

AFFORDABLE COLOR

New printers gather software support

BY SCOTT MACE

Senior Writer

For personal computer owners, color graphics have been the prisoners of the machine. With color printers priced like luxury goods, and with little software to support the devices, color graphics were locked inside the computer by technology as certainly as convicts are held under lock and key.

Advances in printing technology are changing the situation rapidly. Two new processes, ink-jet printing and thermal-transfer printing, provide a new level of color print quality at a low price. At the same time, traditional dot-matrix color printers are falling in price, and increasing sales volumes are fanning the price reductions.

The result: As rapidly as color printers have invaded the office, they could quickly be freed from their bonds and move right into thousands of homes.

The prices of some of these printers are startlingly low. For example, the Okidata Okimate 10 thermal-transfer printer, costing about \$240, offers Commodore and Atari computer users a color printer with crisp, clear color output. The cost of each printed page or transparency is about 66 cents, a price that is seemingly high but is actually in the same range as that of a color slide. The Okimate 10 works with a host of programs that let Commodore and Atari users create color graphics. The printer sells for \$169, and users must then buy a \$69 module — either for the Commodore 64 or Atari home computers — that lets them plug in the printer and start printing. (The Okimate 10 can also print in black and white.)

Apple has impressed its faithful with the announcement of the Scribe, a \$299 thermal-transfer printer designed especially for the Apple IIc. It was announced in April, at the same time as the IIc. Currently, the Scribe is available with black ribbons only, so it can't be used for color work. Apple says the Scribe is selling well — it works on all other current Apple computers and can also print transparencies — but it won't really hit its stride until Apple begins selling color ribbons for it sometime this fall.

Software manufacturers are beginning to support these and other color printers.



Okidata's Okimate 10 uses thermal-transfer technology to provide four-color printing at a cost to the user of about 66 cents a page, approximately the same cost as duplicating a color slide.

Koala Technologies of Santa Clara, California, maker of the Koala Pad and the Gibson Light Pen, announced that it would support 16 color printers on the Graphics Exhibitor, its new program for the Koala Pad. The list of printers includes those made by manufacturers such as C. Itoh, Epson, Transtar, and Canon.

On almost all of these printers, it's possible to combine primary colors — yellow, magenta, and cyan — to create many other colors. Additional colors can be created by placing dots of color immediately next to each other, a process known as "dithering."

The advent of thermal-transfer color printing is big news. By modifying the printheads used in previous thermal printers, manufacturers eliminated the need for special emulsion-coated paper; the Okimate and Scribe printers can print with excellent quality on copier paper, although slightly smoother paper works better. At the same time, thermal-transfer printers can now generate color because the image is laid directly onto the paper, instead of being "cooked" out of the emulsion coating on earlier thermal papers.

Low-cost color printing is causing some marketing changes at Okidata: The Okimate 10 is the firm's first printer to be sold through mass-market outlets such as discount stores. And, although the compa-

ny will not comment directly, it has been reported that Okidata is developing a low-cost color printer, comparable to Apple's Scribe, which will work on Apple and IBM computers. That printer is expected to be sold through computer stores.

Ink-jet color printing has been in the news a bit longer, but price breakthroughs have come primarily in black-and-white printing. The Hewlett-Packard Think Jet printer, for example, sells for \$495. (See *InfoWorld*, July 23, 1984.) Prices for color ink-jet printers start around \$700; the price of the Diablo C-150 is \$1,200. IBM's Color Printer, reportedly identical to the IDS Prism, costs nearly \$2,000; among the programs it works with is IBM's PCjr Color Paint program.

Epson takes an entirely different — and possibly more economical — approach to color printing in its JX-80, a dot-matrix color printer with a suggested retail price of \$800. It uses an inch-wide fabric ribbon with four bands of color: black, yellow, magenta, and cyan. The printhead makes only one pass of each line to print four colors. Epson says each band of the fabric ribbon is good for between 800,000 and 1.5 million characters.

It's not all wine and roses for color printer makers, though. In June, Commodore announced that it would sell a color dot-matrix printer, called the MCS 801,

but according to sources close to Commodore, that product was killed shortly thereafter; the company was unavailable for comment.

For those who do make it to market, the versatility of color printers may help them challenge the established color plotter in the office market. Bill Kershaw, product marketing manager at Apple's accessory products group, which designed and manufactures the Scribe, says plotters produce very good color prints but are slow and don't work well with bit-mapped software programs. (Bit-mapped graphics programs tell the printer what to do to print each bit or pixel on the screen. Memory-mapped graphics, such as those generated by plotters, can draw lines from point to point.)

The Scribe is not designed to be used exclusively for color, and Kershaw is quick to point out the printer's other capabilities. Most important, it has a 24-element printhead, which means it can lay down up to 24 dots between the top and bottom of a line. Kershaw notes that text characters printed in the Scribe's "letter quality" mode are detailed enough to fool the eye into seeing characters that look as though they were typed. "That is better quality than you get off an Imagewriter," says Barney Dewey, the Scribe's product manager.

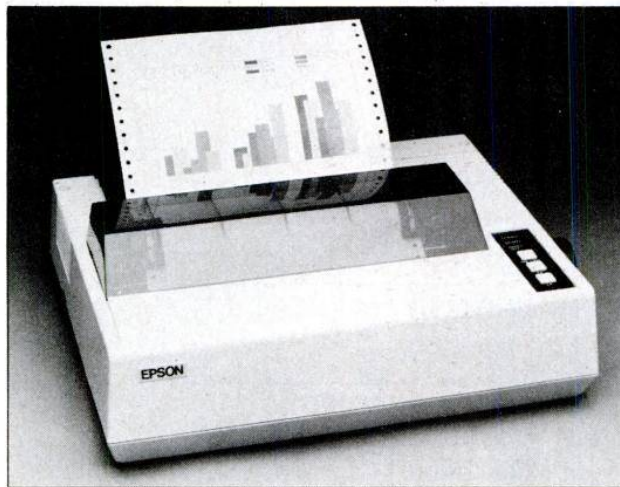
One of the few kinks in Apple's plans for the Scribe are its ribbons, vital to the thermal-transfer process. While most traditional printers use a ribbon made of inked fabric, similar to the cloth ribbon of a typewriter, or a carbon ribbon, a one-shot ribbon that produces a darker, crisper image, the Scribe will use a Japanese-developed thermal-transfer ribbon. It will be manufactured there for Apple, as well as Okidata and other companies.

This ribbon has no equivalent in the world of typewriters. The printing element in printers such as the Scribe and the Okimate 10 generates intense heat in a tiny area for a brief instant; the printhead, the ribbon, and the paper are sandwiched together at that moment. The element in Apple's Scribe heats to 300 degrees Fahrenheit. Okidata's printer goes to about 185 degrees. (Because they act so quickly, say makers, there is no hazard to the user in normal operation.)

In that split second when the element is heated, computer software can activate points on the printhead to actually melt pieces of ribbon and transfer the wax-based ink to the paper. The process transfers the black or color ink, according to Kershaw, leaving an area of clear plastic film on the ribbon where the ink used to

be. "You can't ever print [using] that spot again," says Kershaw, so, as with carbon ribbons, thermal-transfer ribbons are for one-time use only.

On both the Scribe and the Okimate 10 printers, the ribbon is a single color. To print in multiple colors, a different ribbon must be employed, which is divided into three colors in a repeating sequence along the length of the entire ribbon. Each strip of color is 8½ inches long — the length of one pass across the page. Thus, the printers must make up to three passes —



Epson's JX-80 color printer uses traditional dot-matrix printing technology to produce either text or graphics in color.

yellow, cyan, and magenta — across the page to print a complete color picture.

Apple sells its black-and-white Scribe ribbon for \$5, and plans to sell the color ribbon for \$8. Okidata's color ribbon costs \$7.

In certain cases, the computer picture may have only two, one, or no colors in a given line. In such a case, the Scribe and Okimate 10 printers must advance through the entire length of the unused color on that line, a necessary step to keeping the color printing in sequence.

Although the color ribbon cartridges contain just as long a ribbon as the black cartridges, because it takes three times as much ribbon to print one color page, printer users can expect only about a third as many pages out of every ribbon cartridge. Kershaw says Scribe users will be able to print only eight to 12 full-color pictures with a color ribbon. In contrast, a black ribbon is good for about 40 pages of normal work, allowing for normal margins, paragraph breaks, and so forth.

Here exists a rift between Apple's thinking about how widespread color printing will become, and the thoughts of Okidata management. Kershaw says the Scribe "is for the occasional requirement for color. If you think that you're going to buy the Scribe and print all day long, seven days a week, hard color, it's the wrong

machine, and I'll tell you that right away.

"But if you have a monthly report that you want to put a color graph in, if you're doing a term paper or a biology report once a quarter or something for high school, and you want to put in a color chart or graph, or two or three, that's fair. But to do it every day is wrong. There are much more economical ways of doing it."

At this point, Apple is selling the Scribe and black ribbons, but not the color ribbons. Kershaw says Apple is still in the process of getting adequate supplies of ribbon for release later this fall, possibly as late as Christmas. But he also admits that Apple is proceeding cautiously on the introduction of the ribbon. "We are trying to introduce the world to a new technology," he says. To be fair, Apple is the first to use a 24-element printhead; the Okimate 10 printhead has only nine elements, though its new Apple/IBM printer is said to have 24 elements.

Craig Ringuette, Okidata's director of marketing communications, says, "You're going to have to print an awful lot of pictures first" before needing a printer more expensive than the Okimate 10. It is Ringuette who cites the cost of color pictures at 66 cents each. (Apple's costs are about the

same.)

The last link in selling low-cost color printers is software that uses them, and such support, at least for the Scribe and the Okimate 10, is coming. Okidata itself includes a demonstration program with the Commodore printer adapter that currently can use eight different graphics packages, including Chalkboard's tablet; the Flexidraw and Edumate light pens; Super Sketch by Personal Peripherals of Irving, Texas; and the Koala Pad. The Atari-based Okimate 10 currently supports versions of the latter three packages for the Atari.

For its part, Apple's Scribe will also be supported by Koala's new Graphics Exhibitor and Dazzle Draw, a program from Broderbund Software that uses Apple's new double high-resolution graphics routines.

Who's buying color printers? At the upper end, they are business tools for crisp presentations. But the Scribe and the Okimate 10 may appeal to another type of user. "We thought [the Okimate 10] would be popular as a word processing printer, but its initial popularity is with the artists, the people who have been playing with these packages," Ringuette says. "I'm sure that's because artists have heard that this printer is available, and it's the first time they have gotten low-cost color." □

PRINTERS

APPLE SCRIBE PRINTER

Low-budget thermal printer has print, ribbon problems

BY DOUG AND DENISE GREEN

Review Board

The Apple Scribe printer is a sleek-looking printer intended for someone who prints little yet requires a full range of features. Apple's big draw with this unit is that it will produce color — but not until next year, when the special ribbons become available.

When they do, we hope the color ribbons are better than the black-only ribbon we tested. The Scribe's thermal printhead is very quiet, but the single-use ribbons produce only fair-quality print — unless special smooth paper is used, something that increases expenses for a printer otherwise aimed at more thrifty users.

The Scribe is designed to work with the Apple IIc, but you can use it with any of Apple's systems, if you have a serial connector.

The Scribe can print text, graphics, and color. It can print the entire ASCII character set and the standard alternate language characters. It has a dot-matrix printhead with 24 elements. This allows for high-resolution printing. You can print graphics in either high or low resolution.

There are two types of fonts: draft and letter. Letter-mode characters look type-written; draft-mode letters are a bit smaller and resemble dot-matrix characters. Double-width headline characters, subscripts, superscripts, and underlining are available — as long as your software knows the proper codes.

The Scribe prints 10 characters to the inch — unless you tell it otherwise. It can also print 17 characters per inch, and both character sizes can be mixed within a line.

For single-sheet use, you must use the friction-feed platen. Pin feeding for continuous-form paper is also possible. A paper tray attached to the bottom of the printer holds about 40 sheets of paper. It's an attractive feature often lacking in printers.

This printer can be operated solely from your computer, but it also has a convenient control cluster of buttons. These include power, select (which allows

Doug Green, a director of school computer services, has also taught computer programming and worked with mini and microcomputers. Denise Green is an educational computer consultant who teaches computer use to adults. Their software reviews have appeared in various publications.

the printer to receive information from the computer), letter (which selects letter-mode printing), and a single-line/form-feed button.

The type of paper you use with this printer affects its performance. We strongly suggest smooth-bond, 16- to 24-pound-weight paper. You should avoid using rough-bond paper. A supply of Xerox 4024 copier paper came with our Scribe. It represents the paper Apple suggests you use, but its print quality was uneven. We tried using Hammermill thermal paper, a special, very smooth paper. With it, printing quality improved a lot.

We recommend pin-feed paper because it is convenient, but you can use single sheets, envelopes, or transparencies. You might also want to look for rolls of thermal paper that don't require a ribbon.

The printer can be adjusted to accept paper 4 to 10 inches wide. Narrow widths are needed for printing items such as mailing labels.

The Scribe's replaceable ribbon cassette can print 30 to 40 pages of normal text before it is exhausted. These thermal-transfer ribbons use a wax-based ink and are sensitive to temperature extremes. You should operate and store the printer and ribbons between 41 and 95 degrees Fahrenheit for reliable results.

Although we couldn't test the color features, we can tell you how the color ribbon will work. It has successive strips of three different primary colors. By mixing these colors, you can obtain many other combinations. The drawback: The printer must make three passes on each line to produce color. While doing this, it wastes a lot of ribbon and cuts the printing speed by one-third. And don't expect color unless your software has such a capability.

Ribbon waste is not limited to the color mode. Considering how frequently they must be changed, buying black ribbons at \$6 each can get costly. The black ribbon advances even during tabulations and spacings. Although the printer seems to move quickly through tabs and line feeds without printhead movement, there is room for improving the Scribe's intelligence. Like most single-use ribbons, the space actually used for printing requires only about one-third of the total ribbon width.

Several other specialized operations are possible with this printer. You can set the spacing between lines to increments of 1/144 of an inch, and line spacing can be changed between any two lines. You can

set the page length in increments of 1/144 of an inch to any length up to about 70 inches. The paper can be fed either up or down. Also, the location of the left-hand margin is changeable.

Because the Scribe prints in only one direction, its real print speed is slower than advertised. We timed the Scribe at 35 characters per second in the draft mode and 28 characters per second in the letter mode. The shape of the letter-quality characters closely resembles those printed on an electronic typewriter and is impressive — if you use the right paper.

Although the Scribe printer has many sophisticated features, it will most likely be used with software packages. We tested it with the Print Shop, Applewriter II, and Macpaint and found it to work well. You should not assume that the Scribe's many features will be available with your software — unless you see what you want before you make your buy. The 142-page

InfoWorld

Report Card

Apple Scribe



	Poor	Fair	Good	Excellent
Setup	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Ease of Use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Performance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Serviceability	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Summary: The low-budget Apple Scribe printer appeals with features and (potentially) color. But its print quality on ordinary paper isn't great, and there is expensive ribbon waste. Check your software first, and be prepared to use special paper for best results.

Product details: List price, \$299. Unit tested available for the Apple II family with serial connector. Prints at 35 cps maximum. Includes friction feed, tractor feed, 10 or 17 characters per inch, 24-element thermal printhead, one-pass cartridge ribbon. Distributed by Apple Computer Inc., 20525 Mariani Ave., Cupertino, CA 95014; (408) 996-1010.

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REVIEWS

Scribe manual is divided into two parts. Part I is the users guide, Part II is the reference manual. Part I has information about the printer's controls and parts, loading paper and ribbon, setting up the printer, starting to print, and caring for the printer.

Part II contains chapters on Applesoft and Pascal programs, text and control codes, color printing, and graphics printing. In addition, the manual has seven appendices with information on troubleshooting; command summaries; ASCII, binary, and hexadecimal codes; character, printer, and interface specifications; and repacking instructions. The manual also has a glossary, index, and quick-reference card.

The Scribe manual is complete and well-organized. Part I is designed for novice users; Part II is more complex. The chapters on Applesoft and Pascal programs and graphics would be easier to understand if there were more sample programs. They are adequate for experienced programmers, but a few simple examples would save a lot of trial and error.

You can tell this manual is a first edition because it contains some printing errors that could cause confusion. For example, the table of contents on page 4 is missing information, and chapters 1 and 2 have incorrect titles. On page 60, an entire table about alternate language characters has been omitted.

The Scribe has a 90-day warranty during which Apple will repair, replace, or refund your money, depending on the

Considering how often they must be changed, buying black ribbons at \$6 each can get costly.

defect. Check with your own dealer first about servicing and remember — like all printers, it should receive yearly maintenance.

Because the Scribe is new, be certain that your dealer has sold a few. The more a dealer sells, the more experience that staff will have in repairing them. Ask your dealer if he has the Scribe spares kit and if one of the store's technicians has been trained to repair the Scribe. None of the

four dealers we talked with had taken these steps.

Make sure you don't get charged for damage done by the technician. Ours managed to break the tractor housing while removing the print mechanism from the case. The servicing plus is the print-head itself, inexpensive and easy to replace. The Scribe also has a self-test mode to help you determine whether it really needs repair.

To set up the Scribe, you must have the accessory kit. It contains, among other things, the users manual, unpacking instructions, serial connection cable, and ribbon cassette.

If saving \$200 on a printer sounds appealing, please be sure to see the Scribe in action before buying. Do not expect acceptable color printing unless you see it produced in the store. Look closely at the black printing. Make sure you see the printer do everything you want with your favorite software before you take it home. Also, keep in mind that your savings may slowly disappear during the life of the printer as you spend more money on ribbons and paper.

REVIEW RESPONSES

TOO MUCH TIME

Your review of the Rana Systems Super Mini-Floppy Disk Drive (October 29, 1984) missed a key point. The 90-minute copying time for 5 megabytes from a hard disk onto two Rana floppies is miserably slow and shouldn't be tolerated. The hardware used in the Rana system is capable of doing that 5-megabyte backup operation in less than six minutes with verification, or less than four minutes without. That the supplied backup program takes 15 times longer than this indicates that its writer made no effort to understand the hardware's operation and write an efficient program. His week or so of programming time saved is going to cost countless work-years in customer waiting time if the product ever becomes popular. More likely, it will just make the product unmarketable as a hard disk backup device.

*Hall Chamberlin
Wake Forest, NC*

InfoWorld welcomes comments about its reviews from readers. Letters are subject to editing for space and clarity. Please address your correspondence to the Technology Editor, InfoWorld, 1060 Marsh Road, Suite C-200, Menlo Park, CA 94025.

PERIPHERALS

Color for the Scribe

SPECIAL RIBBONS ARE FINALLY AVAILABLE WITH GOOD QUALITY RESULTS, BUT THERE IS SOME WASTE

When we first reviewed Apple's low-cost "home" printer, the Scribe, (December 17, 1984), it was just a black-and-white matter. The promised color capability of the printer was unavailable because the special color ribbons were not on the market.

Apple has now placed the \$5.99 ribbons on dealer shelves in the same cassette design of the black ribbons. We tested the ribbons using a special demonstration program designed to show off the color ribbons and Hammermill Thermal Transfer paper, recommended for best resolution with this thermal ink-transfer printing technology.

You can't use this printer in color unless the software, like the demo program, supports it specifically. The demo program contains four samples of color graphics that

can be printed from a menu. We also printed some original artwork using Dazzle Draw from Broderbund Software, one of about a dozen products that currently work with the color ribbon.

Getting Dazzle Draw to send images to a Scribe with a color ribbon is very easy. We hope that the same is true for all such software. If you wish to send color images to the Scribe from your own programs, you will find the necessary information in the Scribe manual. Such work, however, is best left to experienced programmers.

The ribbon consists of alternating strips of yellow, magenta, and cyan. Each line of print requires three passes from the printhead, one for each of the colors. This gives the Scribe a very large palette of colors. This also means a good deal of ribbon

is wasted. If, for example, you wish to print only in yellow, the printer has to wind past the strips of magenta and cyan, and they'll never be used at all.

Like its black counterpart, the Scribe single-strike color ribbon moves past the printhead at a constant speed, even if there are gaps on a line where nothing is printed. The company claims that you can print from eight to 10 pages using one color ribbon, but that result depends on how you define a page.

For example, we were able to print 14 color screens using Dazzle Draw. This produced seven full pages with two high-resolution screens printed next to each other on the same piece of paper.

For reasons we fail to understand, the Scribe pauses briefly after the yellow and cyan passes. These pauses increase the print time: You can expect about a six-minute wait while Scribe prints a single screen of color graphics. Printing a full page of double high-resolution graphics using the demo disk requires 17 minutes.

Switching ribbons is very easy on the Scribe. We have yet to find another printer

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Charles Spezzano, Whole Earth Software Review, January 15, 1984

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John Lombardi, Reviewer, InfoWorld, April 16, 1984

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where this process is as simple.

To avoid getting white gaps between adjacent lines of print, we suggest feeding your paper one page at a time, even if it has tractor holes. It seems that any uneven pressure from attached pages feeding from the floor or the desk results in registration problems for adjacent lines.

Even under the best of circumstances, you can expect adjacent lines to overlap a bit. The extra ink printed in the overlap region is plainly visible and detracts from the overall appearance of your printed material.

The variety and appearance of the colors is impressive. However, printing black, by printing all three colors on top of each other, yields a greenish cast. (Color printing in magazines is done in a very similar fashion, but a fourth pass of black is added to eliminate such a cast and to produce proper contrast.) The print also has a shiny appearance caused by the wax base of the inks.

We used the recommended Hammermill Thermal Transfer paper provided by Apple, and we also tested the printer with a 20-pound paper that we use for our routine work. As we discovered with the Scribe's black ribbons, the smoothness of the paper affects the quality of the print. When you use rough paper, the color print has an uneven appearance because the ink does not adhere as well.

Be sure the Scribe's color printing meets your standards before you buy either the Scribe printer or the color ribbon. Also, make sure that you have software packages that can take advantage of the Scribe's color ribbon.

Is the quality of the color worth waiting the several minutes it takes to print, not to mention the cost of the special paper? When you consider the \$299 price of the Scribe printer, the color printing produced is amazing. If, however, you expect quality similar to a color photograph of your screen, you will be disappointed.

— Doug and Denise Green

REVIEW RESPONSES

DIMENSION 68000

You state that IBM Basic and Basica will not run on the Dimension 68000 but that Compaq Basic will. It is implied from this that the Compaq machine is more compatible with the IBM than the Dimension, which may be true. But it's also true that IBM's Basic and Basica will run only on an IBM machine because part of it is in read-only memory. The Compaq machine would

have failed this same test.

While I'm sure that we are all interested in the machine's level of compatibility with the IBM PC, I would have been interested in hearing more about the Z80 and Apple operations. That seems to me the most interesting aspect of the machine.

Jack Calaway
Calaway Engineering
Sierra Madre, CA

HARDWARE

☐☐☐ **AT Your PC** (*Tall Tree Systems*) — This combination product can't turn your IBM PC or compatible into a PC AT, but it can give you floppy disk drives compatible with the AT's 1.2-megabyte units. Its performance and the company's attitude toward customers are first-rate, but novice users will need installation guidance. (1/28/85)

☐☐ **Dimension 68000** (*Microcraft*) — This potentially good product needs some work. Its native mode performance does not do justice to the 68000 processor, there are some general quirks in machine operation, and its IBM PC emulation mode fails to render it completely compatible. (1/21/85)

☐☐ **Intec 300 Modem** (*Intec Corp.*) — This system claims to be a "complete" setup for 300-baud communications but, though the hardware works well, the modem is not Hayes compatible and cannot make use of any communications software except for that supplied with the product. The maker needs to rethink the product in terms of flexibility and Hayes compatibility. (4/8/85)

☐☐ **Kaypro 16** (*Kaypro*) — This is a cheap clone of the IBM PC XT, which can match that machine's performance, although it is not as expandable internally. It does include applications. (2/18/85)

☐☐ **Laserjet** (*Hewlett-Packard*) — A laser printer capable of producing high-quality printed material quickly, quietly, and quite cheaply for its class. It may be hard to get your software to work with the device, and it may be somewhat difficult to get it repaired. The Hewlett-Packard Laserjet is definitely a printer for heavy-duty business use. (1/28/85)

☐☐☐ **Micro Decision MD-5E** (*Morrow*) — Surprisingly fast for an 8-bit machine, this model offers good value and performance. It has a menu front end, sensible CP/M error messages, and good supplied software. This is a good choice for word processing, an acceptable one for other tasks. (3/18/85)

☐☐☐ **NEC APC III** (*NEC Information Systems*) — An MS-DOS computer whose lack of complete IBM PC compatibility is offset by its superior display. Its intelligently designed keyboard, good performance speed, and some well-conceived details make it a "must see" for the executive. (2/25/85)

☐☐☐ **NEC PC-8401A** (*NEC Home Electronics Inc.*) — A battery-powered lap-top featuring a very readable 16-line-by-80-character LCD screen and four built-in applications (including Wordstar-To-Go). Its impressive upgrade options and appealing \$999 base price make it worth a look. The machine even runs standard CP/M programs (with an optional disk drive). (3/18/85)

☐☐ **Paradise Graphics Board** (*Paradise Systems Inc.*) — The good points of this plug-in graphics card for the IBM PC are high-quality high-resolution graphics in either color or monochrome mode and freedom from color-screen flicker common to the IBM card. The bad points are standard documentation and cumbersome switching between color and monochrome displays. (3/18/85)

☐☐ **Plus 4** (*Commodore*) — An inexpensive computer with built-in software, this machine nevertheless belies the company's productivity pitch. The software has many features but is severely limited in capacity and won't do for even small businesses. The machine has also abandoned Commodore 64 standards, making the old software library unusable on this machine. (4/1/85)

☐☐ **Toshiba P1340** (*Toshiba America Inc.*) — This is the low end of a three-model line that uses 24-pin dot-matrix printheads to produce letter-quality type. The serial model needs some attention to setup and the documentation has its problems. The unit itself is solid and produces high-quality printing. (4/8/85)

☐☐☐ **TTX Press** (*TTX Inc.*) — Very small and lightweight, this portable printer uses thermal printing technology. While thermal printing in poorer quality than other methods, this device produces type that's clear and readable, can handle standard-size paper, operates on batteries for up to two hours, and is priced right. (2/18/85)

☐☐☐ **Videoshow 150** (*General Parametrics Corp.*) — Separate software and patented hardware that produce stunning high-quality graphics. The system is incredibly easy to use, although at \$4,000 it is not appropriate for the mass market. (3/11/85)

☐☐ **Watson** (*Natural Microsystems Corp.*) — A masterful but costly attachment of computer technology and speech synthesis to the telephone answering machine. Besides doing what most answering machines do, it can set up private message systems, record details of calls in the computer, and store voices in digital form that sounds realistic. (2/25/85)

SOFTWARE

☐☐ **Accounting Partner II** (*Star Software Systems*) — A complete double-entry accounting system that falls down primarily in its documentation, making the program more involved than necessary. With effort, however, the program's performance can be rewarding. (3/4/85)