated a laser printer could only be operated for 3 hours because of the assumption of mutual exclusiveness described earlier. Most laser printers can produce at least 5 pages of simple text per minute, which would theoretically equate to 300 pages per hour (1:152-243; 16:91). In reality, however, laser printers can't print pages at the theoretical maximum because of the computer's processing speed, the printer's processing speed, and other electromechanical factors. Additionally, pages with both graphic images and text take much longer to print than pages with only text.

If you expect to produce a high volume of pages, you need to assess each product's printing speed as well as its processing time. For example, if it takes 30 minutes to print a single page--as it can when you use high-resolution scanned images--and you have only one available printer, you will be able to print only 16 pages during one 8-hour day (6:100).

The capability of a printer in the above example would equate to an average speed of 2 pages per hour. In ACSC, very few of the curriculum materials use full page graphic images. In fact, according to the requirements survey, only an estimated 26 percent of ACSC's present curriculum materials use any graphic images at all. Still, the potential is high for the number of pages with images to increase once a desktop publishing system is acquired. Considering all of the above factors and the assumptions about the work environment, the author conservatively estimated the production requirement of a laser printer handling ACSC curriculum materials to be 18 pages per hour. Consequently, ACSC would need two laser printers capable of producing a combined total of 36 pages per hour in 3 hours of operation each workday in order to print 108 pages per day.

Scanner Requirements

According to the survey results, the combined estimated number of pages with graphic images and those which have simply been reproduced is 8,023 pages per year. This translates into a requirement of approximately 32 pages per day which would need to be scanned into the computer

connected to a desktop publishing workstation. Considering the previously mentioned basic assumptions, and particularly the mutual exclusiveness of using the various components, the author estimated only 1 hour each workday could be dedicated to scanning operations. "Currently scanners take anywhere from 10 to 55 seconds to read in a page. They usually scan images at a faster rate than text because the character recognition step takes additional time" (7:71). Thus, the author assumed a scanner could be expected to scan 60 pages per hour. At that rate, ACSC would only need one scanner to handle the surveyed requirement of 32 pages a day. If the school's requirements for scanning original documents and graphic images into a desktop publishing workstation were to expand in the future, one scanner could still handle the expanded workload by connecting it to a device which allows the scanner to be operated by two desktop publishing workstations on a time-sharing basis. So, one scanner should meet ACSC's current and projected requirements.

Workstation Requirements

Since ACSC needs two laser printers to satisfy its printer requirements, two desktop publishing workstations would be needed to control and operate the printers. Furthermore, the workstations could only be used for 4 hours per day for desktop publishing applications since the remaining 4 hours of the workday would be dedicated to printing and scanning operations. Each workstation would have to produce 27 completed pages per hour in order to satisfy the requirement to print 108 pages per day. This should not be difficult to achieve in the author's opinion.

POTENTIAL USES

The potential uses of desktop publishing in ACSC are almost unlimited. Similar organizations have used desktop publishing

". . . to enhance the visual quality of existing documents; to start a project such as a company newsletter, a book, or journal; to save money spent on professional typesetting services by producing proof sheets on the laser printer or by using them as the final output" (9:69).

Most likely, the school will use the finished products from a desktop publishing system for internal coordination. Some curriculum materials could be produced in final form rather than sending them to the print plant, if the number of copies

was relatively small. Supply requirements for paper and toner cartridges for the laser printer would then exceed the original estimated amounts, causing supply shortages and possible work stoppages. Additionally, the school would have to be careful not to usurp the responsibilities of ECI's print plant by electing to print too many pages.

Survey Results	Text Books	FI Info	Sem Guide	Brief Guide	Hand outs	Misc	Totals
ACSC/EDC:							
Pgs to publisher	875	1,200					2,075
Pgs with images	88	120					208
Reproduced pgs	0	300					300
Pgs typed locally	875	900					1,775
ACSC/EDJ:							
Pgs to publisher	4,900	1,000					5,900
Pgs with images	245	300					545
Reproduced pgs	490	100					590
Pgs typed locally	4,410	900					5,310
ACSC/EDM:							
Pgs to publisher	1,000	2,940	2,940	2,940	80	6,660	16,560
Pgs with images	150	29	29	29	1	1,332	1,571
Reproduced pgs	20	29	29	29	1	3,330	3,439
Pgs typed locally	980	2,911	2,911	2,911	79	3,330	13,121
ACSC/EDN:							
Pgs to publisher	880	1,400					2,280
Pgs with images	88	140					228
Reproduced pgs	792	350					1,142
Pgs typed locally	88	1,050					1,138
ACSC Grand Totals							
Pgs to publisher	7,655	6,540	2,940	2,940	80	6,660	26,815
Pgs with images	571	589	29	29	1	1,332	2,552
Reproduced pgs	1,302	779	29	29	1	3,330	5,471
Pgs typed locally	6,353	5,761	2,911	2,911	79	3,330	21,344

Table 1. Survey Results

Chapter 4

PRODUCT EVALUATIONS

In evaluating each category of products, eight different and pertinent factors were considered. These factors were derived from the author's extensive readings and interviews with knowledgeable people. Each of these factors were given weights from one to eight based on the author's estimate of the factor's relative importance to the other factors. Then, each product was given between one and five points, depending on how well the product satisfied the criteria for that particular factor. The better the product was judged to be, the more points it was awarded. Finally, the weight for each factor was multiplied by the product's assessed points for each factor and summed to obtain the total points for the product.

SCANNERS

"The scanner product group includes graphics scanners, optical character readers (OCRs), and facsimile transmission (fax) units" (21:186). However, for this project, fax units were not reviewed since none of the curriculum personnel interviewed indicated any requirement for them. "Scanners are the hardware that permit desktop publishers to take material that has already been typed, drawn, and photographed and use it in electronic format without having to retype, redraw, or rephotograph it" (21:185).

In this research project, 26 different scanners were evaluated for possible acquisition by ACSC. The evaluation factors for these optical imaging products and their rankings are found in Table 2.

Points range from 1 to 5 (Low to High)		A	B	C	D	E	F	G	H	I	
#	Product Name	Wt 8	Wt 7	Wt 6	Wt 5	Wt 4	Wt 3	Wt 2	Wt 1	Tot Pts	List Price
1	Kurzweil Discover7320	5	5	4	4	5	1	2	1	147	9,950
2	Datascopy JetReader	3	4	5	5	4	4	3	3	144	1,300
3	Microtek MS-300C	4	5	3	4	5	3	3	4	144	1,795
4	Microtek MS-300A	4	5	3	4	5	2	3	4	141	2,495
5	Microtek MSF-300C	4	5	3	3	3	3	3	4	131	1,995
6	Canon IX-12 ImageScan	4	3	4	3	4	5	2	2	129	945
7	Datascopy 730	3	4	5	3	3	3	3	3	127	1,800
8	IOC Reader 400	2	4	5	4	3	1	2	4	117	3,495
9	Dest PC Scan Plus	4	3	2	3	4	2	3	3	111	2,495
10	TLC IS-300	1	1	5	4	5	5	2	1	105	895
11	HP ScanJet	1	1	4	5	5	4	2	1	101	1,495
12	Crystal Scan 300I	2	3	4	1	2	4	3	5	97	1,695
13	The Laser Scan LS-300	2	2	2	2	4	4	2	2	86	1,095
14	EIT Personal Scan2000	2	5	1	1	1	2	3	1	79	2,495
15	IBM 3117 Scanner	1	1	4	2	3	4	1	4	79	1,095
16	Howtek Scanmaster	1	1	4	4	3	1	1	1	77	6,649
17	IBM 3118 Scanner 20	1	1	5	2	2	2	1	4	75	2,750
18	CompuScan PCS PgRead	3	3	1	1	1	1	1	4	69	3,495
19	AST TurboScan	1	1	2	2	2	3	3	4	64	2,395
20	ShapeScan SS-300	1	1	3	1	1	5	2	2	63	795
21	Epson Image Scanner	1	1	1	1	1	5	2	2	51	300
22	CAT Image Scanner	1	1	1	1	1	5	2	1	50	295
23	AT&T Overview Scanner	1	1	1	1	1	3	3	3	48	2,000
24	PixiScanner	1	1	1	1	1	5	1	1	46	269
25	SpectraFAX 200	1	1	1	1	1	1	3	5	44	3,995
26	Scan-CAD Accessory	1	1	1	1	1	2	1	1	39	2,995

Legend for Product Evaluation

- A = Capability of recognizing various fonts
- B = Page formatting capability
- C = Capability to scan graphic images and line art
- D = Gray scale scanning capability
- E = Halftone scanning capability for photographs
- F = Special file capabilities and filing features
- G = Capability to edit scanned images within program
- H = List price (the lower the price, the more points)
- I = Total points = the sum of each weighted value times the assessed points for each factor

Table 2. Scanner Evaluations

Evaluation Criteria

The term optical character recognition refers to equipment that looks at a page; uses optical techniques to decipher which marks on that page are letters, numbers or coded bars; then converts that information into digital form for use by computers. . . . The advantages of OCR equipment include much cheaper data entry than is possible by retyping information; much faster data entry than even the speediest typist could hope to deliver; and about the same to much more accurate data entry than good typists achieve (18:19).

After interviewing curriculum personnel for the requirements survey, the author concluded that most of the pages which would be scanned into a desktop publishing system would come from articles in journals, magazines, and other published sources. Consequently, the OCR capability of the scanner would be the most important consideration.

Until recently, only very expensive OCR machines, such as those made by Palantir and Kurzweil could read typeset text like that normally found in publications. These scanners, sometimes costing over \$30,000 each, were not reviewed in this research study because of their high costs and because of the paucity of published reviews. Nevertheless, as this study discovered, scanners are now available which have excellent OCR capability, and at a cost significantly less than the high-end machines.

The OCR capability was evaluated as the first two criteria factors and was, therefore, given the two highest weights. The first OCR factor measured the variety and number of fonts recognized by the unit's inherent software. The second OCR factor measured the ability of the unit to read page formatting attributes, such as carriage returns, tabs, paragraph markers, and page breaks. The greater the unit's OCR capability as measured in these two factors, the more points assessed.

"Scanners convert drawings and photos into an electronic form. These can then be electronically cropped, scaled and positioned on the finished page by . . . desktop publishing packages . . ." (18:20). In the 13 October 1987 issue of PC Magazine, samples were published from performance tests of graphic images and photographs from each of the scanners reviewed in the article (21:244-250). Based on the author's judgement of the published results of these performance tests, points were given in three related factors to each of the products evaluated. These factors were as follows:

1. The capability to scan graphic images and line art (weight of six).

2. The quality of gray scale scanning (weight of five). "[Today's scanners are] . . . capable of capturing multiple levels of gray and of software capable of working with that information" (7:69).

3. The halftone scanning capability of photographs (weight of four).

Up until now, handling photographs has been the weak link in desktop publishing systems. . . . [E]arly scanners . . . were incapable of producing quality halftones. . . . [Scanners are now] able to sense and manipulate gray-scale information from a continuous-tone photograph" (7:69).

One of the disadvantages of scanners is ". . . that they can require a great deal of memory and disk storage space" (5:180). Some scanners, such as those made by Microtek, have developed methods to compress image files by as much as 90 percent (21:277). Thus, this capability was included in the author's evaluation of the imaging products and given a weight of three.

Some imaging products have the software capability to directly edit scanned images. This capability was given a weight of two in the product evaluations, because scanned images could be read into a drawing program or a desktop publishing program and then edited. However, this would take extra effort and time.

The list price of the scanners was considered relevant because of the austerity of the prevailing budget environment for ACSC. The list price of all the scanners was arranged in ascending order from most expensive to least expensive and then divided into five major price ranges. The lower the list price range of the scanner, the more points it received. This factor was given a weight of one.

MONITORS

Many conventional 80-column by 25-line monitors are capable of displaying a high-resolution picture when used with an appropriate video display board inside the computer. "The IBM Enhanced Graphic Adapter (EGA), as well as the Hercules graphic card, provides high-resolution bit-mapping on the IBM PC" (22:51). Nevertheless, it's an absolute

necessity in desktop publishing to have a monitor which has a what-you-see-is-what-you-get (WYSIWYG) display capability (3:146). "[A WYSIWYG display] . . . can make and view adjustments in page format, font size, character spacing, and so forth" (6:94).

Big screen displays are expensive, but they make the operator vastly more productive and more accurate (it's easy to miss details when you can only see a small portion of the page at a time). We highly recommend a big screen if you'll be desktop publishing more than an hour or two per day (2:50).

It's imperative that the screen offer as close a representation as possible to what will finally print on a laser printer or other high-resolution device. The higher the resolution of the monitor, the closer the resemblance of the screen image to the printed page. . . . [T]hese larger displays will become standard in serious publishing environments, as they offer great time savings over small-screen systems that force you to scroll the screen or zoom in and out of various views of the page. . . . [I]f you produce pages in high volume, the time savings gained from the ability to see the entire page at once, in a size that can be read and edited, may be worth the additional investment (5:180).

The author of this research study evaluated five monitors which could possibly be used by ACSC. The results of this evaluation are in Table 3. The number of products evaluated is relatively small, because these five products are all that are currently available. Given the rapid pace of technology in the development of monitors and video display boards, however, other products should be developed and marketed in the near future.

Points range from 1 to 5 (Low to High)		A	B	C	D	E	F	G	H	I	
#	Product Name	Wt 8	Wt 7	Wt 6	Wt 5	Wt 4	Wt 3	Wt 2	Wt 1	Tot Pts	List Price
1	Taxan Crystal View	2	3	2	4	2	2	3	1	91	2,195
2	Sigma LaserView	3	4	2	3	1	1	1	2	90	2,395
3	Moniterm Viking I	3	3	2	3	1	1	2	1	84	2,395
4	Wyse WY-700	4	1	1	2	1	4	3	1	78	999
5	Thomson 980W	1	2	3	1	3	3	3	2	74	1,095

Legend for Product Evaluation

A = Number of screen drivers
 B = Maximum pixel resolution
 C = Display area of monitor
 D = Maximum bus speed of the board
 E = Quality of display board's construction
 F = List price (lower the price, the more points)
 G = Tilt and/or swivel base
 H = Length of monitor cable
 I = Total points = the sum of each weighted value times the assessed points for each factor

Table 3. Monitor Evaluations

Evaluation Criteria

"The single biggest consideration for ultra-high-resolution monochrome monitors is software drivers. . . . None of the advantages of a high-resolution paper-white display will be apparent if . . . [the software doesn't have a driver to make the monitor work]" (3:148). Thus, this factor was weighted the most and points were assessed based on the number of drivers available with the monitor.

The next two characteristics of monitors, the maximum pixel resolution and the display area of the monitor, directly affect the quality of the display. "Video display resolution (measured by the number of pixels that can be mapped out to the screen) is a primary consideration for desktop publishing applications" (3:146). As the number of pixels which can be displayed by the monitor increases, the ". . . easier [it is] to understand a mixture of 24-, 10-, and 6-point typefaces, along with lines and graphic images . . ." (3:146). In addition to being able to see text and images more discretely on the screen, the actual size of the

display itself is important. "A whole page is great, but two pages on a single screen make the task even easier (3:146). For this evaluation, the author assigned the maximum pixel resolution a weight of seven and the size of the display area a weight of six.

The next two factors evaluated the video display boards which came with the monitors. When making changes to a document using a desktop publishing program, the user doesn't want to wait to see the results. But, how quickly the screen can change to reflect user inputs depends on the maximum bus speed of the board and on how the board is constructed.

Most high-performance monochrome monitor systems utilize an adapter incorporating a video coprocessor This frees the host processor from mundane video signal processing chores and greatly increases the speed at which an image is mapped to the screen--a virtual necessity when as many as 2 megabits of pixel information need to be planted on the screen right now (3:146).

The author assigned a weight of five to the maximum buss speed to the monitor's video board and a weight of four to the quality of the board's construction.

The evaluation of the list prices of the monitors was conducted in the same manner as the scanners. However, the author believed this factor to be more important than the remaining two factors for the evaluation of monitors. As a result, the costs comparisons were assigned a weight of three.

The next factor used in this research report to evaluate monitors was the capability to tilt and swivel the monitor. Accordingly, it was assigned a weight of two. It was considered to be significant because of the following:

All of the effort that goes into making a sharp, high-resolution screen will have been wasted if the glare level is high enough to preclude the long hours needed for most desktop publishing sessions. . . . Some of the glare problems can be reduced by the use of a tilt-and-swivel base (3:148).

The last factor used to evaluate monitors was the length of the cable connecting the monitor to the computer. The author considered this meaningful, because the sheer physical size and weight of the monitor will most likely be too great to set on top of a computer. Consequently, the computer should be mounted vertically in a bracket beside the

desk where the monitor is placed (3:148). If the cable is not long enough to allow this configuration, an extension cable would be required--an additional cost to the school. In regard to the other factors, cable length was given a weight of one.

LASER PRINTERS

"One thing we see changing rapidly is people's expectations of what a document should look like. It has gone from typewriter quality to a typeset look," says Pamela Stone Bliss, research analyst for Dataquest's Office Systems Industry Service, San Jose, CA. "The advent of laser printers is defining a new level of expectations in the way documents should look." Laser printers allow users to expect the synergy of text and graphics on one page, without using scissors (15:14).

The above quotation is just as applicable to the curriculum materials at ACSC. A laser printer will dramatically enhance the appearance of the school's curriculum materials. Many are currently printed with a dot matrix printer which typically has a resolution between 72 and 150 dots per inch (dpi) (9:66). Most laser printers have a resolution of 300 dpi (10:187; 9:66). "This is sometimes called 'near-typeset quality.' To the untrained eye, it looks about the same as a book or a magazine for which a standard of 1250 to 2500 dpi is common" (9:66).

A term frequently used in regard to laser printers and desktop publishing applications is the term font. The alphanumeric characters displayed on a monitor or printed on a page are considered to be type.

Type is classified according to families. A family is a group of alphabets that are stylistically related. Within each family are several typefaces--alphabets sharing the same characteristics. . . . Typefaces are examples of a typeface in a particular type size, 24-point Times Roman Bold is a font, but Times Roman Bold is a face, a member of the Times Roman family. What computer people commonly call a typeface on a laser printer is really a typeface, since it comes in several different sizes (10:194).

"Most laser printers make use of . . . [a] 'page description language' that communicates the computer commands to the printer. The most flexible and popular is PostScript

from Adobe" (9:66). Unfortunately, PostScript will greatly increase the cost of a laser printer because of its licensed technology (9:67). Partially because of this high cost, another page description language has been developed which is widely used in the business environment. It is called Printer Control Language (PCL) and is made by Hewlett-Packard (HP) for its LaserJet Plus and Series II laser printers. Printers using PCL are commonly referred to as LaserJet-compatible or HP-compatible rather than PCL printers.

One of the most notable differences between laser printers using PostScript and HP-compatible printers is the storage and handling of fonts. In a HP-compatible printer, the fonts are often stored in Read Only Memory (ROM) cartridges,

". . . providing speed but limiting the number of fonts, styles and point sizes available. PostScript . . . stores a single model for all fonts, [and] scales or modifies [them] as needed-- a flexible approach but requiring additional processing [memory and time] (4:92).

Thus, HP-compatible printers are not as flexible as PostScript printers because of their ". . . limited ability to change fonts and font sizes" (19:12). However, considering the publication requirements for ACSC, a wide variety of fonts and font sizes would be unnecessary in the author's opinion. Most of the school's curriculum materials are similar to books and technical publications which use very few fonts and font sizes in order to provide standardization and enhance readability. Hence, the author determined the school did not require a laser printer with PostScript capability. However, since the school may desire to purchase a laser printer with PostScript capability, the author evaluated 5 PostScript capable printers that are also HP-compatible. In addition to those printers, 24 other laser printers were evaluated that were HP-compatible. Table 4 shows the results of this evaluation.

Points range from 1 to 5 (Low to High)		A	B	C	D	E	F	G	H	I	List Price
#	Product Name	Wt 8	Wt 7	Wt 6	Wt 5	Wt 4	Wt 3	Wt 2	Wt 1	Tot Pts	
1	Okidata Laserline 6	4	5	2	2	5	5	3	4	134	1,995
2	HP LaserJet Series II	5	3	3	2	5	5	3	3	133	2,595
3*	TI OmniLaser 2115	4	5	3	4	3	1	4	3	131	7,995
4	Ricoh PC Laser 6000	5	2	2	4	3	5	2	4	121	2,595
5*	Laser Connect PS Jet	4	4	2	2	5	2	3	4	118	4,995
6	Quadlaser I	4	3	3	4	3	3	2	2	118	3,795
7*	TI OmniLaser 2108	5	3	2	4	3	1	3	4	118	5,995
8	BlaserStar	4	3	2	2	5	5	2	3	117	2,395
9	CIE LIPS 10 Plus	3	3	3	5	2	3	4	4	117	2,995
10	QMS SmartWriter 80+	4	4	3	2	4	2	2	2	116	4,595
11	Genicom 5010	5	3	3	3	1	3	3	2	115	3,695
12*	QMS PS-800 Plus	5	4	1	2	5	1	3	1	114	5,495
13	QumeLaser TENPlus	3	3	3	4	3	4	2	2	113	3,395
14	Epson GQ-3500	3	3	2	4	3	5	3	2	112	2,199
15	PC ProdLaserImage3000	4	4	2	4	3	1	2	1	112	6,395
16	DataProducts LZR 1230	5	3	4	1	1	3	3	2	111	3,495
17	Kyocera F-3010	4	4	5	1	1	1	3	3	111	8,395
18	C. Itoh Jet-Setter	5	3	2	1	2	5	2	2	107	1,795
19	Destiny Laser Act I	4	1	2	4	3	5	3	2	106	2,595
20	PC ProdLaserImage2000	4	1	3	4	3	3	2	3	105	3,495
21	Kyocera F-1010	4	4	3	1	1	3	2	2	102	3,695
22	Genicom PagePrinter	5	3	2	1	1	4	2	2	100	3,045
23	Printronix L1012	3	3	3	4	1	3	1	1	99	3,495
24	Mannesmann Tally 910	3	4	3	1	1	3	3	4	98	3,695
25*	NEC Silentwriter 890	5	3	2	1	1	2	3	3	97	4,795
26	Kyocera F-2010	4	4	2	1	1	2	3	2	95	4,695
27	Oasys LaserPro Expres	2	4	2	1	1	5	1	1	83	1,895
28	Oasys Silver Express	2	4	2	1	1	4	1	1	80	2,795
29	Varityper VT-600	5	1	2	1	1	1	2	2	77	18,750

Legend for Product Evaluation

- A = Quality of output
- B = Number and quality of printer emulations
- C = Output speed
- D = Rated duty cycle
- E = Ease of maintenance
- F = List price (the lower the price, the more points)
- G = Control features
- H = Quality of documentation
- I = Total points = the sum of each weighted value times the assessed points for each factor
- * = Laser printer with PostScript capability

Table 4. Laser Evaluations

Evaluation Criteria

In the author's opinion, the quality of output was considered to be the most important factor and it was given a weight of eight. Since the author did not personally evaluate the quality of the output from each printer, he relied on the opinion of those who reviewed the printers for various periodicals. Based on the reviewers' comments, the points were assessed in two categories as follows:

<u>Text</u>		<u>Graphics</u>	
Good	3	Good	2
Fair	2	Fair	1
Poor	1	Poor	0

The points for the text and graphics were then added together for this factor's score. In instances where the reviewer did not specifically comment on the text or the graphics, the printer was assigned a rating of fair.

The second most important factor involved the laser printer's ability to emulate the printing characteristics of other printers. This is important because computer programs can only operate a printer thru the program's print drivers. These print drivers are relatively small files written to control a specific printer. Therefore, a printer that can emulate other printers can be used with programs which do not have a print driver designed for it. In fact, the more emulations a printer has, the more flexibility it has to work with other software. Moreover, the quality of these emulations varies with manufacturer. As a result, this factor was given a weight of seven.

The output speed was considered to be the third most important factor. It was given a weight of six and points were awarded as follows:

<u>Pages Per Minute</u>	<u>Points</u>
2 - 4	1
5 - 7	2
8 - 10	3
11 - 13	4
14 - 16	5

The costs of operating and maintaining a laser printer could detract from the value of a printer's relatively low purchase price. The rated duty cycle of a printer is commonly used to estimate the average operability of the printer. The duty cycle ". . . is usually presented in terms of recommended pages per month and . . . will give you a rough estimate of how long it will be before your printer

gives up its toner" (16:154). This factor was given a weight of five and the points were awarded to the printers as follows:

<u>Pages Per Month</u>	<u>Points</u>
3,000 or less	1
4,000	2
5,000	3
6,000	4
7,000 or more	5

Sometimes the reviewer of a printer did not mention the rated duty cycle. In those instances, the author of this research study assessed points to the printer based on the printer engine's manufacturer. The higher the rated duty cycle of the laser printer's engine, the more points that were awarded.

The author also regarded the ease of maintenance to be an important factor and assigned it a weight of four. The ease of maintaining a laser printer depends a lot on the printer's engine. Some print engines have components which

. . . require you to contend with separate consumable components, including toner, developer, photosensitive drum, and fusing unit. . . . Other print engines use all-in-one cartridges that contain almost all the components--toner, developer, drum--that get used up or wear out. As it turns out, when calculated on a per-page basis using the manufacturers' recommended replacement intervals, some of the separate-component systems end up costing more per page than the all-in-one approach (16:154).

The author awarded more points to the printers with the all-in-one cartridge printer engines than those with separate consumables.

With so many different laser printers available, the author believed ACSC should purchase the least expensive printer which would satisfy the school's needs. Accordingly, the list prices of the printers were compared and assigned a points. As with the previous products evaluated in this report, the lower the list price, the more points that were awarded. This factor was given weight of three.

Another factor the author thought should be evaluated is the laser printer's control features.

. . . [M]ore laser printers have conversational 16-character LCD windows (and in English, too), although some . . . [printers] still provide displays with cryptic two-digit codes that stand for operating and error messages. . . . Now more laser printers offer greater access to configuration options than ever before (16:154).

The more operations that can be performed from the front-control panel, the more points awarded to the printer by the author. Additionally, this factor was given a weight of two.

The last factor evaluated was the quality of the printer's documentation. The printer's documentation will likely be used extensively until the printer's operation becomes routine. Even after this initial familiarization period, the documentation can still be useful as new techniques and procedures are tried. Thus, the quality of the documentation was given a weight of one.

SOFTWARE

The author evaluated four popular desktop publishing programs for this research project. Several more are currently available, but no critical reviews of them have been published as yet. All four of the evaluated programs use a graphics interface with pull-down menus to make them more "user friendly." They all strongly encourage the use of a mouse, but are not dependent on one. All four of the evaluated programs are capable of importing text from ACSC's SMART word processing program, if the text file is printed to disk to form an ASCII file.

Although these desktop publishing programs can import files in ASCII format from SMART, they can all operate more efficiently with other more popular word processing programs. This is possible because the desktop publishing programs have been written to directly read the proprietary format of these more popular word processing programs. Thus, the extra step of converting a SMART file into an ASCII format could be eliminated by purchasing a different word processing program. If ACSC were to decide it needed a new or different word processing program to be used in conjunction with its desktop publishing software, then XyWrite is the program to buy according to several reviewers.

As a microcomputer based text generator for composition systems, XyWrite has no competitors. XyWrite's compatibility with almost every other system in the composition systems market has made

it the most popular text processing package for microcomputers in the publishing industry (13:164).

Another common characteristic of the desktop publishing programs evaluated in this study is that they can all read the graphic image files made in PC Paintbrush, copies of which the school already has. Furthermore, these desktop publishing programs can edit images which have been scanned directly into the desktop publishing program. As an alternative, images can be edited in a graphic editing program like PC Paintbrush and then imported into a desktop publishing program.

The program that were evaluated in this research project and the results of the evaluation are Table 5.

Points range from 1 to 5 (Low to High)		A	B	C	D	E	F	G	H	I	
#	Product Name	Wt 8	Wt 7	Wt 6	Wt 5	Wt 4	Wt 3	Wt 2	Wt 1	Tot Pts	List Price
1	Ventura Publisher	5	4	5	4	4	1	5	3	150	\$ 895
2	PageMaker	1	5	3	5	5	2	3	5	123	\$ 495
3	First Publisher	2	3	1	1	3	5	3	3	84	\$ 100
4	GEM Desktop Publisher	1	1	2	1	1	4	3	1	55	\$ 395

Legend for Product Evaluation

- A = Capability to format multi-pages at one time
- B = Ease of page layout
- C = Text editing capability
- D = Automatic hyphenation capability
- E = Image editing capability
- F = List price (lower the price, the more points)
- G = Quality of documentation
- I = Total points = the sum of each weighted value times the assessed points for each factor

Table 5. Software Evaluations

Evaluation Criteria

The author of this research study considered the capability to format multiple pages at one time to be a very useful feature in a desktop publishing program. This capability would allow a person to change the format of an

entire document or even an entire textbook with only a few keystrokes. This characteristic would greatly facilitate the composition and editing of curriculum materials in ACSC. The author assigned a weight of eight to this most important factor.

The next most important factor evaluated in this research study is the ease of page layout. Laying out a page is the process of determining where to put text and graphic images and what fonts to use. The ease of page layout varies with each of these desktop publishing programs. The easier the process the more points awarded by the author. This evaluation factor was given a weight of seven.

The capability to edit text directly from within the desktop publishing program was given a weight of six. When text files are imported into a desktop publishing program, they can be easily edited by any of the programs evaluated in this study. However, some of these desktop publishing programs have the capability to save the edited document into the original word processing program's file format. Another aspect of the text editing capability is a program's ability to flow text around graphic images when it is moved. The better the text editing capability, the more points awarded.

The author thought an automatic hyphenation capability was another important characteristic which should be evaluated. Some of the reviewed programs had very good capability in this area, while others had none at all. With the volume of pages to be formatted at ACSC, this feature would save much time and effort. This factor was given a weight of five.

Since each of these desktop publishing programs have some image editing capability, the author chose to evaluate how much capability each program has. The more image editing features in the program, the more points assessed. This characteristic was given a weight of four.

The author assigned a weight of three to the list price of the desktop publishing software. The lower the list price, the more points assessed. This continued the consideration established with the other products to favor the less expensive products.

When changes are made to a desktop publishing document, the document may or may not immediately reflect the changes by "refreshing" the screen. The speed of screen refreshment is the term used to describe how quickly the desktop publishing software refreshes the screen when a document is edited. In the author's opinion, the faster the speed of

refreshment, the better the program, and hence, the more points awarded to the program. This evaluation factor was assigned a weight of two.

The author believed the quality of documentation was an important factor that should be evaluated. The documentation will not only be critical during the initial period of acquisition, but also later on. If the documentation were poor, then the school could experience sever problems in learning and improving on the desktop publishing process. This factor was given a weight of one.

SUMMARY

Deciding which factors to evaluate and how much to weigh each factor for the various products was not easy. The school may decide to use other factor or to change the weight assigned to a particular factor for any number of reasons. However, considering the assumptions and limitations discussed earlier in this report, the author evaluated the products with the information he could find and assigned weight based on his review of the literature and personal bias. His evaluations resulted in specific recommendations which should satisfy ACSC's requirements.

Chapter 5

RECOMMENDATIONS

SCANNERS

The scanner recommended for ACSC to use is the Kurzweil Discover System 7320. It rated the highest total points in the evaluation of scanners.

The Discover System has the best OCR capability of all the optical imaging systems reviewed in this research study. "[It is a desktop scanner that can read]. . . typeset material with great accuracy" (18:22). Furthermore, the

Discover scans any mix of type sizes from 8 to 24 point and any mix of fonts on a page except for script or decorative faces. . . . Desktop publishers can use it to scan and re-create books, articles, or virtually any other typeset material (21:271).

In his review in PC Magazine, Tom Stanton said this:

. . . Discover System is the first desktop system that delivers what most OCR users have wanted all along: a reliable method of scanning typeset material at a reasonable cost. To give you an idea of how powerful the Discover System can be, I was able to scan both sides of a page from PC Magazine, column by column, in under 5 minutes, then scan graphics in a second pass. In 7 minutes I had an ASCII file. There is no other product on the market today that can do the same thing for less than \$30,000 (20:33).

He also had this to say about the ease of using the system and its OCR capability:

Scanning a full page of text requires almost no preparation, as long as the original is clean. You insert the page in the scanner, select a document name, and start a session. The page moves through the scanner quickly, and a temporary file

is created on the disk. This file remains open until you decide to close it, so you can scan a number of pages from different sources into a single document (20:36).

The image scanning capability of the Discover System is also excellent.

. . . [It] scans images and will save them in your choice of three popular image-file formats. . . . This means that the images are usable with almost any present (or future) desktop publishing package (18:22).

. . . Furthermore, the Kurzweil unit comes with an interface card that provides processing functions independent of the inner workings of the PC [Personal Computer] itself. Thus, you can work at your PC on other tasks while that interface card manages the Discovery System's work. The unit allows scanning of single sheets either one at a time or, by using a stack loading cut sheet feeder, in an unattended batch mode (18:22).

Therefore, the Discover System 7320 should satisfy ACSC's requirements and potential uses better than any other scanner. If, however, ACSC should later determine that having OCR capability is not as important as the author considered it to be, then strong consideration should be given to either of the scanners which tied for second place. The Datacopy JetReader and the Microtek MS-300C were very close to the Discover System and had very similar capabilities. If a choice had to be made between the two, the author would choose the Microtek because of its file compression features, lower list price, and manufacturer's well-established reputation.

MONITORS

The monitor recommended for ACSC to use is the Taxan Crystal View. It rated the highest total points in the author's evaluation.

Capable of 1,280- by 960-pixel resolution and equipped with a crisp black-and-white display, this monitor/controller combination shines at everything it does, from desktop publishing . . . to ordinary DOS [MS-DOS] applications (3:154).

The bus speed on its video coprocessor is the fastest of any of the monitors evaluated. During desktop publishing applications, ". . . a scheme that Taxan refers to as 'font caching' speeds things up considerably . . ." (3:158). "Linear distortion is conspicuously absent from the Crystal View monitor. Both vertical and horizontal lines were perfectly straight, from center to corner" (3:156). Furthermore, it has both a tilt and swivel on its base to reduce glare. "The 6-foot cable allows the PC to be moved next to the desk" (3:156).

In consideration of all the evaluation factors, the Taxan Crystal View was the overall winner, but not by much. In fact, ACSC may want to consider purchasing either of the next two highest rated monitors since they were very close to the Crystal View. The Sigma LaserView and the Moniterm Viking I monitors are almost identical in features and appearance ". . . because Moniterm [Corporation] actually manufactures the display, which Sigma then acquires by way of the . . . market. The Sigma display board, however, makes all the difference" (3:154). The Sigma board produces ". . . the sharpest image . . ." of the big screen monitors currently available (3:152). Unfortunately, the Sigma board is actually two boards attached together, which then requires two full-length slots inside the computer. This may create a serious problem since most computers expect only one slot to be used for a video display board. The major drawback with the Viking I is that it must be used only with applications that have its software drivers. To use it with any other program requires the purchase of a standard video board, which then uses another slot inside the computer (3:152).

LASERS PRINTERS

The laser printer recommended for ACSC to use is the Okidata Laserline 6. It rated the highest total points in the author's evaluation.

The quality of the output from the Laserline 6 is very good. "The built-in fonts are satisfactory in appearance, and the print is solid and black" (16:213). While it has five built-in fonts, more fonts can be added by buying an optional font cartridge made by either Okidata or HP. An alternative approach would be to load more fonts from disk. Regardless of whether the number of fonts is increased or not, the printer should be purchased with its RAM upgraded to 512,000 (512K) bytes of RAM. The printer's standard memory of 128K bytes is insufficient for most desktop publishing applications.

The Laserline 6 can emulate several other printers in addition to the HP LaserJet. Three of the printers it can emulate are compatible with the software already in use at ACSC: the Diablo 630, the IBM Graphics Printer, and the Epson MX-80. Thus, the school's existing software can be used to control this laser printer.

The Okidata Laserline 6 has a rated output speed of six pages per minute. When it was tested by PC Magazine, the output was 5.8 pages per minute. Although this speed is only fair compared to some other laser printers, ". . . it can print six to eight times as fast as . . . [some] daisywheel printers; and, with the noise level of a desktop copier, it is much less offensive than a daisywheel printer" (11:91).

Since the Laserline 6 uses a Canon print engine, the rated duty cycle is about 4,000 pages per month. Considering this duty cycle and ACSC's requirement for 2 laser printers to produce approximately 27,000 pages annually, the school should plan on using 3 cartridges per year between the two printers. Since this printer uses an all-in-one toner cartridge, replacing the cartridge and performing periodic maintenance should be relatively easy.

For the purpose of this evaluation, the list price of \$1,995 for the Laserline 6 included a personality module for the HP LaserJet. "This personality module is a small unit that slides into the back of the printer and defines the emulation capabilities and the interface" (16:213). If ACSC were to purchase only one laser printer rather than the two required thru this research study, the author recommends the additional purchase of a multiuser personality module for the printer.

Costing \$400 more than the standard Laserline 6 personality module but allowing three adjacent PCs to be attached to one printer, this module electronically switches among the three printer ports and prevents the dangerous surges that might be a problem with mechanical switches. If data is coming through one of the ports, the module creates a not-ready status on the other two ports. Only if data ceases to come through a port for 15 seconds will the other two ports again be polled for data (16:213).

Included with the Laserline 6's personality module for the HP LaserJet is a disk of software which simplifies and facilitates control over the printer's emulation abilities. When the printer is configured for one of the non-HP printers, this software translates control sequences into the

HP LaserJet Plus command set (16:213). "This emulation helps out in a pinch, but you get much better results using the printer as a LaserJet compatible, particularly for graphics" (16:213).

Overall, . . . the Okidata Laserline 6 is a good package at a great price. It's the extra little touches--the additional built-in fonts, the manuals, and the configuration software--that make the big difference (16:214).

Since the Okidata Laserline 6 achieved a very narrow margin of points over the other laser printers, ACSC may want to consider either of the printers with the next highest scores, the HP LaserJet Series II or the Texas Instruments (TI) OmniLaser 2115. The HP printer offers some features and capabilities which the Laserline 6 cannot offer. For example, the Okidata printer's memory can only be expanded from 128K to 512K (a half megabyte). However, the memory on the HP Series II can be expanded much more if necessary.

HP makes it easy and fairly affordable to expand the printer's half megabyte of memory by adding expansion boards that boost it by an additional 4 megabytes of RAM. With a total of 4.5 megabytes, there will be plenty of room for both fonts and graphics (16:185).

Its ". . . engine performs at a measured speed of 7.5 ppm [pages per minute], quite close to its rating [of 8 ppm]" (16:185). So, it is about 2 ppm faster than the Laserline 6. Unlike the Laserline 6's front control panel which displayed 2-character messages, the HP Series II uses

. . . a 16-character LCD panel that gives the familiar numeric messages along with prompts in English that spell out their meaning. . . . Need to select a different font but can't get at the commands through your software? Want to change margin settings, paper source, or number of copies? . . . Now you can perform all these jobs simply by pressing the buttons on the control panel. . . . The LaserJet Series II remains the standard against which other laser printers must be judged (16:185-186).

The TI OmniLaser 2115 is also an excellent laser printer which should be considered for acquisition, especially if PostScript capability or faster output speed is desired. "It's a PostScript printer that comes with outlines for three

typeface styles and 3 megabytes of RAM" (16:234). During the tests by PC Magazine, the TI printer produced 9.5 ppm under the HP LaserJet Plus emulation (16:237).

As a PostScript printer, the OmniLaser 2115 generates fonts from its built-in typeface definitions and gets the most out of the latest desktop publishing programs. And because it can emulate the HP LaserJet Plus, its ability to support a wide variety of programs is extended. . . . Since the printer comes with outlines for Times Roman, Helvetica, and Courier, the font needs of most users are covered (16:237).

The most significant disadvantage of the OmniLaser 2115 is its list price of \$7,995. Since the school has a requirement for two laser printers as determined in the requirements survey, the cost of two of these TI printers becomes almost prohibitive. As an alternative, ACSC may consider buying one OmniLaser 2115 and a multi-user printer sharing device with buffering capability. This would enable the OmniLaser to be shared with two or three computers without degrading computer operations. Since the TI's output speed is almost twice as fast as the Okidata's, this may be a viable solution worth investigating further by other researchers.

SOFTWARE

The author recommends the acquisition of Xerox's Ventura Publisher. Although Ventura was the clear winner of the evaluation, the author will also include comments about the very popular PageMaker by Aldus Corporation.

Since ACSC produces curriculum materials which are often combined into textbooks, the school is very similar to book publishers. With this in mind,

Xerox Ventura Publisher is the best overall choice for most book publishers. It is the most versatile and flexible package on the market. Still for short, tricky, graphics-intensive layouts, Aldus' PageMaker is a better choice. It is superior for ads and brochures, and may be the best choice for a publisher who produces unusual and varying formats (2:49).

Ventura can be used for shorter documents, though it is strongest when the design elements are repeated throughout the document. . . . [V]entura

is better suited than PageMaker for longer documents like technical manuals or a thesis requiring indexing and footnotes (1:225).

The capability to create style sheets and copy and modify frames and their associated parameters makes it quite easy to lay out newsletters and other multi-element documents once you've created your basic components. . . . PageMaker lacks this important effort-saving feature. PageMaker also lacks Ventura's automatic placement of text; PageMaker makes you place each column manually (12:58).

Ventura Publisher supports several features that are useful in a technical publishing environment, such as automatic numbering of sections, figures, tables, and footnotes; automatic generation of indexes and tables of contents; captions anchored to figures (above, below, left, or right); leader dots in tab; and running headers and footers with variables for page number, chapter number, and paragraph tags. Ventura Publisher allows document of over 150 pages on computers with 640K bytes of memory, and a binding function lets you assemble several individual documents (chapters) into a very large publication. Ventura automatically renumbers pages and recreates the index and table of contents to reflect the sequence of chapters in the publication, and it can perform batch printing of the entire publication (8:171).

As for page layout and design, Ventura is somewhat more complicated than PageMaker.

In the DOS world, for example, PageMaker and Ventura both enable you to do desktop publishing, but the former uses a drafting table metaphor and the latter, underlying frames. Art directors and paste-up artists can easily adapt to the PageMaker method because they can see graphics elements they've moved to the side of the table. Ventura, on the other hand, slices the page into frames, which may be hidden (1:225).

The layout and pagination functions in Ventura Publisher are the best I've seen in any microcomputer product. A full page of text normally flows in a fraction of a second. . . . From the user's standpoint, an entire 100-page document can be paginated in as little time as it

takes to flow a single page, since Ventura performs text flow for pages not on-screen in the background during idle time (8:171).

In regard to text editing,

Most desktop publishers recommend that you complete the bulk of your word processing in a real word processor and then bring the text into the page makeup process. This is more true for PageMaker than Ventura; once PageMaker imports word processing files, it saves in its own format. . . . Ventura dynamically links frames to a number of popular word processors. Formatting instructions and edit changes made using its rudimentary word processor are then saved back to the native word processing file, where more extensive revisions can be handled without having to reimport the file back into the desktop publisher (1:227).

. . . [A]ny time you edit the text file used by a document (with an external word processor), you automatically update the document as well. . . . If a graphics frame or a portion of a frame blocks text flow, text jumps over or around the occlusion (a feature not found in PageMaker) (8:171).

Ventura has a fast screen refresh speed and a very good automatic hyphenation feature.

Ventura is still the fastest MS-DOS desktop publishing. . . . The hyphenation dictionary is commendable: It's fast and accurate. New in Version 1.1 is an expanded dictionary, which has a more complete hyphenation algorithm. . . . Also, new to Version 1.1 are hyphenation dictionaries for British, English, French, Spanish, and Italian. . . . Because Ventura remains the fastest desktop publishing program, and because of its improved hyphenation . . . we again rate it an excellent performer (12:57).

For advanced desktop publishing users, the features and on-screen performance of Ventura Publisher would be hard to find anywhere else. This product will probably occupy the top spot in high-performance desktop publishing for some time to come (8:176).

There should be no compatibility problems with the software recommended in this research project and with that planned for acquisition by ECI for its print plant, because the software is the same--Xerox's Ventura Publisher. The curriculum materials prepared in Ventura at ACSC can be saved to disks, handcarried to ECI where they would call up the files in their copy of Ventura, and print out the curriculum materials using their high-resolution printers. It would also be possible for ACSC to connect their desktop publishing computers to high-speed telephone modems and transmit the Ventura files to ECI's modems and computers. However, this method would require additional research and investigation.

SUMMARY

In summation, the author recommends the following products for ACSC:

<u>PRODUCT</u>	<u>PRODUCT NAME</u>	<u>UNIT COST</u>	<u>#</u>	<u>TOT COST</u>
Scanner	Kurzweil Discover 7320	\$ 9,950	1	\$ 9,950
Monitor	Taxan Crystal View	2,195	2	4,390
Laser Printer	Okidata Laserline 6	1,995	2	3,990
Software	Xerox Ventura Publisher	895	2	<u>1,790</u>

Total Cost \$20,120

ACSC may decide to purchase products other than those recommended in this research study. Nevertheless, in the author's opinion, the products recommended in this report will satisfy the school's requirements and potential uses. By purchasing these products, ACSC should have the best, most cost-effective desktop publishing system currently available.

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